atg airports ltd

Micro 100+ CCR

Microprocessor Controlled Constant Current Regulator

Installation and Operational Manual
HS16-0-00-03

This manual applies to regulators using firmware v1.00 onwards.

CE

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For personnel familiar with AGL Regulators and safe working practises for this type of equipment, refer to Sections 3 and 4 for a quick guide to Connecting and Commissioning the Micro 100+ CCR.

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AMENDMENT CONTROL

Issue	Date	Author	Amendment description	Firm-ware	Technical Approval	Approved for issue by
1	1.5.18	P. Craven	First issue of manual	V1.00	P. Craven	R. Everett
2	19.6.23	P. Craven / I. Crosland	Table 3-1 added – Minimum recommended supply cable sizes. Section 4.3 updated, including new section 4.3.3 - Configuring the main transformer for a short circuit load test. Section 4.3.4 – updated to include conduction times for 60Hz supply. Section 4.6 - PLF operating descriptions updated. Section 8 - Programming Menus and flowcharts updated. Table 11-1 - CCR Fault Finding - updated. Table 11-2 - CCR Parameter Record Sheet updated. Table 12-9, parts list contactor size 3 coil suppressors changed. Figure 12-1 – wiring diagram updated. Other minor text changes.	V1.00	P. Craven	R. Everett
3	3.10.23	P. Craven	Section 4.6 - Commissioning the Percentage Lamp Failure System, and sections 8.3.2.16 and 8.4.2.2 updated - AT1127 PLF Card replaces AT642.	V1.00	P. Craven	R. Everett

CCR PART NUMBERING SYSTEM

Example Part Number: M100+CCR - 66 15 - 400 - PS - EF/LF/LA/D

Model:
Micro 100+ CCR

Output Current:
6.0A = 06
6.6A = 66
12.0A = 12
20.0A (non std) = 20

Output kVA:
1.0 kVA (non std) = 01
2.5 kVA = 02
4.0 kVA = 04
5.0 kVA = 05
7.5 kVA = 07
10.0 kVA = 10
12.5 kVA = 12
15.0 kVA = 15
20.0 kVA = 20
25.0 kVA = 25
30.0 kVA = 30
Note – 20-30kVA not available in 220V series

Supply Voltage:
208V = 208
220V = 220
240V = 240

380V = 380
400V = 400
415V = 415

460V = 460
480V = 480

Remote Control:

Hard wired:	24V	= 24
	48V	= 48
Serial Comms:	Profibus	= PS
	J-Bus / Modbus RTU	= JS
	Modbus TCP / IP (Ethernet)	= MTS

Optional Accessories. (Note - codes LI, LF, LA not necessary for CCRs manufactured to FAA specification). Add to part number in order shown:

Earth Fault Monitor	= EF
Load Indicator	= LI
Lamp Fault Indicator	= LF
Output Lightning Arrestors	= LA
Field Circuit Isolator	= FCI
Door Safety Interlocks	= DI

Circuit Selector Switch:

Direction / Alternate	= D
2 Way Circuit Switch	= 2W
3 Way Circuit Switch	= 3W
4 Way Circuit Switch	= 4W
5 Way Circuit Switch	= 5W
6 Way Circuit Switch	= 6W

CCRs manufactured to the FAA specification:

FAA Regulator without monitoring (includes LA)	= FAA L-828
FAA Regulator with monitoring (includes LI, LF, LA)	= FAA L-829

SAFETY NOTICES

DANGER – HIGH VOLTAGE CIRCUITRY

This equipment employs high voltage circuitry within the cubicle – up to 5000V for a 30kVA regulator - that presents a hazard of fatal electric shock should personnel come into contact with or close proximity to the conductors.

Installation and servicing of the CCR should only be undertaken by suitably qualified personnel who are familiar with this type of equipment. Extreme caution should be exercised when working on the CCR.

Whilst every practicable safety precaution has been incorporated in the CCR, the following rules must be strictly observed.

KEEP AWAY FROM LIVE CIRCUITS

Do not perform any service work on the CCR, or remove the covers to the main CCR HT cubicle, HT output terminal and mains supply terminal boxes, work on the series circuit or change AGL circuit lamps, without first turning off and isolating the supply to the CCR.

STATUTORY REGULATIONS AND CODES OF PRACTICE

All regulations, codes of practice and safety precautions applicable in the locality should be strictly adhered to. Reference can also be made to the FAA Advisory Circular AC 150/5340-26 'Maintenance of Airport Visual Aid Facilities' for instructions on safety precautions.

The following are examples of statutory regulations which MUST be complied with in the UK:-

- **Electricity at Work Regulations 1989**
- **Electricity Supply Regulations 1988**
- **Health and Safety at Work Act 1974**
- **Management of Health and Safety at Work Regulations 1992**

RESUSCITATION

Maintenance personnel should familiarise themselves with the technique for resuscitation found in first aid manuals.

1 Introduction

1.1 Description

The **atg airports** Micro 100+ CCR is a microprocessor controlled constant current regulator that provides a precise level of current to airfield ground lighting series circuits.

The Micro 100+ CCR is available in three supply voltage ranges: the 220V series is available to operate either from a single or a two phase supply, and the 400V and 480V series operate from a two phase supply. Primary voltage taps are available to provide fine adjustment to suit local conditions; for example the 400V series can be set to operate at 380, 400 or 415V.

The Micro 100+ CCR employs an anti-parallel pair of thyristors to supply a multi-tapped output isolation transformer. These tappings can be selected to match the load on the series circuit so as to minimise the supply current drawn and to reduce the harmonic effects.

Critical protection circuitry is implemented in hardware for maximum operational security.

The Micro 100+ is pre-programmed with default operating parameters suitable for most applications. If required, programming changes and calibration can be performed by accessing the menu driven system using the rotary encoder and pushbutton on the CCR front panel. (Note - the Set-up and Engineering menus are password protected to prevent unauthorised access). Although an external PC is not necessary for service and commissioning work, a USB port is provided.

1.2 Standard Features and available options

1.2.1 Standard Features

The Micro 100+ CCR has the following standard features:

- Accurate control of RMS output current level into all loads from short circuit to full rated load
- 3, 5 or 8 pre-programmed brilliancy levels to IEC/EN, FAA or CAP168 standards
- 8 fully adjustable ‘User Defined’ brilliancy levels, between 0.1 – 100%
- Local control from front panel rotary switch; fast and easy – no need to enter menu system to select brilliancy
- Display of output current true RMS value
- Open circuit protection implemented in hardware for maximum reliability
- Over current protection
- Over current clamp activates if current exceeds 123% of rated value for 1 half cycle caused by a change of load impedance during block switching operations
- Capacitive Current Detection – ensures correct operation of open circuit protection on highly capacitive AGL series loop circuits
- Asymmetric Output Current Detection
- Internal/external brilliancy control; external brilliancy control from 24V, 48V or volt free contact as standard, 8-Wire, 3-Wire encoded or BCD encoded.

- Warning indication of “Tolerance Fault” (output current outside tolerance limits)
- Elapsed time counter records hours run at maximum brilliancy and hours run total
- Adjustable current ramp for switch on, enhances lamp life by reducing stress on lamp filaments
- Black heat - selectable low current output level available for remote “OFF” setting
- Operating parameters configurable from front panel – no need for computer
- Separate compartments for low voltage, mains voltage and high voltage circuitry, all with individual lockable covers
- Supplied with castors as standard for easy manoeuvrability

1.2.2 Optional Features

The Micro 100+ CCR can be supplied with the following options:-

- Lamp Failure Detection – displayed as a total or as a percentage. (Included as standard on FAA L-829 Regulator with monitoring)
- Earth Leakage Resistance Measurement. Continuous measurement of the series circuit resistance to earth at 500V whilst the CCR is operating, or at 1000V during manual testing when the CCR is set to ‘Local OFF’. A two stage alarm / trip output is provided; the resistance value can also be displayed
- Internal Lightning Arrestors on the outgoing circuit. (Included on FAA regulators)
- Power analyser module – measures input and output voltage, current, power, power factor, kVA and regulator efficiency
- Series Circuit Cutout Switch with three position plug-in lid. An additional safety device can be fitted that isolates the series circuit from the high voltage output of the CCR and connects the field cables to earth for safe maintenance. It also provides insulation resistance measuring test points
- Serial communication using Profibus, Modbus TCP/IP (Ethernet) or J-BUS. Permits remote control of the CCR and / or monitoring of operating parameters.

1.3 Specification

The Micro 100+ CCR complies with EN 61822:2009 – Electrical installations for lighting and beaconing of aerodromes – Constant current regulators, FAA AC 150/5345-10 - Specification for Constant Current Regulators and Regulator Monitors, and all applicable EMC standards.

Mains supply voltage range:	+/-10% of nominal
Mains supply frequency:	46.25 to 64.5 Hz
Control method:	Thyristor phase angle control, with control loop closed around output current.
Remote Brilliancy Inputs:	24 / 48V internal or external supply, polarity insensitive. (120V available as an option).
Number of Brilliancy steps:	8
Efficiency (standard models):	90% or better
Power factor:	0.90 or better at full load
Cooling:	Convection cooled
Degree of Protection:	IP2X

2 Installation

2.1 Physical Characteristics

The Micro 100+ CCR cabinet is constructed from mild steel and is naturally ventilated with an IP2X rating. Figure 2-1 below shows the outline drawing of the CCR. The same cabinet is used for all regulators from 2.5kVA to 30kVA.

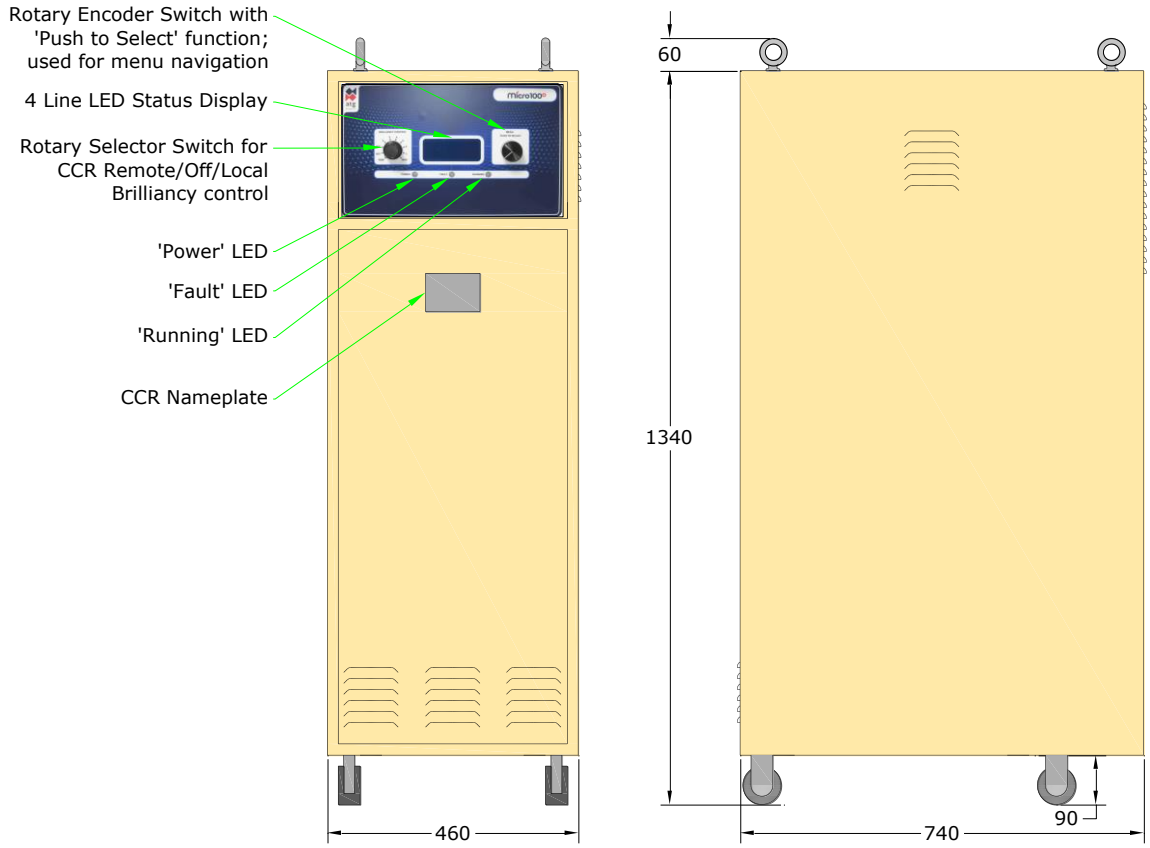


Figure 2-1 CCR Cabinet Outline Dimensions

The cubicle is divided into the following easily accessible compartments:

i) Main Electronics Compartment. Contains the AT1030 Microcontroller Motherboard and all option cards. Accessible via the lower front cover. **Note – there are mains voltages present in this section, at the top right-hand corner of the AT1030 Card. These terminals are protected by a shroud.**

ii) Power and HT Compartment. Contains the thyristor module and optional fuse, main CCR transformer, contactor, RFI filter etc. Accessible via side, rear and top covers. **Note – high voltages are present within this compartment.**

iii) Mains Supply Terminal Box - accessible from the rear

v) Low Voltage Control Terminal Box - accessible from the rear

vi) HT Output Terminal Box - accessible from the rear. **Note – high voltages are present within this compartment.**

Figure 2-2 and Figure 2-3 (below) show the cabinet covers, which can be removed to give access to the individual compartments. Note – locks secure the covers to each of these. Some units include electrical door interlocks, which open the main contactor if a door is opened.

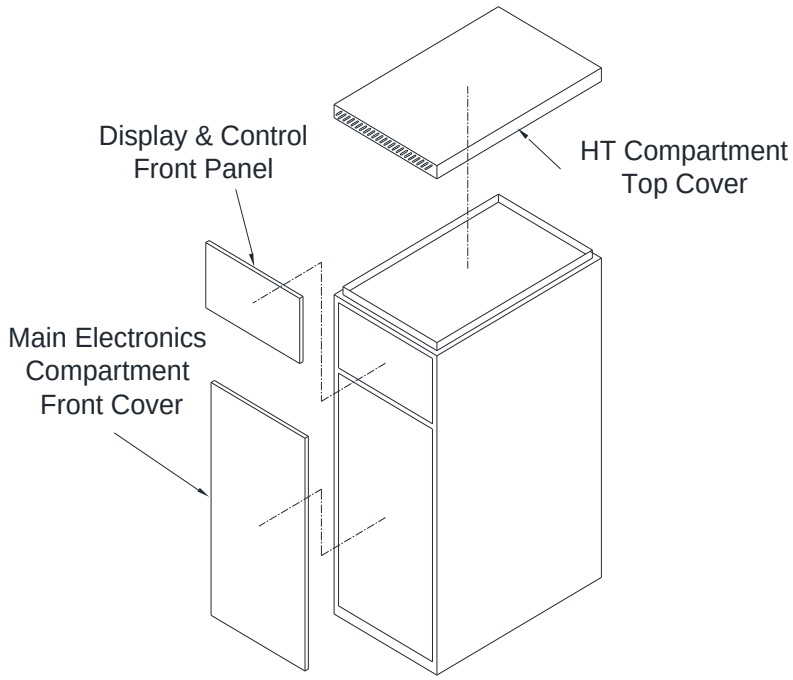


Figure 2-2 CCR Cabinet Covers (Front and Top)

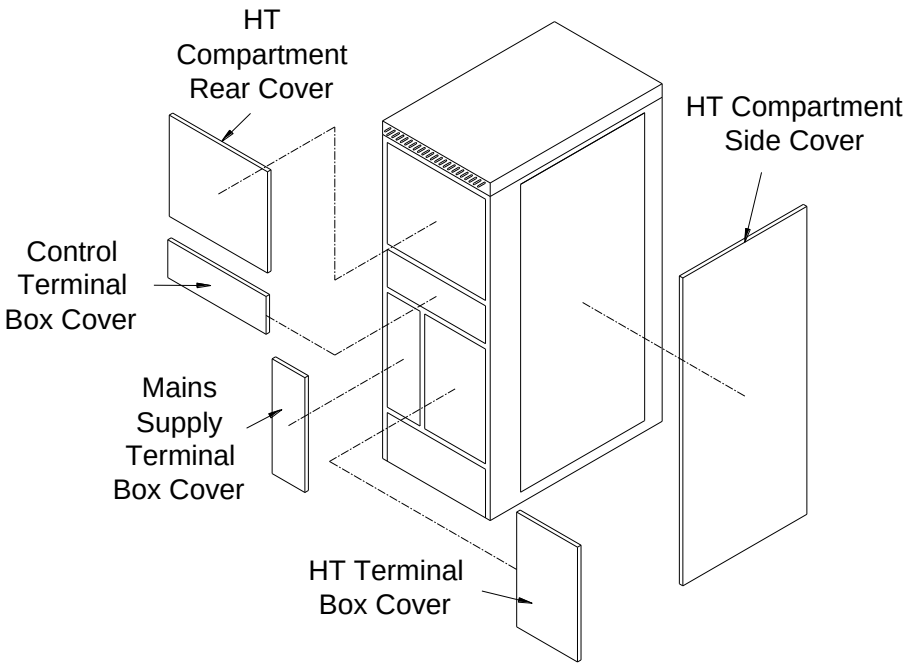


Figure 2-3 CCR Cabinet Covers (Rear)

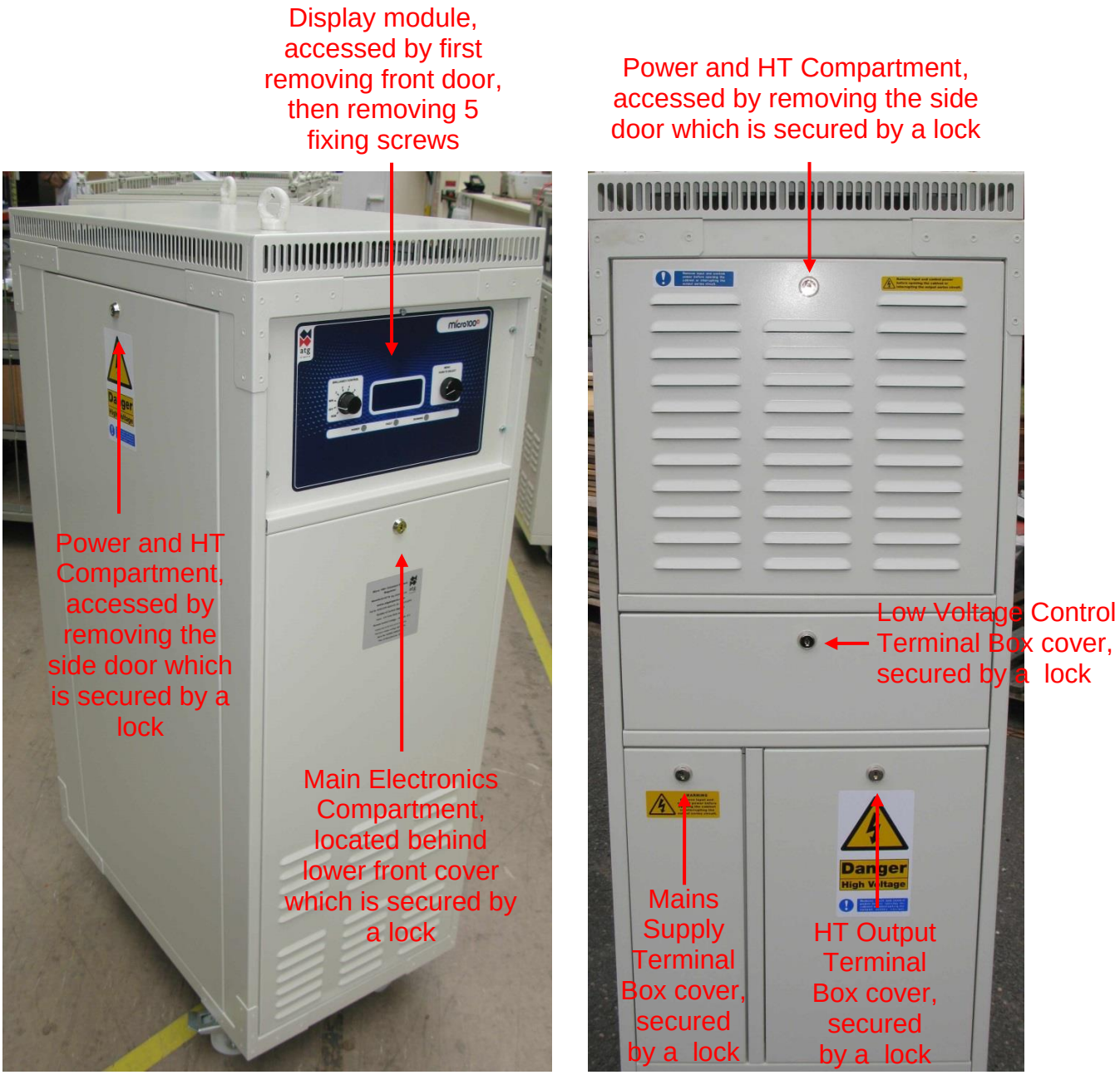


Figure 2-4 CCR front / side view, and rear view showing terminal covers

2.2 Operating environment and clearance around the cabinet

The Micro 100+ CCR is designed for indoor installations in an area that should be clean and dry, free of dust, etc. (Pollution Degree 2, as defined by EN 60439-1). There should be adequate ventilation for cooling by convection, with the following environmental conditions:

Temperature range:	-40°C to 50°C
Relative Humidity:	10% to 95%, non-condensing
Altitude:	Sea level to 2000 metres

To facilitate safe working practices for maintenance, a clearance of 1000mm is recommended at the front and back of the regulator.

2.3 Cabinet weights and manoeuvring of the CCR

The approximate weights of the standard sizes of regulator are listed in Table 2-1

Regulator output size (kVA)	Approximate weight (kg)
2.5	110
4	120
5	130
7.5	170
10	210
12.5	230
15	245
20	300
25	320
30	350

Table 2-1 Approximate weights of regulators

For general manoeuvring of the CCR cabinet around the substation, the cabinet is fitted with four castors on the underside. These are to be used over short distances, such as within the electrical substation and test facilities. The castors are designed only for smooth surfaces. Prior to manoeuvring a CCR, the person responsible for manoeuvring is to check the route to ensure it is clear of obstructions or other hazards to people or equipment. If it is planned to move the CCR outside of the electrical substation and over uneven ground, it is recommended to use a vehicle with a tail lift to transport the CCR to its final destination.

If it is required to lift the CCR cabinet off the ground then the two lifting eyes should be used, with slings or a lifting shackle inserted through the eyebolts, and a suitable lifting device used to elevate the cabinet. A spreader bar should be used to ensure that the

slings or lifting shackles are positioned vertically as the cabinet is raised, so as not to introduce a side load to the lifting eyes. The lift should be performed smoothly without jerking the cabinet as it is raised.

2.4 Input Power Requirements

Table 2-2 provides a guide for typical input current requirements for the standard sizes of regulator, with full rated load connected, and the CCR operating at maximum brilliancy. The supply current drawn is partially dependant on the primary voltage tapping used on the CCR main transformer, and this should be set to suit the supply voltage at the installation.

kVA Rating	Approximate input current requirement with the CCR running at full rated load, at specified main transformer primary tapping voltage								
	220V series			400V series			480V series		
	208V	220V	240V	380V	400V	415V	460V	480V	
2.5	14.1	13.3	12.2	7.7	7.3	7.0	6.4	6.1	
4	22.5	21.3	19.5	12.3	11.7	11.3	10.2	9.7	
5	28.1	26.6	24.4	15.4	14.6	14.1	12.7	12.2	
7.5	42.2	39.9	36.5	23.1	21.9	21.1	19.1	18.3	
10	56.2	53.2	48.7	30.8	29.2	28.2	25.4	24.4	
12.5	70.3	66.5	60.9	38.5	36.5	35.2	31.8	30.5	
15	84.3	79.7	73.1	46.2	43.9	42.3	38.1	36.5	
20	N/A	N/A	N/A	61.6	58.5	56.4	50.9	48.7	
25	N/A	N/A	N/A	76.9	73.1	70.5	63.6	60.9	
30	N/A	N/A	N/A	92.3	87.7	84.5	76.3	73.1	

Table 2-2 CCR Input Current Requirements

A guide for calculating the total load of the series circuit, including AGL cable losses and transformer losses, is included in Section 7.1. This can be used to determine the kVA rating of the regulator which should be used on any given circuit.

The regulator output is designed to remain stable with an input voltage variation of +/- 10% of the nominal supply voltage.

Table 3-1 provides a list of the minimum recommended supply cable sizes for each rating of CCR.

It is recommended that the external distribution circuit breaker or fuses are rated for 125% of the CCR supply current (or the next size larger), unless local regulations specify a different rating requirement. Ensure that the circuit breakers or fuses used provide adequate protection for the supply cables used, and always install in accordance with the current IEE or local codes of practice.

3 Connecting the CCR

3.1 Terminal Categories

Connections to the CCR are divided into three categories: CCR Mains supply Input; Control Terminals and HT Series Circuit Output. Each has its own terminal compartment at the rear of the CCR, each with its own lockable cover. These are shown in Figure 3-1 below:

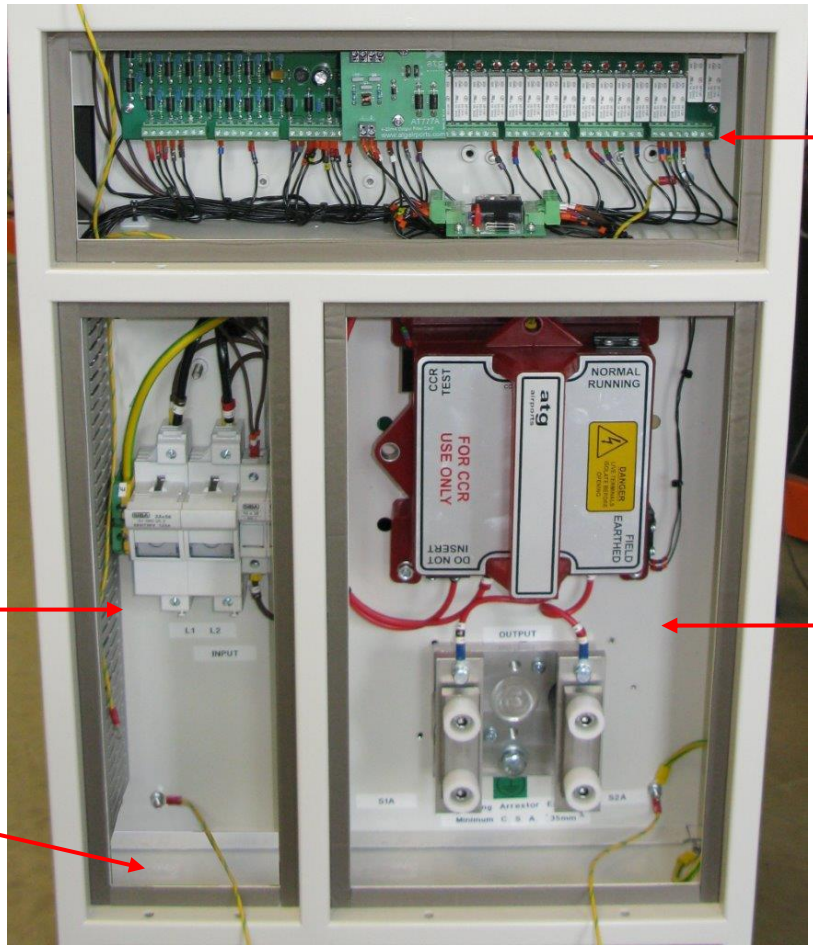


Figure 3-1 Terminal Boxes

The terminal box gland plate – fitted at the bottom – is normally supplied as a blank. Holes will need to be punched at the time of installation. The control cables should enter at the left hand side of the gland plate, and run through the trunking in the left hand side of the Mains Supply Terminal Compartment and through the entry hole into the Low Voltage Control Terminal Compartment. For safety, and to maintain the IP rating of the cubicle, the gland plate must always be fitted. No extra holes should be made in the plate in addition to those used for the cable glands.

Note – Micro 100+ CCRs can be supplied to order fitted with customer specific control connectors, prewired to the internal CCR control terminals. Contact **atg airports** for details.

3.2 CCR Mains Supply Input and Cabinet Earth

This terminal box contains the mains supply fuses or circuit breaker and the control supply fuses. Cable entry is via the gland plate at the bottom of the box; the incoming mains cables connect directly into the fuse carriers (or circuit breaker), to the terminals marked “L1” and “L2”. The typical supply current requirements are listed in Table 2-2 of the previous section, and the minimum recommended CCR supply cable sizes are listed in Table 3-1 below.

kVA Rating	Minimum recommended CCR supply cable sizes					
	220V series		400V series		480V series	
	CSA mm^2	AWG	CSA mm^2	AWG	CSA mm^2	AWG
2.5	4 mm^2	AWG 12	2.5 mm^2	AWG 14	2.5 mm^2	AWG 14
4	6 mm^2	AWG 10	4 mm^2	AWG 12	2.5 mm^2	AWG 14
5	10 mm^2	AWG 8	4 mm^2	AWG 12	4 mm^2	AWG 12
7.5	16 mm^2	AWG 6	6 mm^2	AWG 10	6 mm^2	AWG 10
10	25 mm^2	AWG 4	10 mm^2	AWG 8	6 mm^2	AWG 10
12.5	25 mm^2	AWG 3	10 mm^2	AWG 8	10 mm^2	AWG 8
15	25 mm^2	AWG 3	16 mm^2	AWG 6	10 mm^2	AWG 8
20	N/A	N/A	25 mm^2	AWG 4	16 mm^2	AWG 6
25	N/A	N/A	25 mm^2	AWG 3	25 mm^2	AWG 4
30	N/A	N/A	35 mm^2	AWG 2	25 mm^2	AWG 3
Note - due to cables specified in mm^2 or AWG not always being available in exactly matching sizes, the recommended CSA in mm^2 may be higher or lower than the nearest AWG cable size depending on the supply current of the particular CCR.						

Table 3-1 Minimum recommended CCR supply cable sizes

The earth cable also connects to a terminal within this box. The minimum size of the earth cable, regardless of the CCR power rating, should be 10 mm^2 (AWG 8), but always with a CSA of at least 50% of that of the mains supply cables. Always ensure compliance with the local electrical codes of practise.

3.3 Control Connections

Except for those regulators with custom control connectors fitted to the gland plate or those using serial communication modules, all control connections are made to screw terminals on PCB(s) fitted within the control terminal box. The field cables enter through the gland plate at the bottom of the mains terminal box and pass through a duct within this box, before entering the low voltage control terminal compartment. The PCB terminal will accommodate cable with a cross sectional area from 0.25mm^2 to 2.5mm^2.

In addition to the mains supply input, earth and AGL series loop output connection, no other connections are required to permit the CCR to operate in local control.

For a standard Micro 100+ with an AT712 Relay I/O Card fitted, the CCR can operate with the following Remote Control configurations:

i) 8-Wire Brilliancy Selection, with or without Command On input.
ii) 3-Wire Encoded Brilliancy selection, with or without Command On input (7 Brilliancy Levels)
iii) BCD Encoded Brilliancy Selection, with or without Command On input (8 Brilliancy Levels)

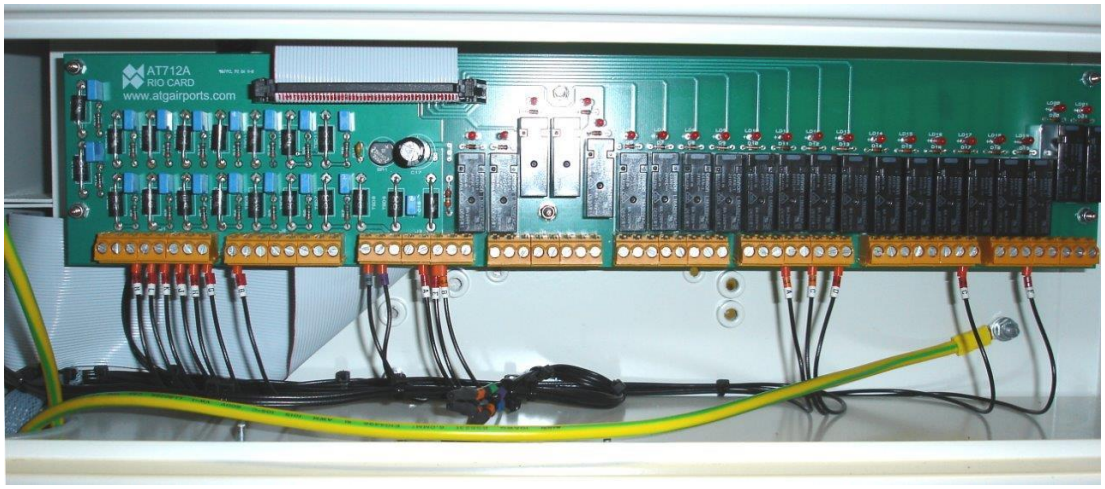


Figure 3-2 AT712 Relay I/O Card fitted in Control Terminal Box

Relay contacts are provided on the AT712 Card for Back Indication of CCR status. The relay contacts are rated at 4A @ 250V AC or 4A @ 30V DC with a resistive load. However, in order to maintain the ELV rating of the control terminal box it is recommended not to apply a voltage greater than 60V DC or 25V AC.

When options such as an integrated Circuit Selector Switch or Power / Current Monitor modules are fitted, additional cards will be mounted over the AT712 Card. Refer to the appropriate supplementary manuals for details.

Optional serial communications modules are available to give Remote Control using Profibus, Modbus TCP/IP (Ethernet) or J-BUS. Contact **atg airports** for details. These modules would normally be fitted in place of the AT712 Relay I/O Card, although they can be used in addition to this to give a monitoring function only.

3.3.1 Remote Brilliancy Selection – up to 8 individual inputs

The default Remote Control Configuration for a standard Micro 100+ CCR with a Relay I/O Card fitted is 8-Wire Remote Brilliancy Selection without Command On. (In this case, the CCR operates whenever a Brilliancy Input is activated). Other modes of operation can be selected via the keypad menu; for example, 8-Wire control can be used with or without the Command On input. To program the operating mode, refer to Section 8.3.2.2 – Remote Control Configuration.

The CCR can be programmed to operate with a maximum of 8 Brilliancy Steps (using all 8 Brilliancy Inputs - normally UK CAP168 brilliancy levels), but it is also possible to configure for 5 step FAA / IEC Style 2 (using Brilliancy Inputs 1 to 5) or 3 step FAA / IEC Style 1 (using Brilliancy Inputs 1 to 3). Whichever configuration is used, the appropriate pre-programmed current levels assigned to each Brilliancy Input are selected via the keypad menu system. These are normally set during factory testing based on the CCR order specification, but can be changed if necessary – refer to Section 8.3.2.7 - Brilliancy Levels Style selection. Alternatively, up to a maximum of 8 User Defined Current / Brilliancy Levels may be selected – see Section 8.3.2.8.

Figure 3-3 and Figure 3-4 show the connections to the Relay I/O Card for 8-Wire control. The optional Command On input is also shown; the use of this is selected via the menu system – refer to Section 8.3.2.2 – Remote Control Configuration.

Figure 3-3 shows the connection using the CCR internal power supply, and Figure 3-4 shows the same scheme using an external power source. Note – when using an external supply, it should be free floating and not referenced to earth.

The CCR Remote Brilliancy inputs can be driven from an external 24V or 48/50V DC supply, of either polarity, or an internal 24V DC supply.

If more than one Brilliancy Input is selected the CCR operates using the highest input, but an alarm is flagged on the front panel.

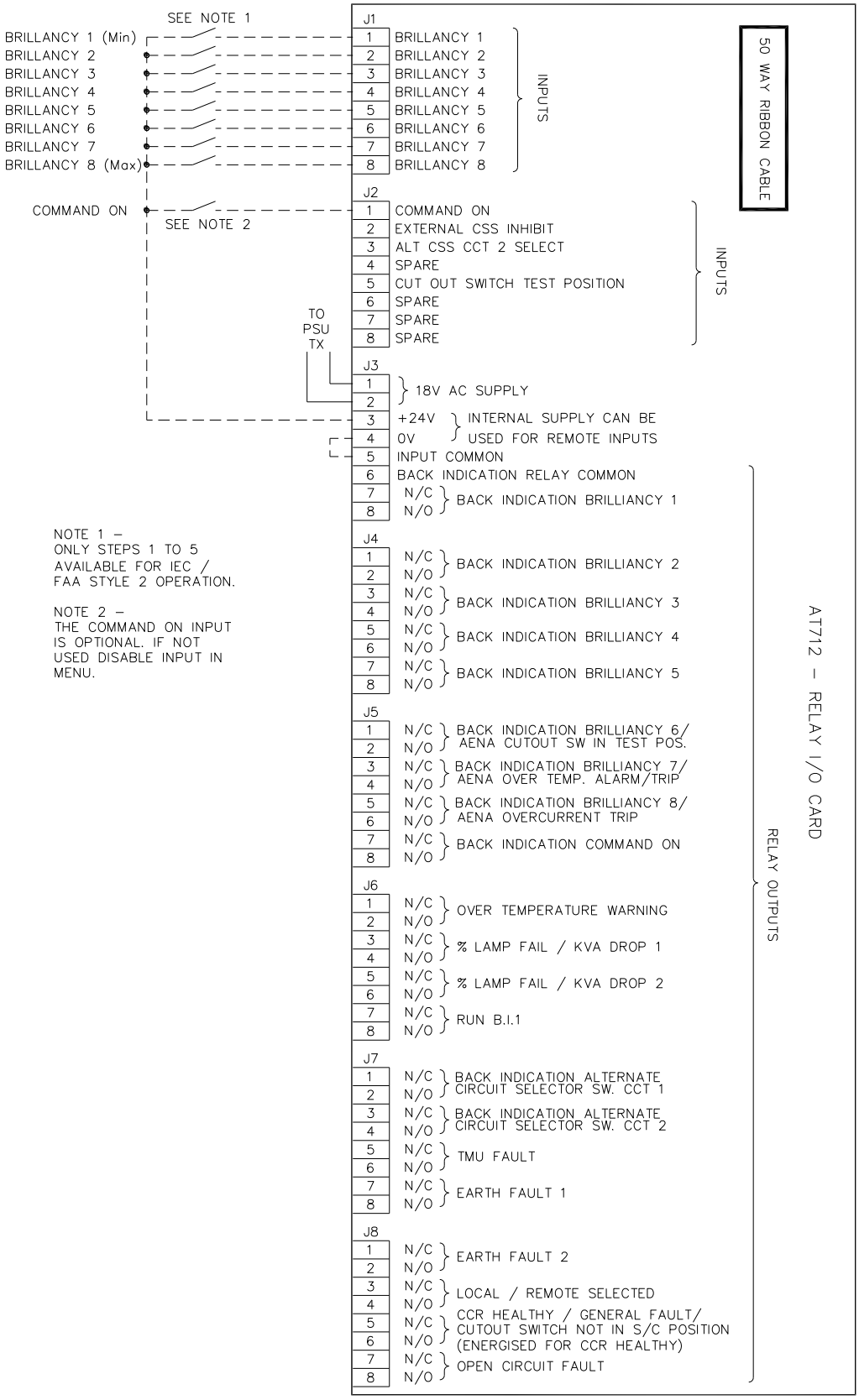


Figure 3-3 Connections for 8-Wire Remote Brilliancy using CCR internal PSU

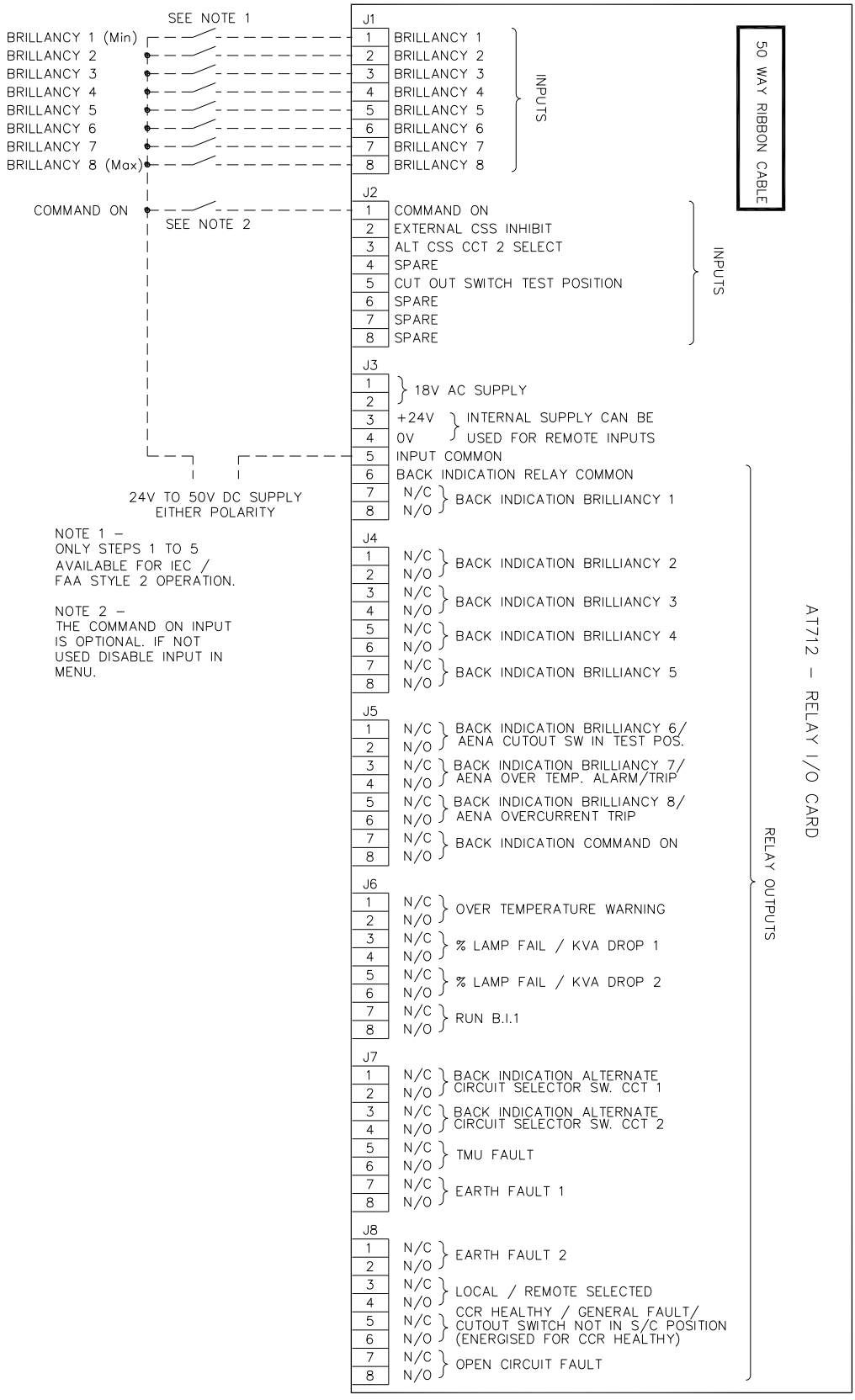


Figure 3-4 Connections for 8-Wire Remote Brilliancy using external PSU

3.3.2 3-Wire Encoded Remote Brilliancy Selection

The circuit of Figure 3-5 below shows the connections for 3-Wire Encoded Remote Brilliancy Selection using the CCR internal power supply. The use of a 'Command On' input is optional; the appropriate configuration should be selected using the keypad menu. All other information in Section 3.3.1 applies. To program the CCR for 3-Wire operation, refer to Section 8.3.2.2.

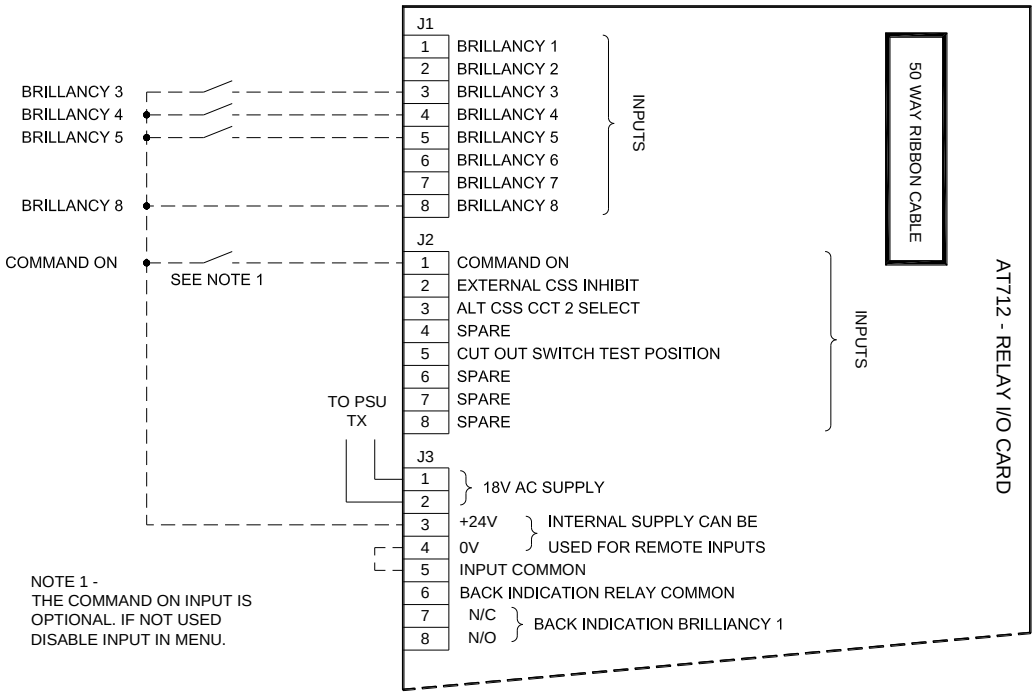


Figure 3-5 Connections for 3-Wire Encoded Remote Brilliancy Selection

Table 3-2 below, describes the encoding. Note – a '1' indicates that the input is selected; 'N/R' indicates not required.

3-Wire Encoded Remote Brilliancy Selection							
Step	**Brilliancy (default UK CAP 168 levels)**	**Remote Input**					
		Brilliancy 8	**Brilliancy 7**	**Brilliancy 6**	**Brilliancy 5**	**Brilliancy 4**	**Brilliancy 3**
Off	Off	0	N/R	N/R	X	X	X
1	0.1%	1	N/R	N/R	0	0	0
2	0.3%	1	N/R	N/R	0	0	1
3	1%	1	N/R	N/R	0	1	0
4	3%	1	N/R	N/R	0	1	1
5	10%	1	N/R	N/R	1	0	0
6	30%	1	N/R	N/R	1	0	1
7	80%	1	N/R	N/R	1	1	0
8	100%	1	N/R	N/R	1	1	1

Table 3-2 3-Wire Encoded Remote Brilliancy Selection

3.3.3 BCD Encoded Remote Brilliancy Selection

The circuit of Figure 3-6 below shows this configuration. The use of a 'Command On' input is optional. All other information described in Section 3.3.1 applies. To program the CCR for BCD encoded operation, refer to Section 8.3.2.2.

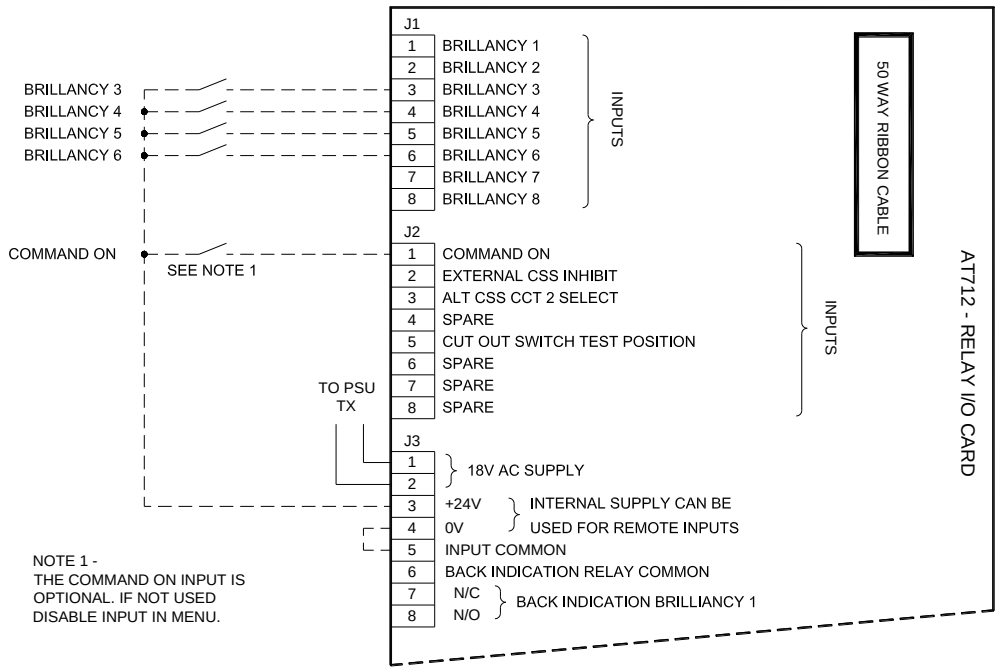


Figure 3-6 Connections for BCD Encoded Remote Brilliancy Selection

Note – it is possible to select from 2 coded tables; BCD (standard) and BCD control Option 2, as shown in Table 3-3 and
Table 3-4. Note – a '1' indicates that the input is selected; 'N/R' indicates not required.

BCD (standard) Encoded Remote Brilliancy Selection							
Step	**Brilliancy (default UK CAP 168 levels)**	**Remote Input**					
		Brilliancy 8	**Brilliancy 7**	**Brilliancy 6**	**Brilliancy 5**	**Brilliancy 4**	**Brilliancy 3**
Off	Off	1	N/R	0	0	0	0
1	0.1%	1	N/R	0	0	0	1
2	0.3%	1	N/R	0	0	1	0
3	1%	1	N/R	0	0	1	1
4	3%	1	N/R	0	1	0	0
5	10%	1	N/R	0	1	0	1
6	30%	1	N/R	0	1	1	0
7	80%	1	N/R	0	1	1	1
8	100%	1	N/R	1	0	0	0

Table 3-3 BCD (standard) Encoded Remote Brilliancy Selection

BCD Option 2 Encoded Remote Brilliancy Selection							
Step	**Brilliancy (default UK CAP 168 levels)**	**Remote Input**					
		Brilliancy 8	**Brilliancy 7**	**Brilliancy 6**	**Brilliancy 5**	**Brilliancy 4**	**Brilliancy 3**
Off	Off	N/R	N/R	N/R	1	1	1
3	1%	N/R	N/R	N/R	1	1	0
4	3%	N/R	N/R	N/R	1	0	1
5	10%	N/R	N/R	N/R	1	0	0
6	30%	N/R	N/R	N/R	0	1	1
7	80%	N/R	N/R	N/R	0	1	0
8	100%	N/R	N/R	N/R	0	0	1
Off	Off	N/R	N/R	N/R	0	0	0

Table 3-4 BCD Option 2 Encoded Remote Brilliancy Selection

3.3.4 External Circuit Selector Switch Connection

The Micro 100+ CCR can be supplied with an optional Integral Circuit Selector Switch. However, if an external CSS is to be used a volt-free inhibit contact should be provided on the CSS control unit to momentarily turn off the regulator during switching of the Circuit Selector Switch.

This contact should be connected to the AT712 “EXTERNAL CSS INHIBIT” input (terminal J2/2), as shown in Figure 3-7 below.

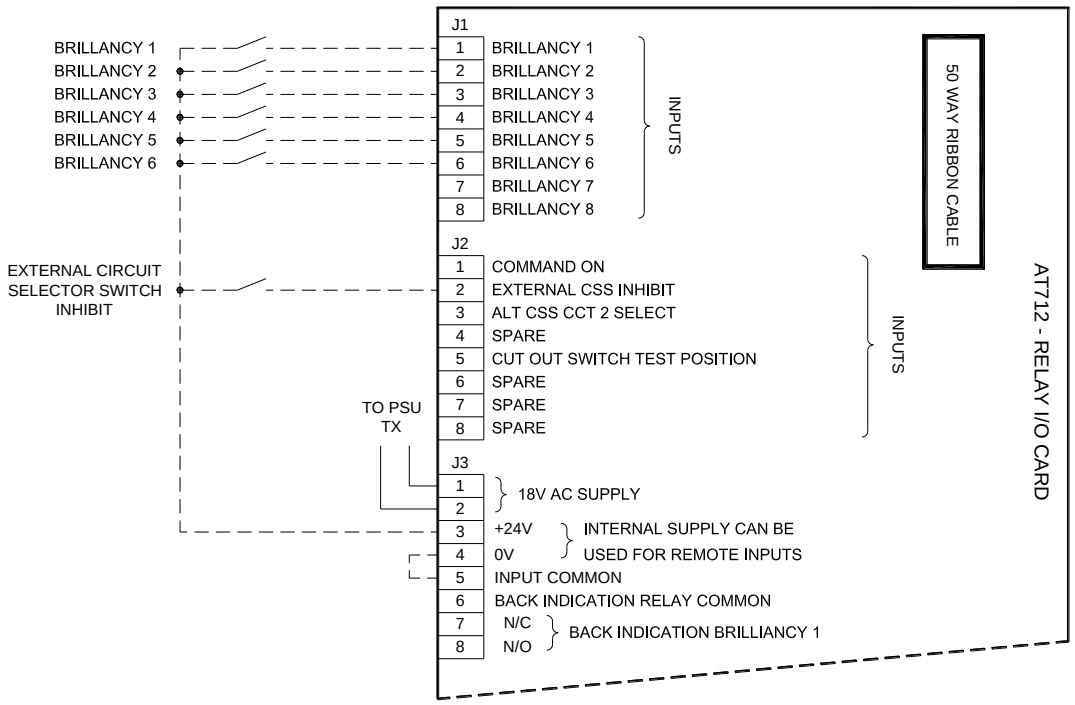


Figure 3-7 Connection for External Circuit Selector Switch inhibit line

When the CSS inhibit contact is CLOSED, the green CCR “RUN” LED on the front panel will flash to indicate that the CCR output is switched off, and the following message will be displayed:

R	E	M	O	T	E		B	R	I	L	L		5				↑	↓	
E	X	T		C	S	S		I	N	H	I	B	I	T					
O	P		C	U	R	R	E	N	T	:			X	.	X	X		A	
O	P		V	O	L	T	A	G	E	:			X	X	X	X		V	

Note – in this condition, the CCR line contactor remains energised.

3.4 HT Series Circuit Output Terminals.

WARNING – HIGH VOLTAGES – UP TO 5000V FOR A 30KVA REGULATOR – ARE PRESENT WITHIN THE HT TERMINAL BOX. THE COVER TO THIS COMPARTMENT SHOULD NEVER BE OPENED WITHOUT FIRST ISOLATING THE REGULATOR MAINS SUPPLY INPUT.

FURTHERMORE, BEFORE THE AGL FIELD CABLES AND CCR OUTPUT TERMINALS ARE SAFE TO TOUCH, THEY SHOULD BE SHORTED TOGETHER AND CONNECTED TO EARTH, PREFERABLY USING A SUITABLE SWITCHING DEVICE. RESIDUAL CHARGE OR INDUCED EMF FROM OTHER AGL CIRCUITS MAY OTHERWISE PRESENT A HAZARD TO PERSONNEL.

CCRS CONTAINING INTEGRAL LIGHTNING ARRESTORS MAY BE SUPPLIED WITH TWO INSULATING COVERS FITTED OVER THE LIGHTNING ARRESTOR TERMINALS. IN THIS CASE, ENSURE THAT THE INSULATING COVERS ARE REFITTED AFTER THE AGL SERIES CIRCUIT CABLES HAVE BEEN CONNECTED.

This terminal box contains 2 HT output terminals for a standard regulator, 4 for an Integral Alternate Circuit Selector Switch, and up to 7 for a Multi-way Circuit Selector. Refer to the manual supplements for connection details for these options.

Figure 3-8 (overleaf) shows photographs of standard output terminals, and a 4-terminal lightning arrestor assembly as used for an integral alternate circuit selector switch or a 3-way simultaneous circuit selector switch. This 4-terminal assembly is fitted with insulating sheets at the sides of the terminals; these are necessary since clearance is limited between the end terminals and the sides of the compartment.

Note – the voltage rating of the AGL cable should be chosen according to the rated output voltage of the regulator used, on the output current setting used; be it 6.0A/6.6A, 12A or 20A. Refer to Table 4-6 and Table 4-7 for the Main CCR Transformer output voltages.

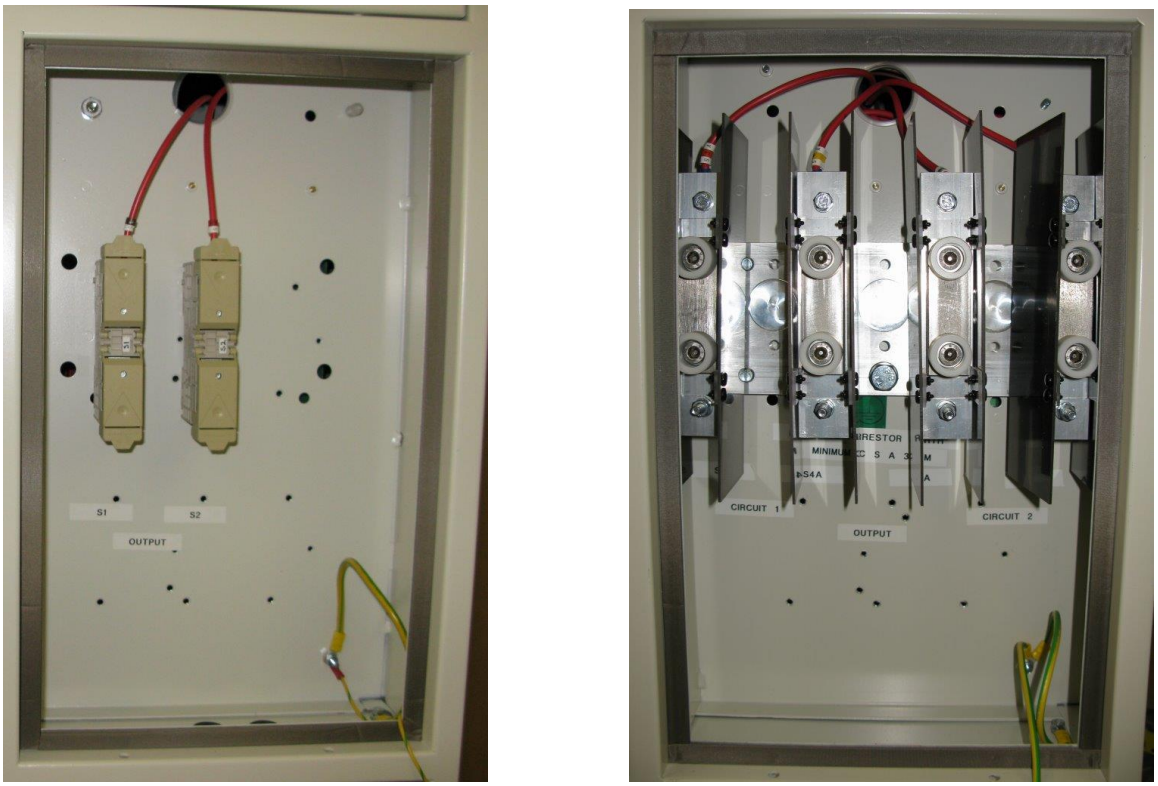


Figure 3-8 Standard Output Terminals and 4 Terminal Lightning Arrestor

For those regulators fitted with Integral Lightning Arrestors, a separate earth connection must be made. This should connect to the aluminium lightning arrestor assembly base plate, using the bolt near the bottom of the plate. The earth cable used should have a cross sectional area of at least 35 mm^2. Refer to Section 5 - Output Lightning Arrestors, for more information.

4 Commissioning

4.1 Introduction

The factory test of the Micro 100+ CCRs includes accurate calibration of the CCR output current level. This is performed using a specialised, calibrated, power analyser. Re-calibration of the regulator should not therefore, be undertaken as part of the commissioning process.

If verification of the output current is required before connecting the AGL circuit, then this can be done by connecting a resistive load bank to the output terminals and running the regulator at maximum brilliancy. If a load bank is not available, then a shorting link can be connected between the output terminals; however, do not operate the CCR into a short circuit at any setting above minimum brilliancy unless the main transformer T101 secondary tapping voltage has been set to minimum; see Section 4.3.4. If this is not done, the high peak current levels may cause the mains input fuses or thyristor protection fuses to fail.

Note – **atg airports** do not consider 'clamp' type RMS ammeters as being sufficiently accurate for the calibration of CCRs, due to the variation in measured current with clamp pressure. If a regulator is to be re-calibrated, this should be done using a suitable in-line 'true RMS' ammeter as described in Section 9.2.

For a standard Micro 100+ CCR with no Option Modules fitted, and providing that the AGL circuit is matched to the CCR rated output current (see rating label), then commissioning of the regulator requires only to:

i) Verify that the default CCR operating parameters are correct for the application, eg 8-Wire Remote Brilliancy Selection, 5 step FAA / IEC Style 2 or 8 step UK CAP168 Brilliancy / Current Levels. (Note - if any special requirements were notified to **atg airports** at the time of ordering, these will have been programmed during factory testing). See Section 4.2

ii) Verify the correct operation of the external control connections.

iii) Set the CCR Main Transformer input voltage taps to suit the local supply, for example 380v, 400v or 415v. Set the Transformer output voltage taps to correctly match the series circuit load - see Section 4.3. For CCR output voltage and load kVA monitoring, program in the output voltage used on the CCR Main Transformer – see Section 8.3.2.17 and section 8.3.2.18.

If any Option Cards or Modules are fitted, then these may require hardware set-up and / or programming of operating parameters. The set-up of the most commonly used Option Cards are included in this manual; the Earth Leakage Resistance Measurement Module is described in Section 4.5, and the Percentage Lamp Failure Card is described in Section 4.6.

Refer to the supplementary manuals for any other optional components fitted, for example, a serial communications module.

When the regulator has been correctly configured, as described in the following sections, it is ready for initial power up.

First, turn the Front Panel Brilliancy Selection rotary switch to “OFF” and energise the mains supply. On power up the following screen will be displayed:

L	O	C	A	L			O	F	F								↓
O	P		C	U	R	R	E	N	T	:			0	.	0	0		A	
O	P		V	O	L	T	A	G	E	:						0		V	

If a fault screen should appear instead of the above, refer to section 8.5, Fault Screen Listings.

4.2 Default CCR Operating Parameters

Table 4-5, overleaf, lists the most important CCR Operating Parameters, along with a brief description and the default setting. A box is provided to record any non-standard settings used. Table 11-2 (commissioning Parameter Record Sheet) has a full listing of parameters with descriptions, default settings and space for recording any parameters changed from default.

Table 4-1 through to Table 4-4 list the pre-programmed current settings available and their associated tolerance limits.

Section 8 describes navigating around the Menu System and programming the CCR using the Front Panel Rotary Menu Selector. Sections 8.3 and 8.4 contain comprehensive listings of all Operating Parameters and the screen displays, along with the default settings. The majority of the parameters can be left on the default setting for the most common applications.

Brilliancy Step	UK CAP 168 Brilliancy level	Default / UK CAP 168			3 Step FAA / IEC Style 1			5 Step FAA / IEC Style 2		
		Current Level, Amps	Range, Amps		Current Level, Amps	Range, Amps		Current Level, Amps	Range, Amps	
			Lower Limit	Upper Limit		Lower Limit	Upper Limit		Lower Limit	Upper Limit
8	N/A	6.00	5.82	6.09	N/A	N/A	N/A	N/A	N/A	N/A
7		5.73	5.64	5.78						
6		4.86	4.78	5.23						
5		4.14	3.82	4.36						
4		3.54	3.36	3.68						
3		3.06	2.96	3.25						
2		2.64	2.51	2.89						
1		2.34	2.17	2.41						
0		0	0	0						

Table 4-1 6.00A pre-programmed current levels.

Brilliancy Step	UK CAP 168 Brilliancy level	Default / UK CAP 168			3 Step FAA / IEC Style 1			5 Step FAA / IEC Style 2		
		Current Level, Amps	Range, Amps		Current Level, Amps	Range, Amps		Current Level, Amps	Range, Amps	
			Lower Limit	Upper Limit		Lower Limit	Upper Limit		Lower Limit	Upper Limit
8	100 %	6.60	6.40	6.70	6.60	6.50	6.70	6.60	6.50	6.70
7	80 %	6.30	6.20	6.36	6.60	6.50	6.70	6.60	6.50	6.70
6	30 %	5.35	5.26	5.76	6.60	6.50	6.70	6.60	6.50	6.70
5	10 %	4.55	4.20	4.80	6.60	6.50	6.70	6.60	6.50	6.70
4	3 %	3.89	3.70	4.05	6.60	6.50	6.70	5.20	5.10	5.30
3	1 %	3.37	3.26	3.58	6.60	6.50	6.70	4.10	4.00	4.20
2	0.3 %	2.90	2.76	3.18	5.50	5.40	5.60	3.40	3.30	3.50
1	0.1 %	2.57	2.39	2.65	4.80	4.70	4.90	2.80	2.70	2.90
0	0 %	0	0	0	0	0	0	0	0	0

Table 4-2 6.60A pre-programmed current levels.

Brilliancy Step	UK CAP 168 Brilliancy level	Default / UK CAP 168			3 Step FAA / IEC Style 1			5 Step FAA / IEC Style 2		
		Current Level, Amps	Range, Amps		Current Level, Amps	Range, Amps		Current Level, Amps	Range, Amps	
			Lower Limit	Upper Limit		Lower Limit	Upper Limit		Lower Limit	Upper Limit
8	100 %	12.00	11.64	12.18	N/A	N/A	N/A	N/A	N/A	N/A
7	80 %	11.45	11.27	11.56						
6	30 %	9.72	9.56	10.47						
5	10 %	8.28	7.64	8.73						
4	3 %	7.08	6.72	7.36						
3	1 %	6.12	5.92	6.51						
2	0.3 %	5.28	5.01	5.78						
1	0.1 %	4.68	4.34	4.82						
0	0 %	0	0	0						

Table 4-3 12.00A pre-programmed current levels.

Brilliancy Step	UK CAP 168 Brilliancy level	Default / UK CAP 168			3 Step FAA / IEC Style 1			5 Step FAA / IEC Style 2		
		Current Level, Amps	Range, Amps		Current Level, Amps	Range, Amps		Current Level, Amps	Range, Amps	
			Lower Limit	Upper Limit		Lower Limit	Upper Limit		Lower Limit	Upper Limit
8	100 %	20.00	19.62	20.40	N/A	N/A	N/A	20.00	19.70	20.30
7	80 %	19.21	18.78	19.28				20.00	19.70	20.30
6	30 %	16.21	15.90	17.45				20.00	19.70	20.30
5	10 %	13.79	12.72	14.54				20.00	19.70	20.30
4	3 %	11.79	11.21	12.27				15.80	15.50	16.10
3	1 %	10.20	9.87	10.85				12.40	12.10	12.70
2	0.3 %	8.79	8.36	9.64				10.30	10.00	10.60
1	0.1 %	7.79	7.24	8.03				8.50	8.20	8.80
0	0 %	0	0	0				0	0	0

Table 4-4 20.00A pre-programmed current levels.

Parameter	Description	Location of parameter	Firmware default setting / comments	CCR Serial Number: User Settings
MAXIMUM OUTPUT CURRENT	CCR Maximum Output Current, 6.0A, 6.6A, 12.0A or 20.0A (note - the output currents available are also dependent on the power transformer fitted)	CCR Engineering Configuration Menu. Section 8.4.2.1	6.60A. (The required value is programmed during factory testing and would not normally be changed).	
REMOTE CONTROL CONFIG.	Remote Control Brilliancy Selection: 8 Wire, 3 Wire Encoded, BCD Encoded, (all with or without Command), or Serial Comms	Set-up Menu. Section 8.3.2.2	8 WIRE	
BRILLIANCY LEVELS STYLE	Current setting for each Brilliancy step; Pre-programmed table to UK Cap 168 levels, 3 Step FAA - IEC/EN Style 1, 5 Step FAA - IEC/EN Style 2 or User Defined	Set-up Menu. Sections 8.3.2.7 and 8.3.2.8	UK CAP168. (The required setting is programmed during factory testing and would not normally be changed).	
TOLERANCE MONITORING	Tolerance Monitoring Unit (TMU), checks that measured CCR output current falls within specified limits	Set-up Menu. Sections 8.3.2.9 and 8.3.2.11	ENABLED (Tol. Mon. limits set according to Brilliancy Levels table selected)	
BLACK HEAT OUTPUT CURRENT IN REM OFF	CCR produces a low current output when in 'OFF' state under remote control. Prevents condensation in tungsten halogen lamps	Set-up Menu. Sections 8.3.2.12 and 8.3.2.13	DISABLED	
EARTH LEAKAGE STAGE 2 TRIP	Two threshold levels can be set for the resistance to earth of the series loop circuit. This parameter selects whether the CCR should trip or alarm once the second threshold is reached (Stage 2). (Note – the Earth Leakage Card is optional)	Set-up Menu. See Section 4.5.2.3	ENABLED. (For reasons of safety, it is recommended to leave ENABLED, to trip the CCR on Stage 2 earth leakage fault)	
% LAMP FAILURE (PLF) CONFIGURATION	Monitors the inductance of the series loop circuit to detect lamp failures. (Note – the PLF Card is optional)	Set-up Menu. The PLF Card Set-up procedure is described in Section 4.6	DISABLED. (Note – if optional AT1127 PLF or AT1031 PLF/PA Card is not fitted, leave as DISABLED)	

Table 4-5 Main CCR Operating Parameters

4.3 Setting the Main Transformer Output Voltage

WARNING – HIGH VOLTAGES – UP TO 5000V FOR A 30KVA REGULATOR – ARE PRESENT ON THE CCR MAIN TRANSFORMER OUTPUT TERMINALS. THE TRANSFORMER IS MOUNTED WITHIN THE HT CUBICLE, THE COVER OF WHICH SHOULD NEVER BE OPENED WITHOUT FIRST ISOLATING THE REGULATOR MAINS SUPPLY INPUT.

FURTHERMORE, THE AGL FIELD CABLES SHOULD BE SHORTED TOGETHER AND CONNECTED TO EARTH BEFORE THE HT CIRCUITRY – INCLUDING THE TRANSFORMER OUTPUT TERMINALS - IS SAFE TO TOUCH. RESIDUAL CHARGE OR INDUCED EMF FROM ADJACENT AGL CIRCUITS MAY OTHERWISE PRESENT A HAZARD TO PERSONNEL.

Figure 10-1 of Section 10 shows the block diagram of the CCR with a primary series field loop connected. The CCR uses an anti-parallel thyristor pair to control the voltage applied to the primary of the main CCR transformer. The conduction period of the thyristors is then controlled so as to give the correct RMS current on the output side of the transformer.

The transformer secondary has multiple tappings such that the output voltage can be adjusted to give the correct operating range according to the load connected to the AGL circuit. This adjustment should be made during commissioning of the CCR. Too low an output voltage will mean that the CCR will not be able to drive the rated current into the load, causing an ‘Open Circuit’ trip or an ‘Under Current’ tolerance alarm. (Depending on the output voltage set, this may only become a problem during conditions of supply voltage dips or when lamps have failed).

The supply current drawn by the CCR is largely determined by the transformer output tapping voltage selected, since the supply current is approximately equal to the secondary current multiplied by the transformer step up voltage ratio. This formula holds true irrespective of the kVA of the load connected to the CCR. By changing the CCR transformer output tapping voltage to correctly match the load, the ratio of the transformer is changed, thus keeping the supply current (and supply kVA), to a minimum.

If the output voltage is set higher than required for a particular load, then the CCR compensates for this mismatch by reducing the thyristor conduction period to maintain the correct RMS output current. However, the CCR supply current and supply kVA will be higher than necessary, and it could be much higher for a badly mismatched transformer output voltage. In this case, the power factor of the supply to the CCR is also very poor, and, due to the short thyristor conduction period, a higher level of harmonic current will be present both on the supply and the output side. The harmonic currents cause a slightly higher output current on the secondary side of the AGL transformers, thus reducing lamp life. This is discussed in more detail in Section 7.3.

Note – for testing of the CCR, a shorting link can be connected between the CCR output terminals. However, do not operate the CCR into a short circuit at any setting

above minimum brilliancy unless the main transformer T101 secondary tapping voltage has been set to minimum; see Section 4.3.3. If this is not done, the high peak current levels may cause the mains input or thyristor protection fuses to fail.

The following sections describe how to adjust the transformer secondary tappings on the different types of power transformers which are used in the CCRs, whilst Section 4.3.4 describes how to verify that the voltage has been set correctly to match the AGL circuit load.

atg airports have developed two standard ranges of transformers for use in the CCRs (described below); one range is designed for operation at a maximum current of 6.6A, whilst the other range can be configured for operation at 12.0A or 6.0 / 6.6A. Note – the 20A transformers have a single set of secondary windings as per the 6.6A designs; refer to the transformer top plate for the tapping voltages.

4.3.1 6.6A Transformer Winding Arrangement

For CCRs designed to operate at a maximum current of 6.6A, the transformers have 3 (or more) isolated secondary windings, as show in Figure 4-1 (400V series). Each section of the secondary winding produces twice the voltage of the preceding section; for example, the voltage of winding section 5 is twice that of section 4. By connecting the appropriate winding sections in series, the CCR output voltage can be set to suit the load on the AGL series circuit Table 4-6 lists the secondary winding voltages for the 6.6A range of Transformers for each size of regulator.

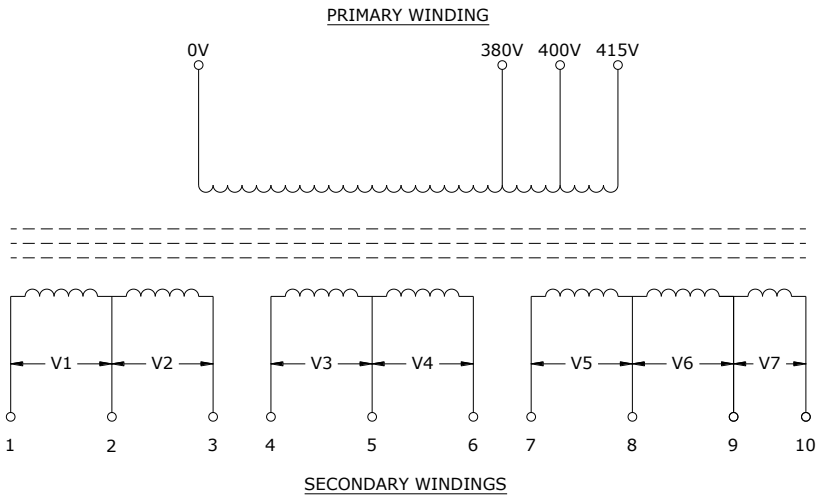


Figure 4-1 6.6A CCR Main Transformer winding arrangement

RATED OUTPUT kVA	RATED OUTPUT VOLTAGE AT 6.6A	WINDING V1 OP VOLTAGE	WINDING V2 OP VOLTAGE	WINDING V3 OP VOLTAGE	WINDING V4 OP VOLTAGE	WINDING V5 OP VOLTAGE	WINDING V6 OP VOLTAGE	WINDING V7 OP VOLTAGE. SEE NOTE
1.0	153	2.4	4.8	9.7	19.5	39	78	N/A
2.5	382	6.06	12.13	24.25	48.5	97	194	N/A
4	610	9.7	19.4	38.8	77.5	155	310	N/A
5	764	12.1	24.2	48.5	97	194	388	N/A
7.5	1146	18.2	36.4	72.8	145.5	291	582	N/A
10	1528	24.25	48.5	97	194	388	776	N/A
12.5	1909	30.3	60.6	121.3	242.5	485	869	100
15	2287	36.4	72.75	145.5	291	582	1044	120
20	3055	48.5	97.00	194	388.00	776.00	1391	161
25	3798	60.6	121.3	242.5	485.00	970.00	1739	201
30	4557	72.75	145.5	291	582	1164	2087	241

Table 4-6 6.6A CCR Main Transformer Output Voltages

Note - winding V7 is only included on transformers rated at 12.5kVA or above. It should be connected for IEC applications to give 0.9PF and the ability to cope with supply voltage dips of up to 10%, and disconnected for FAA applications to give 0.95PF and the ability to cope with supply voltage dips of up to 5%, with full rated load connected.

For transformers where the secondary and/or primary tapping voltages differ from those shown above, the winding arrangement and tapping voltages are indicated on the transformer label.

A third connection is made to the transformer output windings, which goes to the Earth Leakage Detector. This should connect as closely as possible to the mid – voltage point of whichever windings are utilised - see Figure 4-2.

There is also a low current secondary (monitoring) winding provided on the transformer, for use by the (optional) Percentage Lamp Failure Card. This is not shown on these drawings.

To set the maximum output voltage on a 6.6A regulator, all the windings will be connected in series as shown in Figure 4-2 below.

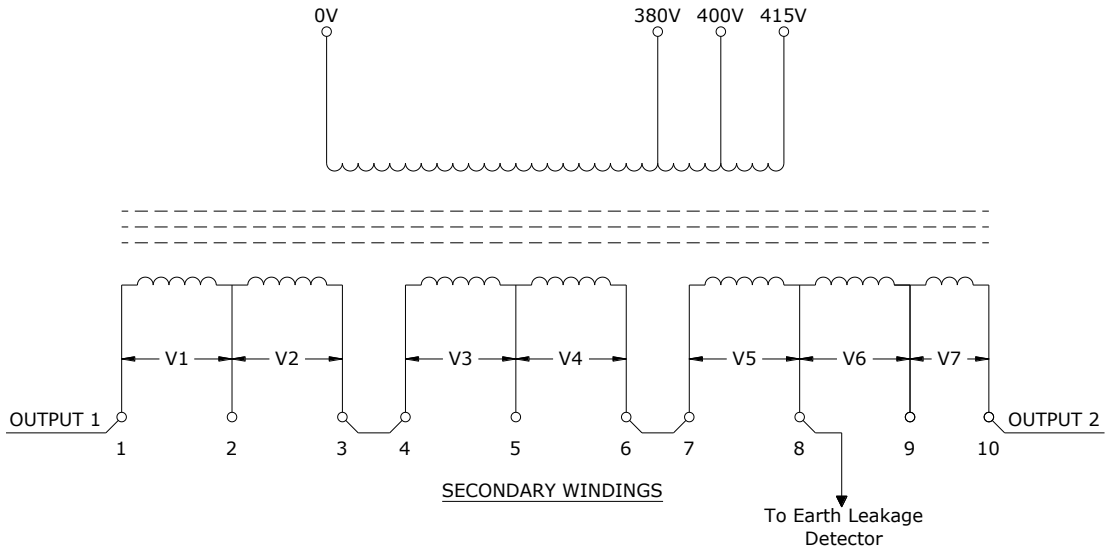


Figure 4-2 6.6A Transformer configured for full voltage

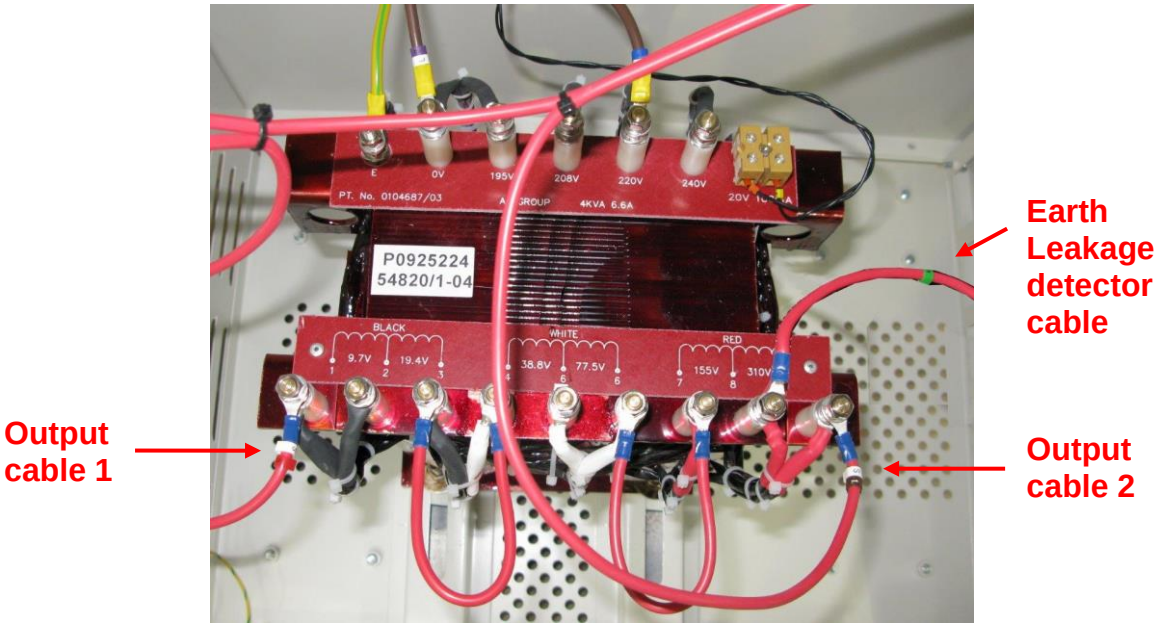


Figure 4-3 Photograph of 6.6A Transformer configured for full voltage

To calculate the required CCR output voltage according to the AGL circuit load, refer to Section 7.1

An example of an intermediate output voltage (based on a 6.6A circuit) is shown below. In this case the output voltage is:

V3 + V4 + V6 +V7

Which for a 15kVA regulator is:

145.5 + 291 + 1044 +120 = 1600.5V

The connections to give this voltage are shown in Figure 4-4.

Note – when connecting together sections of the secondary windings, ensure that the windings are connected with the correct orientation (phasing), as shown in Figure 4-2 or Figure 4-4. In this way, the voltages from each section will add and not subtract.

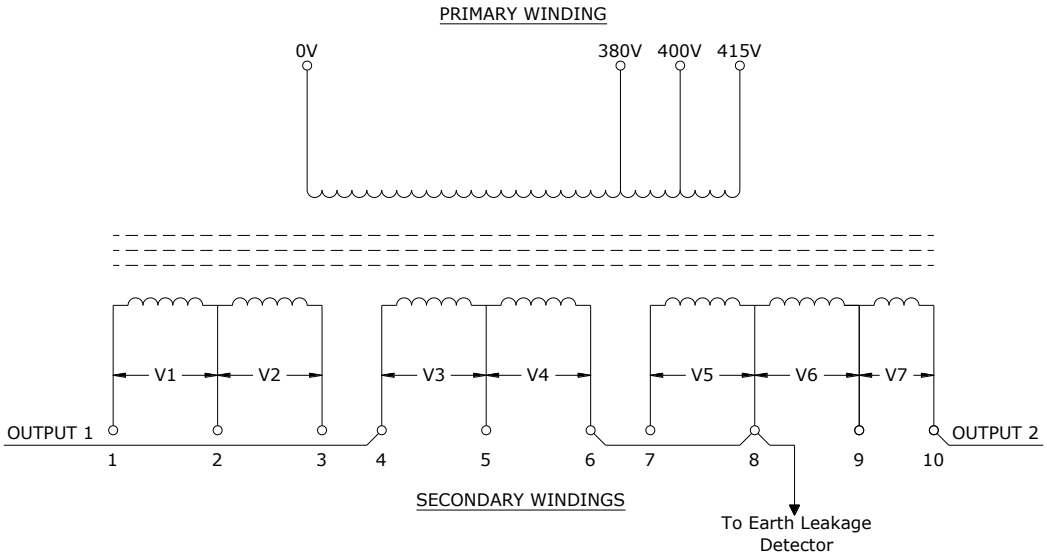


Figure 4-4 6.6A Transformer configured for intermediate voltage

It is important to verify that the transformer output voltage tappings are set to correctly match the load, so that the thyristor conduction period is near to the optimum value at maximum current. This is described in Section 4.3.4.

4.3.2 6.6A / 12.0A Transformer Winding Arrangement

The range of transformers fitted to CCRs which can operate at 6.6A or 12.0A either have 6 isolated secondary windings, arranged as 2 sets of 3 windings, or 4 isolated secondary windings, arranged as 2 sets of 2 windings. Each winding is rated at 6.6A; these can be connected in parallel to give a 12.0A rating, or in series for 6.0A or 6.6A operation, but at twice the output voltage. A different coloured sleeve identifies the cables from each winding. Each section of the secondary winding produces twice the voltage of the preceding section; for example, the voltage of winding section 5 is twice that of section 4.

Figure 4-5 shows the winding arrangement for the 6.6A / 12.0A range of CCR Main Transformers which have 2 sets of 3 secondary windings, whilst Table 4-7 lists the secondary winding voltages for the most common sizes of transformer of this style.

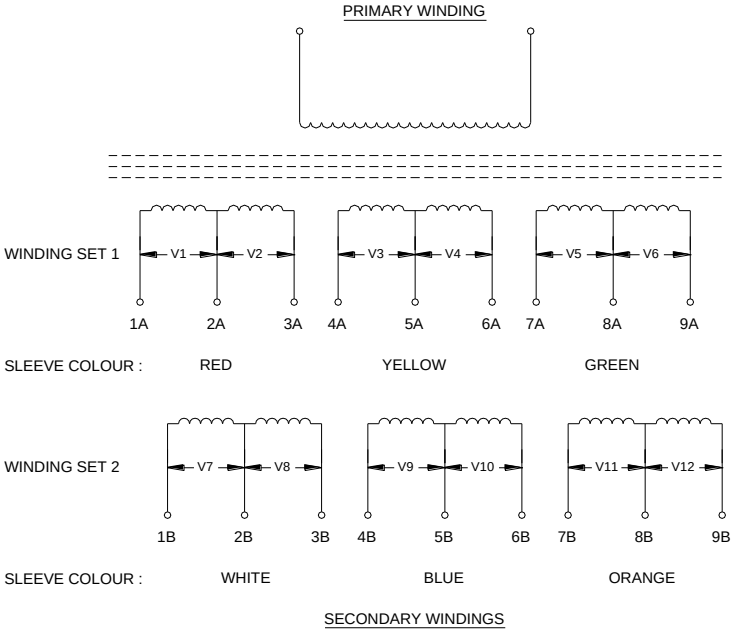


Figure 4-5 6.6A / 12.0A CCR Main Transformer, 2 sets of 3 secondary windings

RATED OUTPUT KVA	RATED OUTPUT VOLTAGE AT 12A	RATED OUTPUT VOLTAGE AT 6.6A	OUTPUT VOLTAGE WINDINGS V1 AND V7	OUTPUT VOLTAGE WINDINGS V2 AND V8	OUTPUT VOLTAGE WINDINGS V3 AND V9	OUTPUT VOLTAGE WINDINGS V4 AND V10	OUTPUT VOLTAGE WINDINGS V5 AND V11	OUTPUT VOLTAGE WINDINGS V6 AND V12
4	315	630	5	10	20	40	80	160
7.5	630	1260	10	20	40	80	160	320
15	1260	2520	20	40	80	160	320	640
22	1890	3780	30	60	120	240	480	960
26	2205	4410	35	70	140	280	560	1120

Table 4-7 6.6A / 12.0A Main Transformer Output Voltages, 2 sets of 3 windings

Figure 4-6 shows the winding arrangement for those Transformers which have 2 sets of 2 secondary windings.

Note – for those transformers whose winding voltages are not listed in Table 4-7, refer to the tapping voltages marked on the transformer itself.

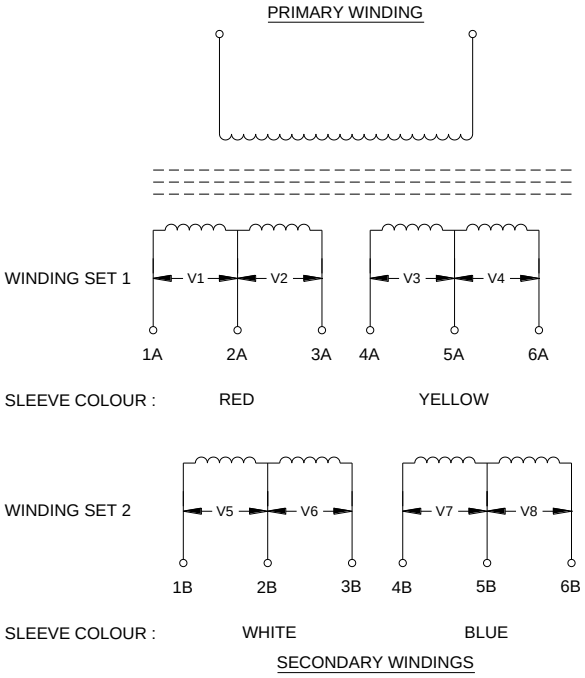


Figure 4-6 6.6A / 12.0A CCR Main Transformer, 2 sets of 2 secondary windings

By connecting the appropriate winding sections in series and / or parallel the required CCR output voltage and current can be obtained. To set the maximum output voltage on a 6.0A or 6.6A regulator, all the windings will be connected in series as shown in Figure 4-7. To set the maximum output voltage for a 12A regulator, winding set 1 will be connected in parallel with winding set 2, using the links provided. This is shown in Figure 4-8.

Note – a third connection is made to the transformer output windings, which goes to the Earth Leakage Detector. This should connect as closely as possible to the mid – voltage point of whichever windings are utilised.

There is also a low current secondary (monitoring) winding provided on the transformer, for use by the (optional) Percentage Lamp Failure Card. This is not shown on these drawings.

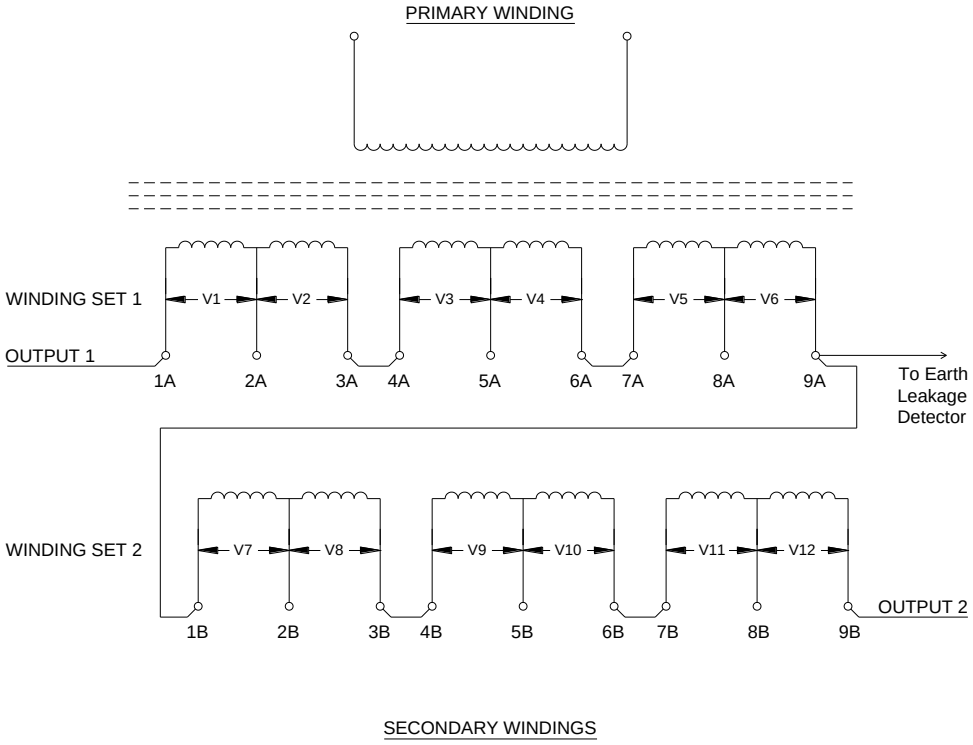


Figure 4-7 6.6A / 12.0A Transformer configured for 6.6A at full voltage

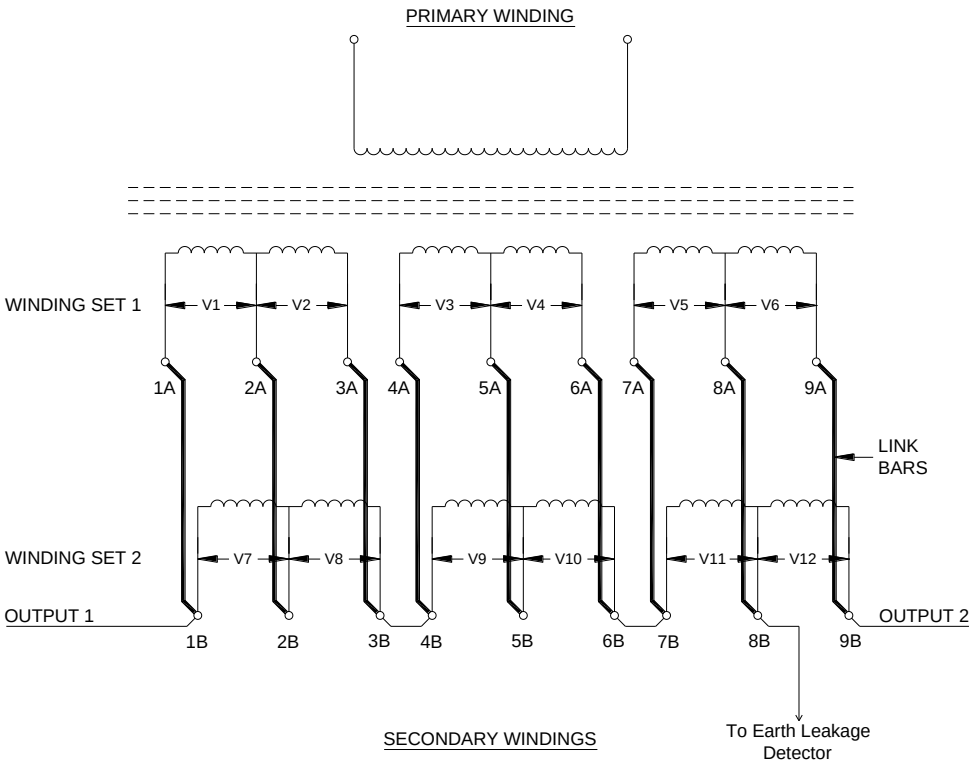


Figure 4-8 6.6A / 12.0A Transformer configured for 12A at full voltage

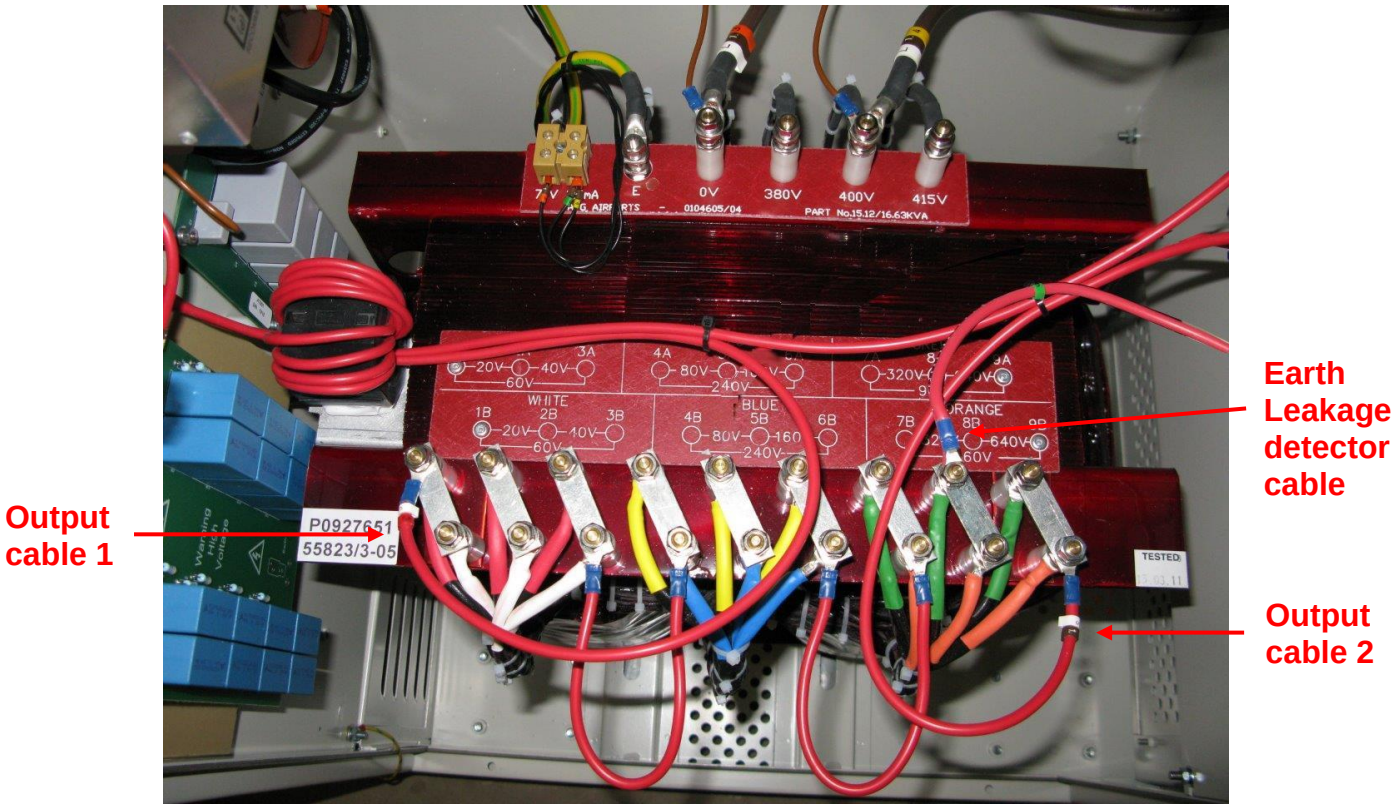


Figure 4-9 Photograph of 6.6A/12.0A Transformer configured for 12.0A, full voltage

To calculate the required CCR output voltage according to the AGL circuit load, refer to Section 7.1

An example of an intermediate output voltage (based on a 6.6A circuit) is shown below. In this case the output voltage is:

$$V4 + V5 + V6 + V10 + V11 + V12$$

Which for a 15KVA regulator is:

$$160 + 320 + 640 + 160 + 320 + 640 = 2240V$$

The transformer connections to give this voltage are shown in Figure 4-10.

Note – when connecting together sections of the secondary windings, ensure that the windings are connected with the correct orientation (phasing), as shown in Figure 4-7 or Figure 4-10. In this way, the voltages from each section will add and not subtract.

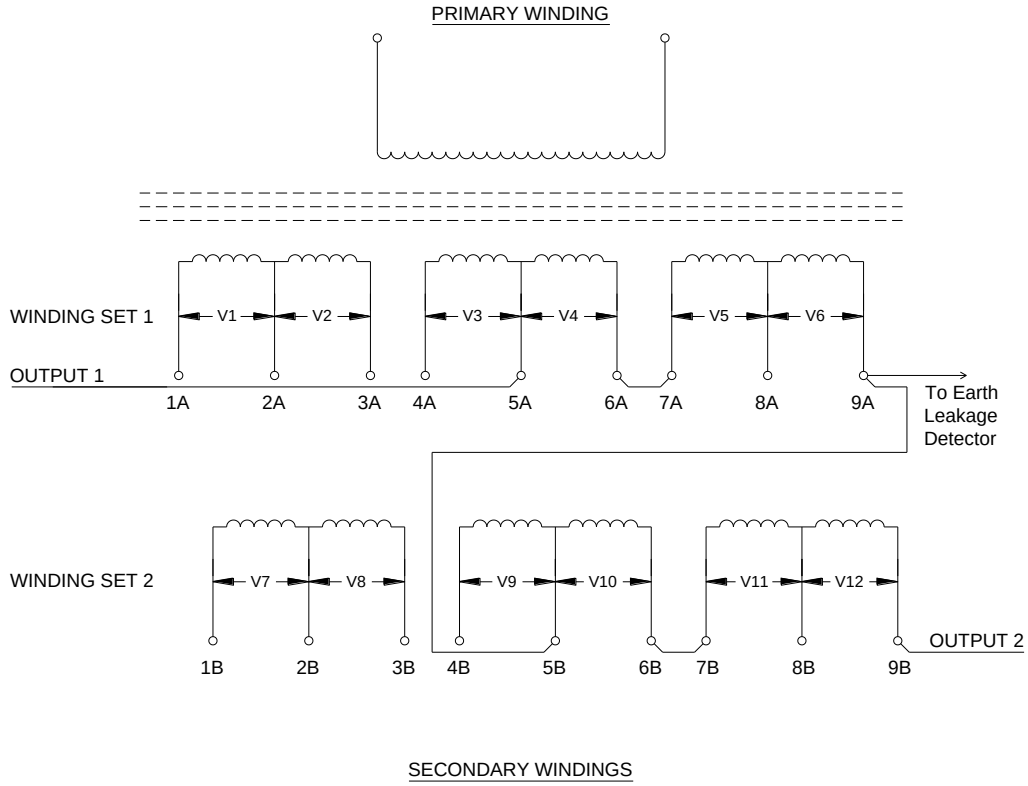


Figure 4-10 6.6A / 12.0A Transformer configured for 6.6A, intermediate voltage

It is important to verify that the transformer output voltage tappings are set to correctly match the load, so that the thyristor conduction period is near to the optimum value at maximum current. This is described in Section 4.3.4

4.3.3 Configuring the Main Transformer for a short circuit load test

When the CCR is to be tested with a shorting link connected to the output in place of the series circuit, only the lowest voltage winding should be connected to the output cables. For a 6.6A transformer this is winding section V1, or for the dual wound 6.6A/12A transformers this would be windings V1 and V7 (where there are two sets of three secondary windings), either connected in series for 6.6A output, or in parallel for 12A output.

Examples are shown in the Figures below; S1 and S2 are the output cables, whilst wire number 5 is for the (optional) earth leakage detector.

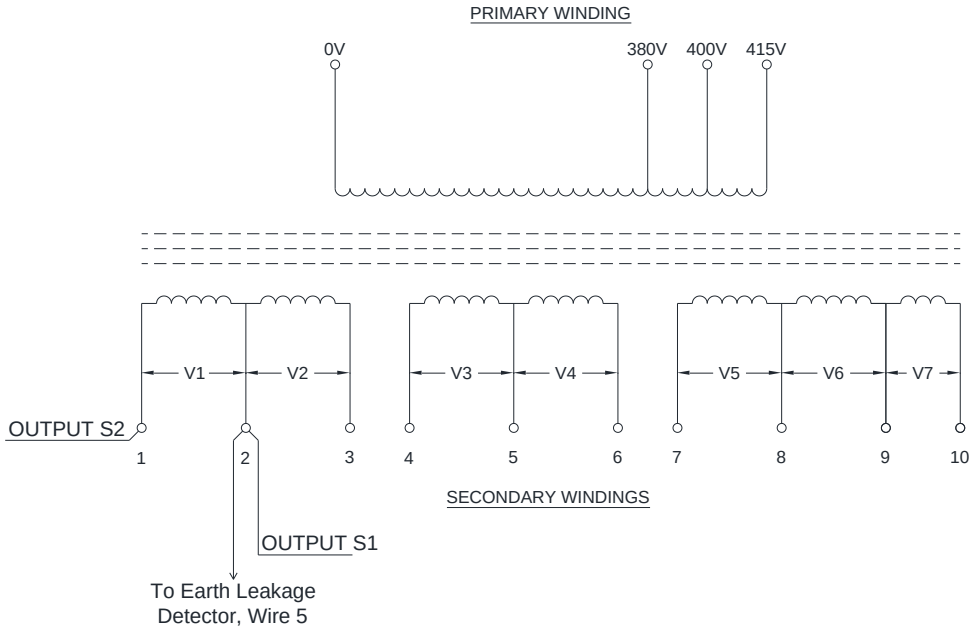


Figure 4-11 6.6A transformer configured for CCR short circuit test, minimum voltage

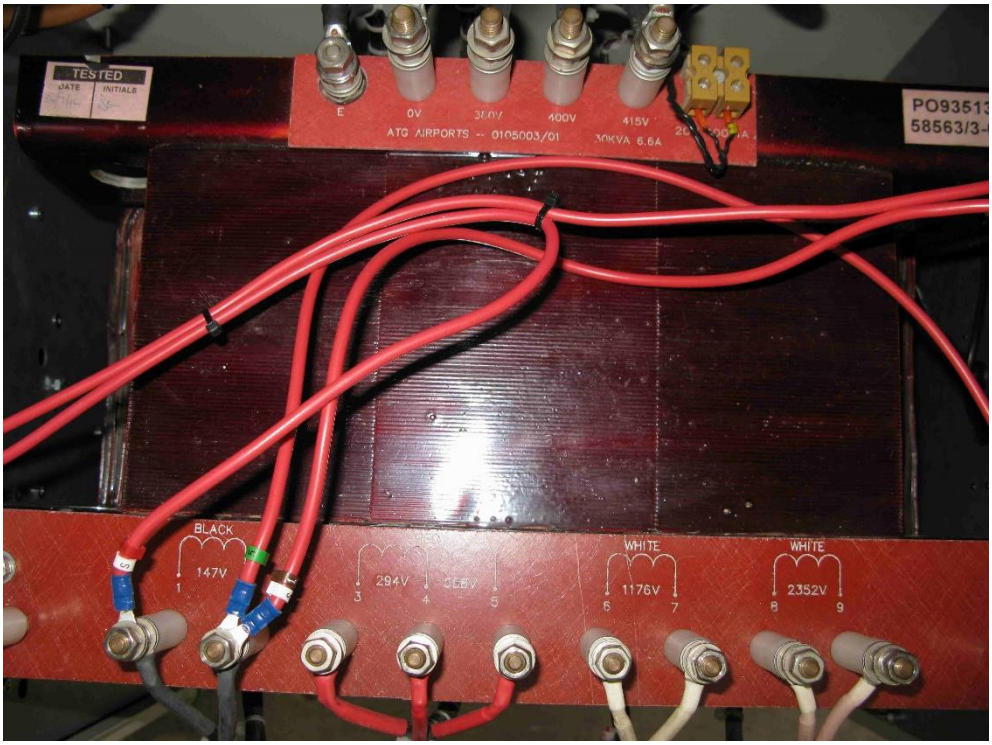


Figure 4-12 Photograph of 6.6A transformer configured for CCR short circuit test, minimum voltage

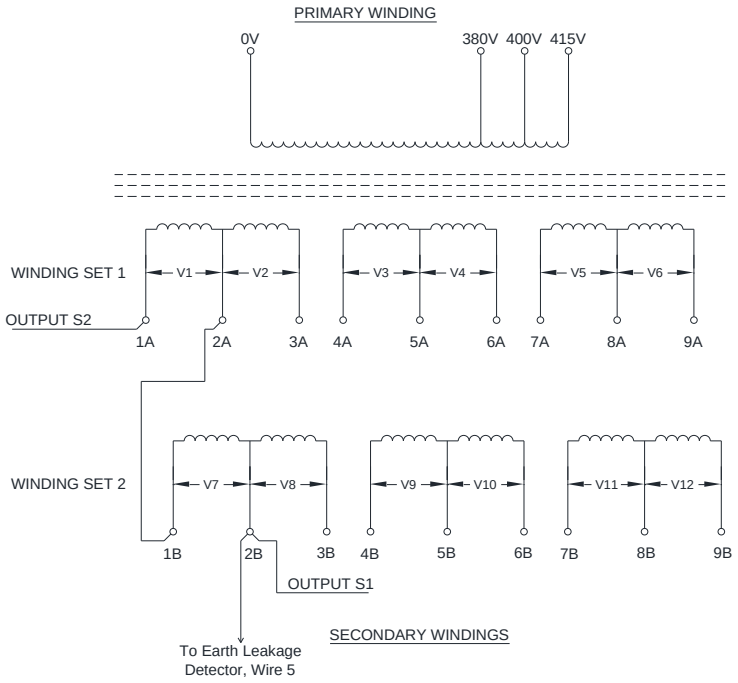


Figure 4-13 6.6A / 12.0A Transformer configured for CCR short circuit test, minimum voltage, at 6.6A output

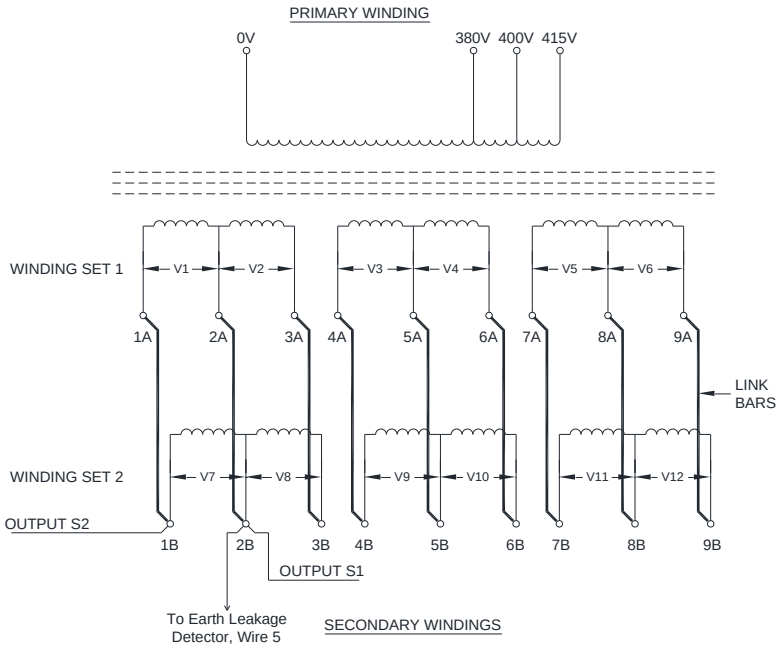


Figure 4-14 6.6A / 12.0A Transformer configured for CCR short circuit test, minimum voltage, at 12A output

4.3.4 Thyristor Conduction Period; Verifying the Transformer Setting

The CCR output voltage should be adjusted to suit the load on the series circuit such that the optimum thyristor conduction period is obtained at maximum output current:

For the majority of CCRs, the optimum thyristor conduction angle is around 121 degrees at maximum output current, which equates to 6.7ms conduction period per half cycle on a 50Hz supply or 5.6ms conduction period per half cycle on a 60Hz supply. This is in order to minimise the supply current harmonics and to achieve a 0.9PF, yet be able to maintain the output current within tolerance with a 10% drop in supply voltage.

For those CCRs of 12.5kVA or above which are built to comply with FAA AC 150/5345-10, the optimum thyristor conduction angle is around 133 degrees at maximum output current, which equates to 7.4ms conduction period per half cycle on a 50Hz supply or 6.16ms conduction period per half cycle on a 60Hz supply. This is in order to minimise the supply current harmonics and to achieve a 0.95PF, yet be able to maintain the output current within tolerance with a 5% drop in supply voltage.

Figure 4-15 shows the output current waveform when the regulator output voltage is set to correctly match the load. The waveform can be observed using an oscilloscope and a current probe clamped over one of the CCR output field cables. Alternatively, the conduction period can be displayed by scrolling down from the ‘Running Mode’ menu to view the ‘Conduction Angle’ display screen; refer to section 8.2.1.7. An example screen is shown below:

O	U	T	P	U	T	:											↑	↓
		6	.	6	0	A				3	5	7	7	V				
C	O	N	D	U	C	T	I	O	N		A	N	G	L	E	:		
1	2	1	º		(	6	.	7	m	s		@		5	0	H	z	)

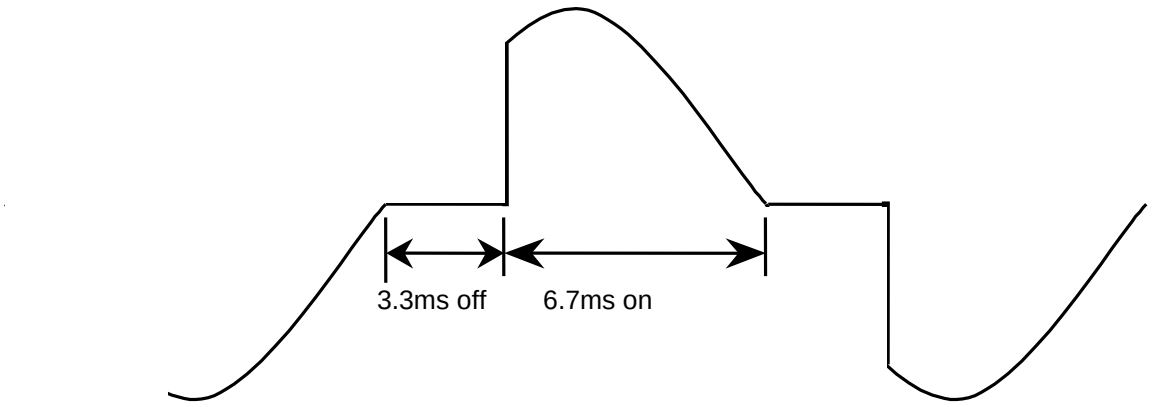


Figure 4-15 Correctly matched CCR Output Current Waveform

If the transformer output voltage is set too high, then the control loop will give a shorter thyristor conduction period to maintain the correct output current. In this case, the CCR supply current will be higher than necessary, the power factor will be worse, and the harmonic current content of both the supply to the CCR, and the output to the AGL primary series circuit, will be worse. However, the CCR will be more tolerant to increases in the series circuit load, and to reductions in the supply voltage.

If, on the other hand, the transformer output voltage is set too low, then there is the possibility that the CCR may not be able to deliver the required output current since full sinusoidal conduction may be reached, (thyristor ‘on’ period of 10ms per half mains cycle) thus limiting the CCR output voltage. In this case, the regulator may trip on ‘Open Circuit’, or give an ‘Under Current’ tolerance alarm.

4.4 Output Voltage and Output Load kVA Monitoring

In order to monitor the CCR output voltage and output load kVA, either of the optional AT1127 PLF or AT1031 PLF / Power Analyser Cards must be fitted. (Note – a PLF card is included in CCRs built to FAA L-829 specification).

The PLF card provides rms measurement of the CCR output voltage, which is then fed to the I^2C serial bus and through the 10-way ribbon cable connector CN1 to the AT1030 Motherboard. The CCR can then be programmed to display output voltage and output load kVA, and also to give an alarm signal if the output load kVA drops by 10% or more at any particular brilliancy.

In order that the CCR output voltage and load kVA can be correctly displayed, the output voltage of the CCR Main Transformer tappings, as connected, should be programmed in via the keypad menu system. Refer to Section 4.4.2 below. Potentiometer RV3 (OP V MSR CAL) on the AT1031 card or RV4 (VFB CAL) on the AT1127 card are used to calibrate the voltage feedback. These are set during factory testing and should not require further adjustment. Do not adjust these potentiometers to correct the displayed value if the tapping voltage used has not been correctly programmed in.

The following sections describe how to use these additional features.

4.4.1 Output Voltage Monitoring Enable

Providing that either the AT1127 PLF Card or AT1031 PLF / Power Analyser Card is fitted and their operation enabled, then the CCR output voltage may be displayed on the ‘Running Mode’ screen, alongside the CCR output current. The output load kVA can also be displayed by scrolling down from the ‘Running Mode’ screen.

Enabling the operation of these cards is done via the ‘PLF/PWR ANALYSER CARD IN USE‘ screen in the Engineering Configuration Menu; refer to Section 8.4.2.2. Note – this is normally set during factory testing of the CCR.

4.4.2 Programming the Output Transformer Tapping Voltage

To correctly monitor the output voltage and output load kVA of the CCR, the actual tapping voltage used on the Main CCR Output Transformer must be entered. If this is not done, then the displayed output voltage and load kVA will not be correct. The actual transformer output voltage is the sum of all sections of the transformer secondary windings that are connected in series. Using the example of Figure 4-4, this would be 2065v

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	M	A	I	N		T	R	A	N	S	F	O	R	M	E	R		↑	↓
	T	A	P	P	I	N	G		V	O	L	T	A	G	E	:			
					1	V													

Press the selector and the arrow (→) moves to the bottom line to indicate that the tapping voltage can now be entered:

	M	A	I	N		T	R	A	N	S	F	O	R	M	E	R	↑	↓
	T	A	P	P	I	N	G		V	O	L	T	A	G	E	:		
→		0	0	0	1	V												

Load the total output transformer tapping voltage that has been connected, one digit at a time, by turning the Rotary Menu Selector and then pressing to enter. (The transformer tapping voltage can be set between 1 and 5000 Volts). After the last digit has been entered the cancel / confirm change screen will be displayed:

	M	A	I	N		T	R	A	N	S	F	O	R	M	E	R	↑	↓
	T	A	P	P	I	N	G		V	O	L	T	A	G	E	:		
→		C	A	N	C	E	L		C	H	A	N	G	E				
		C	O	N	F	I	R	M		C	H	A	N	G	E			

Turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves to 'CONFIRM CHANGE', and then press the menu selector.

4.4.3 kVA Alarm Enable

If 'Output Voltage Monitoring' is activated, then 'KVA Alarm' can also be enabled (this function is always enabled on FAA L-829 regulators). This generates an alarm if the CCR output load kVA drops below 90% of the peak measured load value for the brilliancy step in operation, for a period of 5 seconds.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	K	V	A		A	L	A	R	M	:							↑	↓
		D	I	S	A	B	L	E	D									

Press the menu selector so that the following screen is displayed:

	K	V	A		A	L	A	R	M	:							↑	↓
		E	N	A	B	L	E	D										
→		D	I	S	A	B	L	E	D									

Turn the Rotary Menu Selector clockwise so that the arrow (→) moves to 'ENABLED', then press the menu selector. The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu.

4.5 Commissioning the Earth Leakage Measurement System

Each AGL lamp module is isolated from the high voltage primary series loop circuit by an AGL transformer. The joints connecting the primary windings of these AGL transformers to the series loop cables tend to leak and allow water to penetrate into the transformer. This causes earth faults on the primary loop internally within the transformer, or from the cable joint itself to earth.

This causes two problems:

i) If more than one earth fault develops, then sections of the AGL circuit between the faults can be shorted out. This results in reduced brilliancy levels, or sections of the lamp circuit may switch off altogether.

ii) More importantly, having an earth leakage path presents a safety hazard. The CCR output circuit is isolated from the mains power supply and from earth by the CCR main power transformer. However, if there is leakage to earth at one or more points in the primary series field circuit there will now be a potential difference between other sections of the circuit and earth, and this could be up to several thousand volts for a high power regulator. If personnel come into contact with the high voltage cables under these conditions, this could, depending on the earth leakage resistance and hence the level of current flow through the contactee, result in a lethal electric shock.

For these reasons, it is necessary to detect earth faults before they become a problem.

This section describes commissioning of the **atg airports** Earth Leakage Resistance Measurement system, which is based on the AT699 and AT709 Cards. This system provides a measurement of the resistance to earth of the Primary Series Loop Circuit using two test modes:

i) Continuously when the CCR is operating (and optionally in standby), using a test voltage of 500V DC.

ii) Manual test using a voltage of 1000V DC. Note - this test is only available when the CCR is set to “OFF”. (Performance of this test is described in Section 8.2.2).

Configuration of the Earth Leakage Measurement System operating parameters is described in Section 4.5.2.

Two resistance alarm thresholds are provided, the levels of which can be individually set. The Stage 1 Alarm and Stage 2 Alarm / Trip Threshold levels should be set according to the CCR kVA rating and the Primary Series Loop Circuit characteristics. For reasons of safety, it is recommended that the Stage 2 threshold is programmed to trip the CCR.

The actual resistance measurement circuit is calibrated during factory testing and does not require adjustment during commissioning of the CCR. Note – the

continuous 500V DC test is for indication only; for accurate measurements the 1000V DC manual test should be used.

4.5.1 Calculation of Earth Leakage Resistance Alarm and Trip points

The first part of the commissioning procedure involves the calculation of the desired (Stage 1) Alarm and (Stage 2) Trip thresholds. These should be set according to the CCR rating, and to match the particular AGL Primary Series Loop Circuit.

For an AGL Primary Series Loop Circuit WITHOUT a breakdown of the insulation to earth, the leakage resistance is dependent on the total number of AGL transformers fitted, and the total length of the AGL cable.

4.5.1.1 Calculation of Stage 1 Alarm Threshold

Calculate the Stage 1 Alarm Threshold Resistance as follows:

Stage 1 Alarm Threshold Resistance (Ω) = (1.5 x Maximum CCR output voltage) / ((0.4µA x number of AGL transformers) + (0.01µA x total cable length in km))

The resulting resistance value should be programmed in as described in Section 4.5.2.2.

An example calculation is shown below:

An 8km long series loop circuit is fitted with 200 AGL transformers, and powered from a 7.5kVA regulator. The circuit is rated at 6.6A.

The maximum CCR output voltage is 1147V (when operating at 6.6A).

Stage 1 Alarm Threshold Resistance (Ω) = (1.5 x 1147V) / ((0.4µA x 200) + (0.01µA x 8))

Stage 1 Alarm Threshold Resistance (Ω) = 1720.5V / ((80 x 10^{-6}) + (0.08 x 10^{-6}))A

Stage 1 Alarm Threshold Resistance (Ω) = 21.5MΩ

Owing to the programming steps, the threshold should be set to 20MΩ

4.5.1.2 Calculation of Stage 2 Trip Threshold

The Stage 2 Trip Threshold should be set so as to limit the maximum current that could be conducted to anybody who may come into contact with the AGL Series Loop cables to a level below 10mA. This is the threshold of let go, and therefore the contactee should be able to disengage before a fatal electric shock is received. It is recommended, therefore, that the Stage 2 Threshold should be programmed to trip out the CCR, rather than just triggering an alarm. See Section 4.5.2.2

NOTE – THE OPERATION OF THE EARTH LEAKAGE RESISTANCE MEASUREMENT CIRCUITRY DOES NOT GUARANTEE THAT THE HIGH VOLTAGE OUTPUT FROM THE CONSTANT CURRENT REGULATOR WOULD BE CUT BEFORE A LETHAL ELECTRIC SHOCK COULD BE RECEIVED BY PERSONNEL COMING INTO CONTACT WITH THE PRIMARY SERIES LOOP CONDUCTORS. THE EARTH LEAKAGE MODULE IS DESIGNED ONLY AS AN AID TO SAFETY.

NORMAL SAFE WORKING PROCEDURES SHOULD ALWAYS BE STRICTLY ADHERED TO. BEFORE WORKING ON THE PRIMARY SERIES LOOP CABLING, OR ANY AGL TRANSFORMERS CONNECTED TO THE PRIMARY SERIES LOOP, ENSURE THAT THE CCR FEEDING THE CIRCUIT IS SWITCHED OFF, AND THAT THE MAINS POWER TO THE CCR IS ISOLATED AND LOCKED OFF. IT IS ALSO RECOMMENDED TO CONNECT THE AGL FIELD CABLES TO EARTH TO DISSIPATE ANY STORED CHARGE OR INDUCED EMF.

The Stage 2 Trip Threshold should be calculated as follows:

Stage 2 Trip Threshold Resistance (Ω) = Maximum CCR output voltage / I_B

where I_B = maximum body current, 10mA

The resulting resistance value should be programmed in as described in Section 4.5.2.2.

An example based on a 7.5kVA regulator operating on a 6.6A circuit would give:

Stage 2 Trip Threshold Resistance (Ω) = 1147V / 10mA

Stage 2 Trip Threshold Resistance (Ω) = 115kΩ

Owing to the programming steps, the threshold should be set to 120kΩ

4.5.2 Programming the Earth Leakage System

4.5.2.1 Earth Leakage Resistance Measurement System Configuration

The setting on this screen can be selected between ‘ENABLED’, ‘CONTINUOUS ENABLED’ and ‘DISABLED’. (Note - if the optional AT699 and AT709 cards are not fitted to the CCR then this setting should be left as ‘DISABLED’).

Setting to ‘ENABLED’ provides an earth leakage resistance measurement whilst the CCR is operating using a 500V DC test voltage, and with the possibility to perform a manual test measurement using a 1000V DC test voltage when the Brilliancy Control selector is set to ‘LOCAL OFF’ (refer to section 8.2.2). The ‘ENABLED’ setting will have been selected during factory testing of the CCR if the earth leakage measurement cards are fitted.

Setting to ‘CONTINUOUS ENABLED’ provides an earth leakage resistance measurement whilst the CCR is operating AND when in the ‘OFF’ state, using a 500V DC test voltage. This mode should be used with caution due to the continuous

presence of the DC test voltage on the CCR output circuitry and output field cables even when the CCR is switched off.

To view or change the setting, first enter the Set-up Menu as described in Section 8.3, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	E	A	R	T	H		L	E	A	K	A	G	E				↑	↓
	M	E	A	S	U	R	E	M	E	N	T		C	O	N	F	I	G	:
		E	N	A	B	L	E	D											

The configuration will be set to 'ENABLED' during factory testing if the Earth Leakage Measurement Module is fitted to the CCR.

Press the selector and the screen will change to show the following options, with the arrow (→) moving down to indicate that the setting can now be changed:

	E	A	R	T	H		L	E	A	K	A	G	E				↑	↓
	M	E	A	S	U	R	E	M	E	N	T		C	O	N	F	I	G	:
→		E	N	A	B	L	E	D											
		C	O	N	T	I	N	U	O	U	S		E	N	A	B	L	E	D

Turning the Rotary Menu Selector anticlockwise scrolls down to the other available setting:

	E	A	R	T	H		L	E	A	K	A	G	E				↑	↓
	M	E	A	S	U	R	E	M	E	N	T		C	O	N	F	I	G	:
		C	O	N	T	I	N	U	O	U	S		E	N	A	B	L	E	D
→		D	I	S	A	B	L	E	D										

Turn the Rotary Menu Selector to scroll up or down to set the arrow (→) alongside the desired setting, then press to select that option.

The cancel / confirm change screen will now be shown. Turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu.

4.5.2.2 Programming the Earth Leakage Resistance Alarm and Trip Points

Note – the following screens are not available if the Earth Leakage Measurement is set to 'DISABLED'.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	E	A	R	T	H		L	E	A	K	A	G	E				↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D				
	S	T	A	G	E		1	:											
				1	0		M	Ω											

Press the selector and the arrow (→) will move down to the bottom line to indicate that the setting can now be changed:

	E	A	R	T	H		L	E	A	K	A	G	E				↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	:		
	S	T	A	G	E		1	:										
→				1	0		M	Ω										

The required Earth Leakage Stage 1 Alarm Threshold level can now be set; the valid range is between 5 kΩ and 40 MΩ; the default value is 10 MΩ. Turn the Rotary Menu Selector to increment or decrement the value; turning anticlockwise below 5 kΩ selects 'DISABLED' for this alarm and turning further causes the value to loop round to 40 MΩ.

After adjusting the value press the selector; the cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu back to Menu 2, the Set-up menu.

Now turn the Rotary Menu Selector anticlockwise by one click to scroll down to the following screen:

→	E	A	R	T	H		L	E	A	K	A	G	E				↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	:		
	S	T	A	G	E		2	:										
			2	0	0		k	Ω										

Press the selector and the arrow (→) will move down to the bottom line to indicate that the setting can now be changed:

	E	A	R	T	H		L	E	A	K	A	G	E				↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	:		
	S	T	A	G	E		2	:										
→			2	0	0		k	Ω										

The required Earth Leakage Stage 2 Alarm / Trip Threshold level can now be set; the valid range is between 5 kΩ and 40 MΩ; the default value is 200 kΩ. Turn the Rotary Menu Selector to increment or decrement the value; turning anticlockwise below 5 kΩ selects 'DISABLED' for this alarm and turning further causes the value to loop round to 40 MΩ.

After adjusting the value press the selector; the cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu back to Menu 2, the Set-up menu.

4.5.2.3 Stage 2 Earth Leakage Trip Enable

The Stage 2 Earth Leakage Resistance Threshold can be programmed either to activate an alarm or to trip out the CCR. For reasons of safety, **atg airports** recommend that the Stage 2 Earth Leakage Threshold should be set to trip out the CCR. This functionality is programmed as follows:

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	E	A	R	T	H		L	E	A	K	A	G	E					↑	↓
	S	T	A	G	E		2		T	R	I	P	:						
		E	N	A	B	L	E	D											

Press the selector and the screen will change to show the following options, with the arrow (→) moving down to indicate that the setting can now be changed:

	E	A	R	T	H		L	E	A	K	A	G	E					↑	↓
	S	T	A	G	E		2		T	R	I	P	:						
→		E	N	A	B	L	E	D											
		D	I	S	A	B	L	E	D										

Select between ‘ENABLED’ and ‘DISABLED’ by turning the Rotary Menu Selector to set the arrow (→) alongside the desired setting, then press the Rotary Menu Selector.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits the submenu.

4.6 Commissioning the Percentage Lamp Failure System

The Percentage Lamp Failure System is available as an option on the Micro 100+ CCR. This system is usually based on the AT1127 PLF Card, which is a daughter board which is fitted to the AT1030 Motherboard. (Note – a PLF Card is always included in the CCRs built to comply with the FAA L-829 specification). The card generates an error signal that is a function of the number of failed lamps on the AGL circuit. Note – some CCRs will use the AT1031 PLF / Power Analyser Card (also a daughter board for the AT1030), or the earlier stand-alone AT642 PLF Card. Both cards give the same PLF functionality as described below for the AT1127, but the AT1031 operation is implemented in software rather than hardware.

The error signal is produced by comparing the rise time of the CCR output transformer voltage waveform with that of the current waveform, at the point when the thyristors are triggered. An AGL circuit with all the lamps working is largely resistive; however, when lamps fail the load becomes more inductive (due to the open circuited ground transformer now presenting an inductive load), which results in the rising edge of the current waveform lagging that of the voltage waveform. The time lag between the two waveforms is used to generate an error signal; this is compared with threshold levels which, when exceeded, trigger the PLF alarms.

Note - the system is designed to be used with AGL transformers feeding tungsten lamps; when the lamp fails open circuit the load on the transformer secondary becomes open circuit, and the primary presents an inductive load. Circuits composed of LED fittings may not behave in the same way if the fitting develops a fault, unless they specifically include a facility to open circuit the input to the fitting in the event of a fault. Only in the latter case would the CCR PLF system operate correctly.

The PLF error signal is fed to the I^2C serial bus and, via the 10-way ribbon cable connector CN1, to the AT1030 Motherboard. Using this signal, the Microcontroller is able to calculate the percentage of lamps failed, or, if the total number of lamps on the circuit is programmed in, it can display the number of lamps failed.

The system can be calibrated in two ways: by performing a Quick Auto Calibration with all lamps intact, or more accurately, by performing a Full Calibration with the actual number of lamps removed corresponding to the required alarm points.

The generated PLF error signal under any given percentage of failed lamps will be dependent on the particular AGL circuit characteristics. For example, a particular level of error signal may be produced at 1% of failed lamps on one AGL circuit, and 2% on another circuit. For this reason, the most accurate method to calibrate the system is by either removing lamps from the AGL circuit, or temporarily introducing additional AGL transformers into the circuit, without lamps connected. For example, if a 2% alarm setting is required on a circuit with 100 lamps, connect two additional transformers (of the same VA rating as those in the field circuit) with the secondary connections open circuit, or remove two lamps from the AGL field circuit.

Even the Full Calibration method is partially automated, and any non-linearity in the

PLF error signal over different CCR Brilliancy levels is automatically accounted for. It is recommended though, that the Full Calibration method is done with the number of lamps removed corresponding to the desired alarm thresholds for the 2 Stages.

WARNING – always turn the CCR off and isolate the power supply, and it is recommended to earth down the AGL cables at the CCR output before connecting or disconnecting AGL transformers and / or AGL lamps. The open circuited secondary connections from an AGL transformer can generate high voltages. Ensure that these connections are well insulated during this test, and that personnel do not come into contact with them.

The Full Calibration method is, however, complex and time consuming, and for most applications the Quick Auto Calibration method, using a pre-loaded lamp failure threshold detection curve, will be adequate.

Note – the characteristic of the series loop circuit, as regards the behaviour of the PLF system, changes dependant on the condition of the ground, particularly whether the ground is wet or dry. It is therefore recommended to recalibrate the PLF system every 6 months, especially after a change in weather conditions.

To Set-up the PLF System, the initial AT1127 PLF pcb settings should be made, followed by programming in the number of lamps on the circuit, alarm threshold levels etc, then performing either a Quick or Full Calibration. These are described below.

4.6.1 AT1127 PLF Card Initial Settings

The initial settings for the AT1127 PLF Card listed in Table 4-8 should already have been made during factory testing of the CCR, but should be verified. This should be done with the regulator powered up, but in the ‘OFF’ state. A digital voltmeter will be required to check these; use TP2 or TP15 as the 0V connection.

Jumper link J6 should be fitted between the upper and centre pins for high sensitivity (standard setting), which detects up to a maximum of around 16% lamp outage, or between the lower and centre pins for a range up to around 32%.

Parameter:	Notes:	Measurement Point:	Adjust:	Required setting or measurement:
Voltage waveform rising edge comparator threshold (VTH)	Regulators rated at 7.5KVA and above	TP5	RV2 (VTH)	–1.63v DC +/- 0.02v
	Regulators rated at less than 7.5KVA	TP5	RV2 (VTH)	0.00v DC +/- 0.02v
Current waveform rising edge comparator threshold (ITH)	Regulators rated at 7.5KVA and above	TP1	RV1 (ITH)	–1.63v DC +/- 0.02v
	Regulators rated at less than 7.5KVA	TP1	RV1 (ITH)	–2.42v DC +/- 0.02v

Table 4-8 AT1127 Percentage Lamp Failure Card initial settings

4.6.2 Enabling the PLF System and Operating Settings

The PLF settings need to be programmed via the menu system; enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screens. Note - if the optional AT1127 PLF Card or AT1031 PLF / Power Analyser Card is fitted to the CCR, then the PLF Detection Configuration will have been set during factory testing to either 'ENABLED' or 'ENABLED FAA STYLE'; with this enabled all the other PLF sub-menus will now be available for setting up and calibrating the PLF system. (Refer also to section 8.3.2.16). The second sub-menu – PLF Alarm Delay Time – is set by default to 15 seconds and will not normally require adjustment.

4.6.2.1 Percentage Lamp Failure Detection Configuration

This is the first of the PLF set-up screens; if the optional AT1127 PLF Card or AT1031 PLF / Power Analyser Card is fitted to the CCR, then this will have been factory set to 'ENABLED' or 'ENABLED FAA STYLE'.

→	%		L	A	M	P		F	A	I	L	U	R	E				↑	↓
	(	P	L	F	)		C	O	N	F	I	G	U	R	A	T	I	O	N
		E	N	A	B	L	E	D											

Press the selector and the screen will change to show the following options, with the arrow (→) moving down to indicate that the setting can now be changed:

	%		L	A	M	P		F	A	I	L	U	R	E				↑	↓
	(	P	L	F	)		C	O	N	F	I	G	U	R	A	T	I	O	N
→		E	N	A	B	L	E	D											
		E	N	A	B	L	E	D		F	A	A		S	T	Y	L	E	

Turning the Rotary Menu Selector anticlockwise scrolls down to the other available setting:

	%		L	A	M	P		F	A	I	L	U	R	E				↑	↓
	(	P	L	F	)		C	O	N	F	I	G	U	R	A	T	I	O	N
		E	N	A	B	L	E	D		F	A	A		S	T	Y	L	E	
→		D	I	S	A	B	L	E	D										

The setting on this screen can be selected between ‘ENABLED’, ‘ENABLED - FAA STYLE’ and ‘DISABLED’. If the AT1127 PLF Card is not fitted to the CCR then this setting should be left as ‘DISABLED’.

The ‘ENABLED - FAA STYLE’ means that after the pre-set number of lamps has failed, the monitor can be put into a degraded operation mode by resetting the alarm. When in the degraded operation mode, the monitor will reactivate the alarm upon the failure of an additional pre-set number of lamps (one to five).

Turn the Rotary Menu Selector to scroll up or down to set the arrow (→) alongside the desired setting, then press to select that option.

The cancel / confirm change screen will now be shown:

	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	(	P	L	F	)		C	O	N	F	I	G	U	R	A	T	I	O	N
→		C	A	N	C	E	L		C	H	A	N	G	E					
		C	O	N	F	I	R	M		C	H	A	N	G	E				

Turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits the submenu.

4.6.2.2 Total Number of Lamps in the Circuit

In order to correctly indicate the number of open circuit (failed) lamps, it is necessary to enter in the total number of lamps fitted to the circuit powered by the CCR.

Turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	N	U	M	B	E	R		L	A	M	P	S		I	N		C	C	T
		1	0	0															

Press the selector and the arrow (→) moves to the bottom line to indicate that the value for the total number of lamps fitted to the circuit can now be programmed in:

	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	N	U	M	B	E	R		L	A	M	P	S		I	N		C	C	T
→		1	0	0															

Enter the number of lamps one digit at a time (total of 3 digits) using the Rotary Menu Selector to scroll up and down, and then press the selector button after each digit is set. The permissible setting is between 1 and 400

When all digits have been entered the cancel / confirm change screen will be displayed:

	%		L	A	M	P		F	A	I	L	U	R	E				↑	↓
	N	U	M	B	E	R		L	A	M	P	S		I	N		C	C	T
→		C	A	N	C	E	L		C	H	A	N	G	E					
		C	O	N	F	I	R	M		C	H	A	N	G	E				

Turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits this submenu and shows the new programmed value. (Note – the quantity of lamps has been left at the default value of 100 for the following example screens).

→	%		L	A	M	P		F	A	I	L	U	R	E				↑	↓
	N	U	M	B	E	R		L	A	M	P	S		I	N		C	C	T
		1	0	0															

4.6.2.3 Alarm Threshold levels

The required Stage 1 and Stage 2 Percentage Lamp Failure alarm thresholds now need to be programmed.

Turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	%		L	A	M	P		F	A	I	L	U	R	E				↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	S	:		
		S	1	:				5		L	A	M	P	S	-			5	%
		S	2	:			1	0		L	A	M	P	S	-		1	0	%

Press the selector and the following advisory screen will be displayed:

→	N	O	T	E	:														
	C	A	L	I	B	R	A	T	E		P	L	F		A	T			
	T	R	I	P		P	O	I	N	T	S		F	O	R				
	B	E	S	T		A	C	C	U	R	A	C	Y						

This means that the calibration procedure described in the next section should be performed to achieve the best accuracy of the alarm thresholds.

Press the selector and the following screen will be displayed:

	%		L	A	M	P		F	A	I	L	U	R	E				↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	S	:		
→		E	X	I	T														
		S	1	:				5		L	A	M	P	S	-			5	%

Turn the Rotary Menu Selector anticlockwise to set the arrow (→) alongside the Stage 1 PLF setting:

	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	S	:	
		E	X	I	T													
→		S	1	:				5		L	A	M	P	S	-		5	%

With the arrow (→) alongside the Stage 1 PLF setting, press the selector to show the following screen:

	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D		S	E	T
→		S	1	:				5		L	A	M	P	S	-		5	%

Turn the Rotary Menu Selector to increment or decrement the threshold for the number of lamps out; the range is from 1 to the total number of lamps entered for that circuit. Turning the selector anticlockwise below 1 causes the value to loop round to the total number. Note - the value for the percentage of the total is automatically calculated and displayed.

After adjusting the value press the selector; the cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits the submenu back to this screen:

	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	S	:	
→		E	X	I	T													
		S	1	:				5		L	A	M	P	S	-		5	%

Turn the rotary selector anticlockwise to place the arrow (→) alongside the Stage 2 PLF setting:

	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	S	:	
		S	1	:				5		L	A	M	P	S	-		5	%
→		S	2	:			1	0		L	A	M	P	S	-	1	0	%

With the arrow (→) alongside the Stage 2 PLF setting, press the selector to show the following screen:

	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D		S	E	T
→		S	2	:			1	0		L	A	M	P	S	-		1	0	%

Turn the Rotary Menu Selector to increment or decrement the threshold for the number of lamps out.

After adjusting the value press the selector; the cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu back to this screen:

	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	S	:		
→		E	X	I	T													
		S	1	:				5		L	A	M	P	S	-		5	%

With the arrow (→) alongside 'EXIT', press the selector to return to the original 'Alarm Threshold' screen in the setup menu.

→	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	S	:		
		S	1	:				5		L	A	M	P	S	-		5	%
		S	2	:			1	0		L	A	M	P	S	-		1	0	%

4.6.3 PLF System Calibration

4.6.3.1 Quick PLF Auto Calibration

The Quick Auto Calibration method uses a pre-loaded lamp failure threshold detection curve, and for most requirements this will give adequate detection of the number of failed lamps.

To perform a Quick Auto Calibration of the PLF, all lamps of the circuit must be intact; the system will sample the PLF error signal in the normal circuit condition and add in threshold levels to give an indication of the number of lamps that may fail.

Turn the power to the CCR back on, but leave the Brilliancy Control Selector switch in the 'Off' position. Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen.

→	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	C	A	L	I	B	R	A	T	I	O	N	:						

Press the menu selector; the screen will change to:

	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	C	A	L	I	B	R	A	T	I	O	N	:						
→		E	X	I	T													
		Q	U	I	C	K		C	A	L	I	B	R	A	T	I	O	N

Turn the Rotary Menu Selector to set the arrow against 'QUICK CALIBRATION' then follow the instructions to run the calibration routine. WARNING – the CCR will operate at all levels of brilliancy in order to sample the error signal from the PLF card.

After completing the calibration, with the arrow (→) alongside 'EXIT', press the

selector to return to the original screen and exit the Set-up menu as described in section 8.3.2.25

4.6.3.2 Full PLF Calibration

To achieve the most accurate indication of the number of failed lamps on the circuit, the PLF system requires calibration by sampling the AT1127 Card PLF error signal with lamps removed / AGL transformers open circuited at two levels of open circuit lamps. The error signal can then be calculated for all levels in between. It is recommended, however, that for the most accurate operation, the calibration be done with the number of lamps removed / AGL transformers open circuited that correspond to the two alarm points (2 Stages) that will be used.

WARNING – always turn the CCR off and isolate the power supply, and it is recommended to earth down the AGL cables at the CCR output before connecting or disconnecting AGL transformers and / or AGL lamps. The open circuited secondary connections from an AGL transformer can generate high voltages. Ensure that these connections are well insulated during this test, and that personnel do not come into contact with them.

i/ Switch off the CCR and isolate the power supply. Remove a number of lamps from the field circuit or connect additional AGL transformers in series with the CCR output (same VA rating as those in the field circuit, with the secondary connections open circuited). The number of lamps removed (or open circuit transformers connected) should preferably correspond to the lower of the required alarm thresholds (Stage 1 PLF), programmed as described in Section 4.6.2.3, above.

Turn the power to the CCR back on, but leave the Brilliancy Control Selector switch in the ‘Off’ position. Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen.

→	%		L	A	M	P		F	A	I	L	U	R	E				↑	↓
	C	A	L	I	B	R	A	T	I	O	N	:							

Press the menu selector; the screen will change to:

	%		L	A	M	P		F	A	I	L	U	R	E				↑	↓
	C	A	L	I	B	R	A	T	I	O	N	:							
→		E	X	I	T														
		Q	U	I	C	K		C	A	L	I	B	R	A	T	I	O	N	

Turn the Rotary Menu Selector to reveal the following selection:

	%		L	A	M	P		F	A	I	L	U	R	E				↑	↓
	C	A	L	I	B	R	A	T	I	O	N	:							
→		C	A	P	T	U	R	E		P	L	F		E	R	R		L	1
		C	A	P	T	U	R	E		P	L	F		E	R	R		L	2

With the arrow (→) alongside the 'CAPTURE PLF ERR L1' parameter, press the menu selector; the screen will change to:

	%		L	A	M	P		F	A	I	L	U	R	E		↑	↓
	C	A	L	I	B	R	A	T	I	O	N	:					
→		E	N	T	E	R		N	U	M		O	C		L	A	M	P	S
		F	O	R		L	1		C	A	P	T	U	R	E	:			5

Turn the Rotary Menu Selector to set the number of lamps removed / AGL transformers open circuited for this calibration point, and confirm by pressing the selector switch. If the setting used is different to that programmed for the PLF Stage 1 alarm threshold set in Section 4.6.2.3 above, then the following screen will be displayed, otherwise it will go directly to the warning screen:

→	F	O	R		B	E	S	T		A	C	C	U	R	A	C	Y		
	C	A	L	I	B	R	A	T	E		W	I	T	H		N	U	M	
	O	C		L	A	M	P	S		E	Q	U	A	L		T	O		
	S	T	A	G	E		1		A	L	A	R	M		P	O	I	N	T

Press the menu selector; the screen will change to:

W	A	R	N	I	N	G		C	C	R		O	U	T	P	U	T	↑	↓
W	I	L	L		E	N	E	R	G	I	S	E							
→		C	A	N	C	E	L												
		C	O	N	T	I	N	U	E										

Turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves alongside 'CONTINUE', then press the selector again to record the PLF Card error signals for level one calibration. After running and automatically recording the error signal at each Brilliancy level, the CCR will switch off, and the screen will revert back to the 'Calibrate PLF' screen.

ii/ Repeat the procedure for the second calibration point, as follows.

Switch off the CCR and isolate the power supply. Remove a number of lamps from the field circuit or connect additional AGL transformers in series with the CCR output (with the secondary connections open circuited). The number of lamps removed (or open circuit transformers connected) should preferably correspond to the higher of the required alarm thresholds (Stage 2 PLF), programmed as described in Section 4.6.2.3 above.

Turn the power to the CCR back on, but leave the Brilliancy Control Selector switch in the 'Off' position. Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen.

→	%		L	A	M	P		F	A	I	L	U	R	E				↑	↓
	C	A	L	I	B	R	A	T	I	O	N	:							

Press the menu selector; the screen will change to:

	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	C	A	L	I	B	R	A	T	I	O	N	:						
→		E	X	I	T													
		Q	U	I	C	K		C	A	L	I	B	R	A	T	I	O	N

Turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves alongside the 'CAPTURE PLF ERR L2' parameter:

	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	C	A	L	I	B	R	A	T	I	O	N	:						
		C	A	P	T	U	R	E		P	L	F		E	R	R	L	1
→		C	A	P	T	U	R	E		P	L	F		E	R	R	L	2

Press the menu selector; the screen will change to:

	%		L	A	M	P		F	A	I	L	U	R	E			↑	↓
	C	A	L	I	B	R	A	T	I	O	N	:						
→		E	N	T	E	R		N	U	M		O	C		L	A	M	P	S
		F	O	R		L	2		C	A	P	T	U	R	E	:		1	0

Turn the Rotary Menu Selector to set the number of lamps removed / AGL transformers open circuited for this calibration point, and confirm by pressing the selector switch. If the setting used is different to that programmed for the PLF Stage 1 alarm threshold set in Section 4.6.2.3 above, then the following screen will be displayed, otherwise it will go directly to the warning screen:

→	F	O	R		B	E	S	T		A	C	C	U	R	A	C	Y		
	C	A	L	I	B	R	A	T	E		W	I	T	H		N	U	M	
	O	C		L	A	M	P	S		E	Q	U	A	L		T	O		
	S	T	A	G	E		2		A	L	A	R	M		P	O	I	N	T

Press the menu selector; the screen will change to:

W	A	R	N	I	N	G		C	C	R		O	U	T	P	U	T	↑	↓
W	I	L	L		E	N	E	R	G	I	S	E							
→		C	A	N	C	E	L												
		C	O	N	T	I	N	U	E										

Turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves alongside 'CONTINUE', then press the selector again to record the PLF Card error signals for level two calibration. After running and automatically recording the error signal at each Brilliancy level, the CCR will switch off, and the screen will revert back to the 'Calibrate PLF' screen.

Turn the CCR off and isolate the supply. Remove the test AGL transformers from the circuit, if used, and replace any AGL lamps that were removed.

5 Output Lightning Arrestors

Output Lightning Arrestors are available as an option on the Micro 100+. These are fitted in place of the standard CCR HT output terminals, and function both as the CCR output terminal and the Output Surge Protective Device (SPD). Each Lightning Arrestor terminal consists of a high power MOV and a terminal bar clamp. The assembly meets the impulse surge requirements of IEC 61822:2009 and FAA Advisory Circular 150/5345-10.

Figure 5-1 below shows a 2-pole Output Lightning Arrestor Terminal; more poles can be fitted for CCRs which include integral Circuit Selector Switches. The Lightning Arrestor base plate should be earthed with a cable having a cross sectional area of at least 35 mm^2.

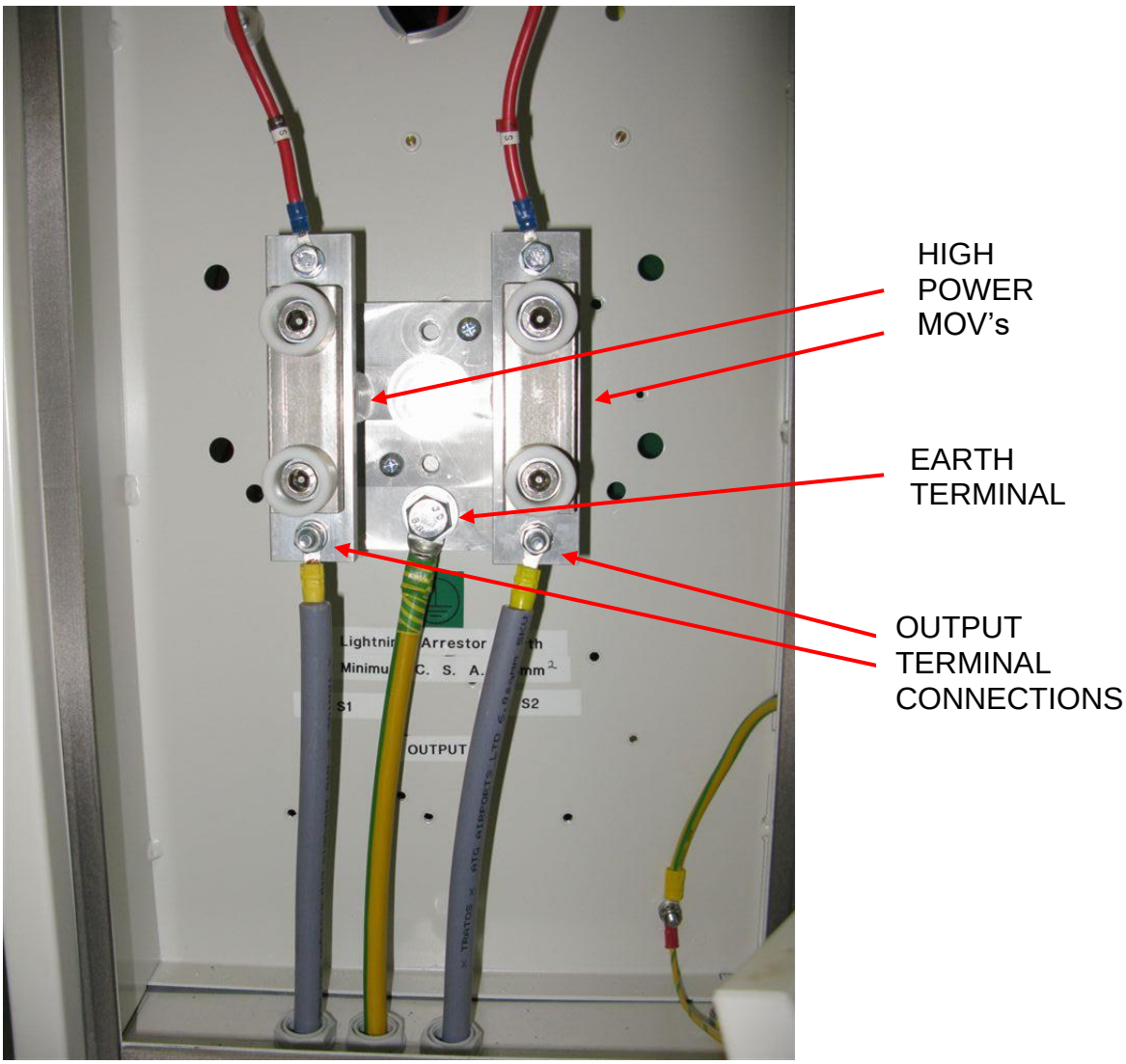


Figure 5-1 Output Lightning Arrestor Terminal

6 Cutout Switch

The Cutout Switch, which is available as an option on the Micro 100+, is a three position plug-in switch / connector which is designed to facilitate safe working on the CCR and the AGL field circuit for maintenance purposes. By using the Cutout Switch to short together and earth down the field circuit (after first isolating the supply to the regulator), any induced voltages on the field circuit cables will be dissipated and so the conductors made safe to work on. The MKV Cutout Switch complies with IEC 61822:2009 and AENA DIN/DSEYN/PPT/002-05/13.

The Cutout Switch is usually mounted in the HT terminal box at the rear of the regulator, but on Micro 100+ CCRs fitted with Alternate or 2 Way Simultaneous Circuit Selector Switches, two Cutout Switches will be mounted behind the HT compartment rear (top) cover.

WARNING – HIGH VOLTAGES – UP TO 5000V FOR A 30KVA REGULATOR – ARE PRESENT WITHIN THE HT TERMINAL BOX AND HT COMPARTMENT. THE COVERS TO THESE COMPARTMENTS SHOULD NEVER BE OPENED WITHOUT FIRST ISOLATING THE REGULATOR MAINS SUPPLY INPUT

Figure 6-1 below shows a Cutout Switch mounted above the CCR lightning arrestor / output terminals in the HT Terminal box of a Micro 100+ CCR.

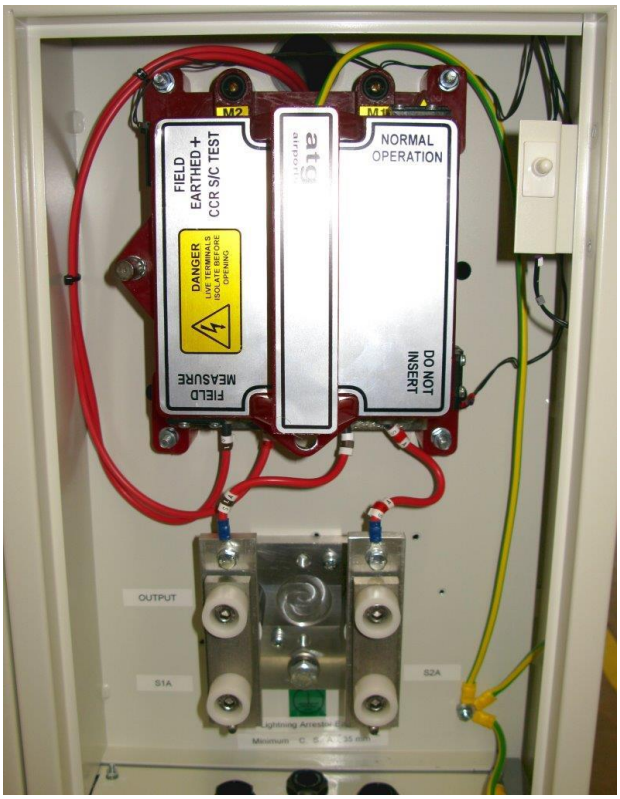


Figure 6-1 Cutout Switch mounted in CCR HT Output Terminal box

The Cutout Switch can be fitted with magnetic reed switches to give positional feedback; the reed switches work in conjunction with the AT726 Cutout Switch Relay

Card. When these are fitted, removal of the Cutout Switch lid will prevent the CCR contactor from energising. Additionally for units built to the AENA specification (Spanish market), Back Indication is given via the control connector that the Cutout Switch is in the test position.

Figure 6-2 below shows the outline of the Cutout Switch, and identifies the cable connections. M1 and M2 are 4mm test terminals – see Section 6.1.3

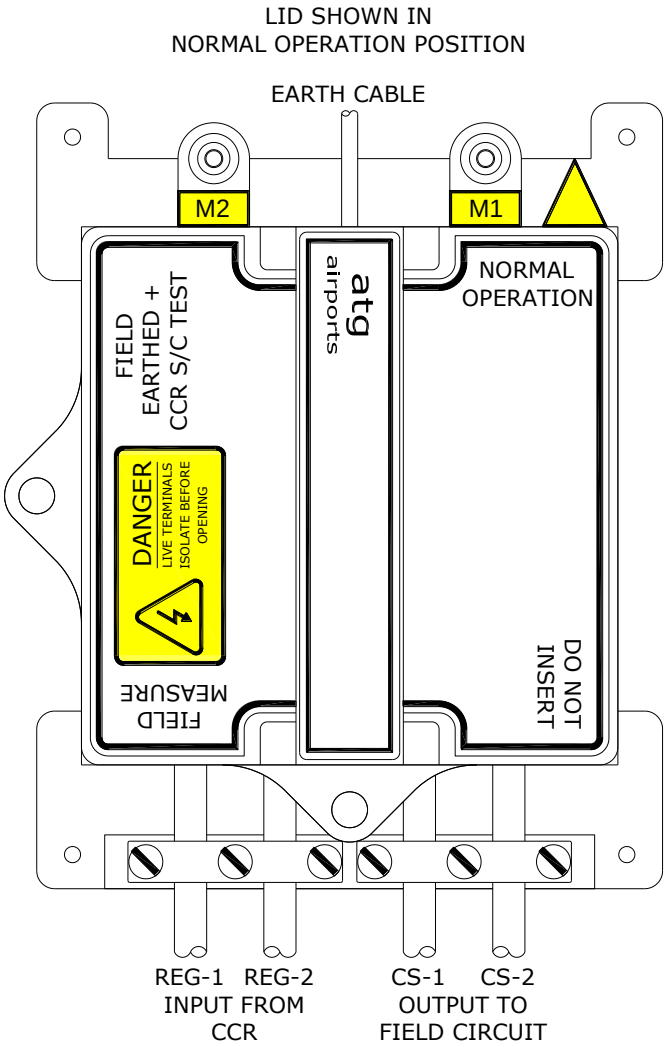


Figure 6-2 Cutout Switch outline drawing

6.1 Use of the Cutout Switch

The lid of the Cutout Switch can be removed and fitted in any of three different orientations in order to give the required connectivity. The three switch positions are described in the following sections. Note – the yellow arrow in the top right-hand corner of the base indicates the active position, alongside the text in this corner of the lid. In the case of Figure 6-2, this is Normal Operation.

WARNING: HIGH VOLTAGES – UP TO 6500V FOR A 30kVA REGULATOR – ARE PRESENT WITHIN THE HT TERMINAL BOX AND HT CUBICLES, AND ON THE TERMINALS OF THE CUTOUT SWITCH. THE COVERS TO THESE COMPARTMENTS SHOULD NEVER BE OPENED, NOR THE CUTOUT SWITCH LID REMOVED, WITHOUT FIRST ISOLATING THE REGULATOR MAINS SUPPLY INPUT.

6.1.1 Cutout Switch in 'Normal Operation' position

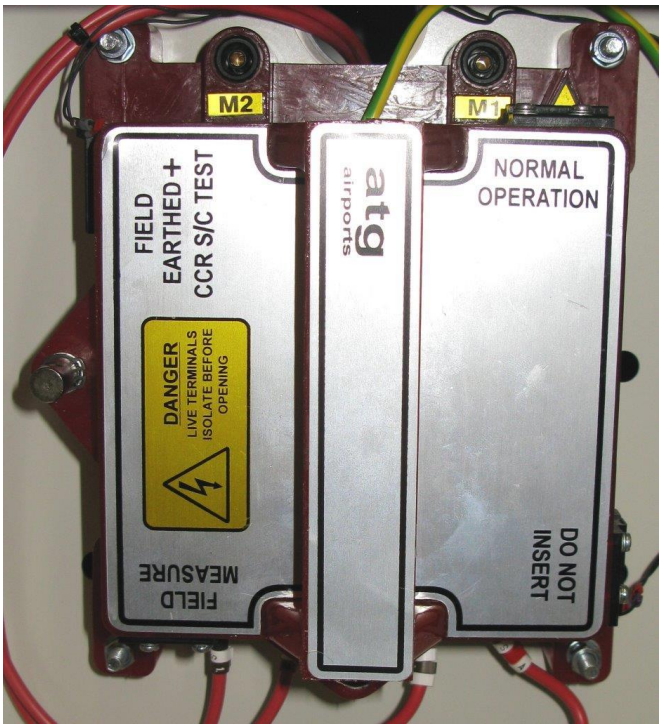


Figure 6-3 Cutout Switch in 'Normal Operation' position

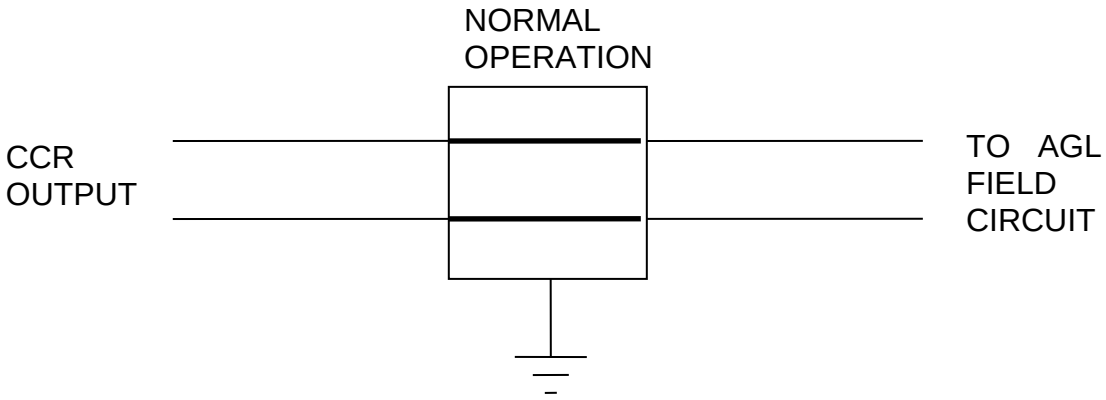


Figure 6-4 Electrical connections of Cutout Switch in 'Normal Operation' position

In the 'Normal Operation' position, the output of the CCR is connected directly to the AGL primary series loop.

6.1.2 Cutout Switch in 'Field Earthed and CCR Short Circuit Test' maintenance position

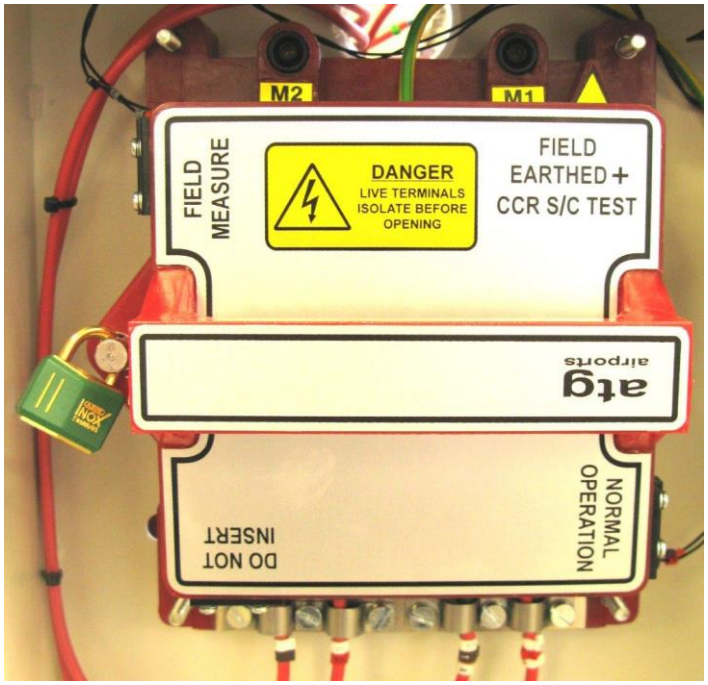


Figure 6-5 Cutout Switch in 'Field Earthed and CCR Short Circuit Test' maintenance position

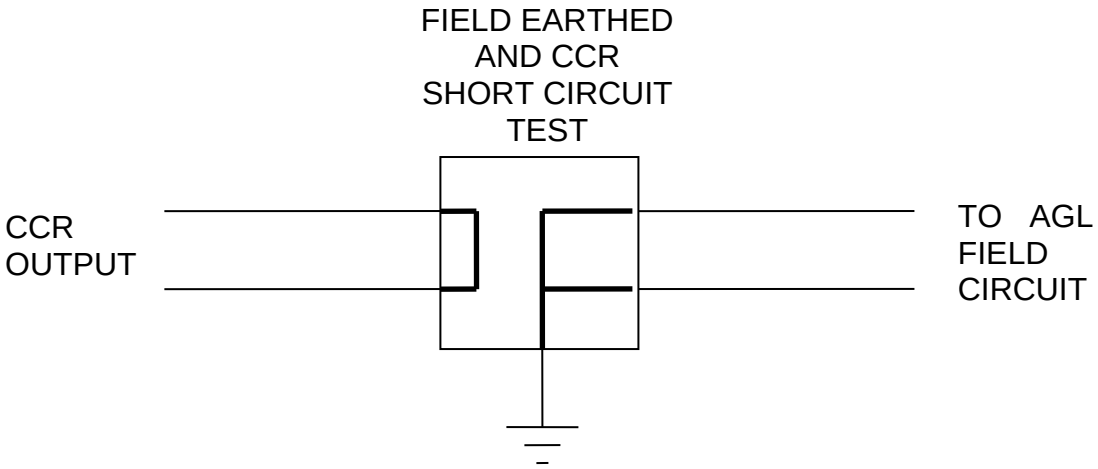


Figure 6-6 Electrical connections of Cutout in 'Field Earthed + CCR S/C Test' maintenance position

In the 'Field Earthed and CCR Short Circuit Test' position, the output of the CCR is shorted together, isolated from the AGL field circuit, and the field circuit is shorted and connected to earth.

The Cutout Switch is fitted in this position so that maintenance work can be safely carried out on the field circuit. Note – a padlock may be attached to lock the Cutout Switch in this position for additional security.

6.1.3 Cutout Switch in ‘Field Measure’ position

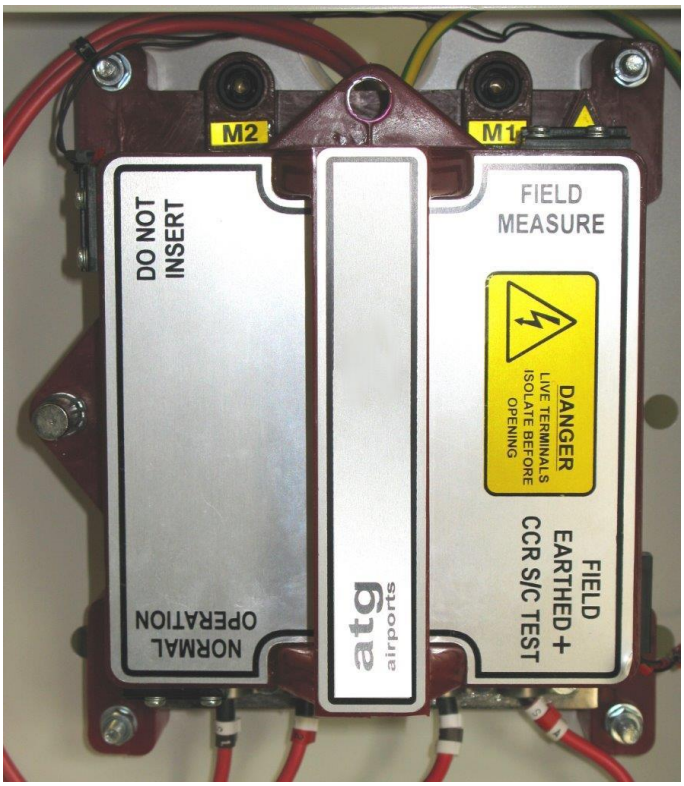


Figure 6-7 Cutout Switch in ‘Field Measure’ position

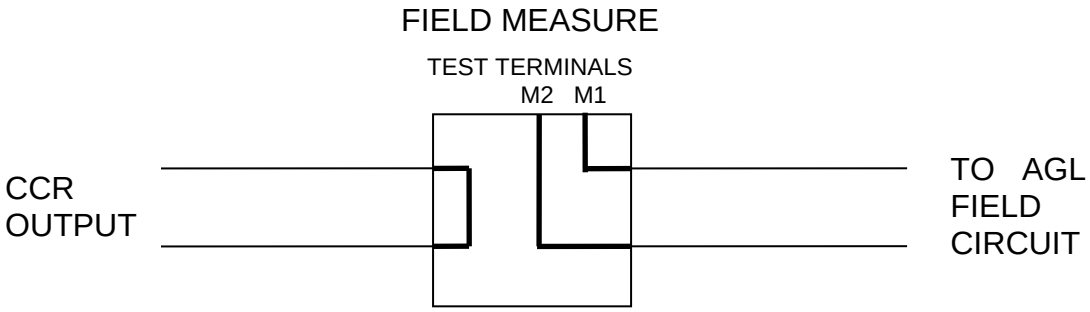


Figure 6-8 Electrical connections of Cutout Switch in ‘Field Measure’ position

In the ‘Field Measure’ position, the output of the CCR is shorted together. Access for instrument connection to both of the load side terminals is provided via 4mm test sockets M1 and M2.

The test terminals allow for insulation or ‘Megger testing’ to measure the resistance of the AGL field circuit to ground, and to measure continuity of the field circuit.

7 General CCR Application Information

7.1 Calculation of the AGL Circuit Load: Regulator Sizing and Required Output Voltage

The CCR kVA rating must be chosen to match the field circuit load requirements. If the CCR is too small, the maximum output voltage will be too low to drive the required current into the load circuit. If it is too big, it will work but at a cost of reduced efficiency.

This section describes how to calculate the total AGL circuit load. The CCR used should be the next size up from this calculated load.

Upon installation, the Main CCR transformer output voltage will have to be set to match the calculated circuit load. The calculated load power (kW) should be divided by the maximum series circuit current to give a value for the desired CCR output voltage:

$$V = P / I$$

The CCR output transformer voltage taps can be configured as described in Section 4.3 to give a total maximum output voltage equal to this value.

7.1.1 AGL Circuit Load

Figure 7-1 below, shows a typical AGL circuit.

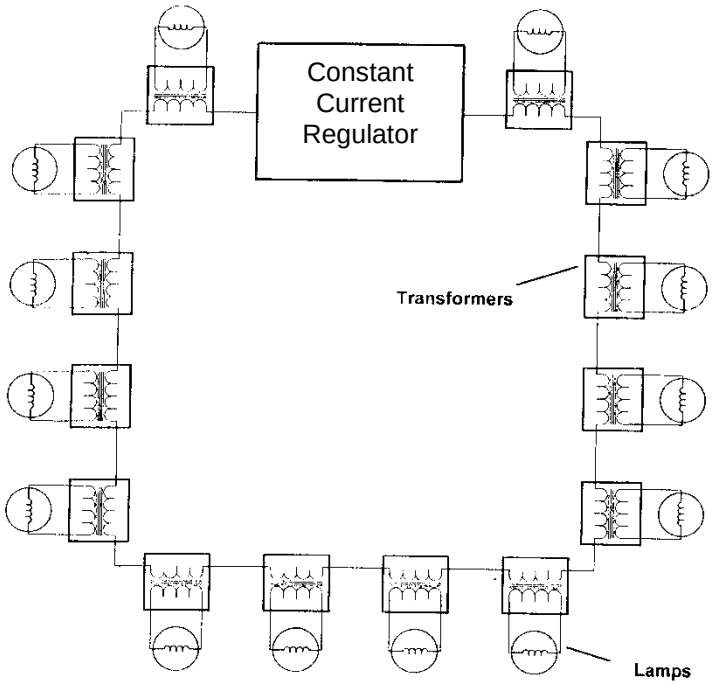


Figure 7-1 Typical Airfield Lighting Circuit

The AGL circuit load therefore consists of the following components:

- The total wattage of all the lamps on the circuit

- An allowance, if necessary, for the losses in long AGL transformer secondary extension leads. AGL transformers are supplied as standard with a secondary lead of 2 metres in length, of 4mm^2 cross sectional area. In this case, the power dissipation in the secondary lead is negligible and can be ignored. If, however, long extension leads of a small CSA were to be used, this would produce an appreciable volt-drop. In this case, the additional I^2R power loss should be calculated and taken into account. (Note – the AGL transformer secondary current can be different from the primary loop current. This should be verified before any calculations are done).

- An allowance of 10% for the inefficiency of the AGL lamp transformers, based on the transformer load being the addition of the above 2 items. Note - If only a small proportion of transformers have long extensions, then as a rough rule of thumb, simply increase the allowance for transformer losses to 15%

- Power losses in the AGL primary series loop cable. This is simply an I^2R power loss. A typical circuit would use 6mm^2 AGL cable, which has a resistance of 3 ohms per kilometre.

- An allowance for lamp failures, conditions of reduced supply voltage and other supply losses - oversize by 10%

In summary, the total CCR load will be:

((Total lamp wattage x 1.1) + (I^2R power loss in the AGL primary series loop cable)) x 1.1

or, if long AGL transformer secondary extension leads are used:

(((Total lamp wattage + AGL tx secondary extension lead I^2R losses) x 1.1)

+ (I^2R power loss in the AGL primary series loop cable))) x 1.1

Note – the load calculations give a value in kilowatts, whilst the CCR is rated in kVA. These figures can be considered to be equivalent for the purposes of rating the CCR.

7.1.2 Example AGL Circuit Load Calculation

Consider the following worked example.

i/ Circuit 1 has 160 lamps each rated at 45w, with 6.6A filaments. The lamps are mounted adjacent to the AGL transformers, such that the secondary leads have negligible losses.

The primary series circuit is also rated at 6.6A, and the total length of the series circuit loop is 5.5 kilometres. 6mm^2 AGL cable has been used, with a resistance of 3 ohms per kilometre

Lamp load	160 x 45w = 7200 watts
Total transformer load (Lamp load plus transformer losses)	7200w x 1.1 = 7920 watts
Primary series circuit cable I^2R power losses	6.6 x 6.6 x 3 x 5.5 = 718.74 watts
Total circuit load	7920w + 718.74w = 8638.74 watts
Overrate by 10% to allow for lamp failures, conditions of reduced supply voltage and other supply losses	8638.74 x 1.1 = 9.5 kilowatts (approx.)

In this case, a 10KVA CCR should be used

The transformer output voltage taps should be configured to give a maximum output voltage of:

V = P/I = 9500/6.6 = 1440 volts

Refer to Section 4.3 to set the transformer output voltage selector taps.

7.2 Load Changing / Block Switching

During ‘Block Switching’ operations, for example, when using electronic switching of the secondary side of the airfield ground lighting transformers to short out and switch off sections of the AGL circuit, there is a momentary overloading of the remainder of the circuit. This is because there is a finite time before the CCR control loop can reduce the CCR output voltage to match the reduced load impedance, and bring the current back to its set point.

The Micro 100+ CCR contains a current clamp, which cuts in if the threshold of 103% of Maximum Output Current is exceeded. In this case, the CCR permits a maximum of half a mains cycle of overload before backing the current off and ramping back up to its set point. This gives a much faster response to overload conditions than would be possible with conventional control circuitry, and therefore reduces the stress on the lamp filaments.

However, it is recommended that during block switching operations, the control system should momentarily reduce the CCR Brilliancy, or switch off the CCR altogether, in order not to stress the AGL lamps.

7.3 Lamp Life

Many lamp transformers today are supplied to ICA, or similar specifications, where performance is defined based on a sinusoidal supply current.

The Micro 100+ regulators manufactured by **atg airports** ltd, in keeping with other regulators of a similar design, use thyristor phase angle control circuitry coupled with a closed loop controller to provide a constant current output. The output waveform is consequently a chopped sine wave, as shown below.

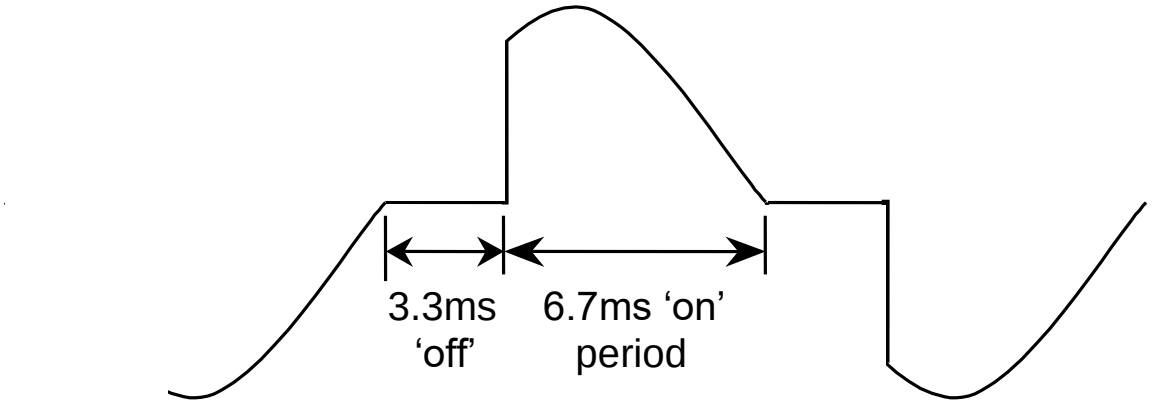


Figure 7-2 Typical output waveform

The conduction periods indicated are for a correctly matched main transformer output voltage, with the CCR operating at full Brilliancy.

Chopping the waveform produces harmonics, particularly the 3rd, (150Hz) 5th (250Hz) and the 7th (350Hz). The shorter the conduction period then the greater the harmonic content. At these frequencies, the lamp transformers actually become more efficient and produce slightly more power, resulting in higher lamp currents - sometimes up to 5% higher - depending on the conditions.

The higher currents cause reduced lamp life, and so to overcome this it is necessary to match the CCR main transformer output voltage as closely as possible to the load by making good use of the transformer output tappings. This will result in a waveform closer to that shown on the previous page, and consequently a lower harmonic content.

The importance of matching the secondary voltage of the output transformer with the required circuit voltage is something that is often overlooked, as the regulator control system is quite capable of accommodating any mismatch. If, however, the mismatch is not corrected it results in reduced lamp life, higher harmonic currents (as explained above), high instantaneous peak currents, reduced power factor of the supply and high supply kVA.

The Micro 100+ CCRs have multiple tappings on the output transformers that permit close matching to the circuit load.

7.4 Black Heat

In certain circumstances, usually on PAPI’s, a "Black Heat" output is required. Black Heat means that a low level of output current flows all the time even if the regulator is commanded "off" by air traffic control, in order to prevent condensation in tungsten halogen light fittings. See Section 8.3.2.12 for details of enabling Black Heat, and Section 8.3.2.13 for setting the Black Heat Current level.

8 Programming Menus

8.1 Overview

This section describes the Microcontroller Menu system, how to load the CCR operating parameters via the Front Panel Keypad and how to Set-up some of the more specialised functions.

The Micro 100+ CCR is pre-programmed with default operating parameters suitable for most applications. Parameters such as the CCR Maximum Output Current will normally be programmed to customer specifications during factory testing, along with any other non-standard requirements if these were notified to **atg airports** at the time the equipment was ordered.

The screens are divided into three menus, as listed below

1. Main menu – displays information about the status of the regulator
2. Set-Up menu – allows programming of CCR operating parameters
3. CCR Hardware Configuration menu – gives access to calibration and engineering screens

Access to the Set-up menu is password protected with a further password to access the CCR Engineering Configuration Menu.

Additionally, there are a number of fault screens that can be activated. CCR faults are divided between those that give a ‘soft’ alarm but allow continued operation, and those that trip the regulator.

8.1.1 How to Navigate Around the Screens

The Micro 100+ uses a Rotary Encoder switch with a ‘Push to Select’ function in order to navigate through the menu system and to reset any faults (this is referred to as the ‘Rotary Menu Selector’). The Brilliancy Control Selector switch on the lefthand side is used for control of the CCR. The Front Control Panel is shown below:

Figure 8-1 Front Control Panel and Display

8.2 Main Menu and CCR Status Screens

Under normal operation, the front panel display shows the regulator's Running Mode screen, which displays the CCR Output Current and, if available, the Output Voltage. The operator can scroll down through the menu from the Running Mode screen by turning the Rotary Menu Selector anticlockwise to show the following screens: Fault List Screen, Hours Run, Earth Leakage Display (if available), PLF Display (if available), Output kVA (if available), Conduction Angle, CCR Product Information, and if the CCR is set to 'Local Off', the Set-up Menu Password Entry screen is also available. After a period of 60 seconds of inactivity the display will revert to show the Running Mode and Output Current.

The Main Menu Flowchart is shown in
Figure 8-2 below, whilst Table 8-1 lists the Main Menu screens and gives a brief description of them.

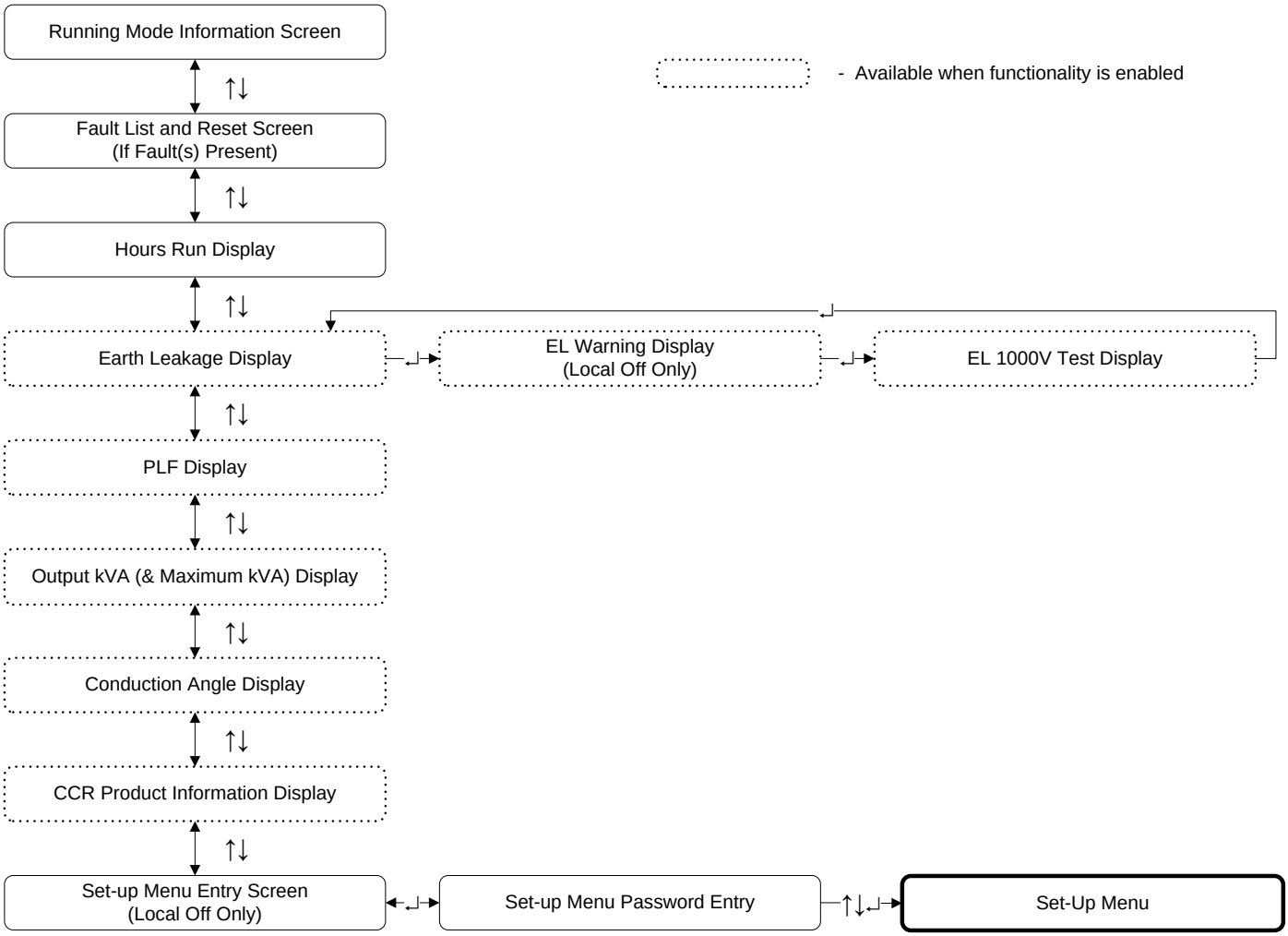


Figure 8-2 Main Menu Flowchart.

Parameter	Description
Running Mode Screen: Output Current (& Output Voltage) Display Screen	Indicates whether the CCR is operating under Local or Remote control, and displays the Brilliancy Level selected and the CCR output current. If 'Voltage Feedback' is enabled, also displays CCR output voltage. The second line shows fault indications, warnings or other information.
Fault list and Reset Screen	If there are any faults registered then these are listed on this screen. Faults can be reset from this screen providing that the faults are no longer present on the CCR.
Hours Run Display Screen	Displays overall Hours Run and the Hours Run at Maximum Brilliancy
Earth Leakage Display Screen	Displays the last measured value of the Resistance to Earth of the Primary Series Loop Circuit. The measurement is either made continuously (at 500V) whilst the CCR is operating, or, when the CCR is set to 'Local Off', a manual test can be made at 1000V. (Note – this screen is only available if the optional Earth Leakage Measurement module has been fitted and its' operation enabled).
PLF Display Screen	Displays the number of lamps failed. (Note – this screen is only available if the Percentage Lamp Failure Card is fitted and its' operation has been enabled).
Output kVA (& Maximum kVA) Display Screen	Displays the measured output kVA. (Note – this screen is only available if 'Voltage Feedback' is enabled). If 'kVA Alarm' is also enabled, displays Maximum recorded kVA for the selected brilliancy level.
Conduction Angle Display Screen	This displays the thyristor conduction angle and the time period of conduction for each half cycle, and can be used as an aid to setting the main transformer T101 secondary tapping voltage during the CCR commissioning procedure.
CCR Product Information Screen	This screen displays product information and the software version number.
Set-up Menu Entry Screen	This screen allows access to Menu 2 – the Set-up Menu. Note – this screen is only available if the Brilliancy Control Selector switch is set to 'OFF'.

Table 8-1 Main Menu screens

If a fault occurs, then this is indicated on the second line of the Running Mode screen. The faults are listed on the next screen down, available by turning the Rotary Menu Selector anticlockwise. The fault screens are described in Section 8.5, and listed in Table 8-4.

8.2.1 Screens Displayed During Normal CCR Operation

The screens displayed during normal operation are described below, and are accessed in the order shown, starting from the 'Running Mode' screen, by turning the Rotary Menu Selector anticlockwise to scroll down through the menu. The display automatically reverts back to the 'Running Mode' screen from any of the other screens within this menu after a period of 60 seconds of inactivity. Note – not all of the screens described below are available depending on the configuration of the CCR.

8.2.1.1 Running Mode Display Screen

The ‘Running Mode’ screen shows the operating status of the CCR. In the following example the CCR has been programmed for IEC Style 2 (5 Step) Brilliancy levels (see section 8.3.2.7), is set to ‘Remote’ control and has been commanded on at Brilliancy 5 (maximum), with a measured output current of 6.60A. The fourth line displays the measured output voltage, and is only available if the PLF / Power Analyser Card is fitted and enabled and Output Voltage Monitoring has also been enabled – see sections 8.3.2.16 and 8.3.2.17.

Since this screen is the first one in this menu, there is only one arrow on the top right-hand side, pointing down to indicate that you can only scroll down from here in the menu, by turning the Rotary Menu Selector anti-clockwise.

R	E	M	O	T	E		B	R	I	L	L		5					↓
O	P		C	U	R	R	E	N	T	:			6	.	6	0	A	
O	P		V	O	L	T	A	G	E	:			3	5	7	7	V	

The second line is used for fault indications, warnings or other information. The second line will cycle from one item to the next if there is more than one message to display. If any faults have been registered, then the number of faults will be indicated. If a fault is of the type which trips the CCR, then a message ‘CCR DISABLED’ will also be shown.

The screen appears as shown below when the CCR is under ‘Remote’ control and has been set to ‘Off’. In this example, ‘Black Heat’ has been enabled, and so a low level residual output current is produced to prevent condensation forming in the light fittings.

R	E	M	O	T	E		O	F	F									↓
E	N	E	R	G	I	S	E	D		B	L	A	C	K		H	E	A	T
O	P		C	U	R	R	E	N	T	:			1	.	5	0	A	
O	P		V	O	L	T	A	G	E	:				8	1	3	V	

Other warnings or indications which may be shown (or cycled through) on the second line of the display include:

- If the CCR has been configured to perform continuous Earth Leakage resistance measurements (‘Continuous Analogue’ under the ‘Earth Leakage Detection Type’ menu – see section 8.3.2.15), then a warning message to that effect will be shown on the second line.
- If a Cutout switch is fitted (optional) and it has been set to the test position, this will be indicated on the second line.
- CSS Inhibit may be displayed if the CCR is being used with an external Circuit Selector Switch, and the CSS inhibit contact is open circuit.

8.2.1.2 Fault List and Reset Display Screen

If there are any faults registered then this is indicated on the second line of the Running Mode Display screen. For example, an 'Open Circuit' fault, which trips (disables) the CCR, indicates the following, with the second line toggling between the messages shown on the screens below:

R	E	M	O	T	E		O	F	F								↓
1		F	A	U	L	T												
O	P		C	U	R	R	E	N	T	:			0	.	0	0		A	
O	P		V	O	L	T	A	G	E	:						0		V	

R	E	M	O	T	E		O	F	F									↓
C	C	R		D	I	S	A	B	L	E	D							
O	P		C	U	R	R	E	N	T	:			0	.	0	0		A	
O	P		V	O	L	T	A	G	E	:						0		V	

A list of the fault(s) registered is shown on the next screen down, which is displayed by turning the Rotary Menu Selector anticlockwise:

1		F	A	U	L	T											↑	↓
	S	E	L	E	C	T		T	O		R	E	S	E	T			
→	O	P	E	N		C	I	R	C	U	I	T		F	A	U	L	T	

Faults can be reset from this screen providing that the faults are no longer present on the CCR; position the arrow (→) against the fault description and press the menu selector. Note – not all faults will trip the CCR – many will show as a 'soft' alarm with the CCR continuing to operate as indicated on the 'Running Mode' screen. Refer to section 8.5 for more information.

8.2.1.3 Hours Run Display Screen

This screen displays the hours run at maximum brilliancy (or effective maximum brilliancy), and the total hours run:

																	↑	↓
H	O	U	R	S		R	U	N										
M	A	X		B	R	I	L	L	:				1	2	4		H	R	S
				T	O	T	A	L	:				6	6	2		H	R	S

8.2.1.4 Earth Leakage Display Screen

This screen is only available if the optional Earth Leakage Measurement module has been fitted and its' operation enabled; refer to section 4.5.2.

When enabled and when the CCR is running, the earth leakage resistance value is

measured using a test voltage of 500V DC; the resulting measurement is displayed on the second line of the display. When the CCR is in the 'Off' state, the display shows the last measured value and the test voltage used. (Note – if no earth leakage test has yet been run, or if 'Earth Leakage' has been enabled but there is no Earth Leakage Measurement module fitted to the CCR, then the second line will read 'NO RESULT AVAILABLE').

If the Rotary Brilliancy Selector Switch is set to 'Off' then lines three and four are also displayed on this screen, showing the possibility to run an earth leakage test at 1000V:

E	A	R	T	H		L	E	A	K	A	G	E					↑	↓
		@		5	0	0	V		>		5	0		M	Ω			
→		P	R	E	S	S		S	E	L	E	C	T		T	O			
		R	U	N		1	0	0	0	V		T	E	S	T			

Refer to section 8.2.2 for more information on this test.

8.2.1.5 Percentage Lamp Failure Display Screen

This screen, which displays the (approximate) number of failed lamps and the (approximate) percentage of failed lamps, is only available if the Percentage Lamp Failure Card is fitted and its' operation has been enabled; refer to section 4.6.

P	E	R	C	E	N	T	A	G	E								↑	↓
L	A	M	P		F	A	I	L	U	R	E							
F	A	I	L	E	D		L	A	M	P	S	:			2			
													(		2	%	)	

8.2.1.6 Output kVA Display Screen

This screen, which displays the measured CCR output kVA, is only available if Output Voltage Monitoring is enabled; refer to section 8.3.2.17.

If the kVA alarm is also enabled, the fourth line will show the measured peak kVA value for the selected brilliancy step. Note - if the output kVA drops by more than 10% from the peak recorded value for that Brilliancy step, due to earth faults on the AGL series circuit for example, then an alarm is raised.

O	U	T	P	U	T		k	V	A								↑	↓
		2	5	.	6	9		k	V	A								
C	U	R	R	E	N	T		S	T	E	P		P	E	A	K	:	
		2	6	.	4	8		k	V	A								

8.2.1.7 Conduction Angle Display Screen

This screen can be used as an aid to setting the main transformer T101 secondary tapping voltage during the CCR commissioning procedure; refer to section 4.3 for more information. The fourth line displays the thyristor conduction angle and the time period of conduction for each half cycle:

O	U	T	P	U	T	:										↑	↓
		6	.	6	0	A			3	5	7	7	V				
C	O	N	D	U	C	T	I	O	N		A	N	G	L	E	:			
1	2	1	º		(	6	.	7	m	s		@		5	0	H	z	)	

8.2.1.8 CCR Product Information Screen

This screen displays product information and the software version number:

																		↓
A	T	G		A	I	R	P	O	R	T	S		L	T	D			
M	I	C	R	O		1	0	0	+		C	C	R					
S	W		V	E	R	S	I	O	N	:								
			v	0	0	.	0	2	.	0	0	0	3	t				

8.2.1.9 Set-up Menu Entry Screen

The final screen in this menu enables access to Menu 2 – the Set-up Menu. Note – this screen is only available if the Brilliancy Control Selector switch is set to 'OFF'.

																	↑	
→	E	N	T	E	R		M	E	N	U		2						
	S	E	T	-	U	P		M	E	N	U							

Refer to section 8.3.1 for further information.

8.2.2 Earth Leakage Resistance – Manual Test at 1000V DC

This test is only available if the optional Earth Leakage Measurement module is fitted and correctly programmed.

The measurement of the Primary Series Loop Earth Leakage Resistance using a test voltage of 1000V DC can only be made when the Brilliancy Control Selector Switch is set to ‘OFF’. From the ‘Running Mode’ screen, scroll down to the ‘Earth Leakage’ screen; with the CCR set to ‘LOCAL OFF’, lines three and four are also displayed showing the possibility to run an earth leakage test at 1000V:

E	A	R	T	H		L	E	A	K	A	G	E						↑	↓
		@		5	0	0	V		>		5	0		M	Ω				
→		P	R	E	S	S		S	E	L	E	C	T		T	O			
		R	U	N		1	0	0	0	V		T	E	S	T				

Press the Rotary Menu Selector, a test confirmation screen will be shown:

E	A	R	T	H		L	E	A	K	A	G	E					↑	↓
R	U	N		1	0	0	0	V		T	E	S	T					
→		C	A	N	C	E	L											
		C	O	N	F	I	R	M										

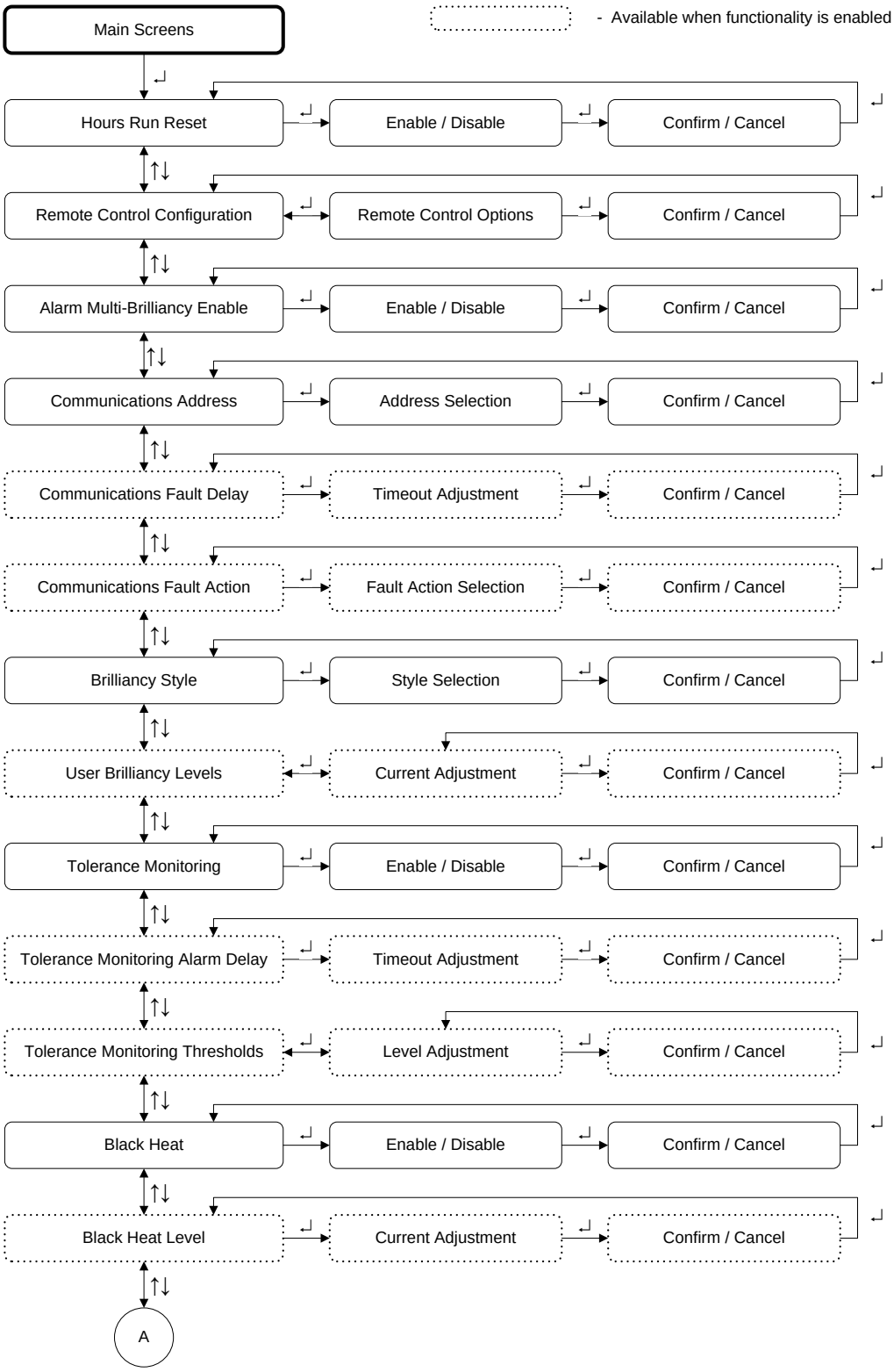
Turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves to the bottom line (alongside ‘CONFIRM’), then press the selector again to confirm running of the test.

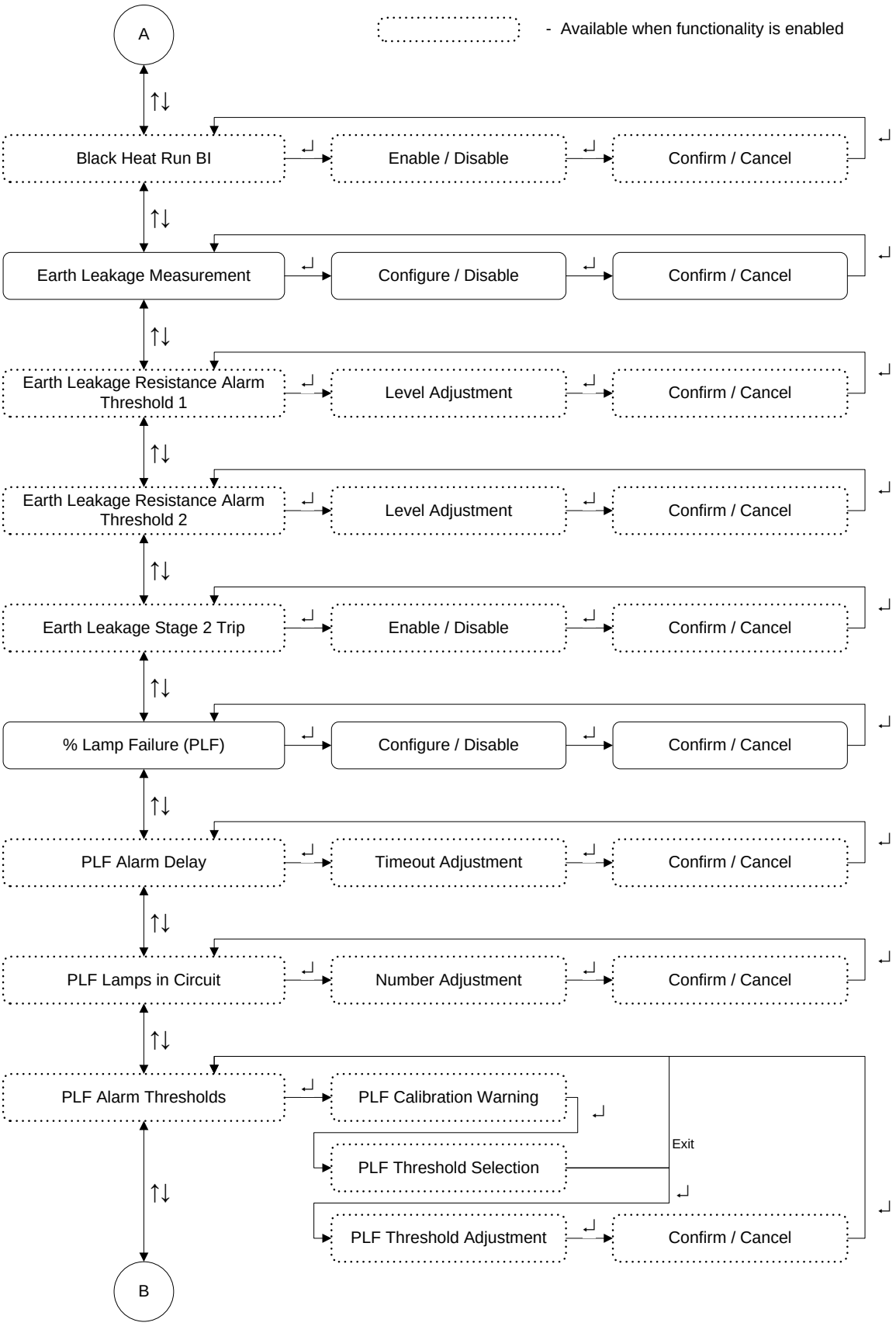
After the test is completed the new earth leakage resistance measurement will be displayed, and the test voltage used to obtain the measurement.

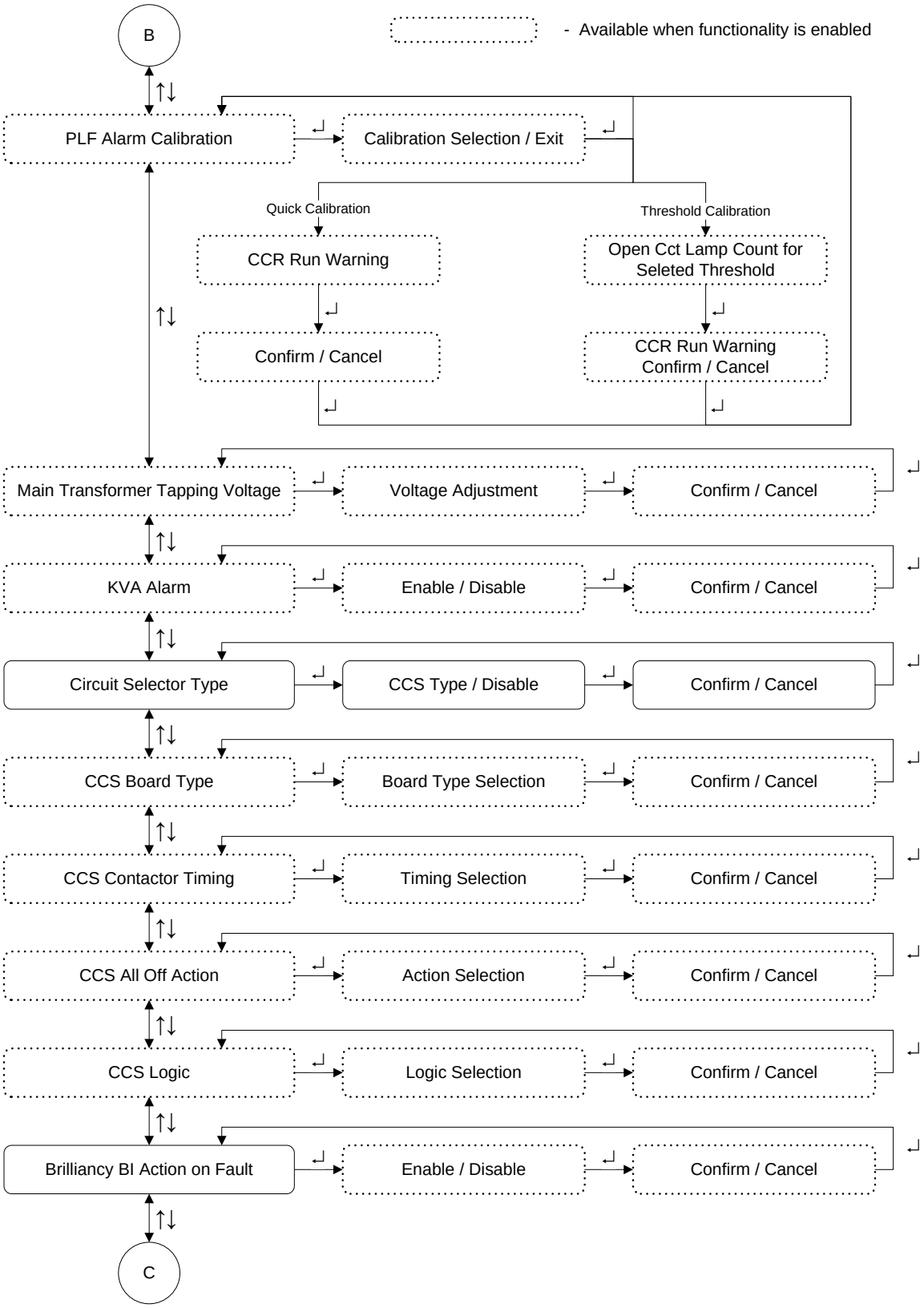
If the CCR is set to run, or if the Earth Leakage test type is set to ‘Continuous Analogue, the display will revert to showing the result of the 500V Earth Leakage resistance testing.

8.3 Menu 2 - Set-up Menu Screens

Menu 2 contains the Set-up and Operating Parameters to allow the user to configure the CCR. The Set-up Menu flowchart is shown in Figure 8-3 below:




A
- Available when functionality is enabled
Black Heat Run BI
Enable / Disable
Confirm / Cancel
Earth Leakage Measurement
Configure / Disable
Confirm / Cancel
Earth Leakage Resistance Alarm Threshold 1
Level Adjustment
Confirm / Cancel
Earth Leakage Resistance Alarm Threshold 2
Level Adjustment
Confirm / Cancel
Earth Leakage Stage 2 Trip
Enable / Disable
Confirm / Cancel
% Lamp Failure (PLF)
Configure / Disable
Confirm / Cancel
PLF Alarm Delay
Timeout Adjustment
Confirm / Cancel
PLF Lamps in Circuit
Number Adjustment
Confirm / Cancel
PLF Alarm Thresholds
PLF Calibration Warning
PLF Threshold Selection
Exit
PLF Threshold Adjustment
Confirm / Cancel
B


B
- Available when functionality is enabled
PLF Alarm Calibration
Calibration Selection / Exit
Quick Calibration
Threshold Calibration
CCR Run Warning
Open Cct Lamp Count for Seleted Threshold
Confirm / Cancel
CCR Run Warning Confirm / Cancel
Main Transformer Tapping Voltage
Voltage Adjustment
Confirm / Cancel
KVA Alarm
Enable / Disable
Confirm / Cancel
Circuit Selector Type
CCS Type / Disable
Confirm / Cancel
CCS Board Type
Board Type Selection
Confirm / Cancel
CCS Contactor Timing
Timing Selection
Confirm / Cancel
CCS All Off Action
Action Selection
Confirm / Cancel
CCS Logic
Logic Selection
Confirm / Cancel
Brilliancy BI Action on Fault
Enable / Disable
Confirm / Cancel
C

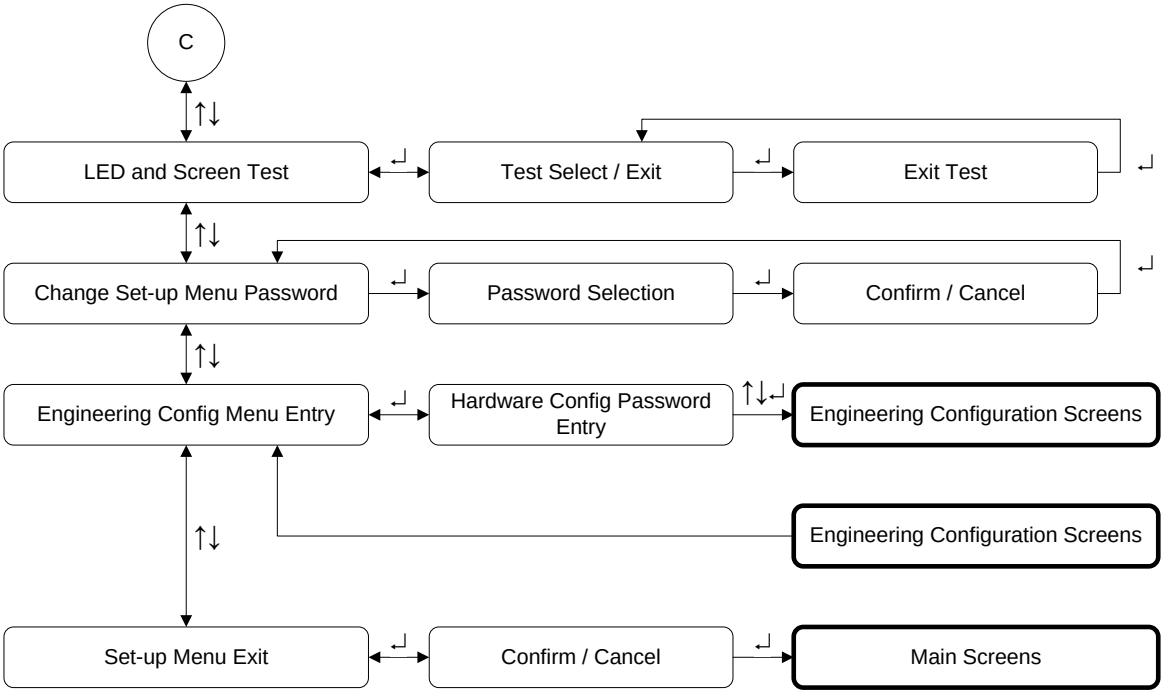


Figure 8-3 Set-up Menu Flowchart

Table 8-2 (below) gives a listing of the screens and the default settings for the operating parameters.

Parameter (Set-up Menu)	**Description**	**Default Setting**
RESET HOURS RUN AT MAX BRILL	Reset the hours run at maximum brilliancy.	
REMOTE CONTROL CONFIG?	Select between 3 Wire, 3 Wire & Command, BCD, BCD & Command, BCD Option 2, BCD Option 2 & Command, 8 Wire, 8 Wire & Command and Serial Communications. Note - selecting Serial Communications opens further screens (see below).	8 WIRE
ALARM ON MULTIPLE REMOTE INPUTS	Enable/ Disable the alarm which alerts if an illegal combination of remote control inputs is detected.	ENABLED
SERIAL COMMS ADDRESS	Select Address of unit for serial communications. (Only available if 'Communication' selected for remote control)	255 (ie, not selected)
SERIAL COMMS FAULT DELAY TIME	Select the delay time (in seconds) before the Communications fault is raised. (Only available if 'Communication' selected for remote control)	5 S
SERIAL COMMS FAULT ACTION	Select the action to be taken in the case of a communications fault. Select between 'CCR LATCH', 'CCR ON' and 'CCR OFF'. (Only available if 'Communication' selected as method for remote control).	CCR LATCH

Parameter (Set-up Menu)	Description	Default Setting
SERIAL COMMS FAULT CIRCUIT SELECTOR ACTION	Select the action to be taken by the circuit selector in the case of a communications fault. (Only available if 'Communication' selected as method for remote control and the CCR is configured to use an internal circuit selector)	Each individual circuit reverts to fail-safe condition; alternate CSS reverts to CCT1
BRILLIANCY LEVELS STYLE	Select between 5 Step Style 2, 3 Step Style 1, 8 Step UK CAP168, User Defined or User Defined DIO.	8 STEP UK CAP 168
USER BRILLIANCY LEVELS	When User Defined Brilliancy Levels are selected, allows adjustment of the current levels. (Note - the default levels are those of UK CAP 168).	Levels as per 8 STEP UK CAP 168
TOLERANCE MONITORING	Enable/ Disable internal Tolerance Monitoring Unit	ENABLED
TOLERANCE MONITOR ALARM DELAY TIME	Set the delay time (seconds) before an out of tolerance alarm is raised	15 S
TOLERANCE MONITOR ALARM THRESHOLDS	Program the Tolerance Monitoring alarm threshold levels. Note – the initial thresholds are taken from either the CAP 168 or 5 / 3 Step tolerance limits. Note - if the User Defined brilliancy (current levels) are changed from the default values, then the Tolerance Levels are automatically moved to be +/- 0.1A from the new operating current value.	
BLACK HEAT OUTPUT CURRENT IN REMOTE OFF	Enable/ Disable Black Heat operation.	DISABLED
BLACK HEAT OUTPUT CURRENT LEVEL	Set the Black Heat current level. (Available if Black Heat operation is enabled)	6.0A CCR = 1.5A 6.6A CCR = 1.5A 12A CCR = 2.5A 20A CCR = 5.75A
BLACK HEAT RUN BI RELAY ACTION	Enable the run back indication output when the CCR is running in 'black heat' (Available if Black Heat operation is enabled)	DISABLED
EARTH LEAKAGE MEASUREMENT CONFIG	Select between 'ENABLED', 'CONTINUOUS ENABLED' and 'DISABLED'. Note - optional AT699 Earth Leakage Detection Card required for this function to operate.	DISABLED
EARTH LEAKAGE ALARM THRESHOLD STAGE 1	Select the threshold of resistance for the 1st stage Earth Leakage Alarm.	10 MΩ
EARTH LEAKAGE ALARM THRESHOLD STAGE 2	Select the threshold of resistance for the 2nd stage Earth Leakage Alarm / Trip.	200 kΩ
EARTH LEAKAGE STAGE 2 TRIP	Configure the stage 2 Earth Leakage detector to give an alarm and continue to run (disabled), or to shutdown (trip) the CCR (enabled). For reasons of safety, trip should be enabled.	ENABLED
% LAMP FAILURE (PLF) CONFIGURATION	Enable Percentage Lamp Failure monitoring; select between 'ENABLED', 'ENABLED FAA STYLE' or 'DISABLED'. Note - requires the optional AT1127 PLF Card or AT1031 PLF / Power Analyser Card to be fitted for this feature to operate.	DISABLED

Parameter (Set-up Menu)	Description	Default Setting
% LAMP FAILURE ALARM DELAY TIME	Set the delay time (seconds) before the Percentage Lamp Failure alarm is raised.	15 S
% LAMP FAILURE NUMBER OF LAMPS IN CCT	Enter the total number of lamps on the AGL circuit.	100
% LAMP FAILURE ALARM THRESHOLDS		
PLF S1 THRESHOLD	Enter the number of failed lamps to trigger a Stage 1 alarm.	5 (5%)
PLF S2 THRESHOLD	Enter the number of failed lamps to trigger a Stage 2 alarm.	10 (10%)
% LAMP FAILURE CALIBRATION		
PLF QUICK CALIBRATION	The 'QUICK' calibration should be only be performed with all lamps on the circuit in good condition (not open circuited); the system will then record the PLF error signal at all brilliancies with the lighting series loop circuit in this state. A pre-set margin (based on typical alarm measurements) will be added to give alarm threshold levels for failed lamps.	N/A
CAPTURE PLF ERR L1	Full Calibration routine - records the PLF error signal for the lamps out threshold level 1, at each brilliancy step.	N/A
CAPTURE PLF ERR L2	Full Calibration routine - records the PLF error signal for the lamps out threshold level 2, at each brilliancy step.	N/A
MAIN TRANSFORMER TAPPING VOLTAGE	To correctly monitor the output voltage, it is necessary to program the main transformer output voltage as connected (sum of each winding section connected). Note - requires the optional AT1127 PLF Card or AT1031 PLF / Power Analyser Card to be fitted for this feature to operate.	0001V
KVA ALARM	When enabled generates an alarm if the CCR output load kVA drops below 90% of the peak measured load value for the brilliancy step in operation, for a period of 5 seconds. Note - requires the optional AT1127 PLF Card or AT1031 PLF / Power Analyser Card to be fitted for this feature to operate.	DISABLED
CIRCUIT SELECTOR TYPE	Disables CSS operation or allows selection of Alternate or Multiway (2 - 6 way) CSS or of External CCS.	DISABLED
CIRCUIT SELECTOR MULTIWAY CARD TYPE	Allows selection of the Multi-Way Circuit Selector Back Indication Current Detection philosophy, depending on the version of PCB fitted.	AT661 REV C ONWARD

Parameter (Set-up Menu)	Description	Default Setting
CIRCUIT SELECTOR CONTACTOR TIMING	Set the time delay before re-energisation of the CCR after changeover of the internal circuit selector. Timings available: 15 mS – Vacuum Relay, 100mS, 150mS, 200mS, 250mS, 300mS, 500mS - Contactors. Set a delay time longer than the actual contactor / relay operating times. (Screen only available when circuit selector is enabled).	500mS CONTACTOR
CIRCUIT SELECTORS ALL OFF ACTION	Set to 'CCR OFF' to turn off the CCR when all circuits are selected to off, even though the CCR itself is selected to on. Alternatively, set to 'CCR ON' – the CCR will continue to operate with all outputs shorted. (Available when Multiway (2 to 6 way) Circuit Selector is enabled).	CCR OFF
CIRCUIT SELECTORS LOGIC	Select normally open or normally closed logic for correct fail-safe modes for each circuit of Multiway Circuit Selector. Note – the relays / contactors should first be wired to use normally open or normally closed contacts according to the fail-safe requirements of each field circuit (eg. stopbar – fail to on – normally open contact required), then the type of contact used for each circuit programmed via this screen.	N/O
BRILL BI RELAYS ACTIVE ON FAULT	Set to enabled to allow Brilliancy Level Back Indication Relays to remain energised under fault trip conditions.	DISABLED
LED & SCREEN TESTS	Allows test of front panel LEDs and OLED screen.	N/A
CHANGE PASSWORD FOR MENU 2 SET-UP	Allows the password for entry to the Set-up menu to be changed.	atg
ENTER MENU 3 ENGINEERING CONFIG	Allows entry to the Engineering Configuration Menu via the password entry screen.	eng
EXIT MENU 2 SET-UP MENU	Allows exit from the set-up menu.	

Table 8-2 Set-up Menu screens

8.3.1 Accessing Menu 2 - Set-up Menu

The Set-up Menu is accessed from the Main Menu by the use of a password. The CCR must first be set to 'Local Off' (by turning the left-hand side Brilliancy Control Selector switch SW1 to 'OFF'), then turn the right-hand side Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	E	N	T	E	R		M	E	N	U		2						↑	
	S	E	T	-	U	P		M	E	N	U								

Press the menu selector; the screen will change to:

	E	N	T	E	R		P	A	S	S	W	O	R	D				↑	↓
	F	O	R		M	E	N	U		2		-		S	E	T	-	U	P
→		a	a	a															

The left-hand arrow (→) moves down from the top line to be alongside the line for the password (this indicates that a parameter can be changed or selected). Enter the correct password one letter at a time using the Rotary Menu Selector to scroll up and down the alphabet, and then pressing selector button. **The default password is 'atg'.** If you enter the password incorrectly the screen will display:

	P	A	S	S	W	O	R	D		E	R	R	O	R				↑	↓
	F	O	R		M	E	N	U		2		E	N	T	R	Y			
→		R	E	T	R	Y													
		C	A	N	C	E	L												

You can re-try the password by first pressing the menu selector and then loading the correct password. There is no limit to the number of retries. If the correct password has been entered, the first screen of the Set-up Menu will be displayed:

→	R	E	S	E	T		H	O	U	R	S		R	U	N			↑	↓
	A	T		M	A	X		B	R	I	L	L							

Turn the Rotary Menu Selector anticlockwise to scroll down to the through the Set-up Menu screens. Pressing the selector will enter the sub-menu and allow the Set-up parameters to be changed as required.

For example, to set the Remote Control Configuration, scroll down to this screen:

→	R	E	M	O	T	E		C	O	N	T	R	O	L				↑	↓
	C	O	N	F	I	G	:												
		8		W	I	R	E												

Press the Rotary Menu Selector and then turn the selector anticlockwise to scroll down through the available settings to the desired Remote Control Input Configuration. The left-hand arrow (→) moves down from the top line alongside the available settings when in the selection mode.

	R	E	M	O	T	E		C	O	N	T	R	O	L				↑	↓
	C	O	N	F	I	G	:												
		8		W	I	R	E		&		C	M	D						
→		S	E	R	I	A	L		C	O	M	M	S						

With the arrow (→) against the desired configuration press the Rotary Menu Selector; the following screen will then be displayed:

	R	E	M	O	T	E		C	O	N	T	R	O	L				↑	↓
	C	O	N	F	I	G	:												
→		C	A	N	C	E	L		C	H	A	N	G	E					
		C	O	N	F	I	R	M		C	H	A	N	G	E				

Turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves to the bottom line (alongside 'CONFIRM CHANGE'), then press the selector again to confirm the selection. Alternatively, if you do not wish to change the setting, press the selector when the arrow (→) is alongside 'CANCEL'.

	R	E	M	O	T	E		C	O	N	T	R	O	L				↑	↓
	C	O	N	F	I	G	:							:					
		C	A	N	C	E	L		C	H	A	N	G	E					
→		C	O	N	F	I	R	M		C	H	A	N	G	E				

The display will exit from the sub-menu and change to the following Menu 2 screen, confirming the new Remote Control Configuration:

→	R	E	M	O	T	E		C	O	N	T	R	O	L				↑	↓
	C	O	N	F	I	G	:												
		S	E	R	I	A	L		C	O	M	M	S						

All of the Set-up and Engineering Configuration screens and sub-menus operate in a similar manner.

To enter Menu 3 – Engineering Configuration, scroll down to the last but one screen within Menu 2:

→	E	N	T	E	R		M	E	N	U		3	-				↑	↓
	E	N	G	I	N	E	E	R	I	N	G		C	O	N	F	I	G	:

By pressing the selector, the password entry screen will then be shown. Refer to 8.4.1 for instructions on accessing the Engineering Configuration menu.

To exit Menu 2 and return to the Main Menu / Run screens, scroll down to the last screen within Menu 2 to display this:

→	E	X	I	T		M	E	N	U		2		-					↑	
	S	E	T	-	U	P		M	E	N	U								

Press the selector to show the cancel / confirm screen:

	E	X	I	T		M	E	N	U		2		-					↑	↓
	S	E	T	-	U	P		M	E	N	U								
→		C	A	N	C	E	L												
		C	O	N	F	I	R	M											

Turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves to the bottom line (alongside 'CONFIRM'), then press the selector again to confirm the exit from the menu.

8.3.2 Menu 2 - Set-up Menu Screens

To access the following screens, first turn the Brilliancy Control Selector switch SW1 to 'OFF', then enter Menu 2 - Set-up Menu, as described above in Section 8.3.1.

To exit Menu 2, scroll down to the last screen 'EXIT MENU 2 SET-UP CONFIGURATION', press the Rotary Menu Selector, then confirm exit. This is described at the end of section 8.3.1 above.

8.3.2.1 Reset Hours Run at Maximum Brilliancy

The CCR records the total number of Hours Run and the number of Hours Run at Maximum Brilliancy. It is possible from this sub-menu to reset to zero the counter for the Hours Run at Maximum Brilliancy; this may be desired after replacing the lamps in a circuit.

Enter the Set-up Menu as described in Section 8.3.1; the first screen within Menu 2 is:

→	R	E	S	E	T		H	O	U	R	S		R	U	N			↑	↓
	A	T		M	A	X		B	R	I	L	L							

To reset the 'Hours Run at Max Brill' press the Rotary Menu Selector and the screen will change to:

	R	E	S	E	T		H	O	U	R	S		R	U	N			↑	↓
	A	T		M	A	X		B	R	I	L	L							
→		C	A	N	C	E	L												
		C	O	N	F	I	R	M											

Turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves to the bottom line (alongside 'CONFIRM'), then press the menu selector again to confirm the selection.

	R	E	S	E	T		H	O	U	R	S		R	U	N			↑	↓
	A	T		M	A	X		B	R	I	L	L							
		C	A	N	C	E	L												
→		C	O	N	F	I	R	M											

The Hours Run at Maximum Brilliancy counter will now be reset to zero.

8.3.2.2 Remote Control Configuration

The Remote Control of the CCR may be performed using 3-Wire Encoded, BCD Encoded, BCD Option 2, 8-Wire Brilliancy Selection or Serial Communications, all with or without Command On. (Note – 8-Wire control is normally used for 3 Step, 5 Step and 8 step applications). Refer to section 3.3 - Control Connections - for more information on the different remote control wiring configurations. This section describes how to program the CCR for the required configuration.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	R	E	M	O	T	E		C	O	N	T	R	O	L				↑	↓
	C	O	N	F	I	G	:												
		8		W	I	R	E												

Press the selector; the cursor will move to the bottom line alongside the default or the previously selected option:

	R	E	M	O	T	E		C	O	N	T	R	O	L				↑	↓
	C	O	N	F	I	G	:												
		B	C	D		O	P	T	I	O	N		2		&		C	M	D
→		8		W	I	R	E												

Turn the Rotary Menu Selector clockwise to show the available options starting at the top of the list:

	R	E	M	O	T	E		C	O	N	T	R	O	L				↑	↓
	C	O	N	F	I	G	:												
→		E	X	I	T														
		3		W	I	R	E												

Turning the Rotary Menu Selector anticlockwise scrolls down through the other available settings:

	R	E	M	O	T	E		C	O	N	T	R	O	L		↑	↓
	C	O	N	F	I	G	:										
		3		W	I	R	E										
→		3		W	I	R	E		&		C	M	D				

	R	E	M	O	T	E		C	O	N	T	R	O	L		↑	↓
	C	O	N	F	I	G	:										
		B	C	D													
→		B	C	D		&		C	M	D							

	R	E	M	O	T	E		C	O	N	T	R	O	L		↑	↓
	C	O	N	F	I	G	:										
		B	C	D		O	P	T	I	O	N		2				
→		B	C	D		O	P	T	I	O	N		2		&	C	M	D

	R	E	M	O	T	E		C	O	N	T	R	O	L		↑	↓
	C	O	N	F	I	G	:										
		8		W	I	R	E										
→		8		W	I	R	E		&		C	M	D				

	R	E	M	O	T	E		C	O	N	T	R	O	L		↑	↓
	C	O	N	F	I	G	:										
		8		W	I	R	E		&		C	M	D				
→		S	E	R	I	A	L		C	O	M	M	S				

Refer to section 3.3 Control Connections, for more information on the different remote control wiring configurations.

Scroll up or down to set the arrow (→) alongside the desired setting, then press the Rotary Menu Selector to select that option.

The following screen will then be displayed:

	R	E	M	O	T	E		C	O	N	T	R	O	L		↑	↓
	C	O	N	F	I	G	:										
→		C	A	N	C	E	L		C	H	A	N	G	E			
		C	O	N	F	I	R	M		C	H	A	N	G	E		

Turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves to the bottom line (alongside ‘CONFIRM CHANGE’), then press the selector again to confirm the selection.

The display will exit from the sub-menu and change to the following Menu 2 screen, confirming the new Remote Control Configuration:

→	R	E	M	O	T	E		C	O	N	T	R	O	L				↑	↓
	C	O	N	F	I	G	:												
		S	E	R	I	A	L		C	O	M	M	S						

8.3.2.3 Alarm enable for Multiple Remote Brilliancy

The CCR will give an alarm if more than one Remote Brilliancy Input is selected when using 8-Wire control. This screen allows the alarm to be disabled.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	A	L	A	R	M		O	N		M	U	L	T	I	P	L	E	↑	↓
	R	E	M	O	T	E		I	N	P	U	T	S	:					
		E	N	A	B	L	E	D											

Press the selector and the screen will change to show the following options:

	A	L	A	R	M		O	N		M	U	L	T	I	P	L	E	↑	↓
	R	E	M	O	T	E		I	N	P	U	T	S	:					
→		E	N	A	B	L	E	D											
		D	I	S	A	B	L	E	D										

Select between ‘ENABLED’ and ‘DISABLED’ by turning the Rotary Menu Selector to set the arrow (→) alongside the desired setting, then press the Rotary Menu Selector.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits the submenu.

8.3.2.4 Communications Address

If the CCR is configured to use ‘Communication’ for remote control, the serial communications address must be set. (This must also be set if ‘read only’ communications are to be used for monitoring purposes).

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	S	E	R	I	A	L		C	O	M	M	S					↑	↓
	A	D	D	R	E	S	S	:										
		2	5	5														

Press the selector and the arrow (→) moves to the bottom line to indicate that the address can now be changed:

	S	E	R	I	A	L		C	O	M	M	S				↑	↓
	A	D	D	R	E	S	S	:									
→			1	6													

The required address can now be set; the valid range is between 001 and 254; the default value of 255 is outside of range and means that the address has not been set. Turn the Rotary Menu Selector to increment or decrement the value; turning anticlockwise past zero causes the value to loop round to 255.

Press the menu selector when the desired value is shown, the cancel / confirm change screen will now be shown. Turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu.

Note: The communications protocol used is dependent upon which communications module is fitted to the CCR. These are described in the corresponding supplementary documentation: Micro 100/200 CCR Communications Card (Profibus), document number HS12-0-03-0*, Micro 100/200 CCR Communications Card (Modbus TCP / IP), document number HS12-0-09-0*, or Micro 100/200 CCR Communications Card (J-Bus), document number HS12-0-04-0*. (Note – the last digit indicates the document issue number).

8.3.2.5 Serial Communication Fault Delay Time

This screen allows adjustment of the time delay between a communications fault being detected and the alarm being activated. Note – this alarm can only be activated if the CCR is configured to use 'Communication' for remote control.

The default alarm delay time is 5 seconds.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	S	E	R	I	A	L		C	O	M	M	S					↑	↓
	F	A	U	L	T		D	E	L	A	Y		T	I	M	E	:	
		5		S														

Press the selector and the arrow (→) moves to the bottom line to indicate that the alarm delay time can now be changed:

	S	E	R	I	A	L		C	O	M	M	S					↑	↓
	F	A	U	L	T		D	E	L	A	Y		T	I	M	E	:	
→		5		S														

Turn the Rotary Menu Selector to increment or decrement the delay time. The valid range is between 2 and 15 seconds; turning anticlockwise below 2 causes the value to loop round to 15 seconds.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu.

8.3.2.6 CCR Action in the event of a Communications Fault

If the CCR is configured to use 'Communication' for remote control, the action to be taken in the event of a serial communications fault can be set using this screen.

The three possible fault actions are:

1) 'CCR - LATCH' (default setting). Selecting this means that the CCR will continue operating with the last instruction received before communication was lost.

2) 'CCR - ON'. This setting will, if the CCR was commanded to 'OFF' by the last instruction received but with a brilliancy level still selected, cause the CCR to turn back on at the brilliancy level of the last instruction. Note – it is always recommended to maintain selection of a brilliancy level from the control system even when the CCR is commanded to 'OFF'. If this is not done, then the CCR will not have a brilliancy level to return to, and will not switch back on in the event of communications failure.

   If the CCR was commanded to 'ON' by the last instruction received, it will continue operating with the previously selected brilliancy.

3) 'CCR - OFF'. Selecting this will turn the CCR off in the event of a communications fault.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the third screen:

→	S	E	R	I	A	L		C	O	M	M	S					↑	↓
	F	A	U	L	T		A	C	T	I	O	N	:					
		C	C	R		-		L	A	T	C	H						

Press the selector and the screen will change to show the following options:

	S	E	R	I	A	L		C	O	M	M	S					↑	↓
	F	A	U	L	T		A	C	T	I	O	N	:					
→		C	C	R		-		L	A	T	C	H						
		C	C	R		-		O	N									

Turning the Rotary Menu Selector anticlockwise scrolls down through the other available settings:

	S	E	R	I	A	L		C	O	M	M	S					↑	↓
	F	A	U	L	T		A	C	T	I	O	N	:					
		C	C	R		-		O	N									
→		C	C	R		-		O	F	F								

Scroll up or down to set the arrow (→) alongside the desired setting, then press the Rotary Menu Selector to select that option.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu.

Note: The fault actions described above apply only when the CCR Brilliancy Selector Switch is set to 'REM'.

8.3.2.7 Brilliancy Levels Style selection

The CCR may operate using output current levels specified by UK CAP 168, FAA or IEC/EN standards (see Table 4-1 through to Table 4-4 of Section 4.2), or levels defined by the user.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	B	R	I	L	L	I	A	N	C	Y		L	E	V	E	L	S	↑	↓
	S	T	Y	L	E	:												
		5		S	T	E	P		S	T	Y	L	E		2			

Press the selector; the arrow (→) will move down to be alongside the default or the previously selected option. Turn the Rotary Menu Selector clockwise to show the available options starting at the top of the list:

	B	R	I	L	L	I	A	N	C	Y		L	E	V	E	L	S	↑	↓
	S	T	Y	L	E	:												
→		5		S	T	E	P		S	T	Y	L	E		2			
		3		S	T	E	P		S	T	Y	L	E		1			

Turning the Rotary Menu Selector anticlockwise scrolls down through the other available settings:

	B	R	I	L	L	I	A	N	C	Y		L	E	V	E	L	S	↑	↓
	S	T	Y	L	E	:												
		8		S	T	E	P		U	K		C	A	P		1	6	8	
→		U	S	E	R		D	E	F	I	N	E	D						

	B	R	I	L	L	I	A	N	C	Y		L	E	V	E	L	S	↑	↓
	S	T	Y	L	E	:													
		U	S	E	R		D	E	F	I	N	E	D						
→		U	S	E	R		D	E	F	I	N	E	D		D	I	O		

Note - section 4.2 contains tables showing the pre-programmed current levels for each of the settings listed above, except for the 'USER DEFINED' levels. The setting of the customised User Defined Current levels is described in Section 8.3.2.8 below.

Turn the Rotary Menu Selector to scroll up or down to set the arrow (→) alongside the desired setting, then press to select that option.

The cancel / confirm change screen will now be shown. Turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu.

8.3.2.8 Set User Defined Brilliancy Levels

This menu is available only if 'USER DEFINED' or 'USER DEFINED DIO' Brilliancy Levels Style have been selected from the previous menu.

For each of the eight User Defined Brilliancy Levels, the CCR output current can be programmed – in amps, to 2 decimal places - to any value between 5% and 100% of Maximum Output Current.

The default or initial current settings for User Defined Brilliancy Levels are those of the Brilliancy Levels Style that were previously selected, be it 5 Step Style 2, 3 Step Style 1 or 8 Step UK CAP 168.

The CCR can also be programmed to turn off on when a particular Brilliancy Level is selected. This is particularly useful when a number of CCRs are controlled in parallel by the same remote Brilliancy control lines, and it is required to turn off one or more CCRs on certain Brilliancy Levels. This is done by setting the User Current Level to '0.00A'. When this Brilliancy Level is selected in operation, the CCR will switch off and display one of the following, depending if the CCR is operating in Local or Remote, with the second line flashing:

L	O	C	A	L			B	R	I	L	L		1					↑	↓
U	S	E	R		B	R	I	L	L	I	A	N	C	Y		O	F	F	
O	P		C	U	R	R	E	N	T	:			0	.	0	0		A	
O	P		V	O	L	T	A	G	E	:						0		V	

R	E	M	O	T	E		B	R	I	L	L		1					↑	↓
U	S	E	R		B	R	I	L	L	I	A	N	C	Y		O	F	F	
O	P		C	U	R	R	E	N	T	:			0	.	0	0		A	
O	P		V	O	L	T	A	G	E	:						0		V	

This section describes how to set the User Current Levels.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	U	S	E	R		B	R	I	L	L	I	A	N	C	Y			↑	↓
	L	E	V	E	L	S	:												

Press the selector to show the following screen:

	U	S	E	R		B	R	I	L	L	I	A	N	C	Y			↑	↓
	L	E	V	E	L	S	:												
→		E	X	I	T														
		B	R	I	L	L		1	:			2	.	8	0		A		

To quit without making any changes, press the selector with the arrow (→) alongside 'EXIT', otherwise turn the Rotary Menu Selector anticlockwise by one click to show the following screen

	U	S	E	R		B	R	I	L	L	I	A	N	C	Y			↑	↓
	L	E	V	E	L	S	:												
		B	R	I	L	L		1	:			2	.	8	0		A		
→		B	R	I	L	L		2	:			3	.	4	0		A		

Turn the selector to set the arrow (→) alongside whichever Brilliancy Level it is necessary to adjust, then press the selector to enter the set screen:

	U	S	E	R		B	R	I	L	L	I	A	N	C	Y			↑	↓
	L	E	V	E	L	S													
		B	R	I	L	L	I	N	A	C	Y		1	:					
→		S	E	T		T	O	:			2	.	8	0		A			

Enter the desired Brilliancy (Current) Level one digit at a time using the Rotary Menu Selector to increase or decrease the value (the active digit will flash on and off), and then press the selector button to move to the next digit. Note – it is possible to set the current to 0.00A, which means the CCR turns off on this Brilliancy setting. Attempting to set a current a level above 0.00A but less than 5% of nominal output current causes the second and third decimal places to go to the minimal value of 5% as a starting point.

When all digits have been entered the cancel / confirm change screen will be displayed:

	U	S	E	R		B	R	I	L	L		L	V	L		1		↑	↓
	S	E	T		T	O	:			2	.	8	0		A				
→		C	A	N	C	E	L		C	H	A	N	G	E					
		C	O	N	F	I	R	M		C	H	A	N	G	E				

Turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits this submenu to once again display the following screen:

	U	S	E	R		B	R	I	L	L	I	A	N	C	Y	↑	↓
	L	E	V	E	L	S	:										
		B	R	I	L	L		1	:			2	.	8	0	A	
→		B	R	I	L	L		2	:			3	.	4	0	A	

Turn the Rotary Menu Selector anticlockwise to move the arrow (→) alongside the next Brilliancy (Current) Level which is to be adjusted; the procedure is as described above.

Once all Brilliancy Levels have been set as required, from the first submenu turn the Rotary Menu Selector clockwise to move the arrow (→) alongside 'EXIT' then press the selector:

	U	S	E	R		B	R	I	L	L	I	A	N	C	Y	↑	↓
	L	E	V	E	L	S	:										
→		E	X	I	T												
		B	R	I	L	L		1	:			2	.	8	0	A	

This exits back to Menu 2, the Set-up menu.

8.3.2.9 Tolerance Monitoring Enable

Tolerance Monitoring checks that the CCR output current falls within the specified tolerance limits; this function is enabled or disabled as described below.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	T	O	L	E	R	A	N	C	E							↑	↓
	M	O	N	I	T	O	R	I	N	G	:						
		E	N	A	B	L	E	D									

Press the selector and the screen will change to show the following options, the arrow (→) will have moved down to be alongside the default or the previously selected option:

	T	O	L	E	R	A	N	C	E							↑	↓
	M	O	N	I	T	O	R	I	N	G	:						
→		E	N	A	B	L	E	D									
		D	I	S	A	B	L	E	D								

Select between 'ENABLED' and 'DISABLED' by turning the Rotary Menu Selector to set the arrow (→) alongside the desired setting, then press the Rotary Menu Selector.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu.

8.3.2.10 Tolerance Monitor Alarm Delay Time

This sub-menu is only available if Tolerance Monitoring has been enabled.

This screen allows adjustment of the time delay between the Tolerance Monitoring threshold being crossed, and the alarm being activated. The default delay time is 15 seconds.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	T	O	L	E	R	A	N	C	E		M	O	N	I	T	O	R	↑	↓
	A	L	A	R	M		D	E	L	A	Y		T	I	M	E	:		
		1	5		S														

Press the selector and the arrow (→) moves to the bottom line to indicate that the alarm delay time can now be changed:

	T	O	L	E	R	A	N	C	E		M	O	N	I	T	O	R	↑	↓
	A	L	A	R	M		D	E	L	A	Y		T	I	M	E	:		
→		1	5		S														

Turn the Rotary Menu Selector to increment or decrement the delay time. The valid range is between 5 and 60 seconds; turning anticlockwise below 5 causes the value to loop round to 60 seconds.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu.

8.3.2.11 Setting User Defined Tolerance Monitor Alarm Threshold Levels

This sub-menu is only available if Tolerance Monitoring has been enabled.

The Tolerance Monitor Alarm Threshold levels are set by default according to the Brilliancy Levels Style selected (see Section 8.3.2.7 above), be it 5 Step FAA / IEC Style 2, 3 Step FAA / IEC Style 1 or 8 Step UK CAP 168. The Upper (MAX) and Lower (MIN) Limits are listed in the tables of Section 4.2.

The Tolerance Monitor Alarm Thresholds can be adjusted from the pre-set values, although it is not generally recommended to adjust these levels when the standard 5 Step FAA / IEC Style 2, 3 Step FAA / IEC Style 1 or 8 Step UK CAP 168 Brilliancy settings are used.

The default or initial Tolerance Monitor Alarm Threshold levels for 'User Defined' brilliancies are taken from one of the standard tables of Section 4.2; if the User Defined brilliancy (current levels) are changed from the default values, then the Tolerance Levels are automatically moved to be +/- 0.1A from the new operating current value. Further adjustments can be made via this sub-menu if necessary.

Adjustment of the Tolerance Monitor Alarm Thresholds is described below.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	T	O	L	E	R	A	N	C	E		M	O	N	I	T	O	R	↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	S			

Press the menu selector and the screen will change to:

	T	O	L	E	R	A	N	C	E		M	O	N	I	T	O	R	↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	S			
→		E	X	I	T														
		B	R	I	L	L		1		M	I	N			2	.	7	0	A

To quit without making any changes, press the selector with the arrow (→) alongside 'EXIT', otherwise turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves alongside the threshold level that is to be adjusted:

	T	O	L	E	R	A	N	C	E		M	O	N	I	T	O	R	↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	S			
		E	X	I	T														
→		B	R	I	L	L		1		M	I	N			2	.	7	0	A

Press the selector to enter the set screen:

	T	O	L	E	R	A	N	C	E		M	O	N	I	T	O	R	↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	S			
		B	R	I	L	L		1		M	I	N		T	H	L	D		
→		S	E	T		T	O	:				2	.	7	0		A		

Enter the desired tolerance alarm threshold one digit at a time using the Rotary Menu Selector to increase or decrease the value (the active digit will flash on and off), and then press the selector button to move to the next digit. When all digits have been entered the cancel / confirm change screen will be displayed:

	B	R	I	L	L		1		M	I	N		T	H	L	D			
	S	E	T		T	O	:				2	.	7	0		A			
→		C	A	N	C	E	L		C	H	A	N	G	E					
		C	O	N	F	I	R	M		C	H	A	N	G	E				

Turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits this submenu to once again display the following screen:

	T	O	L	E	R	A	N	C	E		M	O	N	I	T	O	R	↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	S			
		E	X	I	T														
→		B	R	I	L	L		1		M	I	N			2	.	7	0	A

Turn the Rotary Menu Selector anticlockwise to move the arrow (→) alongside the next tolerance threshold limit which is to be adjusted; the procedure is as described above.

Once all tolerance limits have been set as required, from the first submenu turn the Rotary Menu Selector clockwise to move the arrow (→) alongside 'EXIT' then press the selector:

	T	O	L	E	R	A	N	C	E		M	O	N	I	T	O	R	↑	↓
	A	L	A	R	M		T	H	R	E	S	H	O	L	D	S			
→		E	X	I	T														
		B	R	I	L	L		1		M	I	N			2	.	7	0	A

This exits back to Menu 2, the Set-up menu.

8.3.2.12 Black Heat Output Current in Remote Off

The CCR can be configured to give a 'Black Heat' low level output current when the CCR is set to 'Remote Off', in order to prevent condensation in tungsten halogen light fittings such as PAPI's.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	B	L	A	C	K		H	E	A	T		O	U	T	P	U	T	↑	↓
	C	U	R	R	E	N	T		I	N		R	E	M		O	F	F	:

Press the selector and the screen will change to show the following options, the arrow (→) will have moved down to be alongside the default or the previously selected option:

	B	L	A	C	K		H	E	A	T		O	U	T	P	U	T	↑	↓
	C	U	R	R	E	N	T		I	N		R	E	M		O	F	F	:
		E	N	A	B	L	E	D											
→		D	I	S	A	B	L	E	D										

Select between ‘ENABLED’ and ‘DISABLED’ by turning the Rotary Menu Selector to set the arrow (→) alongside the desired setting, then press the Rotary Menu Selector.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits the submenu.

8.3.2.13 Black Heat Current Level

This sub-menu is only available if ‘Black Heat’ has been enabled. This section describes how to set the Black Heat current level.

The Black Heat current may be set as required to any value between 12% of the Maximum Output Current, and Maximum Output Current; the default value is 1.5A for a 6.0A or 6.6A regulator, or 2.5A for a 12A regulator.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	B	L	A	C	K		H	E	A	T		O	U	T	P	U	T	↑	↓
	C	U	R	R	E	N	T		L	E	V	E	L	:					
			1	.	5	0		A											

Press the selector and the arrow (→) moves to the bottom line to indicate that the current level can now be changed:

	B	L	A	C	K		H	E	A	T		O	U	T	P	U	T	↑	↓
	C	U	R	R	E	N	T		L	E	V	E	L	:					
→			1	.	5	0		A											

Enter the desired Brilliancy (Current) Level one digit at a time using the Rotary Menu Selector to scroll up and down, and then press the selector button. Note – it is not possible to load a value of less than 12% of the CCR maximum rated current, ie, 0.79A on a 6.60A regulator, or greater than the rated current.

When all digits have been entered the cancel / confirm change screen will be displayed:

	B	L	A	C	K		H	E	A	T		O	U	T	P	U	T	↑	↓
	C	U	R	R	E	N	T		L	E	V	E	L	:					
→		C	A	N	C	E	L		C	H	A	N	G	E					
		C	O	N	F	I	R	M		C	H	A	N	G	E				

Turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits this submenu.

8.3.2.14 Black Heat - Run Back Indication Relay Action

This sub-menu is only available if 'Black Heat' has been enabled.

The Run Back Indication Relay can be programmed to 'ENERGISED WITH BH' when the CCR is producing a 'Black Heat' output current in 'Remote Off', or not energised in this condition. The default setting is 'NOT ENERGISED', since the control system would normally interpret a 'Run' Back Indication signal as a fault when the CCR has been commanded to off via the remote control.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	B	L	A	C	K		H	E	A	T							↑	↓
	R	U	N		B	I		R	E	L	A	Y		A	C	T	I	O	N
		N	O	T		E	N	E	R	G	I	S	E	D					

Press the selector and the screen will change to show the following options; the arrow (→) will have moved down to be alongside the default or the previously selected option:

	B	L	A	C	K		H	E	A	T							↑	↓
	R	U	N		B	I		R	E	L	A	Y		A	C	T	I	O	N
		E	N	E	R	G	I	S	E	D		W	I	T	H		B	H	
→		N	O	T		E	N	E	R	G	I	S	E	D					

Select between 'ENERGISED WITH BH' and 'NOT ENERGISED' by turning the Rotary Menu Selector to set the arrow (→) alongside the desired setting, then press the Rotary Menu Selector.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu.

8.3.2.15 Earth Leakage Resistance Measurement Configuration

The optional AT699 and AT709 Earth Leakage Measurement Cards provide an analogue measurement of the earth leakage resistance, ie, the resistance from the primary series loop to ground.

To view or change the first of the Earth Leakage System settings, enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	E	A	R	T	H		L	E	A	K	A	G	E					↑	↓
	M	E	A	S	U	R	E	M	E	N	T		C	O	N	F	I	G	:
		D	I	S	A	B	L	E	D										

The setting on this screen can be selected between ‘ENABLED’, ‘CONTINUOUS ENABLED’ and ‘DISABLED’. However, if the optional AT699 and AT709 cards are not fitted to the CCR then this setting should be left as ‘DISABLED’. If set to ‘DISABLED’, then the other Earth Leakage System set-up screens are not available.

Refer to Section 4.5 for a complete description of how to commission the Earth Leakage Resistance Measurement system, and Section 4.5.2 on programming the operating parameters.

8.3.2.16 Percentage Lamp Failure Detection Configuration (optional)

The optional AT1127 PLF Card and AT1031 PLF & Power Analyser Card (one or the other can be fitted) generate an error signal that is a function of the Percentage of Lamps Failed on the AGL circuit. This error signal is fed to the microcontroller on the AT1030 Motherboard thus enabling a measurement of the number of open circuit lamps on the AGL circuit.

To view or change the setting, first enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	%		L	A	M	P		F	A	I	L	U	R	E				↑	↓
	(	P	L	F	)		C	O	N	F	I	G	U	R	A	T	I	O	N
		D	I	S	A	B	L	E	D										

Refer to Section 4.6 for a full description of how to configure the PLF system, and Figure 8-3 and Table 8-2 give a listing of the sub-menus available if the PLF Configuration is set to ‘ENABLED’

8.3.2.17 Output Voltage Monitoring

In order to monitor the CCR output voltage and output load kVA, the optional AT1127 Percentage Failure Card must be fitted. (Note - this card is included in CCRs built to FAA L-829 specification).

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	O	U	T	P	U	T		V	O	L	T	A	G	E				↑	↓
	M	O	N	I	T	O	R	I	N	G	:								
		D	I	S	A	B	L	E	D										

Refer to Section 4.4.1 for more information on this feature.

8.3.2.18 Output Transformer Tapping Voltage

To correctly monitor the output voltage and output load kVA of the CCR, the actual tapping voltage used on the Main CCR Output Transformer must be entered. Note – this screen is only available if 'Output Voltage Monitoring' has been enabled.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	M	A	I	N		T	R	A	N	S	F	O	R	M	E	R		↑	↓
	T	A	P	P	I	N	G		V	O	L	T	A	G	E	:			
					1	V													

Refer to Section 4.4.2 for more information.

8.3.2.19 KVA Alarm Enable

If 'Output Voltage Monitoring' is activated, then 'KVA Alarm' can also be enabled (this function is always enabled on FAA L-829 regulators). This generates an alarm if the CCR output load kVA drops below 90% of the peak measured load value for the brilliancy step in operation, for a period of 5 seconds.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	K	V	A		A	L	A	R	M	:								↑	↓
		D	I	S	A	B	L	E	D										

Refer to Section 4.4.3 for more information on this feature.

8.3.2.20 Internal Circuit Selector Switch Configuration (optional)

The optional Internal Circuit Selector Switch (CSS) is available in two formats:

i. Alternate Circuit Selector. This version switches the CCR output between two available AGL circuits, using changeover contacts from a contactor or vacuum relay.

ii. Multiway Circuit Selector. The number of circuits that can be controlled can be anywhere between 2 and 6 circuits. The Circuit Selector contactors or vacuum relays are arranged so that when the contact is closed, it shorts out the requisite section of the AGL circuit, thus switching off that section of lights.

If the CCR has been built with an Internal Circuit Selector fitted, then most of the settings for this will have been configured via the menu system during factory testing of the CCR. However, for Multiway Circuit Selectors the correct failsafe settings should be made by wiring to normally open or normally closed switch contacts, and

programming this information in via the menu system. Refer to the supplementary Internal Circuit Selector Manual for a full description of how to configure the Circuit Selector, and a listing of the sub-menus available if the screen shown below has been configured for CSS operation.

To view the first Circuit Selector screen, enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following sub-menu:

→	C	I	R	C	U	I	T		S	E	L	E	C	T	O	R		↑	↓
	T	Y	P	E	:														
		D	I	S	A	B	L	E	D										

This screen allows configuration of the Internal Circuit Selector Switch type, and allows entry to the other CSS set-up screens.

8.3.2.21 Brilliancy Back Indication Relays active during fault trip conditions

The control of the relays can be configured to either switch all relays off when a fatal alarm trips the regulator, or to continue to provide back indication of the demanded Brilliancy Level even during trip conditions.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	B	R	I	L	L		B	I		R	E	L	A	Y	S			↑	↓
	A	C	T	I	V	E		O	N		F	A	U	L	T	:			
		D	I	S	A	B	L	E	D										

Press the selector and the screen will change to show the following options; the arrow (→) will have moved down to be alongside the default or the previously selected option:

	B	R	I	L	L		B	I		R	E	L	A	Y	S			↑	↓
	A	C	T	I	V	E		O	N		F	A	U	L	T	:			
		E	N	A	B	L	E	D											
→		D	I	S	A	B	L	E	D										

Select between ‘ENABLED’ and ‘DISABLED’ by turning the Rotary Menu Selector to set the arrow (→) alongside the desired setting, then press the Rotary Menu Selector.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits the submenu.

8.3.2.22 LED and Screen Tests

The LEDs and the entire screen can be illuminated via this sub-menu for test purposes. Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to display the following screen:

→	L	E	D		&		S	C	R	E	E	N					↑	↓
	T	E	S	T	S													

Press the Rotary Menu Selector to show:

	L	E	D		&		S	C	R	E	E	N					↑	↓
	T	E	S	T	S													
→		E	X	I	T													
		L	E	D		T	E	S	T									

Turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves alongside ‘LED TEST’; pressing the selector turns on all three front panel LEDs. Pressing again turns them off.

Turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves to the bottom line alongside ‘SCREEN TEST’. Pressing the selector turns on all segments of the front panel OLED screen; pressing again turns them off and returns to the screen shown below.

	L	E	D		&		S	C	R	E	E	N					↑	↓
	T	E	S	T	S													
		L	E	D		T	E	S	T									
→		S	C	R	E	E	N		T	E	S	T						

Turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves down alongside ‘EXIT’, then press the selector to exit this submenu.

	L	E	D		&		S	C	R	E	E	N					↑	↓
	T	E	S	T	S													
→		E	X	I	T													
		L	E	D		T	E	S	T									

8.3.2.23 Changing the Set-up Menu Password

This section describes how to change the Menu 2, Set-up Menu entry password. Ensure that a record is kept of the new password.

Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to display the following screen:

→	C	H	A	N	G	E		P	A	S	S	W	O	R	D		↑	↓
	F	O	R		M	E	N	U		2		S	E	T	-	U	P	:
		a	t	g														

Press the menu selector and the arrow (→) will move down to the bottom line, alongside the password, to indicate that this can now be changed:

	C	H	A	N	G	E		P	A	S	S	W	O	R	D			↑	↓
	F	O	R		M	E	N	U		2		S	E	T	-	U	P	:	
→		a	t	g															

Enter the new password one letter at a time using the Rotary Menu Selector to scroll up and down, and then press the selector button. After entering the final letter, the screen will change to:

	C	H	A	N	G	E		P	A	S	S	W	O	R	D			↑	↓
	F	O	R		M	E	N	U		2		S	E	T	-	U	P	:	
→		C	A	N	C	E	L		C	H	A	N	G	E					
		C	O	N	F	I	R	M		C	H	A	N	G	E				

Turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new password and exits the submenu.

8.3.2.24 Enter Menu 3 – Engineering Configuration Menu

Menu 3, the Engineering Configuration Menu, contains parameters that are set during factory testing of the CCR and would not normally require further changes.

The Engineering Configuration Menu is accessed from the Set-up Menu by the use of a password. Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to display the last but one screen:

→	E	N	T	E	R		M	E	N	U		3	-					↑	↓
	E	N	G	I	N	E	E	R	I	N	G		C	O	N	F	I	G	

Accessing the Engineering Configuration menu is described in Section 8.4.1.

8.3.2.25 Exit Menu 2 – Set-up Menu

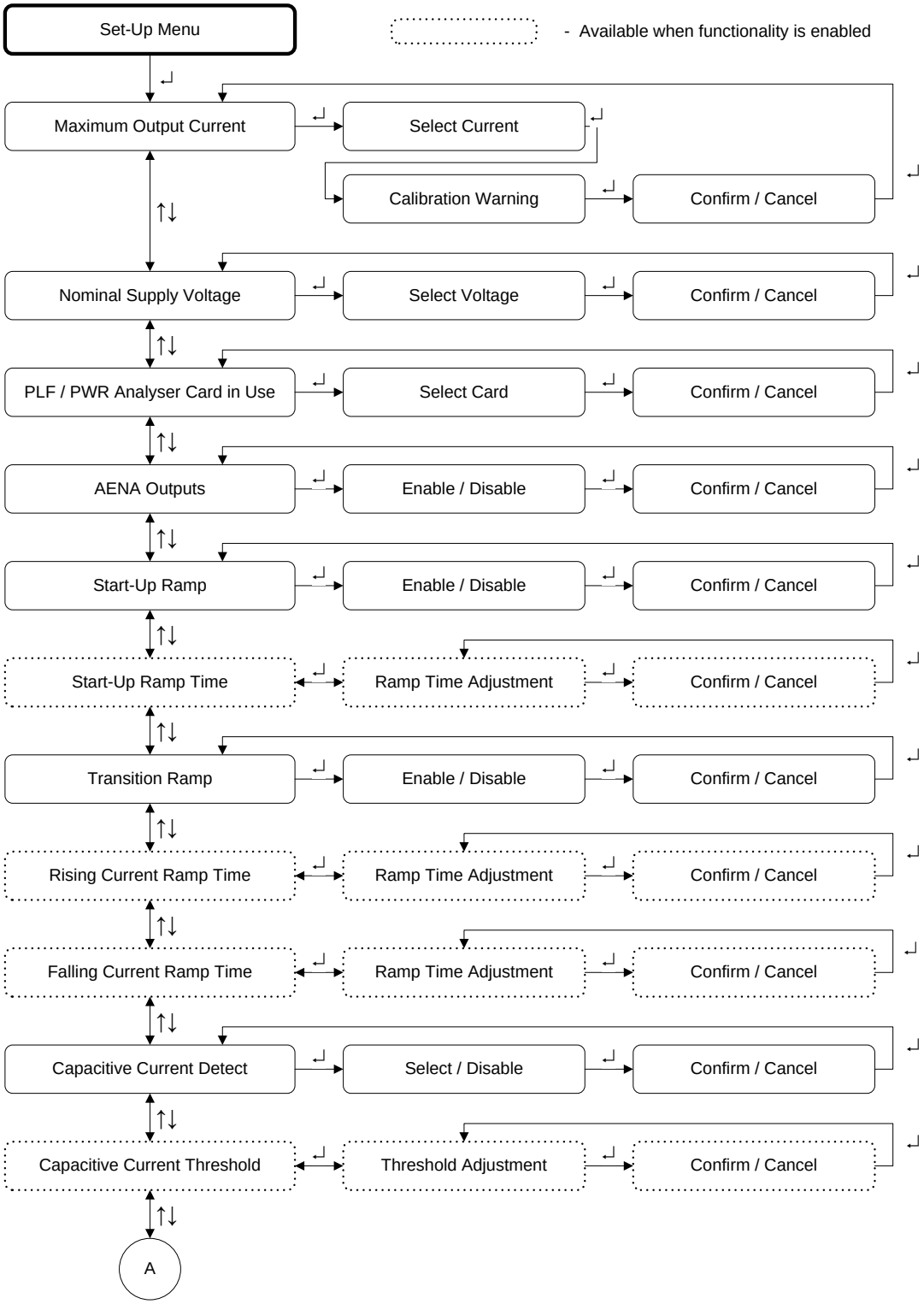
From within the Set-up Menu, turn the Rotary Menu Selector anticlockwise to display the final screen:

→	E	X	I	T		M	E	N	U		2		-					↑	
	S	E	T	-	U	P		M	E	N	U								

Press the menu selector; the cancel / confirm screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM' then press the selector again – this will exit from the Set-up Menu.

8.4 Menu 3 - Engineering Configuration Menu

The Engineering Configuration Menu contains parameters that are set during factory testing of the CCR and would not normally require further changes. Enter this menu as described below. The flowchart of the Menu is shown in Figure 8-4 below:



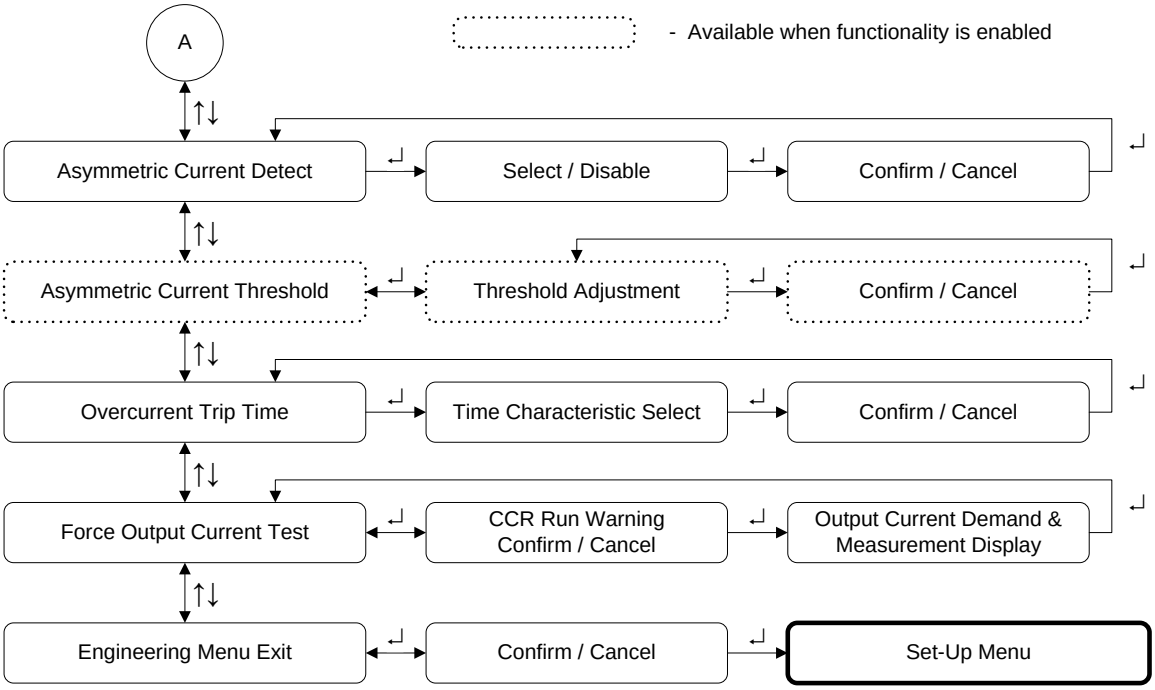


Figure 8-4 Engineering Configuration Menu Flowchart

Table 8-3 (below) gives a listing of the screens and the default settings for the operating parameters.

Parameter	**Description**	**Default Settings**
MAXIMUM OUTPUT CURRENT	Select CCR maximum output current. Available settings are 6.00, 6.60, 12.0 and 20.0A.	6.60A
NOMINAL SUPPLY VOLTAGE	Select the nominal supply voltage for which the CCR has been manufactured. Note - this will be indicated on the CCR nameplate.	415V
PLF / POWER ANALYSER CARD IN USE	Allows selection between AT1031 PLF-PA Card, AT1127 PLF Card or disabled	DISABLED
CCR KVA RATING	Enter the kVA rating of the CCR. Note - screen not available on all CCRs.	30kVA
AENA OUTPUTS	Enables AENA I/O configuration (for Spanish market)	DISABLED
START-UP RAMP	The CCR can be programmed to gradually ramp up the output current to the selected level on start-up, in a set time period, rather than switch on directly at the selected level. Enable/ Disable Start Ramp.	DISABLED
START-UP RAMP TIME	Set the Current Ramp time for CCR start-up. (Only available if Start Up Ramp is enabled)	600ms
TRANSITION RAMP	The CCR can be programmed to gradually ramp up and ramp down the output current on switching transitions, with separate time periods selectable for ramp up and ramp down. (Note – this has no effect on the initial Start-up ramp time). Enable/ Disable Transition Ramp.	DISABLED
RISING CURRENT RAMP TIME	Set the Current Ramp time for rising output current transitions. (Note – this has no effect on the initial Start-up ramp time. This is only available if Transition Ramp is enabled)	600ms

Parameter	Description	Default Settings
FALLING CURRENT RAMP TIME	Set the Current Ramp time for falling output current transitions. (This is only available if Transition Ramp is enabled).	600ms
CAPACITIVE CURRENT DETECTION	Detection of capacitive current flow can be set to trip the CCR, cause a soft alarm but continue operating, or detection can be disabled. For reasons of safety, it should be set to trip the CCR since for circuits using primary series loop cable with an earth screen, an open circuit fault may not otherwise be detected due to current continuing to flow through the capacitance of the earth sheath.	TRIP
CAPACITIVE CURRENT THRESHOLD	Sets the threshold level for detection of capacitive current. The valid range is from 1 to 100; the lower the value the more sensitive is the detector. It can be desensitised if nuisance tripping is encountered.	10
ASYMMETRIC CURRENT DETECTION	This feature detects an imbalance (asymmetry) in the current between the positive and negative half cycles of the CCR output waveshape, which can sometimes be caused by an imbalance in an active (electronic) load on the series loop circuit. Detection of asymmetric current can be set to trip the CCR, cause a soft alarm but continue operating, or detection can be disabled.	ALARM
ASYMMETRIC CURRENT THRESHOLD	Sets the threshold level for detection of asymmetric current. The valid range is from 1 to 100; the lower the value the more sensitive is the detector.	10
OVERCURRENT TRIP TIME	Set the Overcurrent Trip Time characteristic: IEC/EN setting trips in less than 5 seconds for an overcurrent of 102.3%, FAA setting trips in less than 5 seconds for an overcurrent of 105%	IEC (102.3% < 5s)
FORCE OUTPUT CURRENT TEST MENU	Test use only - not to be used on live circuit. Allows manual control of output current in order to test the Overcurrent and Undercurrent trip points	CCR maximum output current
EXIT MENU 3 ENGINEERING CONFIG	Allows exit from the Engineering Configuration Menu.	

Table 8-3 CCR Hardware Configuration Screens

8.4.1 Accessing the Engineering Configuration Menu

Menu 3, the Engineering Configuration Menu, contains parameters that are set during factory testing of the CCR and would not normally require further changes.

The Engineering Configuration Menu is accessed from the Set-up Menu by the use of a password. Enter the Set-up Menu as described in Section 8.3.1, and turn the Rotary Menu Selector anticlockwise to display the last but one screen:

→	E	N	T	E	R		M	E	N	U		3						↑	↓
	E	N	G	I	N	E	E	R	I	N	G		C	O	N	F	I	G	

Press the menu selector; the screen will change to:

	E	N	T	E	R		M	E	N	U		3					↑	↓
	E	N	G	I	N	E	E	R	I	N	G		C	O	N	F	I	G	
→		a	a	a															

Enter the correct password one letter at a time using the Rotary Menu Selector to scroll up and down the alphabet, and then pressing selector button. **The default password is 'e n g'.** If you enter the password incorrectly the screen will display:

	P	A	S	S	W	O	R	D		E	R	R	O	R			↑	↓
	F	O	R		M	E	N	U		3		E	N	T	R	Y			
→		R	E	T	R	Y													
		C	A	N	C	E	L												

You can re-try the password by first pressing the menu selector and then loading the correct password. There is no limit to the number of retries. If the correct password has been entered, the first screen of the Engineering Configuration Menu will be displayed:

→	M	A	X	I	M	U	M		O	U	T	P	U	T					↓
	C	U	R	R	E	N	T	:											
			6	.	6		A	M	P	S									

This sub-menu is described in Section 8.4.2 below.

Turn the Rotary Menu Selector anticlockwise to scroll down to the through the Engineering Configuration Menu screens. Pressing the selector will enter the sub-menu and allow the settings to be changed as required.

To exit from the Engineering Configuration Menu (Menu 3) and return to the Set-up Menu (Menu 2), scroll down to the last screen within Menu 3 to display this:

→	E	X	I	T		M	E	N	U		3							↑	
	E	N	G	I	N	E	E	R	I	N	G		C	O	N	F	I	G	

Press the selector to show the cancel / confirm screen:

	E	X	I	T		M	E	N	U		3							↑	
	E	N	G	I	N	E	E	R	I	N	G		C	O	N	F	I	G	
→		C	A	N	C	E	L		E	X	I	T							
		C	O	N	F	I	R	M		E	X	I	T						

Turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves to the bottom line (alongside 'CONFIRM'), then press the selector again to confirm the exit from the menu.

To exit Menu 2 and return to the Main Menu / Run screens, scroll down to the last screen within Menu 2 to display this:

→	E	X	I	T		M	E	N	U		2		-					↑	
	S	E	T	-	U	P		M	E	N	U								

Press the selector to show the cancel / confirm screen:

																		↑	
	S	E	T	-	U	P		M	E	N	U								
→		C	A	N	C	E	L		E	X	I	T							
		C	O	N	F	I	R	M		E	X	I	T						

Turn the Rotary Menu Selector anticlockwise so that the arrow (→) moves to the bottom line (alongside 'CONFIRM'), then press the selector again to confirm the exit from the menu.

8.4.2 Engineering Configuration Menu Screens

8.4.2.1 Setting the CCR Maximum Output Current

This screen allows the Maximum Output Current (nominal output current) of the regulator to be programmed. This value is indicated on the CCR name plate - and would only need to be re-programmed for the reasons described in Section 9.2.2.

Enter the Engineering Configuration Menu as described in Section 8.4.1; the first screen shown will be:

																		↓
→	M	A	X	I	M	U	M		O	U	T	P	U	T				
	C	U	R	R	E	N	T	:										
			6	.	6		A	M	P	S								

Press the selector and the screen will change to show the following current settings, with the arrow (→) shown alongside the default or the previously selected option:

S	E	T		M	A	X		O	P		C	U	R	R	:			↑	↓
		6	.	0	0		A	M	P	S									
→		6	.	6	0		A	M	P	S									
	1	2	.	0	0		A	M	P	S									

Turning the Rotary Menu Selector anticlockwise scrolls down to show the last available current setting:

S	E	T		M	A	X		O	P		C	U	R	R	:			↑	↓
		6	.	6	0		A	M	P	S									
→	1	2	.	0	0		A	M	P	S									
	2	0	.	0	0		A	M	P	S									

Turn the Rotary Menu Selector so that the arrow (→) moves alongside the required Maximum Output Current setting, then press the menu selector.

A warning screen will now be displayed:

→	W	A	R	N	I	N	G		-		C	H	A	N	G	I	N	G
M	A	X		O	P		C	U	R	R		M	A	Y				
R	E	Q	U	I	R	E		S	T	Y	L	E		A	N	D		
T	R	A	N	S	F	O	R	M	E	R		R	E	C	O	N	F	I	G

The actual CCR output current rating cannot normally be changed (except between 6.00 and 6.60A) since this is fixed by the type of main transformer fitted. The other exception to this rule is for CCRs fitted with the range of dual wound 6.0 / 12.0A transformers, which can operate at 6.00 / 6.60A or 12.0A depending on the configuration of the secondary connections. (Refer to Section 4.3.2 for a description of how to configure the dual wound power transformers, Section 9.3.1 to configure the current measurement CT, and Section 9.2 for re-calibrating the CCR). Therefore, the Maximum Output Current programmed value should not be changed to a different range except where a 12A dual wound transformer is to be re-configured, OR if there has been corruption of the EEPROM memory and a loss of the previously programmed value.

Press the menu selector and the cancel / confirm change screen will be displayed:

	M	A	X	I	M	U	M		O	U	T	P	U	T				↑	↓
	C	U	R	R	E	N	T		S	E	T	T	I	N	G	:			
→		C	A	N	C	E	L		C	H	A	N	G	E					
		C	O	N	F	I	R	M		C	H	A	N	G	E				

Turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits this submenu.

8.4.2.2 Selecting and enabling the PLF / Power Analyser Card

Select the type of PLF or Power Analyser Card from the AT1031 PLF-PA Card, AT1127/AT642 PLF Card or Disabled. Enter the Engineering Configuration Menu as described in Section 8.4.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	P	L	F	/	P	W	R		A	N	A	L	S	E	R			↑	↓
	C	A	R	D		I	N		U	S	E	:							
		D	I	S	A	B	L	E	D										

Press the selector and the screen will change to show the following, with the arrow (→) shown alongside the default or the previously selected option:

	P	L	F	/	P	W	R		A	N	A	L	S	E	R			↑	↓
	C	A	R	D		I	N		U	S	E	:							
→		D	I	S	A	B	L	E	D										
		A	T	1	0	3	1		P	L	F	/	P	A		C	A	R	D

Turn the Rotary Menu Selector so that the arrow (→) moves alongside the required PLF Card type, then press the menu selector.

	P	L	F	/	P	W	R		A	N	A	L	S	E	R	↑	↓
	C	A	R	D		I	N		U	S	E	:					
		A	T	1	0	3	1		P	L	F	/	P	A		C	A	R	D
→	A	T	1	1	2	7	/	6	4	2		P	L	F		C	A	R	D

The cancel / confirm change screen will now be displayed:

	C	C	R		k	V	A		R	A	T	I	N	G	:			↑	↓
→		C	A	N	C	E	L		C	H	A	N	G	E					
		C	O	N	F	I	R	M		C	H	A	N	G	E				

Turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits this submenu.

8.4.2.3 Entering the CCR kVA Rating

The kVA rating of the CCR is entered via this screen. (Note – the screen is not available on all CCRs). Enter the Engineering Configuration Menu as described in Section 8.4.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	C	C	R		k	V	A		R	A	T	I	N	G	:			↑	↓
		3	0		k	V	A												

Press the selector and the screen will change to show the following kVA settings, with the arrow (→) shown alongside the default or the previously selected option:

	C	C	R		k	V	A		R	A	T	I	N	G	:			↑	↓
		2	5		k	V	A												
→		3	0		k	V	A												

Turn the Rotary Menu Selector clockwise to show the first three of the available settings:

	C	C	R		k	V	A		R	A	T	I	N	G	:			↑	↓
→		1		k	V	A													
		2	.	5		k	V	A											
		4		k	V	A													

The available kVA settings are: 1.0, 2.5, 4.0, 5.0, 7.5, 10, 12.5, 15, 20, 25 and 30.

Turn the Rotary Menu Selector so that the arrow (→) moves alongside the required kVA Rating, then press the menu selector. The cancel / confirm change screen will now be displayed:

	C	C	R		k	V	A		R	A	T	I	N	G	:			↑	↓
→		C	A	N	C	E	L		C	H	A	N	G	E					
		C	O	N	F	I	R	M		C	H	A	N	G	E				

Turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits this submenu.

8.4.2.4 AENA Outputs Enable

This screen allows selection of the Back Indication Relay configuration for CCRs built to meet the Spanish AENA standard.

Enter the Engineering Configuration Menu as described in Section 8.4.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	A	E	N	A		O	U	T	P	U	T	S	:					↑	↓
		D	I	S	A	B	L	E	D										

Press the selector and the screen will change to show the following options:

	A	E	N	A		O	U	T	P	U	T	S	:					↑	↓
→		E	N	A	B	L	E	D											
		D	I	S	A	B	L	E	D										

Select between 'ENABLED' and 'DISABLED' by turning the Rotary Menu Selector to set the arrow (→) alongside the desired setting, then press the Rotary Menu Selector.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu.

8.4.2.5 Start-up Ramp Selection

This screen allows the selection of a CCR output current Start-up Ramp.

Enter the Engineering Configuration Menu as described in Section 8.4.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	S	T	A	R	T	-	U	P		R	A	M	P	:				↑	↓
		D	I	S	A	B	L	E	D										

Press the selector and the screen will change to show the following options:

	S	T	A	R	T	-	U	P		R	A	M	P	:				↑	↓
→		E	N	A	B	L	E	D											
		D	I	S	A	B	L	E	D										

Select between ‘ENABLED’ and ‘DISABLED’ by turning the Rotary Menu Selector to set the arrow (→) alongside the desired setting, then press the Rotary Menu Selector.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits the submenu.

When enabled, the default Start-up Ramp Time is 600ms. The time can be adjusted as described below.

8.4.2.6 Start-up Ramp Time

This screen, only available if the CCR output current Start-up Ramp is enabled, allows the Ramp Time to be set.

Note – the Ramp Time relates to the approximate time taken to go from zero to 100% current on start-up. If a lower Brilliancy is selected at Start-up, then the Ramp Time will be proportionally smaller.

After enabling the Start-up Ramp as described in Section 8.4.2.5 above, turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	S	T	A	R	T	-	U	P		R	A	M	P					↑	↓
	T	I	M	E	:														
	(	0		→		6	.	6	A	)									
			6	0	0		m	s											

Press the menu selector; the arrow in the top left-hand corner of the screen will move to the bottom line.

	S	T	A	R	T	-	U	P		R	A	M	P					↑	↓
	T	I	M	E	:														
	(	0		→		6	.	6	A	)									
→			6	0	0		m	s											

It is now possible to set the Ramp Time between 10 and 1600 milliseconds by turning the Rotary Menu Selector; when the desired value is shown press the menu selector.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits the submenu.

8.4.2.7 Transition Ramp

This screen allows the selection of a CCR output current 'Transition Ramp' on changes between output levels.

Enter the Engineering Configuration Menu as described in Section 8.4.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	T	R	A	N	S	I	T	I	O	N		R	A	M	P	:		↑	↓
		D	I	S	A	B	L	E	D										

Press the selector and the screen will change to show the following options:

	T	R	A	N	S	I	T	I	O	N		R	A	M	P	:		↑	↓
		E	N	A	B	L	E	D											
→		D	I	S	A	B	L	E	D										

Select between 'ENABLED' and 'DISABLED' by turning the Rotary Menu Selector to set the arrow (→) alongside the desired setting, then press the Rotary Menu Selector.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu.

When enabled, the default Transition Ramp Time is 600ms. The time can be adjusted as described below.

8.4.2.8 Transition Ramp – Rising Current Ramp Time

This screen, only available if the CCR output current Transition Ramp is enabled, allows the Rising Current Ramp Time to be set.

Note – the Rising Current Ramp Time relates to the approximate time taken to go from zero to 100% current. If a smaller current step is initiated, then the Ramp Time will be proportionally smaller.

After enabling the Transition Ramp as described in the section above, turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	R	I	S	I	N	G		C	U	R	R	E	N	T				↑	↓
	R	A	M	P		T	I	M	E	:									
	(	0		→		6	.	6	A	)									
			6	0	0		m	s											

Press the menu selector; the arrow in the top left-hand corner of the screen will move to the bottom line.

	R	I	S	I	N	G		C	U	R	R	E	N	T			↑	↓
	R	A	M	P		T	I	M	E	:								
	(	0		→		6	.	6	A	)								
→			6	0	0		m	s										

It is now possible to set the Rising Current Ramp Time between 10 and 1600 milliseconds by turning the Rotary Menu Selector; when the desired value is shown press the menu selector.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu.

8.4.2.9 Transition Ramp – Falling Current Ramp Time

This screen, only available if the CCR output current Transition Ramp is enabled, allows the Falling Current Ramp Time to be set.

Note – the Falling Current Ramp Time relates to the approximate time taken to go from 100% to zero current. If a smaller current step is initiated, then the Ramp Time will be proportionally smaller.

After enabling the Transition Ramp as described in the section above, turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	F	A	L	L	I	N	G		C	U	R	R	E	N	T	↑	↓
	R	A	M	P		T	I	M	E	:							
	(	6	.	6		→		0	A	)							
			6	0	0		m	s									

Press the menu selector; the arrow in the top left-hand corner of the screen will move to the bottom line.

	F	A	L	L	I	N	G		C	U	R	R	E	N	T	↑	↓
	R	A	M	P		T	I	M	E	:							
	(	6	.	6		→		0	A	)							
→			6	0	0		m	s									

It is now possible to set the Falling Current Ramp Time between 10 and 1600 milliseconds by turning the Rotary Menu Selector; when the desired value is shown press the menu selector.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside 'CONFIRM CHANGE' then press the selector again – this saves the new setting and exits the submenu.

8.4.2.10 Capacitive Current / Open Circuit Detection Operation

For circuits using primary series loop cable with an earth screen, the standard open circuit detection circuitry may not be effective in detecting an open circuit fault due to current continuing to flow through the capacitance of the earth sheath of the cable. For this reason, an additional capacitive current detection monitor is included.

This menu allows setting of the operation of the capacitive current detection monitor. For reasons of safety the default setting is to trip the CCR in the event of capacitive current flow being detected, but the unit can also be programmed to give an alarm but continue operating, or the function can be disabled altogether.

Enter the Engineering Configuration Menu as described in Section 8.4.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	C	A	P	A	C	I	T	I	V	E							↑	↓
	C	U	R	R	E	N	T		D	E	T	E	C	T	I	O	N	:
		T	R	I	P													

Press the selector and the screen will change to show the following options; the arrow (→) will have moved down to be alongside the default or the previously selected option:

	C	A	P	A	C	I	T	I	V	E							↑	↓
	C	U	R	R	E	N	T		D	E	T	E	C	T	I	O	N	:
→		T	R	I	P													
		A	L	A	R	M												

Turn the Rotary Menu Selector anticlockwise to scroll down to show the other option:

	C	A	P	A	C	I	T	I	V	E							↑	↓
	C	U	R	R	E	N	T		D	E	T	E	C	T	I	O	N	:
		A	L	A	R	M												
→		D	I	S	A	B	L	E	D									

Select between ‘TRIP’, ‘ALARM’ and ‘DISABLED’ by turning the Rotary Menu Selector to set the arrow (→) alongside the desired setting, then press the Rotary Menu Selector. (The default setting is ‘TRIP’, and for reasons of safety and to maintain compliance with IEC/EN 61822:2009 this setting should be used).

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits the submenu.

8.4.2.11 Capacitive Current Detection Threshold

If nuisance tripping is encountered when the AGL circuit is not in fact open circuited, then it might be that the setting for the capacitive current detection circuit is too sensitive for the installation, in which case it can be adjusted as described below.

Note – this screen is not available if the capacitive current detection has been disabled.

Enter the Engineering Configuration Menu as described in Section 8.4.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	C	A	P	A	C	I	T	I	V	E							↑	↓
	C	U	R	R	E	N	T		T	H	R	E	S	H	O	L	D	:
			1	0														

Press the menu selector; the arrow in the top left-hand corner of the screen will move to the bottom line.

	C	A	P	A	C	I	T	I	V	E							↑	↓
	C	U	R	R	E	N	T		T	H	R	E	S	H	O	L	D	:
→			1	0														

Turn the Rotary Menu Selector to increment or decrement the value for the detection threshold. The valid range is from 1 to 100; the lower the value the more sensitive is the detector. Press the selector to enter the desired setting.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits the submenu.

8.4.2.12 Asymmetric Current Detection Operation

This feature detects an imbalance (asymmetry) in the current between the positive and negative half cycles of the CCR output waveshape, which can sometimes be caused by an imbalance in an active (electronic) load on the series loop circuit.

This menu allows setting the operation of the asymmetric current detection monitor. It can be set to trip the CCR in the event of asymmetric current flow being detected, or to give an alarm but continue operating, or the function can be disabled altogether. The default setting is disabled.

Enter the Engineering Configuration Menu as described in Section 8.4.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	A	S	Y	M	M	E	T	R	I	C							↑	↓
	C	U	R	R	E	N	T		D	E	T	E	C	T	I	O	N	:
		D	I	S	A	B	L	E	D									

Press the selector and the screen will change to show the following options; the arrow (→) will have moved down to be alongside the default or the previously selected option:

																	↑	↓
	A	S	Y	M	M	E	T	R	I	C								
	C	U	R	R	E	N	T		D	E	T	E	C	T	I	O	N	:
		A	L	A	R	M												
→		D	I	S	A	B	L	E	D									

Turn the Rotary Menu Selector clockwise to scroll up to show the other option:

																	↑	↓
	A	S	Y	M	M	E	T	R	I	C								
	C	U	R	R	E	N	T		D	E	T	E	C	T	I	O	N	:
→		T	R	I	P													
		A	L	A	R	M												

Select between ‘TRIP’, ‘ALARM’ and ‘DISABLED’ by turning the Rotary Menu Selector to set the arrow (→) alongside the desired setting, then press the Rotary Menu Selector.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits the submenu.

8.4.2.13 Asymmetric Current Detection Threshold

This menu sets the sensitivity of the asymmetric current detector. Note – this screen is only available if the asymmetric current detection has been enabled.

Enter the Engineering Configuration Menu as described in Section 8.4.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	A	S	Y	M	M	E	T	R	I	C								↑	↓
	C	U	R	R	E	N	T		T	H	R	E	S	H	O	L	D	:	
			1	0															

Press the menu selector; the arrow in the top left-hand corner of the screen will move to the bottom line.

	A	S	Y	M	M	E	T	R	I	C								↑	↓
	C	U	R	R	E	N	T		T	H	R	E	S	H	O	L	D	:	
→			1	0															

Turn the Rotary Menu Selector to increment or decrement the value for the detection threshold. The valid range is from 1 to 100; the lower the value the more sensitive is the detector. Press the selector to enter the desired setting.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits the submenu.

8.4.2.14 Overcurrent Trip Time

This screen is used to set the Overcurrent Trip Time characteristic, and is set during factory testing to give the correct trip delay to meet the requirements of either IEC/EN 61822:2009 or the FAA Advisory Circular 150/5345-10. For the European market, the IEC/EN settings are used, with the following trip times for a 6.6A regulator: 3 to 5 seconds for a current of 6.75A or more (102,3%), and less than 300ms for a current of 8.30A or more. Where the FAA standard is called up, the trip times are set to: 5 seconds for a 5% Over-current condition, and 1 second for 25% Over-current.

Enter the Engineering Configuration Menu as described in Section 8.4.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	O	V	E	R	C	U	R	R	E	N	T						↑	↓
	T	R	I	P		T	I	M	E	:								
		I	E	C		(	1	0	2	.	3	%		<		5	s	)	

Press the selector and the screen will change to show the following options; the arrow (→) will have moved down to be alongside the default or the previously selected option:

	O	V	E	R	C	U	R	R	E	N	T						↑	↓	
	T	R	I	P		T	I	M	E	:									
→		I	E	C		(	1	0	2	.	3	%		<		5	s	)	
		F	A	A		(	1	0	5	.	0	%		<		5	s	)	

Turn the Rotary Menu Selector to set the arrow (→) alongside the desired setting, then press the Rotary Menu Selector.

The cancel / confirm change screen will now be shown; turn the selector anticlockwise to set the arrow (→) alongside ‘CONFIRM CHANGE’ then press the selector again – this saves the new setting and exits the submenu.

8.4.2.15 Force Output Current Test Menu

This screen allows the operator to directly control the CCR output current level. The current can be increased above the normal Maximum Output Current value in order to test the over-current Trip Point and Trip Time, or reduced below normal running current levels.

The testing of the over-current detection circuit is, however, part of the factory tests, and would not normally be done by the user. IT SHOULD NOT TO BE PERFORMED ON A LIVE AGL CIRCUIT.

Refer to Section 9.3.2, Checking the Over-current Trip Point and Trip Delay Time, for a full description of the test method.

Enter the Engineering Configuration Menu as described in Section 8.4.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	F	O	R	C	E		O	U	T	P	U	T					↑	↓
	C	U	R	R	E	N	T		T	E	S	T		M	E	N	U	:	

Press the menu selector and the following warning screen will be displayed:

C	C	R		O	U	T	P	U	T		W	I	L	L				↑	↓
E	N	E	R	G	I	S	E												
→		C	A	N	C	E	L												
		C	O	N	T	I	N	U	E										

Turn the selector anticlockwise to set the arrow (→) alongside ‘CONTINUE’ then press the selector again to enter the test screen:

F	O	R	C	E		O	U	T	P	U	T		C	U	R	R	E	N	T
→	S	T	O	P															
	I		D	E	M	A	N	D	:						6	.	6	0	A
	I		M	E	A	S	U	R	E	D	:				6	.	6	0	A

The CCR will turn on at the nominal maximum output current level. Turn the Rotary Menu Selector to increase or decrease the ‘I DEMAND’ to set the CCR output current to the desired level for the test that is being run.

Press the menu selector to stop the test, ie, to turn the CCR off.

If during the test a fault occurs, for example an overcurrent trip during the overcurrent test, then the following screen will be shown:

F	O	R	C	E		O	U	T	P	U	T		C	U	R	R	E	N	T
→	R	E	S	E	T		F	A	U	L	T		&		E	X	I	T	
	I		D	E	M	A	N	D	:						6	.	8	0	A
	I		M	E	A	S	U	R	E	D	:				0	.	0	0	A

Pressing the menu selector will reset the fault(s) and exit this screen and revert to the entry screen:

→	F	O	R	C	E		O	U	T	P	U	T					↑	↓
	C	U	R	R	E	N	T		T	E	S	T		M	E	N	U	:	

If the test screen is then re-entered the ‘I DEMAND’ will start from the last value used; 6.80A in this example. The overcurrent test can therefore be conducted with the CCR output starting immediately at the correct test level, and so the time taken to trip at this current level can be accurately recorded without a delay to adjust the current level.

8.5 Fault Screen Listings

All faults are logged by the Microcontroller on the AT1030 Motherboard and will result in an appropriate fault screen being displayed. The run screen will indicate that a fault is present, whilst scrolling down (by turning the Rotary Menu Selector).to the second screen will indicate what the fault actually is. The fault screens are listed in Table 8-4

If more than one fault has been registered, the fault screen with the highest priority will be the one normally shown. However, it is possible to scroll down to view the other faults by turning the Rotary Menu Selector.

The fault screen will continue to be displayed even if the fault is no longer present, all except for an External Communications fault which auto-resets. To clear a fault screen, press the Rotary Menu Selector at the moment that the fault screen is displayed and follow the instructions on the screen. If the fault is still present, the fault screen cannot be reset.

Note - if the screen indicates 'Verify Failure' on power up, refer to Section 11.1

Table 8-4 gives a listing of the Fault Screens and a description of each fault. Refer also to Table 11-1 CCR Fault Finding.

Fault Screen	Description
Open Circuit	Series loop open circuit, possibly with capacitive load current detected, or main CCR transformer output voltage taps set too low. Door interlock (optional) preventing CCR from operating, or thyristor stack fuse failed (if fitted – depends on CCR specification)
Under Current	Lamp Loop Live fault. Little or no CCR output current.
Over Current	CCR output current overload fault
Supply Under Voltage	CCR supply voltage drops below 75% of nominal for more than 1 second
Supply Over Voltage	Supply above 115% of nominal
Stage 2 Percentage Lamp Failure	The number of failed lamps on the field circuit exceeds the Stage 2 Percentage Lamp Failure threshold
Stage 1 Percentage Lamp Failure	The number of failed lamps on the field circuit exceeds the Stage 1 Percentage Lamp Failure threshold
Tolerance Monitoring Under Current	CCR output current less than lower tolerance limit for the selected brilliancy
Tolerance Monitoring Over Current	CCR output current greater than upper tolerance limit for the selected brilliancy
Stage 2 Earth Leakage	The resistance to earth of the series loop circuit is less than the threshold level for the Stage 2 Earth Leakage Fault Detector. (Note Stage 2 Earth Leakage indicates a higher leakage current flow than Stage 1)
Stage 1 Earth Leakage	The resistance to earth of the series loop circuit is less than the threshold level for the Stage 1 Earth Leakage Fault Detector.
Transformer Over Temperature Shutdown	CCR Shutdown due to Main Transformer over temperature (only available for certain CCR build types)
Transformer Over Temperature Warning	Main Transformer Over Temperature warning (only available for certain CCR build types)

Fault Screen	Description
Over Temperature Shutdown	CCR Shutdown due to over temperature (only available for certain CCR build types)
Over Temperature Warning	CCR Over Temperature warning (only available for certain CCR build types)
Multiple Remote Brilliancy Inputs	More than one Remote Brilliancy Input activated. Only applicable for 8-Wire Remote Brilliancy Control
KVA	CCR output kVA drops below 90% of the peak measured load value for whichever brilliancy step is in operation, for a period of 5 seconds.
Communications	The Internal and/or External Communications have failed. Notes: • The fault reported will be internal if the communications between the microprocessor board and the communications adaptor have failed, or external if the failure is with the external bus (e.g. Profibus, Modbus TCP/IP). • Priority is given to reporting internal communications faults. • External faults are automatically reset.
Capacitive Current Fault / Alarm	Series loop open circuit, with capacitive load current detected. Series loop cables with an earthing sheaf can be prone to capacitive current flow, providing a current path even with a break in the series loop circuit.
Asymmetric Current Fault / Alarm	Imbalance in conduction period between positive and negative half cycles.
High Crest Factor Alarm	Alarm is triggered if the peak output current is at the ADC measurement limit, or within 2% of the ADC limit for a number of consecutive samples.
Main Contactor Fail	Main contactor not energising or contactor auxiliary fault
Door Interlock Fault	Door interlock open (if these are fitted).
Memory Fault	AT1030 Motherboard FRAM memory fault.
PLF/PA Error	Fault reported from the optional AT1031 power analyser card
General Fault	CCR Microcontroller (Watchdog) fault or Main Control Card Common fault

Table 8-4 Fault Screens

9 Maintenance, Hardware Configuration and Calibration

9.1 Introduction

Routine maintenance is generally confined to those items listed in the table below, however the period between maintenance work may need to be reduced according to the installation conditions.

Maintenance	Period
• Visual examination for damage, discolouration / heating of cable connections • Check all connections for tightness, including cabinet earth connection • Check continuity of CCR cabinet earth studs to substation earth	6 Monthly
• Visual examination for damage, discolouration / heating of cable connections • Check all connections for tightness, including cabinet earth connection • Check continuity of CCR cabinet earth studs to substation earth • Clean out any dust which may have built up • Verify CCR output current level using high quality in-line true RMS ammeter	Annually

Table 9-1 Routine maintenance

If a fault should develop it will first be necessary to determine if a fault lies in the regulator or with its associated field circuit. See Section 11 of this manual for a fault-finding guide.

9.1.1 Location of main components of the Micro 100+

The following photographs show the main components of the Micro 100+ CCR:

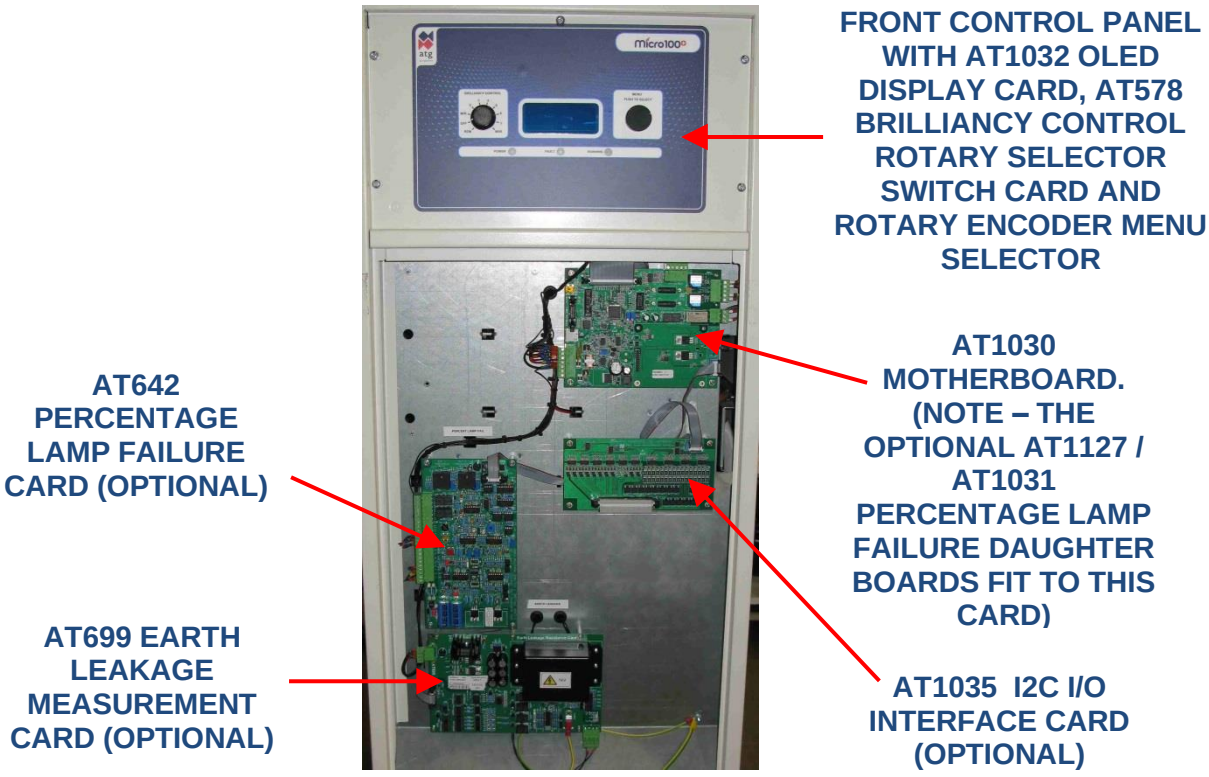


Figure 9-1 Control cards behind front door

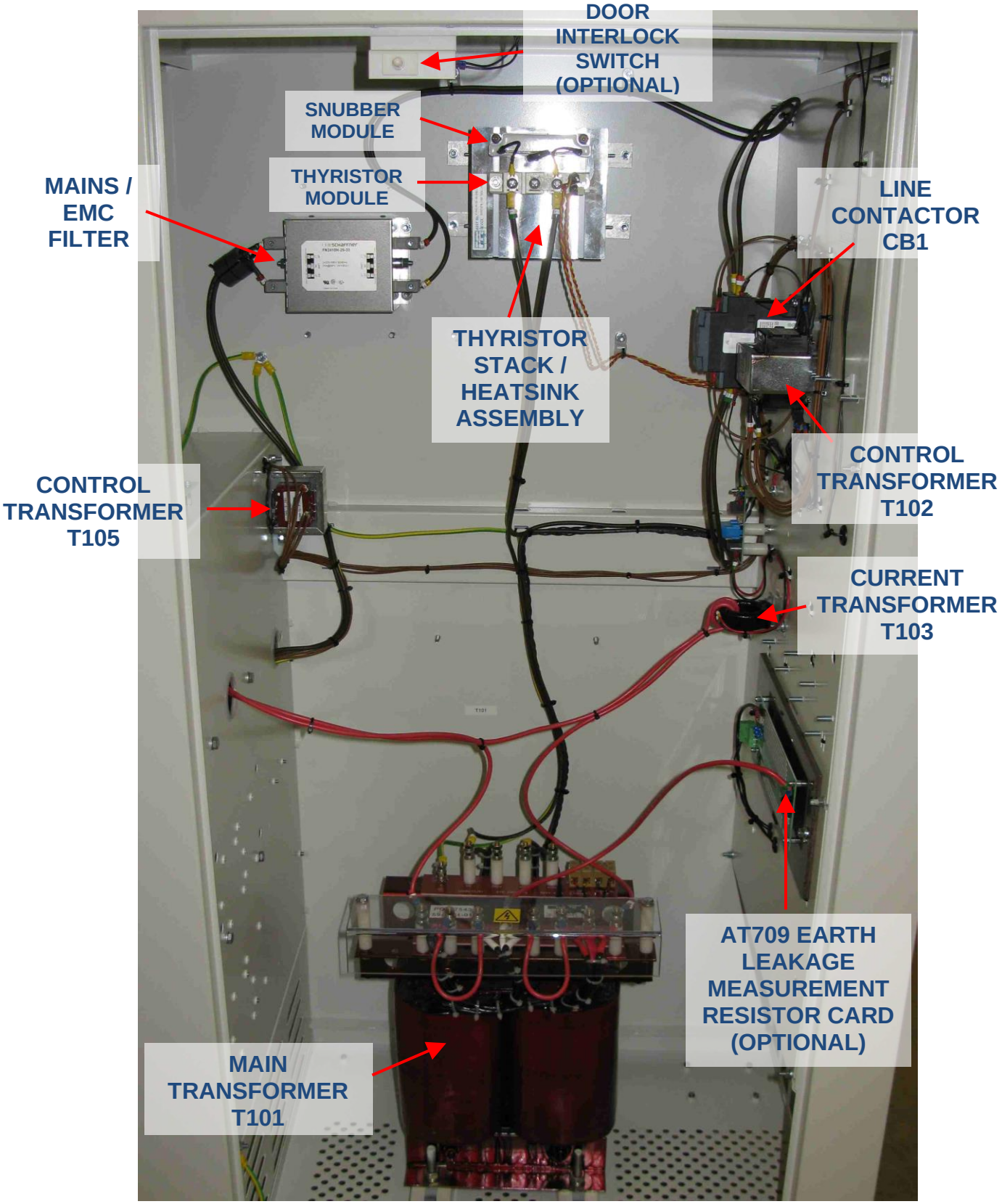


Figure 9-2 Components fitted in HT cubicle – CCRs up to 20A supply current

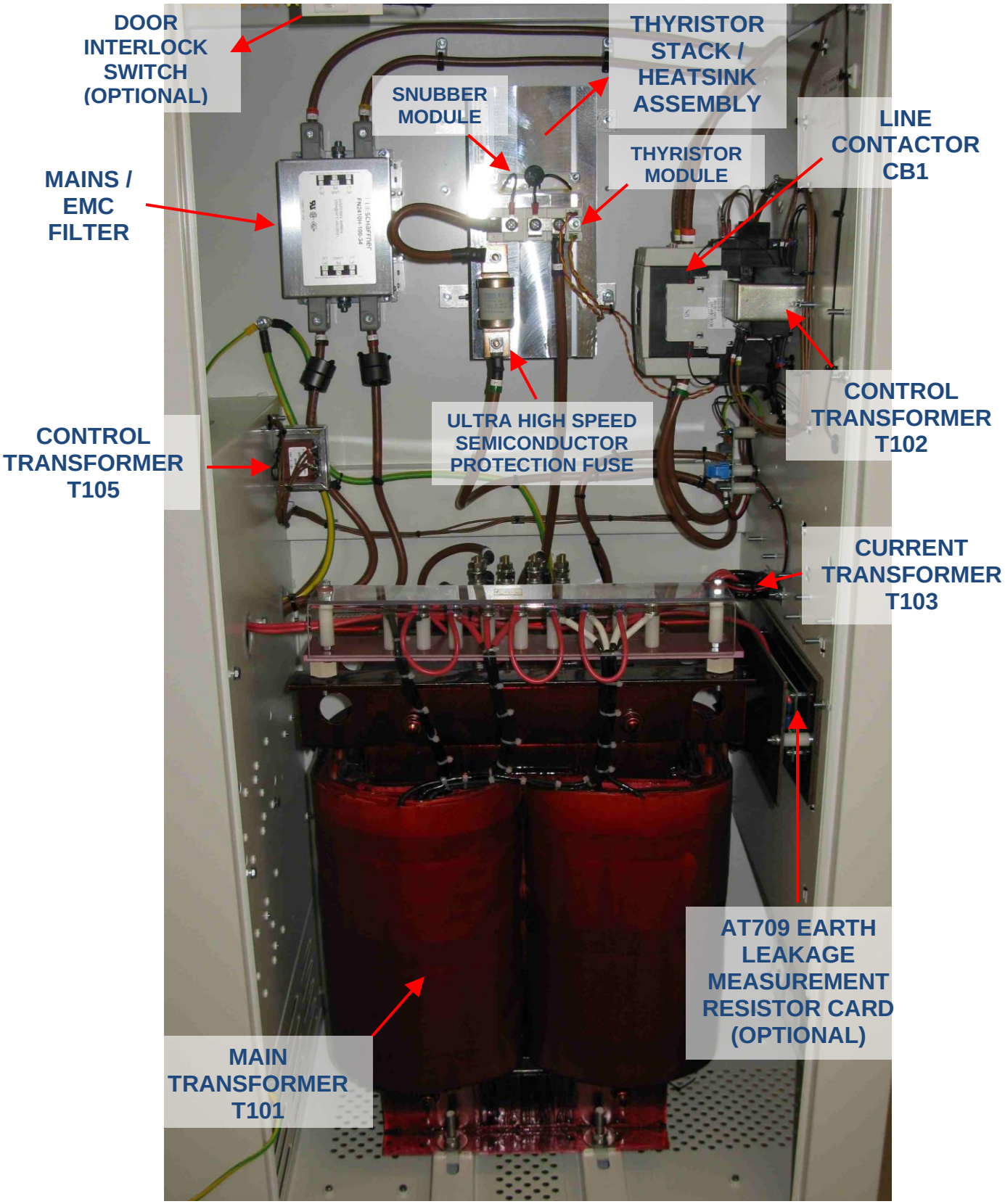


Figure 9-3 Components fitted in HT cubicle – CCRs up to 93A supply current

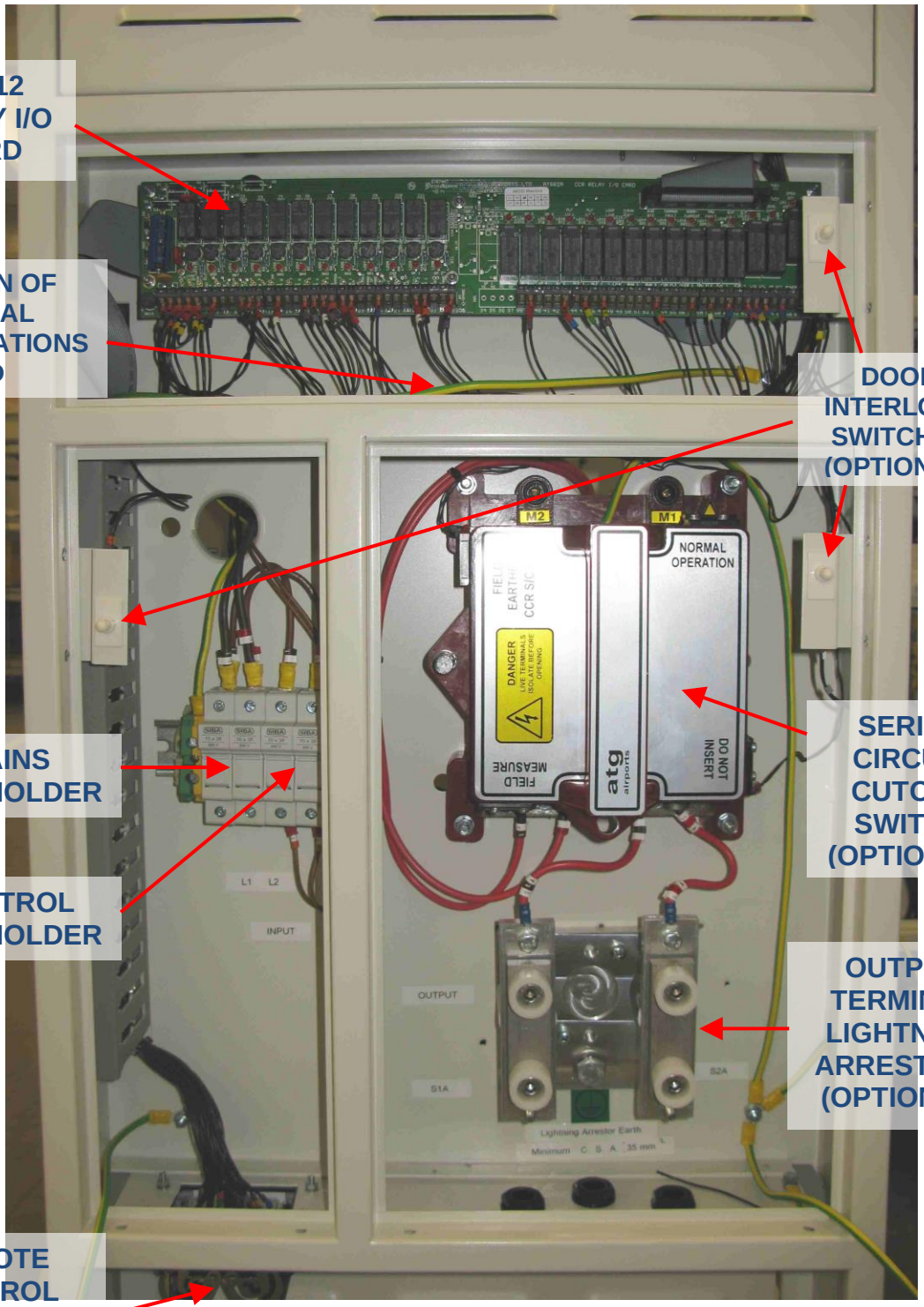


Figure 9-4 Components at rear of CCR

9.2 Calibrating the CCR

Calibration of the regulator output current may be required for the following reasons:

i/ After measuring the maximum output current level of the CCR using a high quality in-line 'true RMS' ammeter (recommended annual test), the current is found to be outside the tolerance limits specified in Table 4-1 to Table 4-4.

ii/ If the AT1030 Control Card has been replaced

atg airports do not recommend the use of 'clamp' type RMS ammeters for calibrating the CCR since the measurement can change substantially with clamping pressure. A high quality, 'true RMS' in-line meter should instead be used, and the meter itself should have a valid certificate of calibration. It should be connected in the CCR output loop in order to measure the actual regulator output current during re-calibration.

9.2.1 Programming the CCR Maximum Output Current

For a normal recalibration of the CCR it is not necessary to check or change the programmed Maximum Output Current value, so this section can be bypassed. However, if it is necessary to change the CCR Maximum Output Current value due to reconfiguration of the CCR, or if the pre-programmed value has been lost due to corruption of the EEPROM memory, then this should be done before calibrating the output current. (Note - the Firmware default value is 6.60A).

The CCR may be programmed to operate at 6.00, 6.60, 12.0 or 20.0 Amps; the value set at manufacture is indicated on the CCR nameplate affixed to the front door. Note - the transformers fitted in the majority of the CCRs are limited to 6.60A maximum output. 12.0A transformers wound with dual sets of secondary windings can operate at 6.00 / 6.60A or 12.0A. If it is required to change the nominal output current of the CCR from 6.00 / 6.60 to 12.0 Amps or vice-versa, then the number of turns through the control loop CT and the configuration of the main CCR transformer output connections will also have to be changed, (see Sections 4.3 and 9.3.1), followed by reprogramming the Maximum Output Current and recalibration of the regulator to the new current rating.

In order to programme the Maximum Output Current value, first turn the Brilliancy Control Selector Switch SW1 to 'OFF', then enter the Engineering Configuration Menu as described in Sections 8.4.1 and set the value as described in Section 8.4.2.1.

9.2.2 Calibrating the CCR Output Current

Do not attempt to calibrate the regulator output current with an AGL circuit connected in case an excess current is applied which could damage the AGL lamps - connect a resistive load or a shorting link to the output of the regulator instead. (Refer to Section 3.4 – HT Series Circuit Output Terminals). If a low value resistive load or a shorting link is used, the CCR Main Transformer output voltage should be reduced to suit the load. This will reduce the crest factor of the output waveform, thus improving the accuracy of the RMS current measurement and ensuring accurate calibration of the regulator. (Refer to Section 4.3 for setting the transformer taps). Connect only the lowest voltage transformer output winding section if a shorting link is connected on the CCR output.

Connect a calibrated in-line 'true RMS' ammeter in the regulator output circuit; the CCR output current will be calibrated to this meter reading.

Ensure there are no alarms present, then turn the Brilliancy Control Rotary Selector Switch fully clockwise to give the maximum output current.

The potentiometers which are adjusted during calibration of the CCR output current and the CCR (front panel) ammeter are shown in the layout of the AT1030 Motherboard in Figure 9-5 below. This card is mounted behind the CCR front door – refer to Figure 9-1.

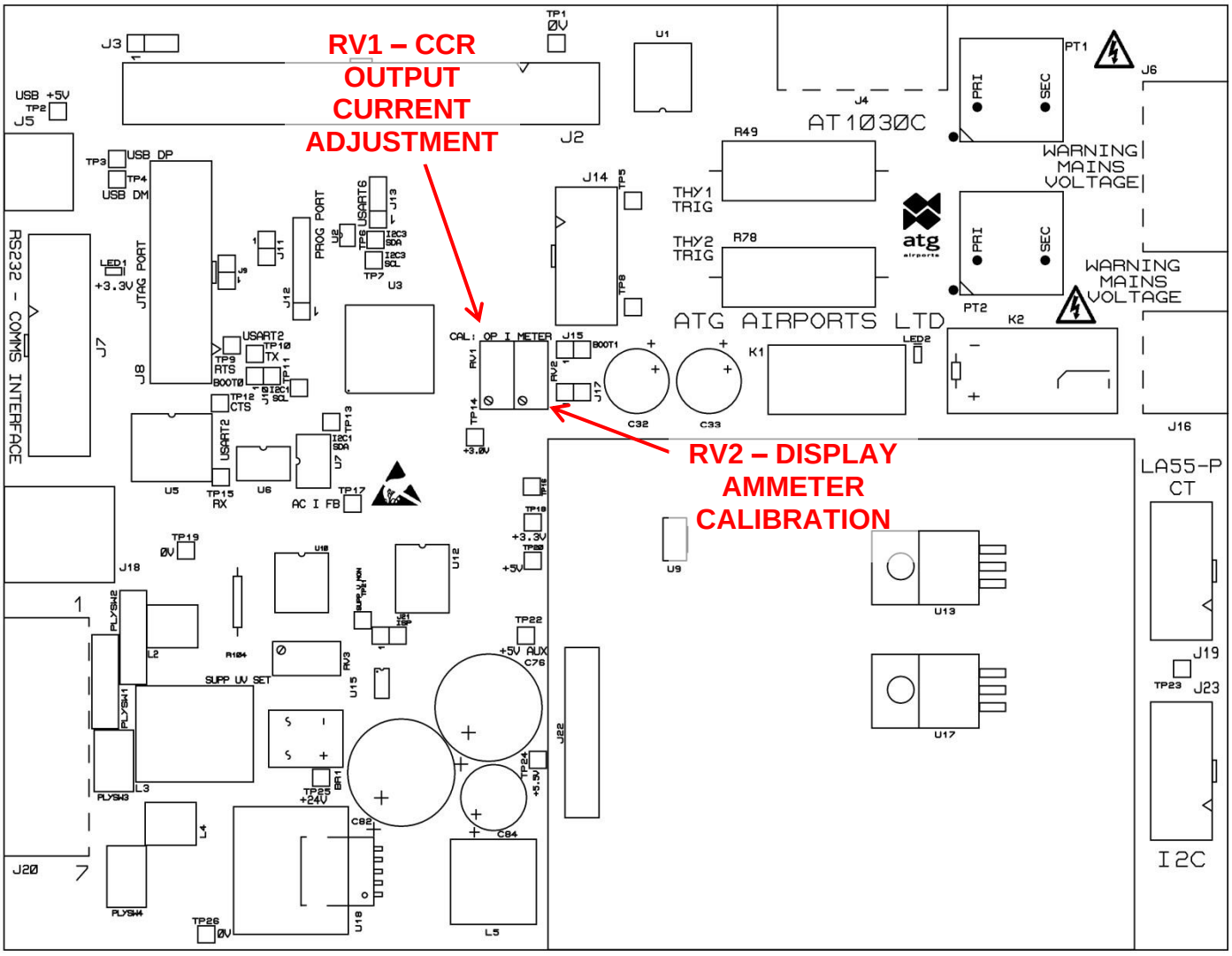


Figure 9-5 AT1030 Motherboard Potentiometer & Test Point Locations

Warning – the thyristor gate / cathode connections and the contactor coil connections are at mains potential – this could be as high as 415V. These connect to terminal blocks J6 and J16 respectively, located at the top right-hand corner of the AT1030 card. Due to the voltages present, a cover is fitted over these terminals.

Turn potentiometer RV1 on the AT1030 Motherboard (labelled 'CAL: OP I') until exactly the required Maximum Output Current – be it 6.00, 6.60, 12.00 or 20.0A - is produced by the CCR and measured on the external true RMS ammeter.

9.2.3 Calibrating the CCR Display Ammeter

After calibrating the CCR output as described above, and with the inline 'true RMS' ammeter still connected to the CCR output and the Brilliancy Control Rotary Selector Switch still set to maximum output current, turn potentiometer RV2 on the AT1030 Motherboard (labelled 'CAL: METER') until the CCR front panel display current reading matches that of the external true RMS ammeter.

9.3 Additional CCR Hardware configuration

9.3.1 Control Loop Current Transformer Primary Turns

The main CT, reference T103, which is used to measure the CCR output current, is set as follows: for 6.00A or 6.60A operation, there should be four primary turns through the CT, for 12.00A operation there should be two primary turns, and for 20.00A one primary turn.

Note – this is always set during factory testing to match the nominal CCR Maximum Output Current. The number of CT primary turns will therefore not require changing unless a transformer with dual sets of secondary windings is fitted - designed for 6.00 / 6.60A or 12.00A operation - and the regulator operating current range is to be changed from 6.00 / 6.60A to 12.00A or vice-versa. In this case, it will be necessary to change the Main Transformer secondary connections (see Section 4.3) and re-program the CCR Maximum Output Current (see section 8.4.2.1) to suit the new operating current, followed by recalibrating the CCR (see section 9.2). All other transformer designs are fixed in terms of the maximum output current.

9.3.2 Checking the Over-current Trip Point and Trip Delay Time

The testing of the over-current detection circuit is part of the factory tests, and would not normally be performed by the user. **It is not part of the CCR commissioning procedure, and should under no circumstances be tested on a live AGL circuit.**

The 'FORCE OUTPUT CURRENT TEST MENU' menu screen is used to set the Overcurrent Trip Time characteristic (Menu 3 - Engineering Config. - see section 8.4.2.14), and is set during factory testing to give the correct trip delay to meet the requirements of either IEC/EN 61822:2009 or the FAA Advisory Circular 150/5345-10. For the European market, the IEC/EN settings are used, with the following trip times for a 6.6A regulator: 3 to 5 seconds for a current of 6.75A or more, and less than 300ms for a current of 8.30A or more. Where the FAA standard is called up, the trip times are set to: 5 seconds for a 5% Over-current condition, and 1 second for 25% Over-current.

If for any reason this test needs to be performed, then a resistive load bank or a shorting link should be connected in place of the AGL circuit. DO NOT PERFORM THIS TEST WITH AN AGL CIRCUIT CONNECTED SINCE EXCESS CURRENTS WILL BE APPLIED.

The CCR Main Transformer output voltage should be adjusted according to the load used (set to minimum if a shorting link is connected), to reduce the current waveshape Crest Factor thus enabling the RMS current measurement to be made more accurately.

Enter the Engineering Configuration Menu as described in Section 8.4.1, and turn the Rotary Menu Selector anticlockwise to scroll down to the following screen:

→	F	O	R	C	E		O	U	T	P	U	T						↑	↓
	C	U	R	R	E	N	T		T	E	S	T		M	E	N	U	:	

Press the menu selector and the following warning screen will be displayed:

C	C	R		O	U	T	P	U	T		W	I	L	L				↑	↓
E	N	E	R	G	I	S	E												
→		C	A	N	C	E	L												
		C	O	N	T	I	N	U	E										

Turn the selector anticlockwise to set the arrow (→) alongside ‘CONTINUE’ then press the selector again to enter the test screen:

F	O	R	C	E		O	U	T	P	U	T		C	U	R	R	E	N	T
→	S	T	O	P															
	I		D	E	M	A	N	D	:						6	.	6	0	A
	I		M	E	A	S	U	R	E	D	:				6	.	6	0	A

The CCR will turn on at the nominal maximum output current level. Turn the Rotary Menu Selector clockwise to increase the ‘I DEMAND’ to set the CCR output current to the desired level for the over-current test that is being run:

6.80A to check the IEC over-current setting,
or
6.93A to check the FAA over-current setting.

The over-current circuit will soon trip and the following screen will be shown:

F	O	R	C	E		O	U	T	P	U	T		C	U	R	R	E	N	T
→	R	E	S	E	T		F	A	U	L	T		&		E	X	I	T	
	I		D	E	M	A	N	D	:						6	.	8	0	A
	I		M	E	A	S	U	R	E	D	:				6	.	8	0	A

Note - the ‘I MEASURED’ value represents the measured current during a test, but also records the peak level reached before a trip condition occurs.

Pressing the menu selector will reset the fault(s) and exit this screen and revert to the entry screen:

→	F	O	R	C	E		O	U	T	P	U	T						↑	↓
	C	U	R	R	E	N	T		T	E	S	T		M	E	N	U	:	

If the test screen is then re-entered the ‘I DEMAND’ will start from the last value used – 6.80A in this example. The overcurrent test can therefore be conducted with the CCR output starting immediately at the correct test level, and so the time taken to trip at this current level can be accurately recorded without a delay to adjust the test current.

9.3.3 Supply Under-voltage Trip Setting

RV3 on the AT1030 Motherboard (labelled ‘SUPPLY UV SET’ - see Figure 9-5) sets the mains supply under-voltage level at which the CCR will trip / switch off.

This is factory set to trip the CCR if the supply voltage falls below 85% of nominal, and would not normally need to be adjusted.

10 CCR Theory of Operation

10.1 Introduction

A constant current regulator provides a controlled source of power for an airfield ground lighting circuit. An AGL circuit consists of a number of lights, each of which is connected to the secondary side of an AGL transformer, the primaries of which are connected together in series. See Figure 7-1, page 7-1. The number of lamps on a circuit can range from just a few to a hundred or more, depending on the application.

The regulator supplies a constant level of current to the primary series loop, and thus to each lamp via the AGL transformer secondary connection. This means that all the lamps operate at the same brilliancy.

The AGL transformer is basically a primary wound current transformer which matches the primary series loop current, be it 6.0, 6.6 or 12.0 amps, to the AGL lamp, which is typically 6.6 amps for a modern lamp. Since the AGL series loop current passes through all of these transformers connected in series, then if a lamp filament fails open circuit, the series loop current is not interrupted. In this case, the AGL transformer merely adds inductance to the series circuit load. Note – high voltages can be present on the secondary connections of AGL transformers in open circuit conditions.

Figure 10-1 (overleaf) shows the block diagram of the CCR with a primary series field loop connected. The CCR uses an anti-parallel thyristor pair to control the voltage applied to the primary of the main CCR transformer. The transformer secondary has multiple tappings such that the output voltage can be adjusted to give the correct range according to the load connected to the AGL circuit. The conduction period of the thyristors is then controlled so as to give the correct RMS current on the output side of the transformer. The brilliancy of the AGL lamps is a function of the RMS current level flowing through them.

10.2 Control Cards

10.2.1 AT1030 Microcontroller Motherboard

The AT1030 Microcontroller Motherboard, which is mounted behind the CCR lower front cover (see Figure 9-1) performs all of the control and current measurement functions (including the thyristor gate control) and fault detection. Whilst most of the control and measurement is performed by the microcontroller, the Open Circuit fault detection – which is a critical safety function - is implemented in hardware. The Motherboard also contains ancillary hardware such as the synchronisation input used for the thyristor gate control timing (fed from the control transformer), the thyristor firing circuitry, under and overvoltage monitoring circuitry, current feedback circuitry and Run Relay.

The Motherboard has two I^2C serial busses (internal and external), an RS232 port for

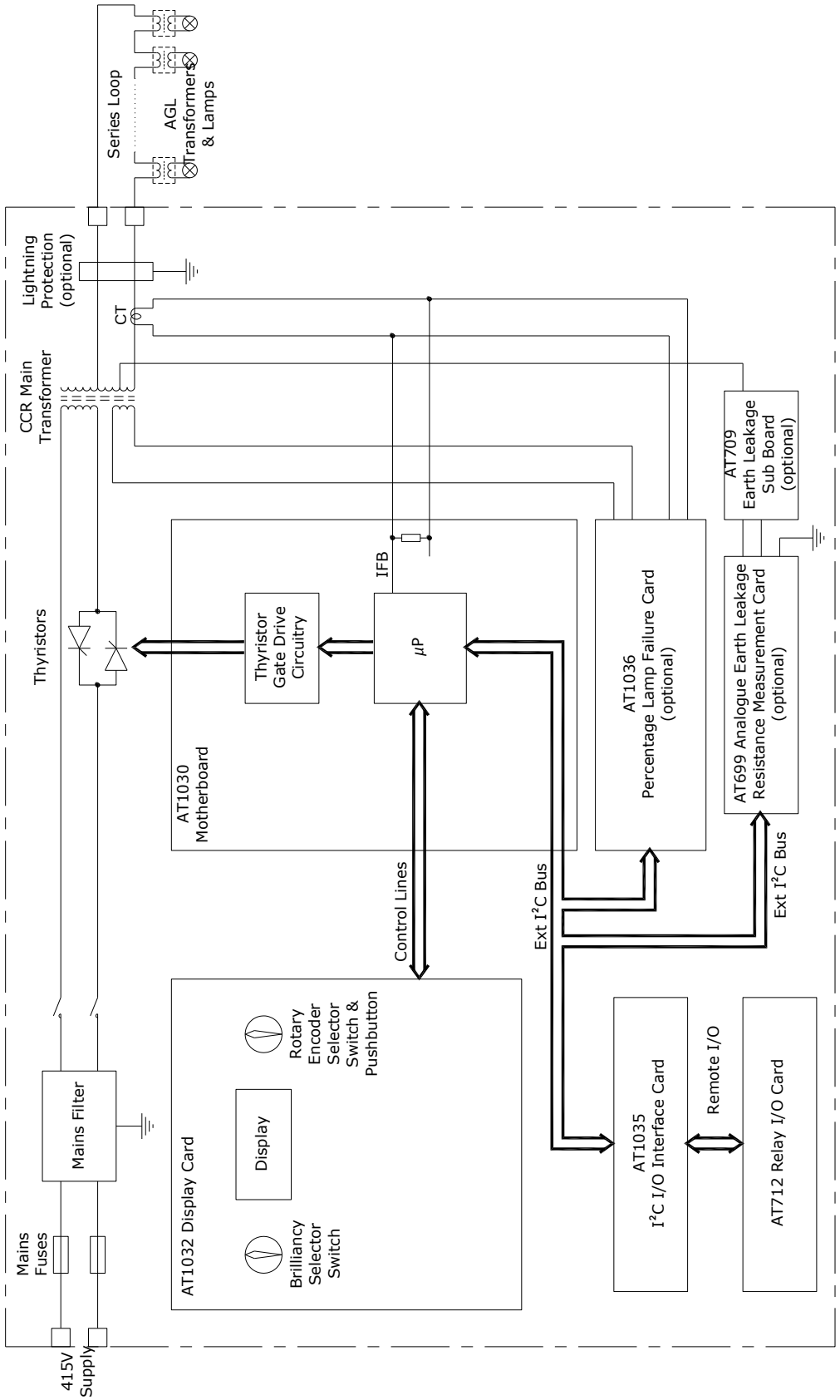


Figure 10-1 Block diagram of CCR

connection to serial communication (remote) control modules, a USB port and a micro SD card slot. The Motherboard has a parallel connection to the AT1032 Display Card (J2 - 40 way ribbon cable connector), which in turn connects to the Brilliancy Control Rotary Selector Switch and to the Rotary Encoder / Menu Selector Switch.

All input control signals are routed to the Microcontroller via the external I2C bus, as are the control signals for the back indication relays.

Warning – the voltage on the thyristor gate / cathode connections, and the main contactor coil connections may be as high as 415V. These connect to terminal blocks J6 and J16 respectively, located at the top right-hand corner of the board (see Figure 9-1). Due to the voltages present, a cover is fitted over these terminals.

10.2.2 AT1032 OLED Display Card

The AT1032 Display card, which is mounted behind the Front Display Panel, contains the 4 line OLED Display and connects to the Brilliancy Control Rotary Selector Switch and the Rotary Encoder / Menu Selector Switch.

There is a 40 way ribbon cable connection to the AT1030 Microcontroller Motherboard.

10.2.3 Optional Cards

10.2.3.1 AT712 Relay I/O Card

The AT712 Relay I/O Card, which is optional, is fitted to regulators using hard wired remote control from volt free contacts or from 24/50V control signals. Relay contacts are provided on the AT712 Card for Back Indication of CCR status. The relay contacts are rated at 4A @ 250V AC or 4A @ 30V DC with a resistive load.

The card is located in the low voltage control terminal box at the rear of the regulator – see Figure 3-1.

10.2.3.2 AT1035 I2C I/O Interface Card

If the AT712 Relay I/O Card is fitted, then the AT1035 Card must also be fitted. This card, which is mounted behind the CCR lower front cover (see Figure 9-1), provides serial to parallel conversion of the remote control I/O signals from the AT1030 Microcontroller Motherboard.

It connects to the AT1030 Motherboard I^2C serial bus via a 10 way ribbon cable, and to the AT712 Relay I/O Card via a 50 way ribbon cable.

10.2.3.3 AT1127 Percentage Lamp Failure Card

This card is a daughter board fitted to the AT1030 Motherboard which is mounted behind the CCR lower front cover. The function of the AT1127 PLF Card is to produce an error signal based on the Percentage of Lamps Failed on an AGL circuit. The error signal is passed to the microcontroller on the AT1030 Motherboard in order to give a display of the number of failed lamps and the percentage of failed lamps.

The principle of operation of the AT1127 PLF Card is that the time delay between the rising edges of the CCR output voltage and current waveforms – at the thyristor switching point - is measured and used to generate an error signal.

When all lamps are intact, the time delay, or phase lag, can be very small – dependent on the particular AGL circuit characteristics. When lamp filaments on the AGL circuit fail open circuit, the load seen by the CCR becomes more inductive, meaning that the rising edge of the current waveform lags that of the voltage waveform. This lag increases as the load becomes more inductive. The error signal generated is proportional to this phase lag, and hence is a function of the percentage of failed lamps.

A more detailed description of this card is given in Section 4.6.

The AT1127 PLF Card also provides CCR output voltage monitoring, and hence the load kVA can also be calculated by the microcontroller. Potentiometer RV4 ‘VFB CAL’ is used to calibrate the voltage feedback; this is set during factory testing and should not require further adjustment. Note – the actual CCR Mains transformer output tapping voltage used should be programmed in via the keypad menu system, in order that the CCR output voltage and load kVA can be correctly displayed. Do not adjust RV4 to correct the display if the tapping voltage has not been correctly programmed in.

10.2.3.4 AT699 Earth Leakage Resistance Measurement Card

Each AGL lamp module is isolated from the high voltage primary series loop circuit by an AGL transformer. The joints connecting the primary windings of these AGL transformers to the series loop cables tend to leak and allow water to penetrate into the transformer. This causes earth faults on the primary loop internally within the transformer, or from the cable joint itself to earth.

This causes two problems:

i) If more than one earth fault develops, then sections of the AGL circuit between the faults can be shorted out. This results in reduced brilliancy levels, or sections of the lamp circuit may switch off altogether.

ii) More importantly, having an earth leakage path presents a safety hazard. If there is leakage to earth at one or more points in the primary series field circuit there will now be a potential difference between other sections of the circuit and earth. If personnel come into contact with the high voltage cables under these conditions, this could, depending on the earth leakage resistance and hence the level of current flow through the contactee, result in a lethal electric shock.

For these reasons, it is necessary to detect earth faults before they become a problem.

The Analogue Earth Leakage Resistance Measurement Module, which is optional, comprises of two boards: the AT699 pcb, which mounts behind the CCR front door, and the AT709 sub Card, which mounts in the HT cubicle. The module operates by superimposing a DC test voltage onto the CCR Main Transformer output; the test voltage is 500V while the CCR is operating, or 1000V for a manual test when the CCR is in the 'OFF' state. If there is an earth fault, this causes a DC leakage current which can be measured, and a calculation is performed to give a leakage resistance value. This value can then be displayed on the CCR front panel.

The Earth Leakage Resistance Measurement Module is calibrated using specialised test equipment, and should not require adjustment. However, the alarm and trip thresholds can be programmed via the Front Control Panel by entering Menu 2 – the Set-up Menu; refer to section 4.5.2.

10.2.4 Optional Serial Communications Cards

10.2.4.1 AT728 Dual Profibus Card

Provides Profibus serial communications; refer to the manual for the Micro 100/200 CCR Communications Card (Profibus).

10.2.4.2 AT683 J-Bus Adapter Card

Provides J-Bus / Modbus RTU serial communications, refer to the manual for the Micro 100 CCR Communications Card (J-Bus).

10.2.4.3 AT1056 Modbus TCP/IP (Ethernet) Adapter Card

Provides Modbus TCP/IP (Ethernet) serial communications, refer to the manual for the Micro 100/200 CCR Communications Card (Modbus TCP/IP)

11 Fault Finding

PROBLEM	POSSIBLE CAUSE	CORRECTIVE MAINTENANCE
Regulator does not operate and Power light is not illuminated.	Mains power source 'OFF'.	Check mains power supply.
	Incorrect supply voltage.	Check supply voltage against regulator rating plate.
	Blown mains fuses F1, F2.	Check for earth faults in the field circuit before replacing. Most regulators built to IEC specification have gRL fuses fitted, which have a combined general line and ultra rapid protection characteristic, thus giving thyristor protection. Failure of a gRL fuse could be caused by current surges on the output circuit due to block switching or earth faults. (Some regulators built to IEC specification and all of those built to FAA specification use a gL fuse on the input, which has a slower failure time under high overload conditions. See Table 12-6 for a complete fuse listing).
	Blown fuses F3, F4.	Check control transformers T102 and T105 for faults before replacing.
	Supply plug J20 of AT1030 Motherboard disconnected.	Re-connect plug J20.
	Faulty control transformer T102.	Check that the (nominally) 18/0/18 V AC supply appears at the AT1030 Motherboard connector J20, terminals 1, 2 and 3 respectively. (Measuring from terminal 2 (0V) to terminal 1 and terminal 3 should actually give around 20V AC).
	Faulty AT1030 Motherboard.	Replace AT1030 Motherboard. After changing this board it will be necessary to re-calibrate the regulator as described in section 9.2
Regulator does not operate, Power and Fault lights are illuminated but Supply Under-voltage fault is displayed or OLED display is blank.	Incorrect supply voltage.	Check supply voltage against regulator rating plate.
	Faulty control transformer T102.	Check that the (nominally) 18/0/18 V AC supply appears at the AT1030 Motherboard connector J20, terminals 1, 2 and 3 respectively. (Measuring from terminal 2 (0V) to terminal 1 and terminal 3 should actually give around 20V AC).
	Incorrectly adjusted supply under voltage detector on AT1030 Motherboard.	Refer to ATG Airports
	Faulty AT1030 Motherboard.	Replace AT1030 Motherboard. After changing this board it will be necessary to re-calibrate the CCR as described in section 9.2
Regulator does not operate, Power and Fault lights are illuminated and Output Current Low fault is registered. (Note - turn the Rotary Menu Selector anticlockwise to view any faults present).	Main CCR Transformer (T101) secondary tapping voltage set too low for load.	Adjust as described in Section 4.3
Regulator does not operate, Power and Fault lights are illuminated and Main Contactor fault is registered. (Note - turn the Rotary Menu Selector anticlockwise to view any faults present).	Faulty Contactor CB1 or faulty AT1030 Motherboard.	Check the coil voltage of CB1. If supply voltage is present, but the contactor fails to operate, CB1 is defective. Replace contactor or replace AT1030 Motherboard and re-calibrate the regulator.
	Faulty or open circuit contactor auxiliary circuit.	With contactor CB1 energised check continuity through auxiliary contact (wires 171 and 172). Replace contactor if faulty.
	Door or cover open (if door interlocks fitted).	Close door / replace cover.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE MAINTENANCE
Regulator does not operate; Power and Fault lights are illuminated and Open Circuit fault is registered. (Note - turn the Rotary Menu Selector anticlockwise to view any faults present).	Ascertain if fault lies within the regulator or the AGL series circuit.	Operate the CCR with a shorting link in place of the AGL circuit. Switch off and isolate the power to the regulator then connect a shorting link between the regulator output terminals S1 and S2, in place of the AGL circuit. If possible, measure the regulator supply current using a true RMS ammeter. Switch back on; the regulator should run at the rated output current without taking excessive input current. If the regulator operates correctly, the problem is with AGL series circuit.
	Blown ultra-rapid semiconductor protection fuse F7 (located next to thyristor, on heatsink). Note – this fuse is not included on most IEC spec regulators.	Check for earth fault on AGL series loop and faulty thyristor before replacing.
	If door interlocks are fitted, check if a door or cover is open.	Close door / replace cover.
	Faulty thyristor.	Shut off power to regulator and check thyristor for short circuit across power terminals, or open circuit between gate and cathode terminals. Replace if faulty.
	Loose or broken connections.	Shut off power to regulator and check all wiring connections for tightness.
When a brilliancy level is selected the regulator operates briefly before tripping and registering an 'Open Circuit' or 'Capacitive Current' fault. (Note - turn the Rotary Menu Selector anticlockwise to view any faults present).	Open circuit / discontinuity on AGL series loop. If the AGL cable has an earth sheath this could then cause capacitive load current to flow.	Repair break in AGL series circuit.
	If the AGL circuit is not in fact open circuited (and all lamps are lighting), then the capacitive current detection circuit may be set too sensitive for the installation.	Capacitive current detection system should be de-sensitised via the menu system.
Regulator does not respond to the remote brilliancy signals	Rotary Brilliancy Selector switch not in Remote position.	Turn switch to Remote position.
	Incorrect remote control configuration selected.	Check operating mode selected for Remote Control, see Section 8.3.2.2.
	Fault on external brilliancy control signals	Check switching of Brilliancy control signals, including Command On input (if programmed for separate 'Command On')
	Faulty AT1035 I2C IO Interface Card or AT712 Relay I/O Card	Replace as necessary.
	Faulty or disconnected 10 way ribbon cable (I2C serial comms) between the AT1030 Card and the AT1035 Card	Replace or re-connect ribbon cable
	Faulty or disconnected 50 way ribbon cable between the AT1035 Card and the AT712 Card	Replace or re-connect ribbon cable

PROBLEM	POSSIBLE CAUSE	CORRECTIVE MAINTENANCE
Maximum displayed output current outside of tolerance limits; 'Tolerance' Fault registered.	AT1030 card out of calibration or new card fitted and has not been calibrated.	Calibrate the CCR as described in section 9.2
CCR output voltage (if enabled) and output load kVA incorrectly displayed	Actual CCR Main Transformer output tapping voltage used not correctly loaded via set-up menu.	Program this as described in Section 4.4.2

Table 11-1 CCR Fault Finding

11.1 Verify Failure and Reloading Operating Parameters

In the event that the Microcontroller has displayed the following message on power up:

V	E	R	I	F	Y		F	A	I	L	U	R	E				↑	↓	
→		A	P	P	L	Y		D	E	F	A	U	L	T	S				
		V	I	E	W		F	R	A	M		M	E	M	O	R	Y		

This indicates either that the AT1030 Motherboard has been powered up for the first time (and has never been commissioned on a CCR), or that there has been corruption of data stored in the FRAM memory IC on the AT1030, or a read failure. Pressing the Rotary Menu Selector – which is the only means to go past this screen - will load default operating parameters, thus requiring a reprogramming of the operating parameters for the regulator. If it is not a new regulator (or a new AT1030 Motherboard), it is therefore worth turning off the power to the CCR then back on again to check that it was not just a random read failure of the FRAM IC on power-up.

If the Rotary Brilliancy Control Switch is set to 'Off' and the Rotary Menu Selector is pressed after the 'Verify Failure' message was observed, the following screen will be displayed:

L	O	C	A	L			O	F	F										↓
O	P		C	U	R	R	E	N	T	:			0	.	0	0		A	
O	P		V	O	L	T	A	G	E	:						0		V	

Providing that a record has been kept of the operating parameters for the regulator in question, it is a straightforward process of reloading these into the two menus. (Note - a Micro CCR Parameter Record sheet is included in the following section for the purposes of recording this data).

The following is a list of the main CCR operating parameters, which should be reprogrammed in the sequence described below; refer also to Section 4.2, and for more detailed information, Section 8.3 and Section 8.4.

Menu 3 - Engineering Configuration Menu:

MAXIMUM OUTPUT CURRENT - (Note – the default value is 6.6A)
PLF/PWR ANALYSER CARD IN USE

Menu 2 - Set-up Menu:

REMOTE CONTROL CONFIG
BRILL LEVELS STYLE
EARTH LEAKAGE MEASUREMENT CONFIG
% LAMP FAILURE (PLF) CONFIGURATION
MAIN TRANSFORMER TAPPING VOLTAGE

11.2 Micro CCR Parameter Record Sheet

CIRCUIT:		**SUBSTATION:**	
CCR SERIAL NUMBER:		**FIRMWARE VERS:**	
CCR KVA RATING:		**OP CURRENT:**	
DATE COMMISSIONED:			

NOTE - IF A CCR IS BEING PROGRAMMED FOR THE FIRST TIME OR IF IT IS BEING RE-PROGRAMMED AFTER A LOSS OF OPERATING PARAMETERS FROM THE FRAM MEMORY, FIRST SET PARAMETERS IN THE ENGINEERING CONFIGURATION MENU SUCH AS THE 'MAXIMUM OUTPUT CURRENT' (IF IT IS DIFFERENT FROM THE DEFAULT VALUE OF 6.60A) AND OTHER PARAMETERS SUCH AS 'PLF/PWR ANALYSER CARD IN USE' BEFORE PROGRAMMING PARAMETERS IN THE SET-UP MENU.

NOTE - THE PARAMETERS / ROWS WITH THE BLUE BACKGROUND ARE THOSE MOST COMMONLY CHANGED FROM DEFAULT. THOSE SCREENS WHICH ARE INDENTED ARE ONLY AVAILABLE WHEN THE PARENT FUNCTION IS SELECTED FROM THE SCREEN ABOVE.

SET-UP MENU

The Set-up Menu is accessed from the Running / Main Menu by the use of a password. The CCR must first be set to ‘Local Off’, by turning the Brilliancy Control Selector switch SW1 to 'OFF'. Turn the right-hand side Rotary Menu Selector anti-clockwise until it displays 'Enter Menu 2 Set-up Menu', then press the Rotary Menu Selector to show 'a a a'.

The default password is 'atg'. Enter the password one letter at a time using the Rotary Menu Selector to scroll up and down the alphabet, and then press the Rotary Menu Selector to enter each letter in turn. If the password is loaded correctly, the display will show the first screen within the Set-up menu: 'Reset Hours Run'.

It is now possible to scroll through the menu using the Rotary Menu Selector; turn anti-clockwise to reach the following screens. Pressing the Rotary Menu Selector will permit modifications to the parameters for the selected screen. The left hand arrow will move to the second line, then turning the Rotary Menu Selector will scroll through the available parameter settings. Press the Rotary Menu Selector to load the new parameter, then turn to select 'Confirm' then press again', or alternatively on 'Cancel' to quit without loading the changes.

To exit the Set-up menu turn the Rotary Menu Selector anti-clockwise until 'Exit Menu 2' is displayed (the last screen), then press the Rotary Menu Selector, then turn to select 'Confirm' then press again.

Refer to the Micro 100+ CCR Installation and Operational Manual for more detailed information on the menu structure.

PARAMETER (SET-UP MENU)	DESCRIPTION	DEFAULT SETTING			SETTING (IF CHANGED)
RESET HOURS RUN AT MAX BRILL	Reset the hours run at maximum brilliancy.	N/A			
REMOTE CONTROL CONFIG	Select between 3 Wire, 3 Wire & Command, BCD, BCD & Command, BCD Option 2, BCD Option 2 & Command, 8 Wire, 8 Wire & Command and Serial Communications. Note - selecting Serial Communications opens further screens (see below).	8 WIRE			
ALARM ON MULTIPLE REMOTE INPUTS	Enable/ Disable the alarm which alerts if an illegal combination of remote control inputs is detected.	ENABLED			
SERIAL COMMS ADDRESS	Select Address of unit for serial communications. (Only available if 'Communication' selected for remote control).	255 (not selected)			
SERIAL COMMS FAULT DELAY TIME	Select the delay time (in seconds) before the Communications fault is raised. (Only available if 'Communication' selected for remote control).	5 S			
SERIAL COMMS FAULT ACTION	Select the action to be taken in the case of a communications fault. Select between 'CCR LATCH', 'CCR ON' and 'CCR OFF'. (Only available if 'Communication' selected as method for remote control).	CCR - LATCH			
SERIAL COMMS FAULT CIRCUIT SELECTOR ACTION	Select the action to be taken by the circuit selector in the case of a communications fault. (Only available if 'Communication' selected as method for remote control and the CCR is configured to use an internal circuit selector).	Each individual circuit reverts to fail-safe condition; alternate CSS reverts to CCT1			
BRILLIANCY LEVELS STYLE	Select between 5 Step Style 2, 3 Step Style 1, 8 Step UK CAP168, User Defined or User Defined DIO.	8 Step (UK) CAP 168			
USER BRILLIANCY LEVELS	When User Defined Brilliancy Levels are selected, allows adjustment of the current levels. (Note - the default levels are those of UK CAP 168).	Levels as per 8 STEP UK CAP 168			
Set User Levels	**CCR OUTPUT CURRENT RATING**	**6.00A**	**6.60A**	**12.0A**	
	BRILL 1	2.34	2.57	4.68	
	BRILL 2	2.64	2.90	5.28	
	BRILL 3	3.06	3.37	6.12	
	BRILL 4	3.54	3.89	7.08	
	BRILL 5	4.14	4.55	8.28	
	BRILL 6	4.86	5.35	9.72	
	BRILL 7	5.73	6.30	11.45	
	BRILL 8	6.00	6.60	12.00	
TOLERANCE MONITORING	Enable/ Disable internal Tolerance Monitoring Unit.	ENABLED			
TOLERANCE MONITORING ALARM DELAY TIME	Set the delay time (seconds) before an Out of Tolerance alarm is raised.	15 S			

PARAMETER (SET-UP MENU)	DESCRIPTION	DEFAULT SETTING			SETTING (IF CHANGED)
TOLERANCE MONITORING ALARM THRESHOLDS	Allows adjustment of the Tolerance Monitoring alarm threshold levels. The tolerance levels for 8 Step brilliancy are listed here. Note - if the User Defined brilliancy (current levels) are changed from the default values, then the Tolerance Levels are automatically moved to be +/- 0.1A from the new operating current value. For 5 and 3 Step brilliancy levels these are always +/- 0.1A from the desired output current.	N/A			
	CCR OUTPUT CURRENT RATING	**6.00A**	**6.60A**	**12.0A**	
	BRILL 1 MIN	2.17	2.39	4.34	
	BRILL 1 MAX	2.41	2.65	4.82	
	BRILL 2 MIN	2.51	2.76	5.01	
	BRILL 2 MAX	2.89	3.18	5.78	
	BRILL 3 MIN	2.96	3.26	5.92	
	BRILL 3 MAX	3.25	3.58	6.51	
	BRILL 4 MIN	3.36	3.70	6.72	
	BRILL 4 MAX	3.68	4.05	7.36	
	BRILL 5 MIN	3.82	4.20	7.64	
	BRILL 5 MAX	4.36	4.80	8.73	
	BRILL 6 MIN	4.78	5.26	9.56	
	BRILL 6 MAX	5.23	5.76	10.47	
	BRILL 7 MIN	5.64	6.20	11.27	
	BRILL 7 MAX	5.78	6.36	11.56	
	BRILL 8 MIN	5.82	6.40	11.64	
	BRILL 8 MAX	6.09	6.70	12.18	
BLACK HEAT OUTPUT CURRENT IN REMOTE OFF	Enable/ Disable Black Heat operation.	DISABLED			
BLACK HEAT OUTPUT CURRENT LEVEL	Set the Black Heat output current level.	6.0A FLC = 1.5A 6.6A FLC = 1.5A 12A FLC = 2.5A 20A FLC = 5.75A			
BLACK HEAT RUN BI RELAY ACTION	Energise or de-energise the Run Relay when Black Heat output current is operating in Remote OFF.	NOT ENERGISED			
EARTH LEAKAGE MEASUREMENT CONFIG	Select from Enabled, Continuous Enabled (500V test voltage also applied when CCR in 'Off' state) or Disabled. Note - requires the optional AT699 Earth Leakage Detection card must be fitted for this function to operate.	DISABLED			
EARTH LEAKAGE ALARM THRESHOLD STAGE 1	Select the threshold of resistance for the 1st stage Earth Leakage Alarm.	10 MΩ			
EARTH LEAKAGE ALARM THRESHOLD STAGE 2	Select the threshold of resistance for the 2nd stage Earth Leakage Alarm / Trip.	200 kΩ			

PARAMETER (SET-UP MENU)	DESCRIPTION	DEFAULT SETTING	SETTING (IF CHANGED)
EARTH LEAKAGE STAGE 2 TRIP	Configure the stage 2 Earth Leakage detector to give an alarm and continue to run (disabled), or to shutdown (trip) the CCR (enabled).	ENABLED	
% LAMP FAILURE (PLF) CONFIGURATION	Select from Enabled, Enabled FAA Style or Disabled. Note - only available if either of the optional AT1127 PLF or AT1031 PLF / Power Analyser Cards are fitted and enabled in the 'PLF/PWR Analyser card in use' screen in the Engineering Configuration Menu.	DISABLED	
% LAMP FAILURE ALARM DELAY TIME	Set the delay time (seconds) before the Percentage Lamp Failure alarm is raised.	15 S	
% LAMP FAILURE NUMBER OF LAMPS IN CCT	Enter the total number of lamps on the AGL circuit.	100	
% LAMP FAILURE ALARM THRESHOLDS	Set the alarm threshold points.		
S1	Enter the threshold for the number of lamp fittings or % lamps failed to trigger a Stage 1 alarm.	5	
S2	Enter the threshold for the number of lamp fittings or % lamps failed to trigger a Stage 2 alarm.	10	
% LAMP FAILURE CALIBRATION	Calibration screens for PLF. (Only available if PLF monitoring is enabled). Select from Quick Calibration, Capture PLF err. L1 and Capture PLF err. L2. For the latter two options, lamps need to be removed corresponding to the two alarm levels to be sampled.	N/A	
QUICK CALIBRATION	Performs a quick auto calibration; all lamps must be intact.	N/A	
CAPTURE PLF ERR L1	Full Calibration routine - select PLF alarm threshold level 1 error sample / capture.	N/A	
ENTER NUM OC LAMPS FOR L1 CAPTURE	Turn the Rotary Menu Selector to show the number of lamp fittings which will be open circuited for calibration of this threshold level (ideally the same as the Stage 1 (S1) alarm threshold above), then press the Rotary Menu Selector. The CCR will then switch on and sample the error signal.	5	
CAPTURE PLF ERR L2	Full Calibration routine - select PLF alarm threshold level 2 error sample / capture.	N/A	
ENTER NUM OC LAMPS FOR L2 CAPTURE	Turn the Rotary Menu Selector to show the number of lamp fittings which will be open circuited for calibration of this threshold level (ideally the same as the Stage 1 (S2) alarm threshold above), then press the Rotary Menu Selector. The CCR will then switch on and sample the error signal.	10	
MAIN TRANSFORMER TAPPING VOLTAGE	Enter the total main transformer output voltage as connected (sum of each winding section connected). Note - only available if either of the optional AT1127 PLF or AT1031 PLF / Power Analyser Cards are fitted and enabled in the 'PLF/PWR Analyser card in use' screen in the Engineering Configuration Menu.	0001V	
KVA ALARM	When enabled generates an alarm if the CCR output load kVA drops below 90% of the peak measured load value for the brilliancy step in operation, for a period of 5 seconds. Note - only available if either of the optional AT1127 PLF or AT1031 PLF / Power Analyser Cards are fitted and enabled in the 'PLF/PWR Analyser card in use' screen in the Engineering Configuration Menu.	DISABLED	

PARAMETER (SET-UP MENU)	DESCRIPTION	DEFAULT SETTING		SETTING (IF CHANGED)
CIRCUIT SELECTOR TYPE	Disables (internal) CSS operation or allows selection of Alternate or Multiway (2 to 6 way) CSS.	DISABLED		
CIRCUIT SELECTOR MULTIWAY CARD TYPE	Select AT661 rev C & onwards or AT661 rev A/B. Defines the Multi-Way Circuit Selector Back Indication Current Detection philosophy, depending on the PCB type fitted.	AT661C ONWARD		
CIRCUIT SELECTOR CONTACTOR TIMING	Allows selection of vacuum relay (15ms) or contactor (100ms up to 500ms) to set the changeover switching time of the internal circuit selector. Set a delay time longer than the actual contactor / relay operating times. (Screen only available when circuit selector is enabled).	500MS		
CIRCUIT SELECTOR ALL OFF ACTION	Set to 'CCR OFF' to turn off the CCR when all circuits are selected to off, even though the CCR itself is selected to on. Alternatively, set to 'CCR ON' – the CCR will continue to operate with all outputs shorted. (Available when Multiway (2 to 6 way) Circuit Selector is enabled).	CCR OFF		
CIRCUIT SELECTOR LOGIC	Select normally open or normally closed logic for correct fail-safe modes for each circuit of Multiway Circuit Selector. Note – the relays / contactors should first be wired to use normally open or normally closed contacts according to the fail-safe requirements of each field circuit (eg. stopbar – fail to on – normally open contact required), then the type of contact used for each circuit programmed via this screen.	N/Op	1, 2, 3, 4, 5, 6	
		N/Cl		
BRILL BI RELAYS ACTIVE ON FAULT	Set to enabled to allow Brilliancy Level Back Indication Relays to remain energised under fault trip conditions.	DISABLED		
LED & SCREEN TESTS	Allows test of front panel LEDs and OLED screen.	N/A		
CHANGE PASSWORD FOR MENU 2 SET-UP	Allows the password for entry to the Set-up menu to be changed.	atg		
CCR MENU 3 ENGINEERING CONFIG	Allows entry to the Engineering Configuration Menu via the password entry screen.	eng		
EXIT MENU 2 SET-UP MENU	Allows exit from the Set-up menu.			

ENGINEERING CONFIGURATION MENU

The Engineering Configuration Menu is accessed from the Set-up Menu by the use of a password. From the Set-up Menu, turn the right-hand side Rotary Menu Selector anti-clockwise until it displays 'Enter Menu 3 Engineering Config', then press the Rotary Menu Selector to show 'a a a'.

The default password is 'eng'. Enter the password one letter at a time using the Rotary Menu Selector to scroll up and down the alphabet, and then press the Rotary Menu Selector to enter each letter in turn. If the password is loaded correctly, the display will show the first screen within the Engineering Configuration Menu: 'Maximum Output Current'.

It is now possible to scroll through the menu using the Rotary Menu Selector; turn anti-clockwise to reach the following screens. Pressing the Rotary Menu Selector will permit modifications to the parameters for the selected screen. The left hand arrow will move to the second line, then turning the Rotary Menu Selector will scroll through the available parameter settings. Press the Rotary Menu Selector to load the new parameter, then turn to select 'Confirm' then press again', or alternatively on 'Cancel' to quit without loading the changes.

To exit the Engineering Configuration Menu turn the Rotary Menu Selector anti-clockwise until 'Exit Menu 3' is displayed (the last screen), then press the Rotary Menu Selector, then turn to select 'Confirm' then press again.

Refer to the Micro 100+ CCR Installation and Operational Manual for more detailed information on the menu structure.

PARAMETER (ENGINEERING CONFIGURATION MENU)	DESCRIPTION	DEFAULT SETTINGS	SETTING (IF CHANGED)
MAXIMUM OUTPUT CURRENT	Select CCR maximum output current. Available settings are 6.00, 6.60, 12.0 and 20.0A.	6.6A	
NOMINAL SUPPLY VOLTAGE	Select the nominal supply voltage for which the CCR has been manufactured. Note - this will be indicated on the CCR nameplate and will have been programmed during factory testing of the CCR	415V	
PLF/PWR ANALYSER CARD IN USE	Select from AT1031 PLF-PA Card, AT1127 PLF Card or disabled	DISABLED	
CCR KVA RATING	Enter the kVA rating of the CCR. Note - screen not available on all CCRs	30KVA	
AENA OUTPUTS	Enables AENA I/O configuration (for Spanish market)	DISABLED	
START-UP RAMP	The CCR can be programmed to gradually ramp up the O/P current to selected level on start-up, in a set time period, rather than switch on directly at the selected level. Enable/ Disable Start Ramp	DISABLED	
START-UP RAMP TIME	Set the Start Up Current Ramp time. (Only available if Start Up Ramp is enabled)	600ms	
TRANSITION RAMP	The CCR can be programmed to gradually ramp up and ramp down the output current on switching transitions, with separate time periods selectable for ramp up and ramp down. (Note – this has no effect on the initial Start-up ramp time). Enable/ Disable Transition Ramp	DISABLED	
RISING CURRENT RAMP TIME	Set the Current Ramp time for rising output current transitions. (Note – this has no effect on the initial Start-up ramp time. This is only available if Transition Ramp is enabled)	600ms	
FALLING CURRENT RAMP TIME	Set the Current Ramp time for falling output current transitions. (This is only available if Transition Ramp is enabled).	600ms	
CAPACITIVE CURRENT DETECTION	Detection of capacitive current flow can be set to trip the CCR, cause a soft alarm but continue operating, or detection can be disabled. For reasons of safety, it should be set to trip the CCR since for circuits using primary series loop cable with an earth screen, an open circuit fault may not otherwise be detected due to current continuing to flow through the capacitance of the earth sheath	TRIP	
CAPACITIVE CURRENT THRESHOLD	Sets the threshold level for detection of capacitive current. The valid range is from 1 to 100; the lower the value the more sensitive is the detector. It can be desensitised if nuisance tripping is encountered.	10	
ASYMMETRIC CURRENT DETECTION	This feature detects an imbalance (asymmetry) in the current between the positive and negative half cycles of the CCR output waveshape, which can sometimes be caused by an imbalance in an active (electronic) load on the series loop circuit. Detection of asymmetric current can be set to trip the CCR, cause a soft alarm but continue operating, or detection can be disabled	ALARM	
ASYMMETRIC CURRENT THRESHOLD	Set the Overcurrent Trip Time characteristic: IEC/EN setting trips in less than 5 seconds for an overcurrent of 102.3%, FAA setting trips in less than 5 seconds for an overcurrent of 105%	10	
OVERCURRENT TRIP TIME	Configure the stage 2 Earth Leakage detector to give an alarm and continue to run (disabled), or to shutdown (trip) the CCR (enabled)	IEC (102.3% < 5s)	
FORCE OUTPUT CURRENT TEST MENU	Test use only - not to be used on live circuit. Allows manual control of output current in order to test the Overcurrent and Undercurrent trip points	CCR maximum output current	
EXIT MENU 3 ENGINEERING CONFIG	Allows exit from the Engineering Configuration Menu.	N/A	

Table 11-2 CCR Parameter Record Sheet

12 Parts Listings and Circuit Schematic

Table 12-1 to Table 12-10 provide a list of all major components fitted the CCR, with the exception of the cabinet, covers and fixings. The list includes the parts for all voltage and power ratings, plus the optional components available for the Micro 100+ series. When choosing spare parts, check carefully the specification of the regulator for which the parts are to be purchased.

The recommended spares quantity varies depending on the quantity of CCRs for the project, and on how many of these CCRs use any given part.

Items which are recommended to purchase as spares include a letter in the listing denoting the spare parts category; a typical spares kit would include those parts denoted category ‘A’ and ‘B’.

The categories are defined as follows:

Category A – fuses only in this category. Refer to Table 12-6 for the quantities of each fitted; it is recommended to keep 2 spares of each type (2A control and power fuse) for every CCR on site which would use these components.

Category B – keep 1 spare part from this category where there are 5 or more CCRs on site which would use these components. Eg, 7410-1030 Control Card

Category C – keep 1 spare part from this category where there are 15 or more CCRs on site which would use these components.

For example, all Micro 100+ CCRs use the AT1030 Control Card (stock number 7410-1030), and so a mixture of different CCRs, which could be in terms of voltage or kVA rating, or optional parts fitted, will make up the total quantity of CCRs using this part in order to determine whether it should be included in the list of recommended spares.

On the other hand, the Micro 100+ CCRs with built-in Circuit Selector Switches use a different Microcontroller Front Panel than that for a standard CCR, and the Front Panel is specific to the exact type of Circuit Selector fitted. In this case, the quantities of each particular variant of Circuit Selector Switch are used to determine the type and quantity of recommended spare Microcontroller Front panels.

T101 CCR POWER TRANSFORMERS						
220V SERIES, 6.6A OUTPUT				400V SERIES, DUAL 6.6 / 12A OUTPUT		
CCR RATING, kVA	MANUFACTURER	ATG AIRPORTS STOCK CODE		CCR RATING, kVA	MANUFACTURER	ATG AIRPORTS STOCK CODE
1	ATG AIRPORTS	2690-0689		3.78	ATG AIRPORTS	2690-0610
2.5	ATG AIRPORTS	2690-0690		7.5	ATG AIRPORTS	2690-0611
4	ATG AIRPORTS	2690-0691		11.34	ATG AIRPORTS	2690-0615
5	ATG AIRPORTS	2690-0692		15	ATG AIRPORTS	2690-0612
7.5	ATG AIRPORTS	2690-0693		18.9	ATG AIRPORTS	2690-0616
10	ATG AIRPORTS	2690-0694		22.68	ATG AIRPORTS	2690-0613
12.5	ATG AIRPORTS	2690-0695		26.46	ATG AIRPORTS	2690-0614
15	ATG AIRPORTS	2690-0696				
400V SERIES, 6.6A OUTPUT				480V SERIES, 6.6A OUTPUT		
CCR RATING, kVA	MANUFACTURER	ATG AIRPORTS STOCK CODE		CCR RATING, kVA	MANUFACTURER	ATG AIRPORTS STOCK CODE
1	ATG AIRPORTS	2690-0674		1	ATG AIRPORTS	2690-0699
2.5	ATG AIRPORTS	2690-0675		2.5	ATG AIRPORTS	2690-0700
4	ATG AIRPORTS	2690-0676		4	ATG AIRPORTS	2690-0701
5	ATG AIRPORTS	2690-0677		5	ATG AIRPORTS	2690-0702
7.5	ATG AIRPORTS	2690-0678		7.5	ATG AIRPORTS	2690-0703
10	ATG AIRPORTS	2690-0679		10	ATG AIRPORTS	2690-0704
12.5	ATG AIRPORTS	2690-0680		12.5	ATG AIRPORTS	2690-0705
15	ATG AIRPORTS	2690-0681		15	ATG AIRPORTS	2690-0706
20	ATG AIRPORTS	2690-0682		20	ATG AIRPORTS	2690-0707
25	ATG AIRPORTS	2690-0683		25	ATG AIRPORTS	2690-0708
30	ATG AIRPORTS	2690-0684		30	ATG AIRPORTS	2690-0709

Table 12-1 Parts List: T101 Power Transformers

Note – other transformer types from those listed above may be fitted depending on the exact specification of the CCR. Check the part number for the transformer actually fitted if a replacement is to be ordered.

REF	OPTION CODES WHERE FITTED	QTY	COMPONENT TYPE	DESCRIPTION	MANUFACTURER	MFTR P/N	ATG AIRPORTS STOCK CODE	SPARE PART CATEGORY / COMMENT
FP		1	FRONT PANEL	STANDARD MICRO 100+ MICROCONTROLLER FRONT PANEL	ATG AIRPORTS	8500-2020K	8500-2020K	B
FP	D	1	FRONT PANEL	ALTERNATE CIRCUIT SELECTOR MICRO 100+ MICROCONTROLLER FRONT PANEL	ATG AIRPORTS	8500-2021K	8500-2021K	B
FP	2W	1	FRONT PANEL	2W SIMULTANEOUS CIRCUIT SELECTOR MICRO 100+ MICROCONTROLLER FRONT PANEL	ATG AIRPORTS	8500-2022K	8500-2022K	B
FP	3W	1	FRONT PANEL	3W SIMULTANEOUS CIRCUIT SELECTOR MICRO 100+ MICROCONTROLLER FRONT PANEL	ATG AIRPORTS	8500-2023K	8500-2023K	B
FP	4W	1	FRONT PANEL	4W SIMULTANEOUS CIRCUIT SELECTOR MICRO 100+ MICROCONTROLLER FRONT PANEL	ATG AIRPORTS	8500-2024K	8500-2024K	B
FP	5W	1	FRONT PANEL	5W SIMULTANEOUS CIRCUIT SELECTOR MICRO 100+ MICROCONTROLLER FRONT PANEL	ATG AIRPORTS	8500-2025K	8500-2025K	B
FP	6W	1	FRONT PANEL	6W SIMULTANEOUS CIRCUIT SELECTOR MICRO 100+ MICROCONTROLLER FRONT PANEL	ATG AIRPORTS	8500-2026K	8500-2026K	B
AT558		1	PCB	BRILLIANCY SELECTOR ROTARY SWITCH CARD	ATG AIRPORTS	AT558C	7400-1558A	C
AT637	2W/3W/4W/5W/6W	1	PCB	SIMULTANEOUS / MULTIWAY CIRCUIT SELECTOR SWITCH CARD	ATG AIRPORTS	AT637	7400-1637A	
AT657	D	1	PCB	DIRECTION / ALTERNATE CIRCUIT SELECTOR CARD	ATG AIRPORTS	AT657A	7400-1657A	PART OF 8500-2021K
AT661C	2W/3W/4W/5W/6W	1	PCB	SIMULTANEOUS / MULTIWAY CIRCUIT SELECTOR CONTROL CARD	ATG AIRPORTS	AT661C	7400-1661A	B
AT663A	2W/3W/4W/5W/6W	1	PCB	SIMULTANEOUS / MULTIWAY CIRCUIT SELECTOR RELAY I/O CARD	ATG AIRPORTS	AT663A	7400-1663A	B
AT683	JS	1	PCB	J-BUS / MODBUS RTU COMMUNICATION CARD	ATG AIRPORTS	AT683	7400-1683A	B
AT699	EF	1	PCB	EARTH LEAKAGE DETECTION CARD	ATG AIRPORTS	AT699	7400-1699A	C
AT709	EF	1	PCB	EARTH LEAKAGE SUB - CARD	ATG AIRPORTS	AT709	7400-1709A	C
AT712	24/48	1	PCB	RELAY I/O CARD (STANDARD IEC SPECIFICATION)	ATG AIRPORTS	AT712A	7400-1712A	B
AT728	PS	1	PCB	DUAL PROFIBUS COMMUNICATION CARD	ATG AIRPORTS	AT728	7400-1728A	B
AT753	FAA	1	PCB	MAINS INPUT SURGE ARRESTOR 415V	ATG AIRPORTS	AT753	7400-1753A	C
AT754	FAA	1	PCB	MAINS INPUT SURGE ARRESTOR 240V	ATG AIRPORTS	AT754	7400-1754A	C
AT820	FAA	1	PCB	MAINS INPUT SURGE ARRESTOR 500V	ATG AIRPORTS	AT820	7400-1820A	C
AT1026	FCI	1	PCB	CUTOUT SWITCH RELAY CARD	ATG AIRPORTS	AT1026	7410-1026	B
AT1030		1	PCB	MICROCONTROLLER MOTHERBOARD	ATG AIRPORTS	AT1030	7410-1030	B
AT1032		1	PCB	OLED DISPLAY BOARD	ATG AIRPORTS	AT1032	7410-1032	B
AT1035	24/48	1	PCB	I2C I/O INTERFACE CARD	ATG AIRPORTS	AT1035	7410-1035	B
AT1127	LF, FAA L-829	1	PCB	PERCENTAGE LAMP FAILURE CARD	ATG AIRPORTS	AT1127	7400-1642	C
AT1056	MTS	1	PCB	MODBUS TCP / IP COMMUNICATION CARD	ATG AIRPORTS	AT1056	7400-1056	B

Table 12-2 Parts List: Circuit Boards, including optional

CONTROL TRANSFORMERS - ALL BUILD STANDARDS						SPARES CATEGORY	220V SERIES - QUANTITY								400V SERIES - QUANTITY										480V SERIES - QUANTITY										
REF	PRI. VOLTS	SEC VOLTS AND VA	MFTR	MFTR P/N	ATG AIRPORTS STOCK CODE		1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA
T102	0-208-220-240V	18/0/18v (22VA) TO AT1030, 0-220v (22VA) TO AT1030, 15/0/15v (12VA) TO AT699, 0-20v (3VA) SPARE	DOUGLAS TRANSFORMERS	M5978	2690-0020	C	1	1	1	1	1	1	1	1																					
T105	0-208-220-240V	18/0/18 (22VA) TO AT712A RIO CARD, 0-9v (6VA) TO PROFIBUS / MODBUS / J-BUS CARD	DOUGLAS TRANSFORMERS	M5979	2690-0021	C	1	1	1	1	1	1	1	1																					
T102	0-380-415-440V	18/0/18v (22VA) TO AT1030, 0-220v (22VA) TO AT1030, 15/0/15v (12VA) TO AT699, 0-20v (3VA) SPARE	DOUGLAS TRANSFORMERS	M5866	2690-0013	C									1	1	1	1	1	1	1	1	1	1	1										
T105	0-380-415-440V	18/0/18 (22VA) TO AT712A RIO CARD, 0-9v (6VA) TO PROFIBUS / MODBUS / J-BUS CARD	DOUGLAS TRANSFORMERS	M5700	2690-0014	C									1	1	1	1	1	1	1	1	1	1	1										
T102	0-460-480-500V	18/0/18v (22VA) TO AT1030, 0-220v (22VA) TO AT1030, 15/0/15v (12VA) TO AT699, 0-20v (3VA) SPARE	DOUGLAS TRANSFORMERS	M5986	2690-0072	C																				1	1	1	1	1	1	1	1	1	1	1
T105	0-460-480-500V	18/0/18 (22VA) TO AT712A RIO CARD, 0-9v (6VA) TO PROFIBUS / MODBUS / J-BUS CARD	DOUGLAS TRANSFORMERS	M5987	2690-0075	C																				1	1	1	1	1	1	1	1	1	1	1

Table 12-3 Parts List: Standard Control Transformers

CONTROL TRANSFORMERS FOR CCR OPTIONS									
REF	OPTION CODES WHERE FITTED	QTY	DESCRIPTION	PRIMARY VOLTAGE	SECONDARY VOLTAGE(S) AND RATINGS	MFTR	MFTR P/N	ATG AIRPORTS STOCK CODE	SPARE PART CATEGORY
220V SERIES									
T106	2W/3W/4W/ 5W/6W	1	CONTROL SUPPLY FOR AT661 MULTIWAY CIRCUIT SELECTOR CARD	0-208-220-240V	0-18v (24VA), 0-18v (12VA), 0-9v (6VA)	DOUGLAS TRANSFORMERS	M6293	2690-0012A	C
T107	D	1	CONTROL SUPPLY FOR AT657 DIRECTION / ALTERNATE CIRCUIT SELECTOR CARD	0-208-220-240V	0-18v (12VA)	DOUGLAS TRANSFORMERS	M6545	2690-0017A	C
400V SERIES									
T106	2W/3W/4W/ 5W/6W	1	CONTROL SUPPLY FOR AT661 MULTIWAY CIRCUIT SELECTOR CARD	0-380-400-415V	0-18v (24VA), 0-18v (12VA), 0-9v (6VA)	DOUGLAS TRANSFORMERS	M5586	2690-0012	C
T107	D	1	CONTROL SUPPLY FOR AT657 DIRECTION / ALTERNATE CIRCUIT SELECTOR CARD	0-380-400-415V	0-18v (12VA)	DOUGLAS TRANSFORMERS	M6546	2690-0017	C
480V SERIES									
T106	2W/3W/4W/ 5W/6W	1	CONTROL SUPPLY FOR AT661 MULTIWAY CIRCUIT SELECTOR CARD	0-460-480-500V	0-18v (24VA), 0-18v (12VA), 0-9v (6VA)	DOUGLAS TRANSFORMERS	M6300	2690-0016	C
T107	D	1	CONTROL SUPPLY FOR AT657 DIRECTION / ALTERNATE CIRCUIT SELECTOR CARD	0-460-480-500V	0-18v (12VA)	DOUGLAS TRANSFORMERS	M6299	2690-0018	C
CURRENT TRANSFORMERS					RATING				
T103	STD CCR AND 2W/3W/4W/ 5W/6W	1 - 7	CURRENT TRANSFORMER	N/A	150:0.5 AMPS, 1VA CL0.5	NORATEL	TI-077554 ISS 3	2690-0009	

Table 12-4 Parts List: Control Transformers for options; CT's

REF	CCR OPTION CODES	QTY	COMPONENT TYPE	DESCRIPTION	RATING	MANUFACTURER	MFTR P/N	ATG AIRPORTS STOCK CODE	SPARE PART CATEGORY
OUTPUT TERMINALS AND LIGHTNING ARRESTORS									
OUTPUT TERMINAL	ALL EXC. LA, FAA	2 - 7	TERMINAL	STANDARD CCR OUTPUT TERMINAL	125A	WEIDMULLER	WFF 35	2720-0071	
COVER	ALL EX. LA, FAA	4 - 14		TERMINAL COVER		WEIDMULLER	WAH 35	2720-0075	
LIGHTNING ARRESTOR	LA, FAA	1	MOV / TERMINAL	2 OUTPUTS - METAL OXIDE VARISTOR AND TERMINAL ASSEMBLY	MOV IMPULSE RATING - 15kA, 10 x 20µS	ATG AIRPORTS	7200-0210	7200-0210	C
LIGHTNING ARRESTOR	LA - 2W	1	MOV / TERMINAL	3 OUTPUTS - METAL OXIDE VARISTOR AND TERMINAL ASSEMBLY	MOV IMPULSE RATING - 15kA, 10 x 20µS	ATG AIRPORTS	7200-0212	7200-0212	C
LIGHTNING ARRESTOR	LA - 3W	1	MOV / TERMINAL	4 OUTPUTS - METAL OXIDE VARISTOR AND TERMINAL ASSEMBLY	MOV IMPULSE RATING - 15kA, 10 x 20µS	ATG AIRPORTS	7200-0213	7200-0213	C
LIGHTNING ARRESTOR	LA - 4W	1	MOV / TERMINAL	5 OUTPUTS - METAL OXIDE VARISTOR AND TERMINAL ASSEMBLY	MOV IMPULSE RATING - 15kA, 10 x 20µS	ATG AIRPORTS	7200-0214	7200-0214	C
LIGHTNING ARRESTOR	LA - 5W	1	MOV / TERMINAL	6 OUTPUTS - METAL OXIDE VARISTOR AND TERMINAL ASSEMBLY	MOV IMPULSE RATING - 15kA, 10 x 20µS	ATG AIRPORTS	7200-0215	7200-0215	C
LIGHTNING ARRESTOR	LA - 6W	1	MOV / TERMINAL	7 OUTPUTS - METAL OXIDE VARISTOR AND TERMINAL ASSEMBLY	MOV IMPULSE RATING - 15kA, 10 x 20µS	ATG AIRPORTS	7200-0216	7200-0216	C
LIGHTNING ARRESTOR	LA - D	1	MOV / TERMINAL	4 OUTPUTS - METAL OXIDE VARISTOR AND TERMINAL ASSEMBLY	MOV IMPULSE RATING - 15kA, 10 x 20µS	ATG AIRPORTS	7200-0211	7200-0211	C
CUTOUT SWITCH ASSEMBLIES									
CUTOUT SWITCH	FCI	1 OR 2	ISOLATING SWITCH	SAFETY ISOLATING SWITCH	12A	ATG AIRPORTS	2610-0022A	2610-0022A	
CUTOUT SWITCH + INTERLOCK	FCI (EG, AIR. NZ)	1 OR 2	ISOLATING SWITCH	SAFETY ISOLATING SWITCH WITH REED RELAY INTERLOCK TO DISCONNECT CCR OUTPUT	12A	ATG AIRPORTS	2610-0024A	2610-0024A	
CUTOUT SW + INTLK + BACK IND	FCI (EG, AENA SPEC, SP)	1	ISOLATING SWITCH	SAFETY ISOLATING SWITCH WITH REED RELAY INTERLOCK TO DISCONNECT CCR OUTPUT, AND POSITION BACK INDICATION	12A	ATG AIRPORTS	2610-0023A	2610-0023A	
CIRCUIT SELECTOR RELAYS, MAX. 6.6A, UP TO 10kVA									
C1 - C6	2W/3W/4W /5W/6W/D	1 - 6	CONTROL RELAY	24V LOW CONSUMPTION DC COIL, INC. SUPPRESSOR. 3 NO AND 2 NC CONTACTS	CONTACT RATING: 10A	TELEMECANIQUE	CAD-32BL	2610-0140	B
CIRCUIT SELECTOR RELAYS, 12.5kVA TO 30kVA AT 6.6A, ALL KVA RATINGS AT 12A									
C1 - C6	2W/3W/4W /5W/6W/D	1 - 6	VACUUM RELAY	CIRCUIT SELECTOR RELAY, 6.6A, 12.5kVA TO 30kVA, AND 12A AT ALL KVA RATINGS	CONTACT RATING: 50A @ 12kV AC	JENNINGS	RJ2B-26S	2515-0055	B

Table 12-5 Parts List: Output Terminals, Cutout Switch, Lightning Arrestors and CSS Relays

FUSES							SPARES CATEGORY	220V SERIES - QUANTITY. F2/F4=NUETRAL LINK ON SINGLE PHASE (L-N) MODELS. 2 PHASE MODEL QTY IN (-)								400V SERIES - QUANTITY											480V SERIES - QUANTITY										
REF	COMP. TYPE	VOLT RAT	CURR RAT	MFTR	MFTR P/N	ATG AIRPORTS STOCK CODE		1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA
FUSES FOR IEC BUILD STANDARD																																			
F1, F2	HOLDER (10x38mm	N/A	N/A	SIBA	5106304.2	2720-0090		1	1	1						1	1	1	1	1							1	1	1	1	1						
F1, F2	gG FUSE, 10x38mm	500V	6A	SIBA	5006308.6A	2550-0406	A									2											2										
F1, F2	gG FUSE, 10x38mm	500V	10A	SIBA	5006308.10A	2550-0407	A	1 (2)									2											2									
F1, F2	gRL FUSE, 10x38mm	500V	20A	SIBA	6003434.20A	2550-0320	A		1 (2)									2	2										2	2							
F1, F2	gRL FUSE, 10x38mm	500V	30A	SIBA	6003434.30A	2550-0330	A			1 (2)										2										2							
F1, F2	HOLDER, 22x58mm	N/A	N/A	SIBA	5106004.2	2720-0092					1	1	1	1	1						1	1	1	1	1	1					1	1	1	1	1	1
F1, F2	gRL FUSE, 22x58mm	690V	40A	SIBA	5014034.40A	2550-0440	A				1 (2)										2										2					
F1, F2	gRL FUSE, 22x58mm	690V	50A	SIBA	5014034.50A	2550-0350	A															2										2				
F1, F2	gRL FUSE, 22x58mm	690V	63A	SIBA	5014034.63A	2550-0363	A					1 (2)											2										2			
F1, F2	gRL FUSE, 22x58mm	690V	80A	SIBA	5014034.80A	2550-0380	A						1 (2)											2										2		
F1, F2	gG FUSE, 22x58mm	500V	100A	SIBA	5006008.100A	2550-0416	A							1 (2)											2										2	2
F1, F2	gG FUSE, 22x58mm	400V	125A	SIBA	5006008.125A	2550-0417	A								1 (2)											2										
F3, F4	HOLDER, 10x38mm	N/A	N/A	SIBA	5106304.2	2720-0090		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
F3, F4	gG FUSE, 10x38mm	500V	2A	SIBA	5006308.2A	2550-0302	A	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

FUSES							SPARES CATEGORY	220V SERIES - QUANTITY. F2/F4=NUETRAL LINK ON SINGLE PHASE (L-N) MODELS. 2 PHASE MODEL QTY IN (-)								400V SERIES - QUANTITY										480V SERIES - QUANTITY									
REF	COMP. TYPE	VOLT RAT	CURR RAT	MFTR	MFTR P/N	ATG AIRPORTS STOCK CODE		1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA
F7	aR FUSE, 35 x 85mm	690V	180A	SIBA	5007406.180A	2550-0180	A							1	1									1	1								1	1
F2, F4	NUETRAL LINK, 10x38mm	N/A	N/A	SIBA	5006308.N	2550-0402		2 (0)	2 (0)	2 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)																			
F2	NUETRAL LINK, 22x58mm	N/A	N/A	SIBA	5006008.N	2550-0404		0 (0)	0 (0)	0 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)																			
FUSES FOR FAA BUILD STANDARD																																			
F1, F2	HOLDER, 10x38mm	N/A	N/A	SIBA	5106304.2	2720-0090		1	1							1	1	1	1								1	1	1	1	1						
F1, F2	gG FUSE, 10x38mm	500V	6A	SIBA	5006308.6A	2550-0406	A									2											2									
F1, F2	gG FUSE, 10x38mm	500V	10A	SIBA	5006308.10A	2550-0407	A	1 (2)									2											2								
F1, F2	gG FUSE, 10x38mm	500V	16A	SIBA	5006308.16A	2550-0408	A											2											2	2						
F1, F2	gG FUSE, 10x38mm	500V	20A	SIBA	5006308.20A	2550-0409	A		1 (2)										2																	
F1, F2	gG FUSE, 10x38mm	500V	25A	SIBA	5006308.25A	2550-0410	A																							2						
F1, F2	HOLDER, 22x58mm	N/A	N/A	SIBA	5106004.2	2720-0092				1	1	1	1	1	1					1	1	1	1	1	1	1					1	1	1	1	1	1
F1, F2	gG FUSE, 22x58mm	690V	32A	SIBA	5006008.32A	2550-0411	A			1 (2)										2											2					
F1, F2	gG FUSE, 22x58mm	690V	40A	SIBA	5006008.40A	2550-0412	A				1 (2)										2											2				
F1, F2	gG FUSE, 22x58mm	690V	50A	SIBA	5006008.50A	2550-0413	A															2											2			
F1, F2	gG FUSE, 22x58mm	690V	63A	SIBA	5006008.63A	2550-0414	A					1 (2)											2													

FUSES							SPARES CATEGORY	220V SERIES - QUANTITY. F2/F4=NUETRAL LINK ON SINGLE PHASE (L-N) MODELS. 2 PHASE MODEL QTY IN (-)								400V SERIES - QUANTITY										480V SERIES - QUANTITY									
REF	COMP. TYPE	VOLT RAT	CURR RAT	MFTR	MFTR P/N	ATG AIRPORTS STOCK CODE		1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA
F1, F2	gG FUSE, 22x58mm	690V	80A	SIBA	5006008.80A	2550-0415	A						1 (2)										2									2		
F1, F2	gG FUSE, 22x58mm	500V	100A	SIBA	5006008.100A	2550-0416	A							1 (2)											2									2	2
F1, F2	gG FUSE, 22x58mm	400V	125A	SIBA	5006008.125A	2550-0417	A								1 (2)											2									
F3, F4	HOLDER, 10x38mm	N/A	N/A	SIBA	5106304.2	2720-0090		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
F3, F4	gG FUSE, 10x38mm	500V	2A	SIBA	5006308.2A	2550-0302	A	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
F7	aR FUSE, 17.5 x 63.5 mm	690V	40A	SIBA	5007306.40A	2550-0040	A	1	1	1						1	1	1	1	1							1	1	1	1	1						
F7	aR FUSE, 17.5 x 63.5 mm	690V	80A	SIBA	5007306.80A	2550-0053	A				1	1									1	1	1									1	1	1			
F7	aR FUSE, 17.5 x 63.5 mm	690V	100A	SIBA	5007306.100A	2550-0100	A						1											1											1		
F7	aR FUSE, 35 x 85mm	690V	180A	SIBA	5007406.180A	2550-0180	A							1	1										1	1									1	1
F2, F4	NUETRAL LINK, 10x38mm	N/A	N/A	SIBA	5006308.N	2550-0402		2 (0)	2 (0)	2 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)																					
F2	NUETRAL LINK, 22x58mm	N/A	N/A	SIBA	5006008.N	2550-0404		0 (0)	0 (0)	0 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)																					

NOTE - 220V SERIES SINGLE PHASE (L-N) MODELS USE 1 OF EACH FUSE, WITH F2 AND F4 REPLACED BY A NUETRAL LINK. 220V 2 PHASE MODELS USE 2 OF EACH FUSE. ALL FUSEHOLDERS DUAL TYPE.

FUSE TYPES:

gG	GENERAL LINE FUSE
gRL	COMBINED LINE AND SEMICONDUCTOR PROTECTION FUSE
aR	ULTRA HIGH SPEED SEMICONDUCTOR PROTECTION FUSE (FITTED TO THYRISTOR STACK ASSEMBLY; ABOVE PART NUMBERS FOR REPLACEMENT FUSES ONLY)

Table 12-6 Parts List: Fuses

CIRCUIT BREAKERS / MCB'S - OPTIONAL, IN PLACE OF LINE FUSES. COMBINED WITH ULTRA HIGH SPEED SEMICONDUCTOR PROTECTION FUSE. (NOTE - MCB'S NOT AVAILABLE ABOVE 10KVA ON 220V SERIES, OR ABOVE 20KVA ON 400V SERIES, AND NOT AVAILABLE ON 480V SERIES)							SPARES CATEGORY	220V SERIES - QUANTITY. F2/F4=NEUTRAL LINK ON SINGLE PHASE (L-N) MODELS. 2 PHASE MODEL QTY IN (-)								400V SERIES - QUANTITY									
REF	COMP. TYPE	VOLT. RAT.	CURR. RAT.	MFTR	MFTR P/N	ATG AIRPORTS STOCK CODE		1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA
F1	MCB, SINGLE POLE 10A TYPE C	440V	10A	ABB	S201MC10	2550-1810	C	1																		
F1	MCB, SINGLE POLE 20A TYPE C	440V	20A	ABB	S201MC20	2550-1820	C		1																	
F1	MCB, SINGLE POLE 32A TYPE C	440V	32A	ABB	S201MC32	2550-1832	C			1																
F1	MCB, SINGLE POLE 40A TYPE C	440V	40A	ABB	S201MC40	2550-1840	C				1															
F1	MCB, SINGLE POLE 63A TYPE C	440V	63A	ABB	S201MC63	2550-1863	C					1														
F1	MCB, SINGLE POLE 80A TYPE C	440V	80A	ABB	S801N-C80	2550-1880	C						1													
F2	HOLDER, SINGLE 10x38mm	N/A	N/A	SIBA	5106304	2720-0097		1	1																	
F2	HOLDER, SINGLE 22x58mm	N/A	N/A	SIBA	5106005.1	2720-0098				1	1	1														
F1, F2	MCB, 2 POLE 6A TYPE C	440V	6A	ABB	S202MC6	2550-2006	C									1										
F1, F2	MCB, 2 POLE 10A TYPE C	440V	10A	ABB	S202MC10	2550-2010	C	(1)									1									
F1, F2	MCB, 2 POLE 20A TYPE C	440V	20A	ABB	S202MC20	2550-2020	C		(1)									1	1							
F1, F2	MCB, 2 POLE 32A TYPE C	440V	32A	ABB	S202MC32	2550-2032	C			(1)										1						
F1, F2	MCB, 2 POLE 40A TYPE C	440V	40A	ABB	S202MC40	2550-2040	C				(1)										1					
F1, F2	MCB, 2 POLE 50A TYPE C	440V	50A	ABB	S202MC50	2550-2050	C															1				
F1, F2	MCB, 2 POLE 63A TYPE C	440V	63A	ABB	S202MC63	2550-2063	C					(1)											1			
F1, F2	MCB, 2 POLE 80A TYPE C	440V	80A	ABB	S802N-C80	2550-2080	C						(1)											1		
F3, F4	HOLDER, 10x38mm	N/A	N/A	SIBA	5106304.2	2720-0090		1	1	1	1	1				1	1	1	1	1	1	1	1			
F3, F4	gG FUSE, 10x38mm	500V	2A	SIBA	5006308.2A	2550-0302	A	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)				2	2	2	2	2	2	2	2			
F7	aR FUSE, 17.5x63.5mm	690V	40A	SIBA	5007306.40A	2550-0040	A	1	1	1						1	1	1	1	1						
F7	aR FUSE, 17.5x63.5mm	690V	80A	SIBA	5007306.80A	2550-0053	A				1	1									1	1	1			

CIRCUIT BREAKERS / MCB'S - OPTIONAL, IN PLACE OF LINE FUSES. COMBINED WITH ULTRA HIGH SPEED SEMICONDUCTOR PROTECTION FUSE. (NOTE - MCB'S NOT AVAILABLE ABOVE 10KVA ON 220V SERIES, OR ABOVE 20KVA ON 400V SERIES, AND NOT AVAILABLE ON 480V SERIES)							SPARES CATEGORY	220V SERIES - QUANTITY. F2/F4=NEUTRAL LINK ON SINGLE PHASE (L-N) MODELS. 2 PHASE MODEL QTY IN (-)								400V SERIES - QUANTITY										
REF	COMP. TYPE	VOLT. RAT.	CURR. RAT.	MFTR	MFTR P/N	ATG AIRPORTS STOCK CODE		1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA
F7	aR FUSE, 17.5x63.5mm	690V	100A	SIBA	5007306.100A	2550-0100	A																			
F7	aR FUSE, 35 x 85mm	690V	180A	SIBA	5007406.180A	2550-0180	A																			
F2, F4	NEUTRAL LINK, 10x38mm	N/A	N/A	SIBA	5006308.N	2550-0402		2 (0)	2 (0)	1 (0)	1 (0)	1 (0)														
F2	NEUTRAL LINK, 22x58mm	N/A	N/A	SIBA	5006008.N	2550-0404		0 (0)	0 (0)	1 (0)	1 (0)	1 (0)														
NOTE - 220V SERIES SINGLE PHASE (L-N) MODELS USE SINGLE POLE MCB'S FOR F1 AND F3, WITH F2 AND F4 REPLACED BY A NEUTRAL LINK. 220V 2 PHASE MODELS USE 2 POLE MCB.							SPARES CATEGORY	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA
FUSE TYPES:								220V SERIES - QUANTITY. F2/F4=NEUTRAL LINK ON SINGLE PHASE (L-N) MODELS. 2 PHASE MODEL QTY IN (-)								400V SERIES - QUANTITY										
gG - GENERAL LINE FUSE																										
aR - ULTRA HIGH SPEED SEMICONDUCTOR PROTECTION FUSE (FITTED TO THYRISTOR STACK ASSEMBLY; ABOVE PART NUMBERS FOR REPLACEMENT FUSES ONLY)																										

Table 12-7 Parts List: Circuit Breakers (optional, in place of line fuses)

EMC FILTERS - ALL BUILD STANDARDS							SPARES CATEGORY	220V SERIES - QUANTITY								400V SERIES - QUANTITY										480V SERIES - QUANTITY									
REF	COMP. TYPE	VOLT. RAT. (AC)	CURR . RAT.	MFTR	MFTR P/N	ATG AIRPORTS STOCK CODE		1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA
F101	EMC FILTER	520V	25A	SCHAFFNER	FN2410H-25-33	2620-0011		1	1							1	1	1	1								1	1	1	1	1						
F101	EMC FILTER	520V	32A	SCHAFFNER	FN2410H-32-33	2620-0013				1										1																	
F101	EMC FILTER	520V	60A	SCHAFFNER	FN2410H-60-34	2620-0021					1	1									1	1	1									1	1	1			
F101	EMC FILTER	520V	100A	SCHAFFNER	FN2410H-100-34	2620-0026							1	1	1									1	1	1									1	1	1

Table 12-8 Parts List: EMC Filters

CONTACTORS AND COIL SUPPRESSORS - ALL BUILD STANDARDS. (NOTE - STOCK CODES 2610-xxxK INCLUDES THE CONTACTOR AND THE APPROPRIATE COIL SUPPRESSOR)							SPARES CATEGORY	220V SERIES - QUANTITY								400V SERIES - QUANTITY										480V SERIES - QUANTITY										
REF	COMP. TYPE	VOLT RAT	CURR RAT	MFTR	MFTR P/N	ATG AIRPORTS STOCK CODE		1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA
CB1	CONTACTOR, 230V AC COIL	690V	35A	SIEMENS	3RT2025-1AL2O	2610-0220K	C	1	1	1																											
CB1	CONTACTOR, 230V AC COIL	690V	55A	SIEMENS	3RT2035-1AL20	2610-0221K	C				1	1																									
CB1	CONTACTOR, 230V AC COIL	690V	90A	SIEMENS	3RT2038-1AL20	2610-0222K	C						1																								
CB1	CONTACTOR, 230V AC COIL	690V	100A	SIEMENS	3RT2045-1AL20	2610-0236K	C							1	1																						
CB1	CONTACTOR, 400V AC COIL	690V	35A	SIEMENS	3RT2025-1AR60	2610-0091K	C									1	1	1	1																		
CB1	CONTACTOR, 400V AC COIL	690V	55A	SIEMENS	3RT2035-1AR60	2610-0102K	C													1	1	1	1														
CB1	CONTACTOR, 400V AC COIL	690V	90A	SIEMENS	3RT2038-1AR60	2610-0104K	C																	1													
CB1	CONTACTOR, 400V AC COIL	690V	100A	SIEMENS	3RT2045-1AR60	2610-0111K	C																		1	1											
CB1	COIL SUPPRESSOR	240 - 400V	N/A	SIEMENS	3RT2926-1CE00	2610-0109	C	1	1	1						1	1	1	1																		
CB1	COIL SUPPRESSOR	240 - 400V	N/A	SIEMENS	3RT2936-1CE00	2610-0103	C				1	1	1	1	1					1	1	1	1	1	1	1											
CB1	CONTACTOR, 500V AC COIL	690V	55A	SIEMENS	3RT2035-1AQ20	2610-0249K	C																				1	1	1	1	1	1	1	1			
CB1	CONTACTOR, 500V AC COIL	690V	90A	SIEMENS	3RT2038-1AQ20	2610-0223K	C																												1		
CB1	CONTACTOR, 500V AC COIL	690V	100A	SIEMENS	3RT2045-1AQ20	2610-0251K	C																													1	1
CB1	COIL SUPPRESSOR	400 - 600V	N/A	SIEMENS	3RT2936-1CF00	2610-0245	C																				1	1	1	1	1	1	1	1	1	1	1

Table 12-9 Parts List: Contactors

THYRISTOR STACK ASSEMBLIES - IEC BUILD STANDARD (NOTE - SEE BELOW FOR REPLACEMENT THYRISTORS)						SPARES CATEGORY	220V SERIES - QUANTITY								400V SERIES - QUANTITY										480V SERIES - QUANTITY										
COMP. TYPE	VOLT. RAT. (AC)	VA RATING	MFTR	MFTR P/N	ATG AIRPORTS STOCK CODE		1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA
THYRISTOR, HEATSINK AND SNUBBER	480V	7.5kVA	POWER PRODUCTS INT.	05-0361/10	7500-1750A		1	1	1						1	1	1	1	1							1	1	1	1	1						
THYRISTOR, HEATSINK AND SNUBBER	480V	15kVA	POWER PRODUCTS INT.	05-0362/10	7500-1751A					1	1									1	1	1									1	1	1			
THYRISTOR, HEATSINK AND SNUBBER	480V	20kVA	POWER PRODUCTS INT.	05-0362/20	7500-1752A							1											1											1		
THYRISTOR, HEATSINK, SNUBBER AND SEMICONDUCTOR FUSE	480V	30kVA	POWER PRODUCTS INT.	05-0330/10F	7500-1758A								1	1										1	1									1	1

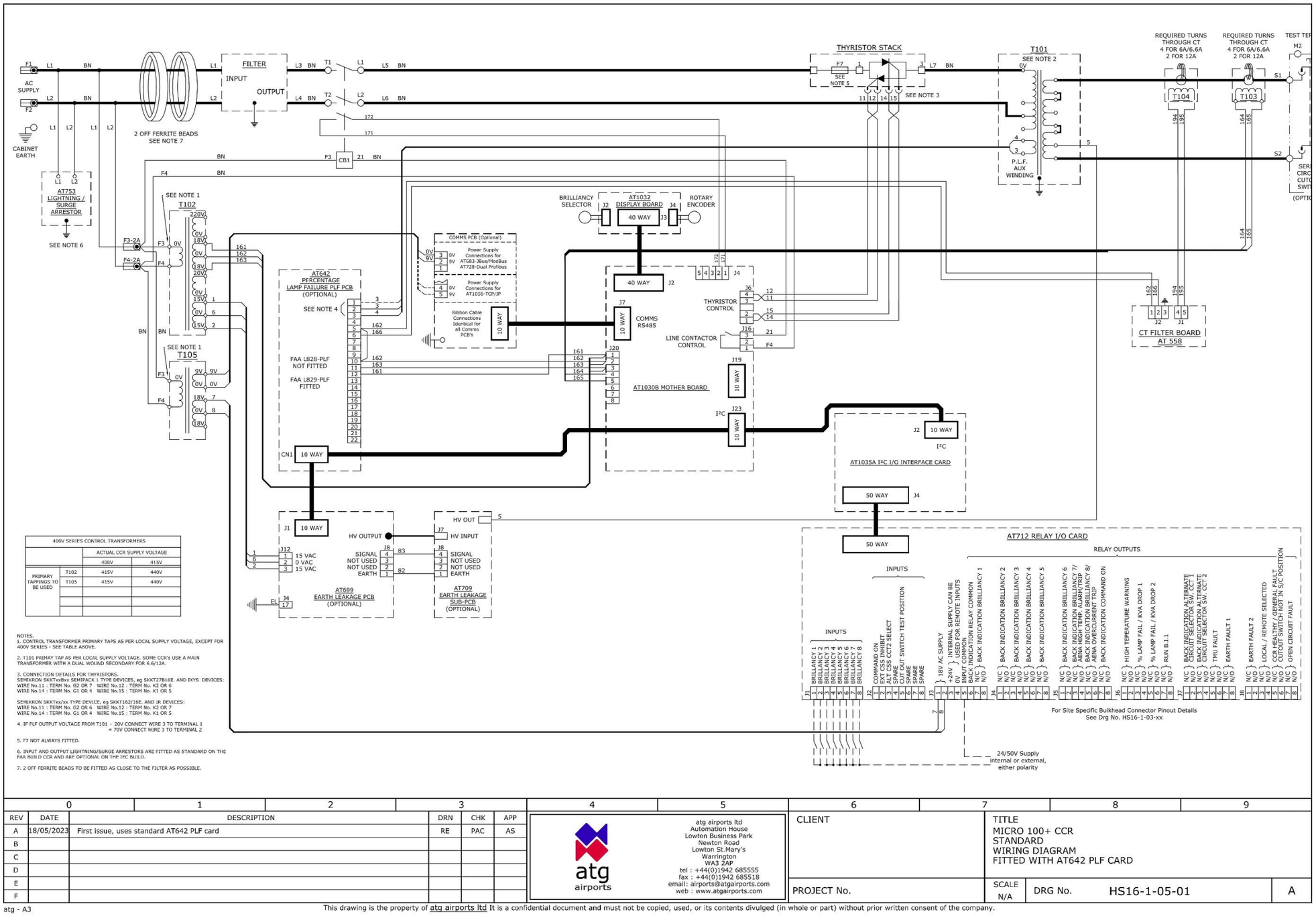
THYRISTOR STACK ASSEMBLIES - FAA BUILD STANDARDS (NOTE - SEE BELOW FOR REPLACEMENT THYRISTORS)							220V SERIES - QUANTITY								400V SERIES - QUANTITY										480V SERIES - QUANTITY										
COMP. TYPE	VOLT. RAT. (AC)	VA RATING	MFTR	MFTR P/N	ATG AIRPORTS STOCK CODE		1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA
THYRISTOR, HEATSINK, SNUBBER AND SEMICONDUCTOR FUSE	480V	7,5kVA	POWER PRODUCTS INT.	05-0328/10F	7500-1754A		1	1	1						1	1	1	1	1							1	1	1	1	1						
THYRISTOR, HEATSINK, SNUBBER AND SEMICONDUCTOR FUSE	480V	15kVA	POWER PRODUCTS INT.	05-0329/10F	7500-1755A					1	1									1	1	1									1	1	1			
THYRISTOR, HEATSINK, SNUBBER AND SEMICONDUCTOR FUSE	480V	20kVA	POWER PRODUCTS INT.	05-0329/20F	7500-1756A							1											1											1		
THYRISTOR, HEATSINK, SNUBBER AND SEMICONDUCTOR FUSE	480V	30kVA	POWER PRODUCTS INT.	05-0330/10F	7500-1758A								1	1										1	1									1	1

REPLACEMENT THYRISTORS - ALL BUILD STANDARDS						SPARES CATEGORY	220V SERIES - QUANTITY								400V SERIES - QUANTITY										480V SERIES - QUANTITY										
COMP. TYPE	VRRM, VDRM	CURR. RATING	MFTR	MFTR P/N	ATG AIRPORTS STOCK CODE		1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA	1.0kVA	2.5kVA	4.0kVA	5.0kVA	7.5kVA	10kVA	12.5kVA	15kVA	20kVA	25kVA	30kVA
THYRISTOR	1600V	27A	SEMIKRON	SKKT27B16E	2323-0176	B	1	1	1						1	1	1	1	1							1	1	1	1	1						
THYRISTOR	1600V	55A	SEMIKRON	SKKT57B16E	2323-0181	B				1	1									1	1	1									1	1	1			
THYRISTOR	1600V	95A	SEMIKRON	SKKT92B16E	2323-0184	B						1											1											1		
THYRISTOR	1600V	160A	SEMIKRON	SKKT162B16E	2323-0191	B							1	1										1	1										1	1
SNUBBER MODULE	440V		SEMIKRON	SKRC 440	2323-0230		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
SNUBBER MODULE	660V		SEMIKRON	SKRC 660	2323-0231																					1	1	1	1	1	1	1	1	1	1

Table 12-10 Parts List: Stack Assemblies and Thyristors

DOOR SAFETY INTERLOCKS (OPTIONAL)								
REF	CCR OPTION CODES	QTY	COMPONENT TYPE	DESCRIPTION	RATING	MANUFACTURER	MFTR P/N	ATG AIRPORTS STOCK CODE	SPARE PART CATEGORY
ISOLATING SWITCH	DI (EG, AENA SPEC, SP)	6	ISOLATING SWITCH	LIMIT SWITCH	1A / 125V AC	OMRON	D3D-131	021020	
ISOLATING SWITCH	DI (EG, AENA SPEC, SP)	6	ISOLATING SWITCH	CONNECTOR HOUSING		JST	HLP-03V	021021	
ISOLATING SWITCH	DI (EG, AENA SPEC, SP)	12	ISOLATING SWITCH	CONNECTOR INSERT	18-22AWG	JST	SSF-21T-P1.4	021023	

Table 12-11 Parts List: Door Interlocks



400V SERIES CONTROL TRANSFORMERS			
		ACTUAL CCR SUPPLY VOLTAGE	
		400V	415V
PRIMARY TAPPINGS TO BE USED	T102	415V	440V
	T105	415V	440V

NOTES.
1. CONTROL TRANSFORMER PRIMARY TAPS AS PER LOCAL SUPPLY VOLTAGE, EXCEPT FOR 400V SERIES - SEE TABLE ABOVE.

2. T101 PRIMARY TAP AS PER LOCAL SUPPLY VOLTAGE. SOME CCR'S USE A MAIN TRANSFORMER WITH A DUAL WOUND SECONDARY FOR 6.6/12A.

3. CONNECTION DETAILS FOR THYRISTORS.
SEMIKRON SKKTxxBxx SEMIPACK 1 TYPE DEVICES, eg SKKT27B16E. AND IXYS DEVICES:
WIRE No.11 : TERM No. G2 OR 7 WIRE No.12 : TERM No. K2 OR 6
WIRE No.14 : TERM No. G1 OR 4 WIRE No.15 : TERM No. K1 OR 5

SEMIKRON SKKTxx/xx TYPE DEVICE, eg SKKT162/16E. AND IR DEVICES:
WIRE No.11 : TERM No. G2 OR 6 WIRE No.12 : TERM No. K2 OR 7
WIRE No.14 : TERM No. G1 OR 4 WIRE No.15 : TERM No. K1 OR 5

4. IF PLF OUTPUT VOLTAGE FROM T101 – 20V CONNECT WIRE 3 TO TERMINAL 1
= 70V CONNECT WIRE 3 TO TERMINAL 2

5. F7 NOT ALWAYS FITTED.

6. INPUT AND OUTPUT LIGHTNING/SURGE ARRESTORS ARE FITTED AS STANDARD ON THE FAA BUILD CCR AND ARE OPTIONAL ON THE IFC BUILD.

7. 2 OFF FERRITE BEADS TO BE FITTED AS CLOSE TO THE FILTER AS POSSIBLE.

REV	DATE	DESCRIPTION	DRN	CHK	APP
A	18/05/2023	First issue, uses standard AT642 PLF card	RE	PAC	AS
B					
C					
D					
E					
F					

atg airports
atg airports ltd
Automation House
Lowton Business Park
Newton Road
Lowton St.Mary's
Warrington
WA3 2AP
tel : +44(0)1942 685555
fax : +44(0)1942 685518
email: airports@atgairports.com
web : www.atgairports.com

CLIENT

TITLE
MICRO 100+ CCR
STANDARD
WIRING DIAGRAM
FITTED WITH AT642 PLF CARD

PROJECT No.

SCALE N/A

DRG No. HS16-1-05-01

A

atg - A3

Figure 12-1 Micro 100+ CCR Standard Wiring Diagram