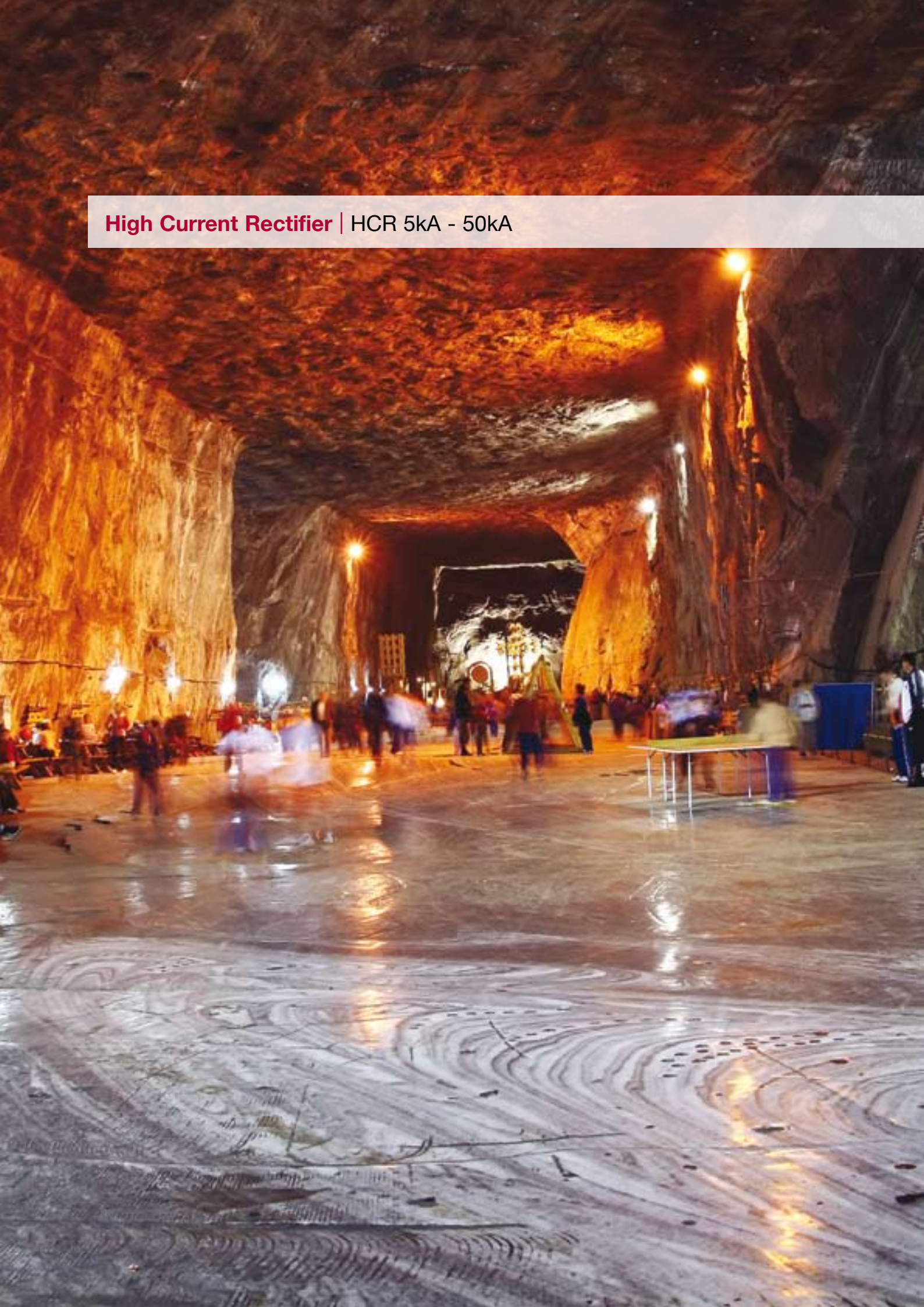
High Current Rectifier | HCR 5kA - 50kA



Concept

Thycon's High Current Rectifiers (HCR) utilise high power thyristor technology with advanced microprocessor-based control, monitoring and diagnostics. They are DC power supply programmable for either controlled current or controlled voltage operation.

Features and benefits

- continuous, accurate voltage and current regulation
- low harmonic distortion
- input unity power factor
- energy saving
- soft-start control
- multi-stage
- multiple program storage
- built-in process timers
- precise control - fully programmable
- microprocessor-based diagnostics and controls
- high overload capacity
- robust technology
- no moving parts
- fuseless design
- high efficiency
- high reliability
- long life
- low maintenance cost
- cost effective
- compact, modular construction
- indoor or outdoor enclosures
- Australian made

Principle of operation

Compact and highly reliable, the system employs a double-wound transformer with a secondary controlled rectifier bridge providing infinitely variable output from 0 - 100%.

The equipment is fan or water-cooled and fully enclosed making it suitable for operation in harsh environments.

The following control facilities allow reliable and precise programming of either voltage or current versus time or load:

- voltage regulation with current limiting
- current regulation with voltage limiting
- linear ramped output
- voltage compensation
- continuous or multiple-level programming
- adjustable process times
- adjustable total ampere-hour limit
- between full load and no load, and for mains fluctuations up to 6%
- constant current regulation: ±1%
- constant voltage regulation: ±1%
- ramp linearity: ±1%

Installation and testing

The Thycon HCR offers modular design for quick and easy site installation. All that is required is the installation of power cables and control/monitoring cabling. The HCR is tested comprehensively prior to delivery and needs minimal site commissioning.

A Thycon HCR can also be provided as a complete containerised assembly that can be placed in the harshest Australian conditions and easily relocated to other sites.

Reliability and maintenance requirements

Thycon has been supplying rectifiers for 40 years and has demonstrated their high reliability and low maintenance demands in industrial applications. Transformers and power electronic converters can be forced or naturally cooled, which contributes to high reliability and low ongoing maintenance. The power components (transformers, switchgear and instrument transformers) are all standard commercial products of proven reliability and long life expectancy.

Thycon HCR maintenance requirements are dependent on environmental and application conditions. We accommodate customer requirements from basic to full warranty maintenance. Each maintenance plan ensures the equipment operates in top condition with maximum availability of engineers and parts at minimum cost to the customer. Qualified engineers perform the maintenance with the full back up and resources of Thycon.

3 phase 5MVA thyristor converter

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 HCR.

Control and monitoring
Smart digital signal processing provides voltage and current regulation of the HCR. The control is automatic, continuous and linear about the set-point selected by the user ensuring an inherently fast transient response.

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

Control and status
The HCR provides a simple control and status interface.

Start and *Stop* push buttons allow you to operate the equipment and to go online. *Power Available* and *Power On* LEDs indicate that the mains power is available and that the HCR is online. A *Cancel* button is used as an audible silence alarm acknowledge.

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

- power monitoring - voltage / current / kW / kVA / power factor / harmonic distortion
- operating status and alarms
- event history
- password protected user defined settings
- service control and test options

The system monitor stores the last 200 system events in a non-volatile information buffer for fast, efficient fault diagnosis and status indication even after a re-start or a complete power outage.

Low-level interface
Operating status of the equipment to a remote monitoring system can be performed in the form of 8 standard voltage-free contacts. An additional summary alarm and load on bypass relay is available for secondary monitoring or remote interlocking.

High-level interface
Real-time performance monitoring of the HCR is performed via serial or TCP/IP connection. A basic hardcopy of operating events and data can be obtained by connecting a printer. An optional high-level interface via Modbus, SNMP or web html can be provided for immediate performance monitoring and analysis. Additional features enable you to notify your network server of alarm conditions, and send emails to designated recipients.

5MVA thyristor converter arm

HCR data such as real-time waveforms, alarms and system events can be stored in solid state, non-volatile memory holding up to 500 MBs of information. Connecting the HCR to a PC using any of the available ports allows you to maintain a full history of the equipment over its lifetime.

Options

Active pf and harmonic filtering control

High input impedance reduces voltage notching and input harmonics, thereby minimising required ratings of standby generator equipment.

Typical input power factors are 0.85 for 6-pulse and 0.92 for 12-pulse systems, although a pf of 0.99 is available when combined with a Thycon Active Power Factor Regulator (APR). These values remain stable under varying loads on the HCR.

A Thycon APR provides additional power factor and harmonic filtering to ensure 0.99 pf and <5% THID (or <1% THVD) at the HCR supply.

Remote monitoring

Modem connection enables the HCR to dial and notify Thycon or a remote user automatically whenever an alarm condition arises. Thycon's Service Centre automatically logs data, performs analysis and diagnostics, and then alerts our 24-hour service staff if further intervention is required. All HCR utilisation and incidents found or reported are logged and a full report is provided for each occurrence. The report highlights remedial actions, cautions and follow up recommendations. Alternatively, the remote user can interrogate the HCR at will.

Thycon power system monitor

The HCR monitor offers the user a web-based interactive diagnostic tool and database management system for continuous real-time monitoring of HCR system utilisations, alarms, events and variables. The system logs data to your PC's hard disk for future analysis and display.

Expansion

Future expansion and redundancy can be achieved by parallel connection of the HCR modules. Each module can be isolated manually or automatically from the load bus without affecting availability of supply.

Container modules

The HCR can be provided as a complete containerised assembly that can be placed in the harshest Australian conditions and easily relocated to other sites.

Thycon HCR advantages

Design advantages

Simple, reliable design	Uncomplicated design facilitates high strength, durability and reliability.
Robust technology	Robust construction achieves reliable performance and long equipment life, as proven by 40 years of Thycon installations.
Component rating	Commercially available standard mains frequency thyristors are used as single devices up to 2.4kA. Series or parallel matching of components is only required to achieve high power applications.
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 the IGBT and transistor devices used in other HCR systems.
Fuseless design	Operates without power fuses. 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.
Surge protection	Built in surge protection increases the attenuation of over-voltages caused by distribution faults and lightning.
Isolating transformers	Incorporation of these within the input or the bypass supply enable complete isolation from electrical noise and the effects of harmonic currents generated within the distribution network.
Isolation between input and output	Incorporation of full galvanic isolation using an earth-screened transformer provides greater safety levels.
Compatibility	The control panel provides the operator with an efficient, user-friendly interface.
Modular construction	Construction from standardised components and modules ensures high mean time between failures (MTBF) and low mean time to repair (MTTR).
Environment	No special ventilation or air conditioning is required. Thycon equipment can be containerised and installed in the extremes of Australian environments.

Performance advantages

Input power factor	Typical input power factors are at 0.85 for 6-pulse and 0.92 for 12-pulse systems, with a pf of 0.99 if combined with a Thycon APR. These values remain stable under varying loads on the HCR.
Input current harmonics	High input impedance reduces voltage notching and input harmonics.
Efficiency	System operates up to 98% efficiency resulting in lower running costs and heat dissipation.
Transient response	A fast dynamic response enables correction of transient step load changes within one power cycle period.
Parallel operation	Easy paralleling with similar systems during any stage of the HCR lifetime means increased flexibility and permits future growth as required.

Technical data 300kW - 2000kW

	300kW	*600kW*	*1000kW*	*2000kW*
Input (three phase, three wire)				
Voltage*:	415 V ±10%	415 V ±10%	415 V ±10%	415 V ±10%
Frequency:	50Hz ±6%	50Hz ±6%	50Hz ±6%	50Hz ±6%
Voltage limit:	adjustable 0 - 100%	adjustable 0 - 100%	adjustable 0 - 100%	adjustable 0 - 100%
Current limit:	adjustable 0 - 100%	adjustable 0 - 100%	adjustable 0 - 100%	adjustable 0 - 100%
Output (DC)				
Voltage regulation:	< ±1%	< ±1%	< ±1%	< ±1%
Current regulation:	< ±1%	< ±1%	< ±1%	< ±1%
Efficiency:	up to 98%	up to 98%	up to 98%	up to 98%
Dimensions w x d x h (mm)	1200 x 1000 x 1800	1800 x 1000 x 1800	1800 x 1000 x 1800	2400 x 1000 x 1800

Specifications are subject to change without notice
** Other supply voltages are optional*