

Fig. 1: MCR³ 20kVA full option



Microprocessor controlled Constant Current Regulator

Type MCR³

ADB
Airfield Solutions

Compliance with Standards

FAA: AC 150/5345-10 (current edition), L-828, L-829

ICAO: Aerodrome Design Manual Part 5, para. 3.2
(current edition)

IEC: 61822

CENELEC: EN61822

Various national standards

Uses

The MCR3 regulator is specially designed for the supply of airport lighting series circuits at various intensity levels.

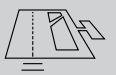
Features

The MCR³ is the next generation of ADB's MCR-type of which several thousand units are in use worldwide. The well-known microprocessor controlled thyristor regulator has been further modernized. Its new set-up allows on-site upgrading, from a basic constant current regulator to a full option unit including following features:

- Full digitally controlled and regulated CCR,
- An integrated menu driven human machine interface (HMI) allowing full configuration on-site without any additional equipment,
- Upgradeable remote maintenance diagnostic functionality (available in 2006),
- Optional built-in circuit selector or master for the AGLAS individual lamp control and monitoring system (ILCMS),
- High regulation response dynamic,
- Crowbar for optimal regulation behavior in case of important load changes (available in 2006),
- Remote control and monitoring via combined multiwire, and single or redundant field bus (J-BUS),
- Flash memory allows remote updating of the CCR with the latest software version, or reconfiguration,
- Completely stand alone as well for configuration as for operation.

Perfectly suited for new technology LED lights and conventional lamp lights, or any combination thereof.

Fig. 2: MCR³ in substation



Concept (Fig. 3)

The MCR's operating principle is based on back to back coupled thyristors adjusting the supply to the output transformer. A digital regulator determines the thyristor firing angle to adjust the output current to a reference value. The reference value varies with the selected brightness step.

The regulator consists of three main components:

- 1) a power module
- 2) a digital control module
- 3) an output transformer

Optional dedicated PCBs for earth default and lamp default detection, and various remote control modes, as well as built-in circuit selectors or an AGLAS Master for an ILCMS turn the CCR into an integrated full option control and monitoring unit.

Control module

The control module consists of a number of individual PCBs, each laid out to cover one function as indicated in the block diagram. (Fig. 3)
The on-board microcontroller controls and monitors the operation of the regulator.

The main monitoring functions are:

- Supply voltage monitoring
- Output current monitoring for overcurrent
- Output monitoring for open circuit (too low output current)

Power modules

The MCR power modules are built around thyristor packs. Irrespective of the supply voltage, the complete power range – from 2.5 to 30 kVA – is covered by three modules, rated 50, 63 and 110 A. Together with the control PCBs, the power module forms an easy serviceable low voltage compartment.

Components back view MCR³ (Fig. 4)

1. Remote control PCB's
2. Output transformer

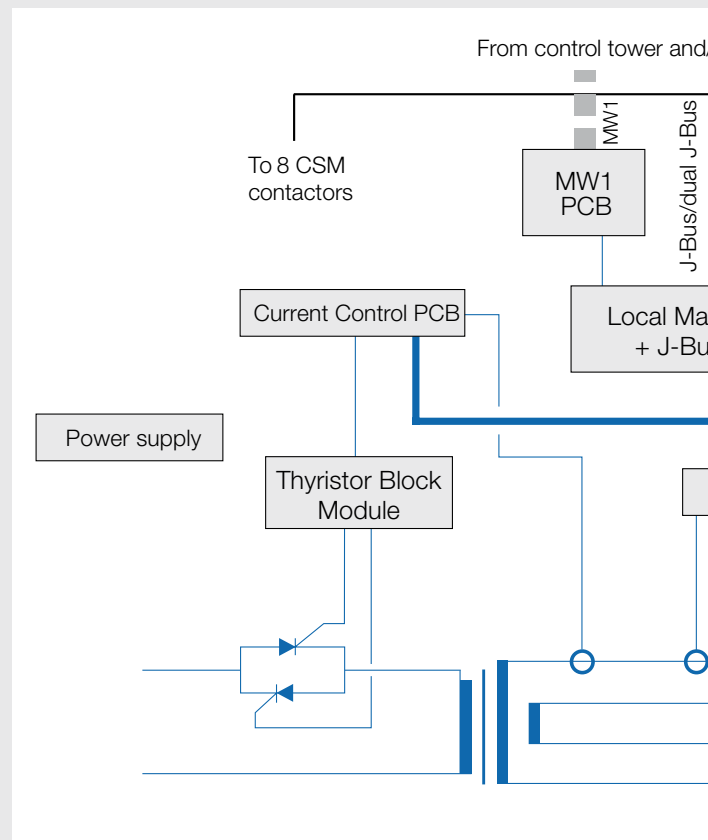


Fig. 3: MCR³ block diagram

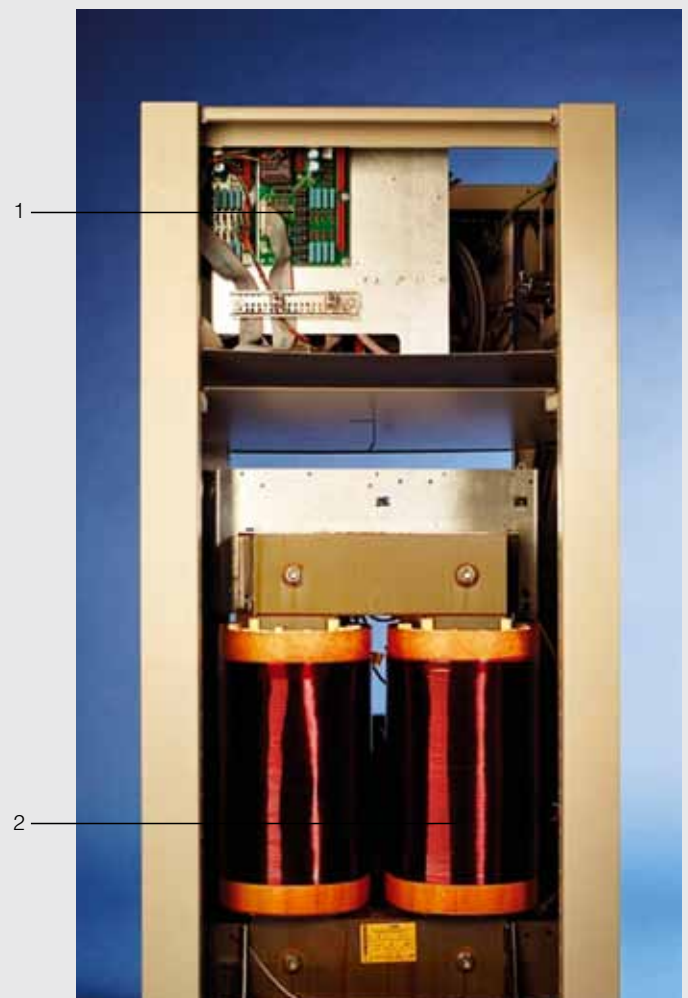


Fig. 4: Back view MCR³

/or maintenance center

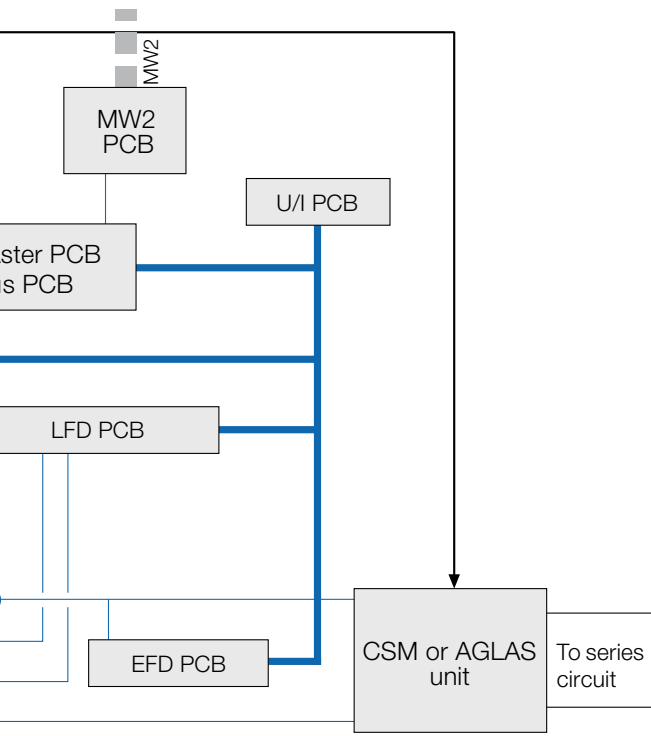


Fig. 6: Front view MCR³ – 15 to 30 kVA

Construction (Fig. 6)

The FAA-style stand alone execution houses a complete regulator in one enclosure, divided into two compartments:

- 1) Low voltage compartment, containing the power, the control and monitoring PCBs, and a fused input switch.
- 2) High voltage compartment, containing the output transformer, current and voltage measurement transformers, and lightning arrestors.

Optional incorporated circuit selector or AGLAS master units for an ILCMS are located below the power compartment of the CCR. Regulators up to 10 kVA, without circuit selector or AGLAS master unit, are stackable.

Finish

Baked epoxy powder coating.
Colour: light grey RAL 7032 with RAL 7005 front panel.

Components front view MCR (Fig. 5)

- 1. Menu driven HMI with command buttons
- 2. Control module
- 3. Main fused switch
- 4. Tap settings for output transformer
- 5. High voltage compartment

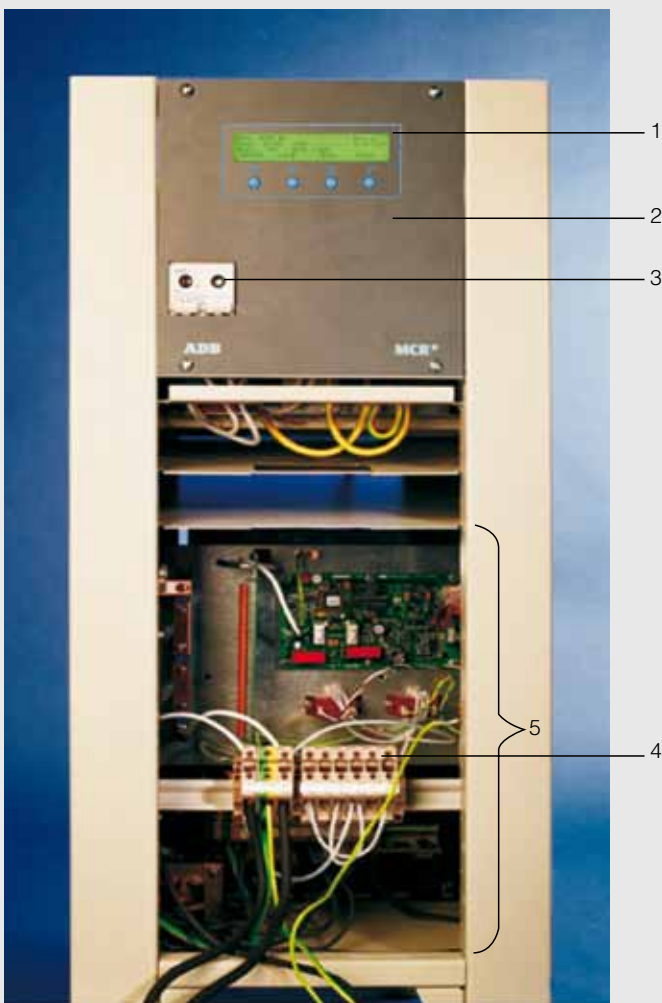


Fig. 5: Front view MCR³ – 2.5 to 10 kVA

Standard Options

Lamp Fault Detection (LFD)

The LFD provides accurate and real time detection of the number of burnt out lamps and power loss in a series circuit.

The option consists of a PCB mounted into the low voltage compartment of the CCR, a current transformer, including voltage limitation for level adaptation, and a voltage measurement directly on the power transformer.

The number of failed lamps is reported to the alphanumeric display (Fig. 7) on the CCR front – on which also the LFD functionality can be adjusted, to the remote control system, or to a PC when connected to the CCR.

Earth Fault Detection (EFD)

The EFD PCB measures the insulation resistance of the series circuit to the ground with the regulator both ON and OFF. A stabilized DC voltage is applied between the series circuit and the ground, irrespective of the operating voltage.

The resistance is calculated from the resulting leakage current, and is reported to the alphanumeric display on the CCR front to the remote control, or the case occurring, to a laptop PC connected to the CCR. The measuring range is from 10 K Ω to 250 M Ω . The accuracy of this measurement is better than 2 % from 100 k Ω to 40 M Ω .

Rolling castors

The MCR can be equipped with two fix and two pivoting rolling castors to ease displacement during service activities. Not for stacked units.

Plug-in, H.V. cut out

An electro mechanical interlocking safety device isolates the series circuit from the CCR output. It also provides earthing and insulation resistance measurement functions. See catalogue leaflet A.06.455 for SCO description.

Time counter

Optional elapsed time indication can be read directly from the HMI display on the CCR front. The elapsed time meter option includes three types of indication:

- CCR on time
- CCR on 100% brightness step
- CCR on other brightness steps

Circuit selector

The IEC compliant built-in circuit selectors allow simultaneous control of up to 8 partial circuits or individual control of 2 circuits, thus providing substantial savings in space and installation costs. (Fig. 8)

If used in combination with LFD, the lamp default detection is available for either:

- Individual sub circuits
- The total circuit connected to the CCR

Dual LFD functionality in case of circuit selector for alternate switching of 2 individual circuits.

Calibration needs to be performed accordingly for each (sub) circuit considered.

LDF indications for combined sub circuits will be erroneous

Circuit selectors are also available as separate wall mounted cabinets.



Fig. 7: Display MCR³

AGLAS master

The built-in AGLAS Master allows for additional savings in space and both, cabling and installation cost, while the common use of H.V. components provides additional savings.

Over-voltage protection

Protects the input against over-voltage spikes by means of optional 40kA 8/20 μ S surge arrestors.

Cut-out SCO

Switching device providing optimum safety to service personnel. Also see catalogue leaflet A.06.455.



Fig. 8: MCR³ 7.5 kVA with built-in Circuit Selector

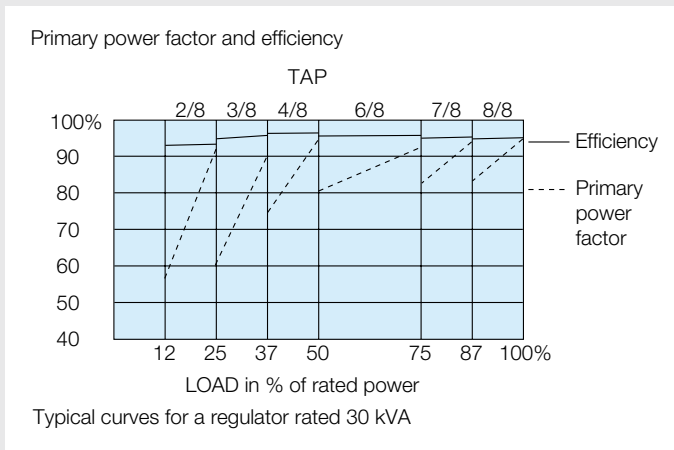


Fig. 9

Standard Output Current Presets (A)

Selector switch position	CCR Type					
	3-step	4-step	5-step	6-step	7-step	8-step
1	4.8 (15)	3.3 (10)	2.8 (8.5)	2.7 (8.2)	2.2 (6.7)	2.2 (6.7)
2	5.5 (17)	4.4 (13)	3.4 (10)	3.4 (10)	2.8 (8.5)	2.8 (8.5)
3	6.6 (20)	5.5 (17)	4.1 (12)	3.9 (12)	3.4 (10)	3.4 (10)
4	-	6.6 (20)	5.2 (16)	4.5 (14)	4.1 (12)	3.9 (12)
5	-	-	6.6 (20)	5.4 (16)	5.2 (16)	4.6 (14)
6	-	-	-	6.6 (20)	6.4 (19)	5.5 (17)
7	-	-	-	-	6.6 (20)	6.4 (19)
8	-	-	-	-	-	6.6 (20)

Notes
 () Values for 20 A CCR
 Minimum output currents:
 1.8 A (6.6 A) or 5.5 A (20 A)

Fig. 10

Technical Data

Performance figures are always equal to, or better than specified hereunder.

Input voltage ratings

FAA types: 220, 230, 240, 380, 400 or 415 V, 50/60 Hz, single phase, 2-wires

IEC types: 230 or 400 V

Remote control voltage

Multiwire: 24 or 48 to 60 V DC

Multiplex: J-Bus protocol over RS485

Any combination of multiwire and BUS (or redundant bus)

Brightness control (Fig. 10)

Up to 8 brightness steps, user adjustable in 255 levels

Output current regulation

Within $\pm 1\%$ of 6.6 A (or 20 A), under either IEC or FAA standard conditions. NB: At lower brightness settings, tolerances on output current exceed 1%

Regulation response time

Less than 0.5 seconds at full (100%) resistive load (power factor = 1)

Open circuit output voltage

Less than 1.4 times the nominal output voltage (RMS)

Efficiency (Fig. 9)

90 to 92% depending on the size, under nominal resistive load, nominal output current and nominal input voltage

Primary power factor (Fig. 9)

> 0,9 for ratings up to 10 kVA

> 0,95 for ratings 15 kVA and up

under same conditions as "Efficiency"

Taps on secondary of output transformer to match the MCR to the actual load of the series circuit and to achieve best efficiency and primary power factor (Fig. 9). Also to reduce waveform distortion.

Temperature

– Operating temperature: -20°C to +55°C

– Non operating temperature: -40°C to +70°C

– Temperature rise under the most adverse conditions meets ANSI C57.12.91

Degree of protection: IP 21

Remote Control and Monitoring:

The MCR offers the following choices:

1. A multiwire remote control

With two voltage levels: either 24 or 48 V DC.

The multiwire version provides remote control and back indications of all basic functions such as remote control of brightness steps or back indication of alarms due to overcurrent, open circuit and the mode of operation (local or remote). The remote control and feedback signals are user programmable.

2. A multiplex remote control

The multiplex version is possible thanks to the integration of a microprocessor into the control module. It uses a single or two redundant field bus(es) with hardware according to RS485 and J-Bus protocol. It allows the remote monitoring of a larger quantity of parameters.

3. Combined remote control

Any combination of multiwire, single or redundant bus is possible.

This combination can be most helpful to separate control from monitoring functions.



Fig. 11: Taps on secondary of output transformer

Output Parameters

Both series cable and the series transformers induce a reactive factor to the load.

Due to the reactive loads induced by both, the series cable and the series transformer, the total load connected to the CCR is never pure resistive. Therefore the only correct way to express the power rating of a CCR is in kVA. The output parameters are thus essentially:

Output current (A)	Max. RMS output voltage (V)	Rated power kVA (*)
6.6	378	2.5
6.6	606	4
6.6	757	5
6.6	1136	7.5
6.6	1515	10
6.6	1894	12.5
6.6	2272	15
6.6	3030	20
6.6	3788	25
6.6	4545	30
20	1250	25
20	1500	30

(*) kVA = kW, if the power factor is 1

Outline Dimensions

Rating kVA	Fig.	Dimensions (mm)	Net weight (kg)
2.5	Fig. 5	600* x 400 x 940	57
4			83
5			88
7.5			123
10			155
15	Fig. 6	600* x 600 x 1270	187
20			220
25			235
25			235
30			250

* Width dimension will be different with optional cut-out.
See leaflet A.06.455.

Packing Data

Rating kVA	Net weight (kg)	Seaworthy packing	
		Case dimensions (mm)	Gross Weight (kg)
2.5	57	860 x 560 x 1300	62
4	83		133
5	88		138
7.5	123		173
10	155		205
15	187	860 x 760 x 1580	237
20	220		270
25	235		285
25	235		285
30	250		300

Note: In case of the following options the heights should be increased:

- 500 mm for circuit selector or AGLAS master
- 100 mm for rolling castors

Suggested Specification

The Constant Current Regulator shall be full digitally controlled and regulated by micro-processors using thyristors in series with the output transformer for automatic current regulation against load and mains voltage variations. It shall comply strictly with IEC 61822 and FAA specifications L-828 and L-829, when making use of the required monitoring options, of Advisory Circular 150/5345-10 (current edition).

Use: indoor in ambient temperature up to 55°C.

- Design and construction: self contained, metal sheet, floor standing or stackable (for ratings up to 10 kVA).
- Cooling: natural air cooled. Forced air cooling shall not be accepted. Degree of protection IP 21.
- Full digital current regulation, optionally crowbar assisted with response time of only 0.5 seconds.
- Brightness control: in 3, 4, 5, 6, 7, 8 brightness steps adjustable over 255 values.
- Operational parameters will be adjustable directly from the front display of the CCR. Via a PC connected to the CCR over a dongle, it shall also be possible to recalibrate the CCR. Software updates will be possible using flash memory.
- Possibility to display the status values.
- Remote control and monitoring with a single or two redundant well established field bus(es) or multiwire remote control with either 24 V or 48 to 60 V DC power or any combination thereof.
- Remote monitoring: via potential free N/O contacts.
- Automatic input voltage compensation.
- Permanent monitoring of input voltage with automatic shutdown on low voltage (lower than 0,8 of nominal voltage) and automatic restart when the supply voltage exceeds 0,85 of nominal voltage.
- Tripping in case of output overcurrent and open circuit.
- In case of shutdown, the CCR will be re-energized by a remote or local OFF/ON operation.
- Fused switch in power input (HRC: High Rupture Capacity) and fuses in auxiliary circuits.
- Primary power factor, efficiency, temperature rise: as per FAA L-828 / IEC 61822.
- Local control and monitoring: to be provided for all regular functions.
- True RMS output current digital ammeter.
- Positive back indication of operation such as:
 - Shutdown by output over current
 - Shutdown by output open circuit
 - Discrepancy between actual and selected output current
- The regulator shall be fully compatible with our L-827 monitoring system.
- Taps on the output winding shall allow for matching the regulator output capacity to the actual series circuit load.
- For detailed specification of the options, see paragraph "standard options".

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