

THYCON

Est. 1968



Constant Current Regulator
MC4 3kW – 30kW



Fig. 1 30kW MC4

Concept

The THYCON MC4 Constant Current Regulator is designed to provide true sinusoidal output current at all load intensities to airfield runway lighting systems.

The THYCON MC4 CCR's pluggable control & power module ensures minimum MTTR, simplifies field training requirements and reduces spare parts inventory requirements while the 25+ year design life and low component count, ensures long term minimum cost of ownership through industry leading reliability and performance.

Designed and Published by Thycon.

Application

Airfield lighting systems consist of large groups of lamps that are suitable for high- intensity applications such as:

- approach lighting
- taxiway lighting
- visual approach slope indicators (VASI)
- stop bars
- runway edge lighting
- centre line lighting

MC4 features and benefits

- true constant current source
- continuous, accurate regulation of intensity
- microprocessor-based diagnostics and controls
- soft-start and intensity transition (extends lamp life)
- robust technology
- fuseless design
- long lamp life
- long cable life
- high efficiency
- high reliability
- cost effective
- substantial system application savings
- designed for 3rd party maintenance
- compact, modular construction
- indoor or outdoor enclosures
- Australian made
- conforms to and exceeds relevant IEC, FAA and ICAO standards

Principle of operation

Accurate control of lamp current is essential for maintaining long lamp life and maximum brightness. A 6.6A, 200W lamp has an expected lifetime of 1000 hours at rated current. Increasing the current by 6% can reduce the lamp lifetime to 600 hours, whereas a 6% decrease in current can increase the lamp life to 2500 hours but reduce the luminous flux by 30 - 40%.

The Thycon MC4 CCR regulates lamp current using a current source topology that results in load changes directly adjusting the loop voltage, while the loop current remains unaffected. This extends the lifetime of the lamps (see Figs. 4–5). Traditional voltage sources are undesirable because high current surges inherently occur during load and intensity changes (see Fig. 2), thus reducing lamp lifetime. Lamp resistance is highly dependent on filament temperature. The resistance variation from no load to full load can be up to 14 times and affects the current supplied from a voltage-sourced system. A current source CCR is not affected by the number of failed lamps or type of lamp, such as LED, fluorescent and tungsten-halogen lamps.

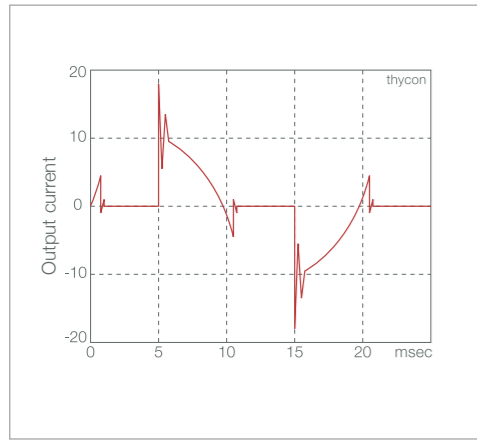


Fig. 2 Traditional voltage source CCR at 3.3A

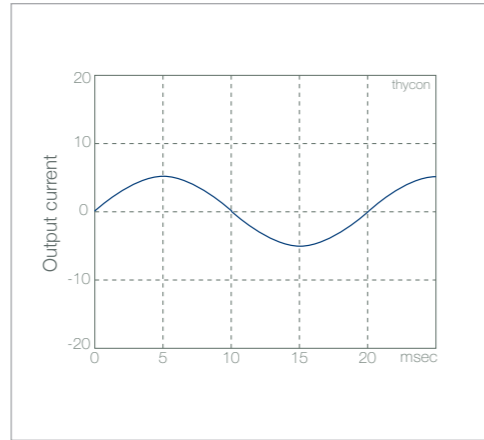


Fig. 3 MC4 current source CCR at 3.3A

Sinusoidal current source ensures smooth regulation that extends life time of airfield lights and cables.

The standard MC4 provides:

- sinusoidal output current and voltage throughout the load range and for all intensity settings (see fig. 6)
- input power factor >0.95 at all loads (see fig. 6)
- supply harmonic injection of <3%
- soft-start and intensity transition facility (extends lamp life)
- local and remote control
- individually pre-settable lamp currents with accuracy of $\pm 0.5\%$
- comprehensive protection:
 - open circuit
 - over-voltage
 - over-current

Installation and testing

The THYCON MC4 CCR's modular design ensures quick and easy site installation. The MC4 is comprehensively tested prior to delivery and requires minimal commissioning or ongoing maintenance.

Reliability and maintenance requirements

THYCON has been supplying CCRs for almost 50 years, and has proven their design life and reliability in critical applications in both defence and commercial aviation.

The THYCON MC4 CCR's naturally cooled design ensures peak reliability with minimal ingress of environmental contaminants and component abrasion often associated with forced cooled systems. The MC4 uses commercial off the shelf power

components (capacitors, switchgear, instrument transformers, etc) of proven reliability and design life. The availability of multiple substitutable components within the MC4 ensures future design components are always available.

The THYCON MC4 CCR's robust design means they require minimal maintenance, even in harsh conditions, while the simple power circuit and single pluggable power & control module minimises user training requirements and spare parts inventory lists.

THYCON offers full after sales support for our MC4 with trained personnel available to support the product. Reactive, pro-active preventive and lifetime warranty maintenance programmes are available to care for your product.

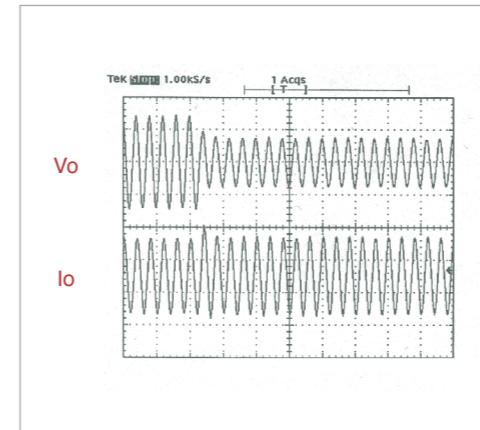


Fig. 4 MC4 output response to 100 - 50% load change

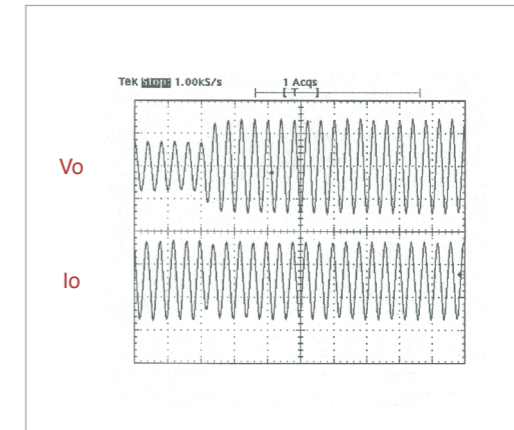
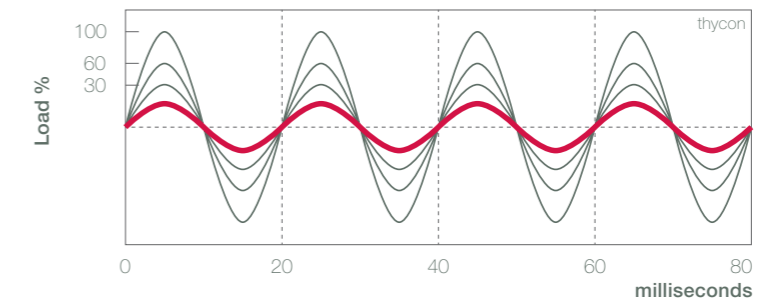
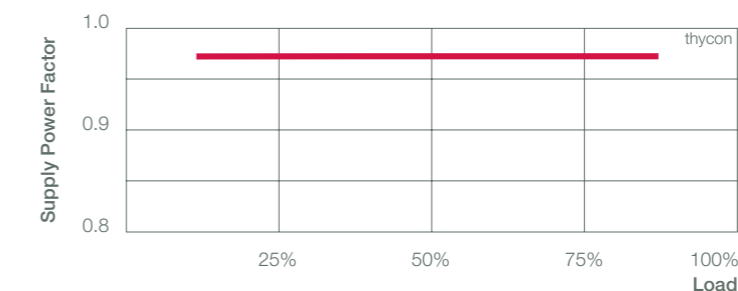
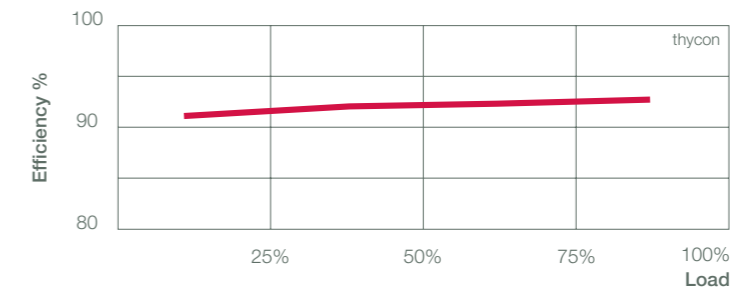


Fig. 5 MC4 output response to 50 - 100% load change

Fig. 6 MC4 performance at rated current



Constant current output (red), airfield cable and load voltage (grey)



Training and support

Training and support can be provided to on-site personnel to ensure that they are fully versed in the operation, maintenance and fault rectification of the THYCON MC4 CCR.

The MC4 is designed to accommodate third party maintenance.

Control and monitoring

Smart digital signal processing provides current regulation of the MC4. The control is automatic, continuous and linear about the set-point selected by the user. This ensures an inherently fast transient response. A soft-start mechanism at turn-on and smooth regulation throughout the operating range eliminates the typical switching effects of traditional current regulation methods and extends the lifetime of airfield lights - as many of our customers have observed - up to 15 years.

The MC4 can be controlled and monitored from the unit itself and remotely via serial or TCP/IP. The system is totally automatic and does not require manual restarting for fault-initiated supply disturbances.

Control and status

The standard MC4 has a simple user interface. *Start, Stop, Local, Remote* and *Intensity Setting* control allow you to operate and control the equipment. LEDs indicate the standby, on-line, regulating and alarm status of the MC4. A *Cancel* button is used as an alarm acknowledge.



Monitoring

The MC4 system monitor is a smart LCD panel featuring a simple and effective user interface that incorporates advanced diagnostic facilities enabling immediate access to:

- output power monitoring - voltage, current, power (kW), power factor
- operating status, alarms, % lamp fail, earth leakage
- password protected user defined settings
- service control and test options

Low-level interface

Low voltage control inputs to select current intensity level and 16 standard voltage-free contacts to indicate operating status of the equipment to a remote monitoring system can be provided.

High-level interface

Real-time performance monitoring of the MC4 is performed via serial or TCP/IP connection. An optional high-level interface via Modbus or web HTML can be provided for immediate performance monitoring and analysis.

THYCON MC4 CCR advantages

Design advantages

Compatibility	Designed for the airfield environment, the control panel provides the operator with an efficient, user-friendly interface.
Environment	No special ventilation or air conditioning is required.
Fuseless design	No power fuses are required. Power components are liberally over-rated so that simple and reliable methods of circuit breaker protection can be used. This greatly reduces down time and eliminates the need for stock control of spare fuses.
Modular construction	Construction from standardised components and modules ensures high mean time between failures (MTBF) and low mean time to repair (MTTR).
Robust technology	Robust construction achieves reliable performance and long equipment life, as proven by 50 years of Thycon installations.
Simple, reliable design	Uncomplicated design facilitates high strength, durability and reliability. The power circuit uses simple, robust switches to regulate sine wave output current. This method of control eliminates the switching stresses, losses and interference that traditional technology experiences.
Surge protection	Built in surge protection increases the attenuation of over-voltages caused by load faults and lightning.
Thyristor technology	Use of thyristors (SCRs) eliminates the need for special high speed semiconductor fuses resulting in a simpler design with increased reliability. Thyristors have the highest power and fault tolerance of all semiconductor devices and can withstand faults of up to 10 times the current for 1000 times the period of IGBT and transistor switching technologies.
Input power factor	Power factor of >0.95 remains stable under varying loads and intensities and contributes to input cable and electricity savings.
Input current harmonics	High input impedance reduces voltage notching and input harmonics. A fast dynamic response enables correction of transient step load changes within one power cycle period without the over voltage spikes experienced with voltage-controlled technology.
Transient response	THYCON MC4 CCR current source technology eliminates lamp damaging over-current issues experienced during load and intensity changes by traditional voltage controlled systems.
True current source technology	Substantial savings in cable costs are due to the sinusoidal output current. Traditional systems produce high switching voltage spikes that require high-voltage rating cable.
Significant runway cable cost savings	The significantly lower low crest factor of the MC4 enables the use of lower voltage and less costly cable. Significant savings can be made in the large cable requirements of runways.
Significant lamp lifetime extension	Steep temperature transition of filaments is the main cause of lamp failure. Substantial lifetime extension and replacement savings of lamps can be made due to the sinusoidal, soft-start and smooth intensity transition characteristics of the MC4.

Technical data

Performance

Input: Power factor >0.95 at all loads (see Fig. 6)
 Optional power factor >0.95 at all intensities
 Harmonic injection <3%

Output: True RMS output current regulation to an accuracy of 0.5%

Options

Remote control: Modbus / Jbus protocol over RS232 & RS422 / 485
 Modbus TCP / IP over ethernet
 Web browser over ethernet
 Direct connection I/O via wiring terminals:
 Inputs: 8 isolated control inputs, 12-24V DC current sinking / sourcing
 Outputs: 16 isolated, voltage-free, changeover contacts. Contacts rated for 30VDC 4A max, 240VAC 6A max

Real-time performance data: True RMS output current, true RMS output voltage, kW, kVA and power factor
 Additional options: Alarm status
 Indication of failed lamps
 Earth fault detection
 Lightning arrestors
 Hours run meter
 8 position local / remote / current selector switch

General data

Model: MC4
 Input: 400/415 V, Single Phase, 50 Hz, 480V 60HZ single phase
 Output: 0 - 6.6A, ± 0.5% / 0-12A available
 Efficiency: Up to 93%
 Electrical safety: To AS3250
 Interference: To AS1044
 Response time: Less than 1 cycle (20ms)
 Cooling: Natural air cooled
 Operational temperature: -40°C to +55°C
 Operational humidity: Up to 95%
 Altitude: 0 to 2000 meters above sea level

- Units supplied with 2 x fixed, 2 x swivel heavy duty wheels. Fixed feet available.

Specification is subject to change without prior notice



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