THYCON

Est.1968

Power Quality and Control Solutions

Short Form Catalogue

1968 - 2018

THYCON

50 YEARS

Since the company's foundation in 1968, THYCON's dedication to research and development innovation has enabled its product line to grow steadily in response to technical advances and market needs. Today, it encompasses airfield lighting regulators, high-current rectifiers, inverters, UPS, static frequency converters, power factor correctors, transformers, and more recently, fault current limiters, energy storage and micro-grids for which it's received recent innovation awards.

In 2016, THYCON was honoured with the prestigious *Victorian Government Hall of Fame – Manufacturer of the Year Award* for its clean, commercial-scale alternative power supply solutions.

Victorian Minister for Industry and Employment, Hon Wade Noonan MP, said the State Government was committed to building a strong advanced manufacturing sector, which had the potential to underpin growth across the economy. "It is innovative companies such as THYCON that make a significant contribution to our quality of life," he said.

THYCON was also ranked #17 in the 2016 *AFR* Most Innovative Companies list for the Fault Current Limiter (TFCL) that enables connection of distributed energy resources, such as renewables and cogeneration to the electricity grid.

The TFCL enables fast fault limitation where breakers are unable to intervene with sufficient speed. The main disadvantages and reliability issues of current technologies include the impact on voltage regulation and stability, size/footprint, impact on system efficiency and lack of fail safes. These issues are addressed by the TFCL, ensuring it is easy to install, requires little maintenance and is low cost by nature. Unlike electronic limiters or breakers, the TFCL requires no control electronics and is failsafe. Being self-acting and self-resetting, it is also suitable for remote and isolated installations.

In 2015, THYCON was awarded #24 in the 2015 *BRW* Most Innovative Companies list, for its 320kW Uninterruptible Mini Grid Power Supply (UMGPS) solution that enables clients to operate independently of the grid 24 hours a day.

THYCON's UMGPS is able to provide a 24×7 off-grid solution on a commercial scale – using only solar and battery energy storage – with the capability to synchronously transfer the Mini Grid to the commercial grid in times of need.

For commercial applications, the UMGPS reduces the need for electrical networks to invest in infrastructure to meet peak load fluctuations, by providing local energy storage close to the source of demand. This reduces pressure to install generator and distribution infrastructure to meet these peaks, reducing the level of investment required to maintain the grid.

For Military bases and remote locations, the UMGPS reduces the dependence on external fuel deliveries. The deployment of a 24×7 grid-independent renewable energy facility provides tactical independence of these facilities, securing their power requirements against external interruptions while reducing daily energy costs.

THYCON's dedicated customer service includes preventive maintenance, 24x7 remedial service, smart monitoring, customer training programs, and engineering advisory services. The company's reputation for robust, long life, quality equipment is well established, with many products still in operation after more than 25 years of service.

Our enduring reputation and philosophy for state-of-the-art and rugged design provides an excellent foundation for our new THYCON TOTAL CARE SERVICES that provide lifetime warranty for appropriately maintained installations.

2016 VICTORIAN MANUFACTURING HALL OF FAME

FINANCIAL REVIEW 2016 most INNOVATIVE companies

BRW. 2015 most INNOVATIVE companies

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Communications

Voltage-free contacts

All Thycon products are provided with a standard single voltage-free summary alarm relay that activates whenever an alarm condition occurs. You can monitor the relay, which is rated to 240V/1A, using either normally open or normally closed contacts.

External alarms card

This optional feature provides eight dedicated relay outputs for external, low-level, voltage-free monitoring of any Thycon product.

Alarms for UPS, for example, include:

- new
- summary
- ambient over-temperature
- overload
- battery discharging
- input supply fail
- battery low
- offline

Additional external alarm cards can be installed if separate monitoring systems are to be used. A normally open and normally closed contact is available for each alarm status. Each relay is rated to 240V/1A.

Remote LED panel

This panel utilises external alarm cards to provide visual and audible alarms at a location remote to the Thycon system. It includes *Audible Cancel* and *Alarms Test* push buttons.

Remote LCD panel

An LCD panel identical to that mounted on the product can be installed at remote sites. Control and emergency stop functions on the remote panel are disabled to prevent accidental shutdown of the equipment.

SNMP interface

By installing a protocol converter and SNMP interface, computer networks can utilise the SNMP traps provided with all Thycon products.

MODBUS

Industry standard MODBUS over RS232, RS485 or TCP/IP networking is available for PLC style communications.

The serial port is electrically isolated from the power equipment to avoid any possibility of interference with the system operation. It supports both 2-wire and 4-wire RTU operation.

The Modbus option provides access to the operating status of the Thycon equipment, including all alarm states and measured quantities, as well as the logged alarms and configuration information.

Thycon SMART monitor

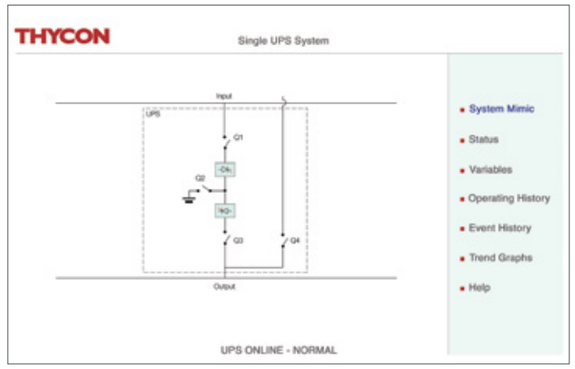
A web page server can be included to provide a real-time monitoring function using a standard web browser on any connected PC, either locally or remotely via LAN or WAN.

The web home page displays a mimic diagram of the equipment with key status information and links to associated pages that provide detailed information on status, alarms, measured quantities and online documentation. The web server module incorporates a database to log all equipment measurements at regular intervals. This information is then used to display trend graphs of quantities such as output voltage, current and power on the web browser.

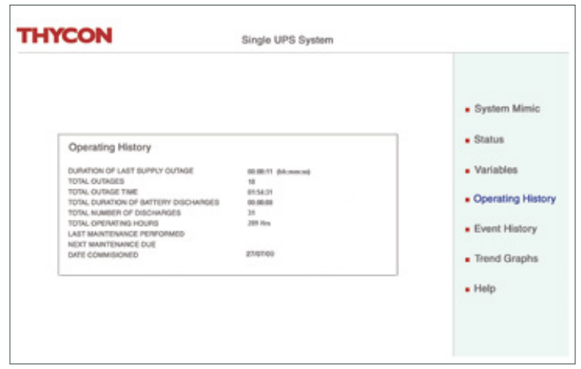
The web server module may also be configured to automatically generate email messages to nominated destinations on specified alarm conditions so that the appropriate personal can be notified immediately when power system events require attention.

Local printer

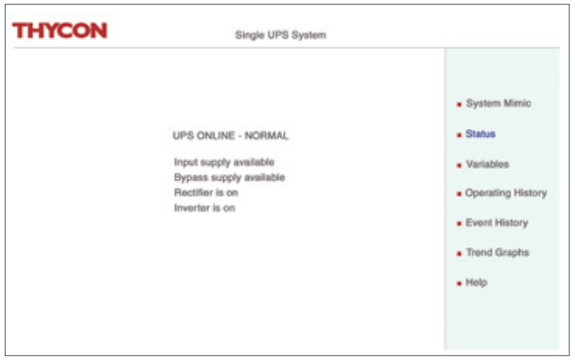
Printers can be connected directly to Thycon products in order to log alarms and system data either in real time or periodically to record all operating variables.



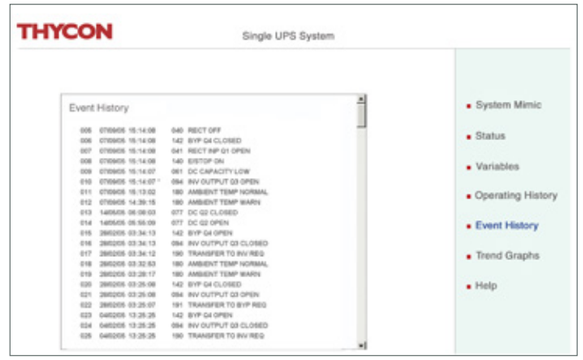
UPS power system monitor - system mimic



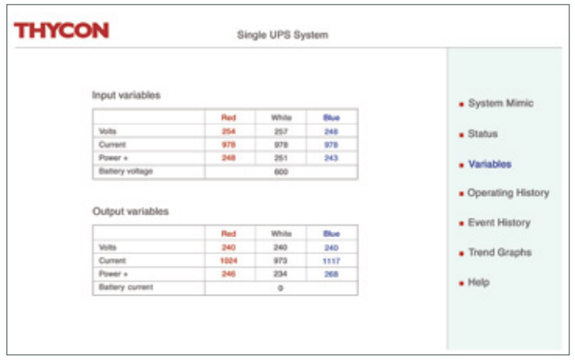
UPS power system monitor - operating history



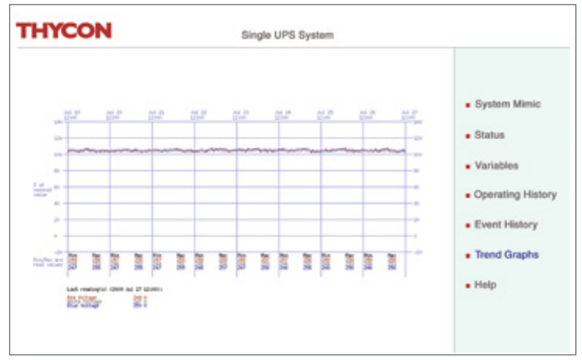
UPS power system monitor - status



UPS power system monitor - event history



UPS power system monitor - variables



UPS power system monitor - trend graphs

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Commercial Stand Alone UPS

ComPower Micro RT

1-20 kVA

1-3 kVA

6 kVA

10 kVA

Light Industrial Modular UPS

FlexiPower Series 25

FP100

FP150

FlexiPower Series 60

50 - 3600kW

FP360

Industrial Stand Alone UPS

MPX Single Phase

10-200 kVA

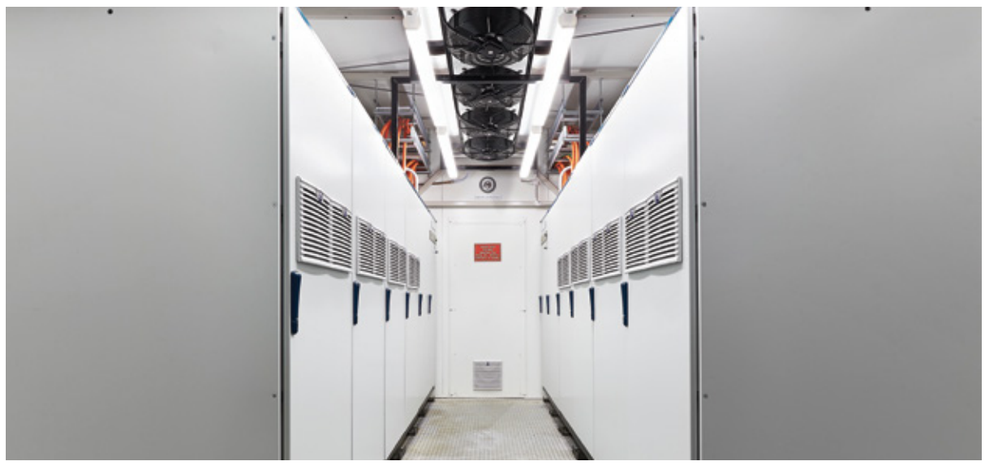
MPX 3 phase

90-1600 kVA

Industrial Modular UPS

DCM

400-4000 kVA



Designed and Published by Thycon.

ComPower Micro RT 1-20kVA

General Data	1 kVA	2kVA	3kVA
Input			
Voltage	60/70/80-144 Vac or 120/140/160-288 Vac*		
Frequency	50/60+/-5Hz (auto sensing)		
Phase	Single		
Input power factor	>0.99 (full load)		
Output			
Voltage	100/110/115/120/127 Vac or 200/208/220/230/240 Vac		
Capacity	1000VA/800W	2000VA/1600W	3000VA/2400W
Power factor	0.8 lagging to unity within KW rating of unit		
Frequency stability	+/-0.1% unless synchronized to line		
Crest factor	3 : 1		
Efficiency (AC-AC)	>85%	>85%	>88%
Autonomy (Built-in battery)	>7min	>7min	>5min
DC Start	Yes		
Battery			
Quantity	3pcs	6pcs	6pcs
Capacity	7AH	7AH	9AH
Voltage	36Vdc	72Vdc	72Vdc
Recharge time	3 hrs to 90%		
Built-in charger (max charging current)	~1.8A	~2.1A	~2.7A
Display			
LED	Normal, battery, bypass, programmable outlet 1, programmable outlet 2,self-test, battery weak & bad, site wiring fault, fault, overload and load/battery level conditions		
Key	On/0ff button (test/alarm silence button)		
Self Diagnostics	Upon power on and software control		
Protection			
Overload	AC mode <105% continuously >121% - 150% for 10 sec shutdown >150% immediately	Back up mode <105% continuously >146%-148% for 5 sec shut down >188% tor 0.16 sec shut down	
Battery	Advanced battery Discharge Management (ABDM)		
Physical			
Dimensions (WxHxD) mm	440 X 88 (2U) X 405	440 X 176 (4U) X 520	440 X 176 (4U) X 520
Input Connection 230V System	10A, IEC320-C14	10A, IEC320-C14	16A, IEC320-C20
Outlets(IEC/Local) 230V	6pcs IEC320-C13	6pcs IEC320-C13	4pcs IEC320-C13 + 1 x IEC320-C19
Net Weight	15.7kgs	29.4kgs	29.7kgs
Environment			
Operating Temperature	0°C - 40°C		
Altitude	0-2000m up to 40 °C, 3000m up to 35 °C		
Humidity	90% RH Maximum, Non-Condensing		
Noise	<50dB (at 1 meter)		
Computer Interface			
Interface Type	True RS232 and USB Interface as standard		
Communication Slots	Relay Contact Board, SNMP/WEB card. etc.		
Compatible Platforms	Windows 95/98/NT/2000/XP, Novell Netware, Linux, etc.		
Safety Conformance			
Quality Assurance	ISO9001 Certified Company		
Safety Standard	EN62040-1, UL 1778		
Performance	EN62040-3		
EMC Standard	EN62040-2. EN61000-3-2, EN61000-3-3, FCC Class A		
Marks	CE. UL, cUL, FCC		

Specifications are subject to change without notice

General Data	6 kVA	10 kVA	15 kVA	20 kVA
Input				
Voltage	160- 280Vac* single phase	160 - 280Vac* (1P/1P) 277 - 485Vac (3P/1P)	190 - 486Vac (3P/1P)	
Frequency	45 - 65 Hz		45- 70 Hz	
Phase/ wire	Single+G	Single I Three+G	Three+G	
Power factor	1P/1P: Up to 0.99 at 100% Linear		3P/1P: Up to 95% at 100% Linear Load	
Current THD	Load 1P/1P: <6% at 100% Linear Load		3P/1P: <30% at 100% Linear Load	
Output				
Voltage	200/208/220/230/240Vac Selectable (208/120Vac) Optional		200/208/220/230/240Vac	
Capacity	6000VA / 5400W	10000VA / 9000W	15000VA / 13500W	20000VA / 18000W
Power Factor	0.9 lagging			
Crest Factor	3:1 acceptable			
Efficiency (AC to AC, Normal)	Up to 90%			
DC Start	Yes			
Battery				
Capacity	7AH		9AH	
Quantity	20pcs		16pcs or 20pcs	
Voltage	240Vdc		192Vac or 240Vac	
Recharge time	4 Hours to 90%			
Display				
Status on LED + LCD	Line Mode, Backup Mode, ECO Mode, Bypass Supply, Battery Low, Battery Bad/Disconnect, Overload, Transferring with Interruption, & UPS Fault			
Readings on LCD	Input Voltage, Input Frequency, Output Voltage, Output Frequency, Load Percentage, Battery Voltage & Inner Temperature.			
Self-Diagnostics	Upon Power-on & Front Panel Setting			
Protection				
Overload (with simulated thermal tripping I-T curve)	AC Mode: <105% continously >121% - 150% for 10 sec >150% immediately		Bypass Mode: <105% continously >146% - 148% for 5 sec shut down >188% for 0.16 sec shut down	
Physical				
Dimensions (W x H x D) UPS Module Rack Configuration	440 x 88 (2U) x 680	440 x 132 (3U) x 680	440 x 220 (5U) x 720	
Dimensions (W x H x D) Battery Module Rack Configuration	440 x 132 (3U) x 680	440 x 132 (3U) x 680	440 x 132 (3U) x 680	
Net Weight	~24kg (UPS), ~68kg (Battery	~30kg (UPS), ~70kg (Battery)	~42kg (UPS), ~70kg (Battery)	
Optional Extended Battery Bank (20pcs 12V/7AH)	Dimension : 440 x 133 (3U) x 660, weight 68kg			
Environment				
Operating Temperature	0°C - 40°C			
Temperature Warning	The battery design life is based on a temperature of 25°C Ambient temperature above this range will reduce battery life			
Altitude	0-2000m up to 40°C, 3000m up to 35°C			
Humidity	90% RH Maximum, Non-Condensing			
Noise	<50dB (at 1 meter)			
Computer Interface				
Interface Type	Standard RS232 Interface & EPO			
Communication Slots	2nd RS232**, USB**, RS485**, Dry Contact Relay**, SNMP/WEB Card**, etc. (Optional)			
Safety Conformance				
Quality Assurance	ISO9001 Certified Company			
Saftety Standard	EN62040-1, U L1778			
EMC Standard	EN61000-6-2, EN62040-2, EN61000-4, EN61000-2, FCC Class A			
Marks	CE, UL			

*160~ 176Vac @≤75% load

**These cards are not suitable to use simultaneously

Specifications are subject to change without notice

Designed and Published by Thycon.

THYCON

Light Industrial Modular UPS

FPX 10 – 500kVA

THYCON's FlexiPower UPS boasts the highest performance, lowest total cost of ownership (TCO) and greatest availability of any modular UPS system.

FlexiPower Series 25 Frame Technology scales from 10kW to 250kW at up to 322kW/sqm.

FlexiPower Series 60 Frame Technology scales from 50kW to 3600kW at up to 533kW/sqm.

FlexiPower Technology allows you to scale your power or provide redundancy whenever you require it without risk to your site.

THYCON's FlexiPower Frame Technology features hot-swappable:

- UPS Power Modules
- CB Modules
- Battery Modules

that allow safe removal and/or insertion without the need to power down or transfer to raw mains supply.

These unique features directly address today's requirement for continuous uptime by achieving **99.999999% availability** (nine nines).

THYCON's FlexiPower UPS Power Module Technology offers leading performance advantages:

- 97% energy efficiency
- Smooth input current ramp up, so no need to oversize diesel generator or distribution
- Safe battery tests (no need to disconnect mains during tests)
- Continuous monitoring of Battery Modules and System Temperature & Humidity to ensure environmental continuity
- Local and remote monitoring 24/7 to ensure any unlikely performance or environmental issues are informed and managed immediately
- 20 year lifetime design

Designed and Published by Thycon.

Model		FP050	FP100	FP150	FP200	FP240	FP360	FP480	FP600
General Data									
Nominal power per frame [kW]		10-50	10-100	10-150	10-200	50-240	50-360	50-480	50-600
Nominal power per module [kW]		10,20,25	10,20,25	10,20,25	10,20,25	50,60	50,60	50,60	50,60
Number of modules per cabinet		1-2	1-4	1-6	1-8	1-4	1-6	1-8	1-10
Topology / Technology		Online double conversion							
Input									
Mains	Input Wiring	Three phases +N+PE							
	Rated Voltage	400/415Vac							
	Rated Voltage	Load >95% (–20%,+15%), >85% (–27.5%,+15%), ≤75% (–35%,+15%)							
	Input frequency	40-70 Hz							
	THD	<3% for linear load, <5% for non-linear load							
	Input Power Factor	0.99 (with 100% load)							
Bypass	Input Wiring	Three phases +N							
	Rated Voltage	400/415Vac							
	Input Frequency	50/60Hz (±2% / ±4%)							
Battery	Rated Voltage	480-600Vdc (selectable number of batteries)							
	Location	Internal				External			
	Type	Lead-Acid or Ni-Cd							
	Block (for Lead Acid Battery)	20-50							
	Charger (Amp/module)	20A				40A			
Output									
Inverter	Output Wiring	Three phases +N							
	Voltage	400/415 Vac±1%							
	Frequency	Tracking the bypass input (Online Mode); 50/60 Hz±0.1% (Battery Mode)							
	THD	<2% for linear load; <3% for non-linear load							
	Output voltage stability	Static ±1%, Dynamic ±3% (load jump 0-100%)							
	Output power factor	Cos ϕ = 1							
	Efficiency	97% (module) / 96.7% (full frame)							
	Overload capacity	Inverter: load <125% continuous; 125% for 10 min; 150% for 1 min							
	Short circuit capability	3 x In (>40ms)							
Bypass	Efficiency	99.1%							
	Overload capacity	Bypass: 135% long term; <1000% per 100ms							
	Short circuit capability	Dependent on the calibre of the bypass fuses type gG-gl							
Environment									
Operating System		0-40°C (No power de-rating)							
Storage temperature		- 40° - 70°C							
Relative Humidity		0% - 95% (Non condensing)							
Maximum Operating Altitude		1000 m. Above 1000 m, de-rating 1% for each additional 100 m							
Audible Noise		<65dBA							
Certifications		CE; EN/IEC 62040-1; EN/IEC 62040-2; EN/IEC 62040-3; EN/IEC 62040-4							
Connectivity		Basic: RS485, RS232, Dry Input. Pro: Basic + Dry contacts, Ethernet, Bluetooth.							

Specifications are subject to change without notice

Thycon FlexiPower Technology™ achieves the Highest Efficiency & Availability as well as the ability to maintain while online.

UPS & Battery Maintenance can be performed online at all times

• In a redundant system, each UPS Power and Battery Module can be unplugged, checked, and reinstated in the system without taking the entire system offline. UPS power is maintained to your critical load during each service.

Fully Monitored Service

• Each Isolator, UPS Power and Battery Module is monitored for performance, temperature and humidity.
• Full monitoring and reporting are available as desired or required allowing the THYCON Service Team to be fully aware and prepared in the unlikely event of a failure.

Lifetime Product Warranty

• Competitive monitoring and service contracts allow THYCON to provide ongoing warranty for the lifetime of the product.

1 **Frame Design**

• Top or bottom cable entry
• Single or Dual Input Feed
• Interchangeable UPS Power Modules or Battery Modules
• Fault-Tolerant Parallel Ring Communications Bus between frames ensures communication even when the cable is cut, short circuited or disconnected.

2 **Hot-Swappable Isolator Modules**

• CB25 and CB60 allow testing of each UPS Power Module prior to connection as well as independent connection of input, bypass, battery and output power.

3 **Hot-Swappable UPS Power Modules**

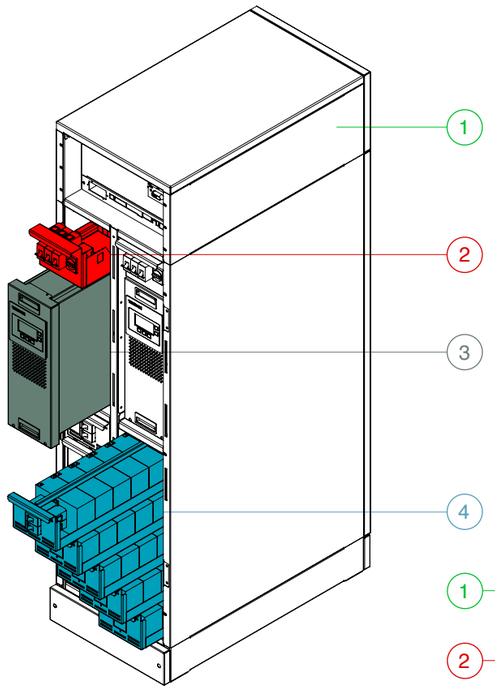
• UP25 and UP60 each contain a display, controller, rectifier, inverter, static bypass and back-feed protection and provide ultimate redundancy by achieving 99.9999999% availability.
• UPS Modules are 97% Energy Efficient.
• Vertical module design achieves significant power/sqm gains of up to 533kW/sqm.

4 **Hot-Swappable Battery Modules**

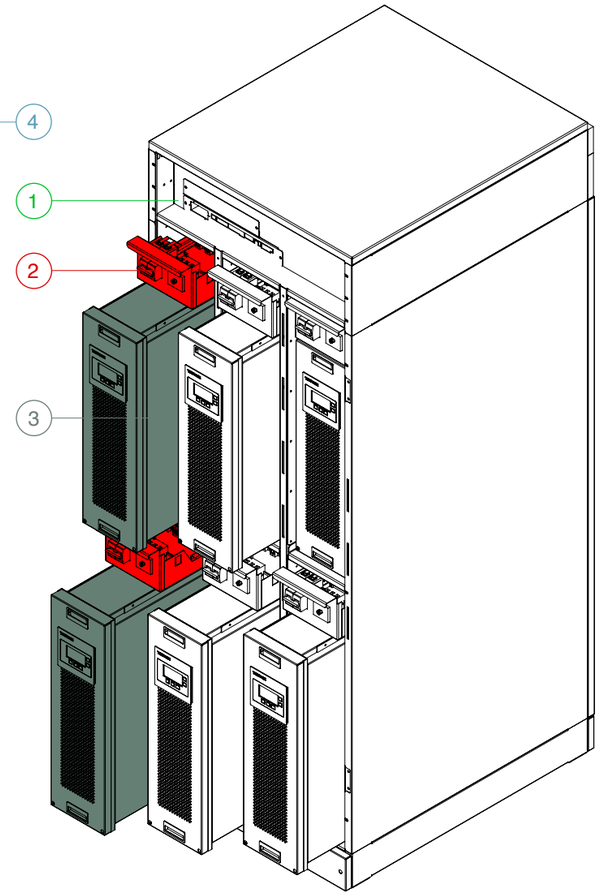
• BT25 contains an isolator, monitoring and 44 x 9Ah batteries allowing each string to be isolated, checked and returned to service without taking the system off-line.

THYCON

SERIES 25



SERIES 60



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Model	FP050	FP100	FP150	FP200	FP240	FP360	FP480	FP600
Max # Modules	2	4	6	8	4	6	8	10
Module Type	UP10, UP20, UP25	UP10, UP20, UP25	UP10, UP20, UP25	UP10, UP20, UP25	UP50, UP60	UP50, UP60	UP50, UP60	UP50, UP60
Max Power kVA/kW	50/50	100/100	150/150	200/200	240/240	360/360	480/480	600/600
Maximum Batteries	2 x 44	4 x 44	6 x 44	8 x 44	-	-	-	-
Dim (WxHxD)	415 x 975 x 750	415 x 1,555 x 750	610 x 1,555 x 750	800 x 1,555 x 750	500 x 1,980 x 900	740 x 1,980 x 900	970 x 1,980 x 900	1,200 x 1,980 x 900
Weight frame (no modules)	90kg	142kg	225kg	305kg	250kg	316kg	390kg	454kg
Weight / CB & Module	5 & 25kg	5 & 25kg	5 & 25kg	5 & 25kg	7 & 55kg	7 & 55kg	7 & 55kg	7 & 55kg
Weight / Battery Tray	28kg	28kg	28kg	28kg	-	-	-	-
Colour	Standard (Interpon - Sable Bass GN297A or RAL 9004) Option (Customer request - Interpon colour chart)							

*Specifications subject to change without notice

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Single Phase Industrial UPS Systems & Frequency Converters

MPX Industrial 10-200kVA

Features & Benefits

- Australian designed and made.
- Industrial strength 25 years + design life
- Integrated Output Transformer on all models
- Fuseless design, fully circuit breaker protected
- Options
- Input & bypass isolation transformer
- Unity input power factor & low harmonic versions
- SNMP, Modbus, web page, voltage free alarm contacts.

Technical data 10 kVA - 200 kVA

	Up to 30kVA	*Up to 50kVA*	*Up to 100kVA*	*Up to 200kVA*
***Input** - single phase*				
Voltage	240 VAC	240 VAC	240 VAC	240 VAC
Phases	1 + neutral	1 + neutral	1 + neutral	1 + neutral
Frequency	50 Hz	50 Hz	50 Hz	50 Hz
***Output -** single phase*				
Output PF Rating	0.8, 0.9 or 1.0	0.8, 0.9 or 1.0	0.8, 0.9 or 1.0	0.8, 0.9 or 1.0
Overload for 10min. / 1min	125% / 150%	125% / 150%	125% / 150%	125% / 150%
Output Voltage	240VAC	240VAC	240VAC	240VAC
Output Frequency	50/60/400 Hz	50/60/400 Hz	50/60/400 Hz	50/60/400 Hz
Ambient temperature range	0 to 50ºC	0 to 50ºC	0 to 50ºC	0 to 50ºC
Humidity	0 to 95% Non Condensing	0 to 95% Non Condensing	0 to 95% Non Condensing	0 to 95% Non Condensing
***Dimensions** - UPS system* w x d x h (mm)	600 x 1000 x 2150	1200 x 1000 x 2150	1800 x 1000 x 2150	2400 x 1000 x 2150

Specifications are subject to change without notice

THYCON

UPS Range – Features & Options Summary

	COMMERCIAL			MODULAR/HOT-SWAPPABLE			INDUSTRIAL	
	Compower			Flexipower			25+ Year Design Life	
Range	Micro	Mini	Maxi	Mini	Maxi	Ultra	MPX	DCM
Rating	1kVA to 20kVA	10kVA to 50kVA	60kVA to 500kVA	10kVA to 200kVA	50kVA to 250kVA	100kVA to 500kVA	10kVA to 1.6MVA	200kVA to 4MVA
Phases	Single	Three	Three	Three	Three	Three	Three	Three
Backfeed Protection	N/A	Optional	Optional	Optional	Standard Feature	Optional	Optional	Optional
Battery Data Logger	N/A	Optional	Optional	Optional	Optional	Optional	Optional	Optional
External Batteries	N/A	Optional / Standard Feature	Standard Feature	Optional	Standard Feature	Optional	Standard Feature	Standard Feature
Internal Batteries	Standard Feature	Optional	N/A	Optional / Standard Feature	N/A	N/A	N/A	N/A
Internal Bypass	Standard Feature	Standard Feature	Standard Feature	Standard Feature	Standard Feature	Optional	Optional	Optional
Module Rating	N/A	N/A	N/A	10kVA/ 20kVA	50kVA	100kVA	N/A	800kVA
Parallelable	Standard Feature	Standard Feature	Standard Feature	Standard Feature	Standard Feature	Standard Feature	Standard Feature	Standard Feature
Relay	N/A	Optional	Optional	Optional	Optional	Optional	Optional	Optional
SNMP/ Modbus	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional
Output Transformer	Optional	Optional	Optional	Optional	Optional	Optional	Standard Feature	Standard Feature
Country of origin	R.P.C	Switzerland	Switzerland	Switzerland	Switzerland	Switzerland	Australia	Australia

Specifications are subject to change without notice

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Industrial UPS Three Phase

MPX Industrial 10 – 1600kVA

Industrial UPS

Thycon has adopted a total system approach in designing the MPX Series UPS. Major innovations in the design of transformers, reactors and static converters and a commitment to high manufacturing standards have enabled us to produce a system of simple construction offering high efficiency, output range capability and space saving features.

Thycon's world-leading Static Flywheel Technology provides an efficient and robust UPS power solution. Our approach combines the best of rotary and static concepts to produce a system that has the high current capacity and energy storage of the former with the efficiency, reliability, low mean time to repair and lower cost of the latter.

The development of Thycon Static Flywheel technology allows our UPS system to store substantial reserve power for transient conditions and high crest factor loads.

Combining our proprietary technology with the high efficiency switching means of our converters ensures very low harmonic voltage distortion, current distortion and power loss.

Inherently capable of supplying up to 0.8 leading power factor without de-rating, the MPX Series has been proven by over 1000 MVA of Thycon installations to deliver reliable performance and long equipment life.

Technical data 60 kVA - 400 kVA

	MPX-60	*MPX-120*	*MPX-200*	*MPX-400*
***Input** - three phase*	***60kVA***	***120kVA***	***200kVA***	***400kVA***
Voltage	415 VAC	415 VAC	415 VAC	415 VAC
Voltage tolerance	+10% - 15%	+10% - 15%	+10% - 15%	+10% - 15%
Phases	3 + neutral	3 + neutral	3 + neutral	3 + neutral
Frequency	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%
Power walk-in	15s	15s	15s	15s
***Current output** - three phase*				
System rating	60kVA / 48kW	120kVA / 96kW	200kVA / 160kW	400kVA / 320kW
Power factor range (within rated kW)	0.7 lag to 0.8 lead	0.7 lag to 0.8 lead	0.7 lag to 0.8 lead	0.7 lag to 0.8 lead
Overload for 10min. / 1min	125% / 150%	125% / 150%	125% / 150%	125% / 150%
Voltage	415V / 240VAC	415V / 240VAC	415V / 240VAC	415V / 240VAC
Voltage tolerance: balanced load 100% unbalanced load	 ± 1% ± 3%	 ± 1% ± 3%	 ± 1% ± 3%	 ± 1% ± 3%
Voltage adjustment	± 5%	± 5%	± 5%	± 5%
Voltage transient performance: 50% full load step Loss / return of AC input	 ± 8% ± 5%	 ± 8% ± 5%	 ± 8% ± 5%	 ± 8% ± 5%
Uninterrupted transfer of critical load				
from UPS to bypass or from bypass to UPS	± 5%	± 5%	± 5%	± 5%
Recovery time	10ms	10ms	10ms	10ms
Phase displacement: balanced load 100% unbalanced load	 120° ± 1° 120° ± 3°	 120° ± 1° 120° ± 3°	 120° ± 1° 120° ± 3°	 120° ± 1° 120° ± 3°
Frequency	50 Hz	50 Hz	50 Hz	50 Hz
Frequency tolerance (unlocked) Frequency tracking rate THD	± 0.1% 10Hz / s 2%	± 0.1% 10Hz / s 2%	± 0.1% 10Hz / s 2%	± 0.1% 10Hz / s 2%
Efficiency	91%	92%	93%	94%
***Environmental** - UPS system*				
Ambient temperature range	0 to 40ºC	0 to 40ºC	0 to 40ºC	0 to 40ºC
Heat dissipation at full load	5 kW	8.4 kW	12 kW	22 kW
Audible noise at 2 metres	60 dBA	60 dBA	<65 dBA	<70 dBA
***Dimensions** - UPS system* w x d x h (mm)	 600 x 1000 x 1800	 1200 x 1000 x 1800	 1800 x 1000 x 1800	 2400 x 1000 x 1800

Specifications are subject to change without notice

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Technical data 600 kVA - 1600 kVA

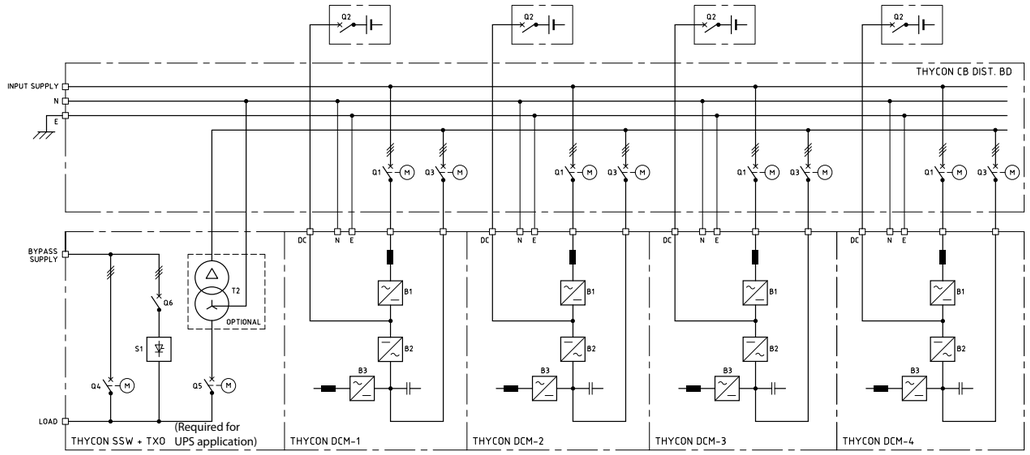
	MPX-600	*MPX-800*	*MPX-1200*	*MPX-1600*
***Input** - three phase, three wire & ground*	***600kVA***	***800kVA***	***1200kVA***	***1600kVA***
Voltage	415 VAC	415 VAC	415 VAC	415 VAC
Voltage tolerance	+10% - 15%	+10% - 15%	+10% - 15%	+10% - 15%
Phases	3 + neutral	3 + neutral	3 + neutral	3 + neutral
Frequency	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%
Power walk-in	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%
***Current output** - three phase*	15s	15s	15s	15s
System rating	600kVA / 480kW	800kVA / 640kW	1200kVA / 960kW	1600kVA / 1280kW
Power factor range (within rated kW)	0.7 lag to 0.8 lead	0.7 lag to 0.8 lead	0.7 lag to 0.8 lead	0.7 lag to 0.8 lead
Overload for 10min. / 1min	125% / 150%	125% / 150%	125% / 150%	125% / 150%
Voltage	415V / 240VAC	415V / 240VAC	415V / 240VAC	415V / 240VAC
Voltage tolerance: Balanced load 100% unbalanced load	± 1% ± 3%	± 1% ± 3%	± 1% ± 3%	± 1% ± 3%
Voltage adjustment	± 5%	± 5%	± 5%	± 5%
Voltage transient performance:				
50% full load step	± 5%	± 5%	± 5%	± 5%
Maximum recovery time	10ms	10ms	10ms	10ms
Phase displacement:				
Balanced load	120° ± 1°	120° ± 1°	120° ± 1°	120° ± 1°
100% unbalanced load	120° ± 3°	120° ± 3°	120° ± 3°	120° ± 3°
Frequency	50Hz	50Hz	50Hz	50Hz
Frequency regulation	± 0.1%	± 0.1%	± 0.1%	± 0.1%
Frequency tracking rate	10Hz / s	10Hz / s	10Hz / s	10Hz / s
THD	2%	2%	2%	2%
Efficiency	94%	94%	95%	95%
Environmental				
Ambient temperature range	0 to 40ºC	0 to 40ºC	0 to 40ºC	0 to 40ºC
Heat dissipation at full load	31 kW	37 kW	50 kW	67 kW
Audible noise at 2 metres	<70 dBA	<70 dBA	<70 dBA	<70 dBA
Dimensions ***Dimensions** - UPS system* w x d x h (mm)	 3000 x 1000 x 1800	 3000 x 1000 x 1800	 4800 x 1000 x 1800	 5400 x 1000 x 1800

Specifications are subject to change without notice

Designed and Published by Thycon.

Double Conversion Module

DCM 200kVA–4000kVA



Single-line diagram for a Thycon DCM system.

Concept

- High power, mature thyristors are favoured over newer IGBTs for their high current and overload capabilities and their inherently low losses.
- Fully rated thyristors are utilised in each DCM thereby avoiding the requirement for series or parallel connections.
- The circuit topologies do not rely on high frequency switching which further minimises losses and allows the use of air-cooling without air-conditioning.
- Minimised number of control boards and components.
- The use of rugged, passive components and mechanics.
- Fuseless power circuit design. Resettable circuit breaker protection is used in favour of single use fuses.

The DCM

The Thycon DCM concept is aimed at reducing the cost of installation and ownership of power converters used in UPS (Uninterruptible Power Supplies) and SFC (Static Frequency Converters) in the 0.4 – 13 MVA power range. This is achieved through the following design strategies using Thycon's new paralleling approach which:

- Achieves a high degree of converter standardisation.
- Allows locally-based customisation (to reduce transportation and importation costs) and local service and support.
- Minimises the number of components for the highest reliability.
- Uses standard components for ease of sourcing and low-cost maintenance.
- Uses low-loss circuitry for efficient operation, simple cooling and easy installation.

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Item	*DCM - 400*	*DCM - 600*	*DCM - 800*
Input			
Rated Voltage (V)	415	415	415
Rated Frequency (Hz)	50/60	50/60	50/60
Rated Current (A)	480	730	980
Phases	3P+N	3P+N	3P+N
THID (%)	<5	<5	<5
Power Factor	>0.99	>0.99	>0.99
Fault Withstand (kA)	<100	<100	<100
Output			
Module Rating (kVA / kW)	400 / 320	600 / 480	800 / 640
Max Capacity (kVA)	16 x 400	16 x 600	16 x 800
Rated Frequency (Hz)	50/60	50/60	50/60
125% Nominal Current (min)	12	12	12
150% Nominal Current (min)	2	2	2
Crest Factor	Unlimited	Unlimited	Unlimited
Efficiency (%)	97	97	97.8
Max. Ambient Temperature (°C)	50	50	50
Dimensions (ex. fan) W x D x H (mm)	800 x 1200 x 1925	800 x 1200 x 1925	800 x 1200 x 1925

Specifications are subject to change without notice.

Item	*SSW - 2000*	*SSW - 4000*
Input / Output		
Rated Voltage (V)	415	415
Rated Frequency (Hz)	50/60	50/60
Rated Current (A)	5000	10000
Fault Withstand (kA)	<70	<70
Performance		
Transfer Time (ms)	<2	<2
Max. Ambient Temperature (°C)	50	50

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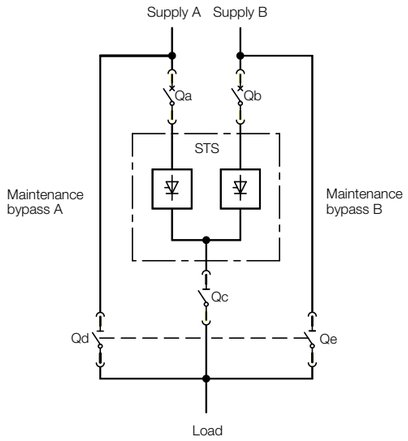
Designed and Published by Thycon.

Static Transfer Switches

STS 100 – 3000A | STSi 100 – 3000A



Concept

Static Transfer Switches (STS) are essential for achieving highly reliable and redundant supply to critical systems.

The STS provides power to items requiring a single AC supply by selecting from one of many input AC supplies. If one supply becomes unavailable the STS automatically transfers the critical load to an alternative AC supply source. Manual selection of supply is also possible.

Applications

STSs are suitable for back up power supply protection where multiple independent supplies are available on stand-by and ready for use when required.

Typical STS applications include:

- data centres to eliminate single points of (power supply) failure
- active maintenance bypass for UPS
- fault isolation

Principle of operation

Thycon provides two classes of static transfer switch for the various requirements of critical systems:

- Thycon STSt
- Thycon STSi

Both classes statically interrupt the supply to the load the instant a failure of the incoming AC source is detected. The load is isolated and then immediately re-connected to the alternative source.

Both the STSt and STSi implementation use break-before-make transfer characteristics to ensure that two supply sources can be truly independent and that the failure of one has no impact on the other.

The Thycon STSt and STSi inhibit transfer and raise an alarm condition in the system monitor under the following fault conditions:

- open circuit switching device within the STS
- short circuit switching device within the STS
- supply phase synchronism out of tolerance
- output phase voltage imbalance
- control fault
- load fault
- device over-temperature
- ambient over-temperature

Thycon's Point of Wave Transfer Technology ensures the STS transfers to the same point of the alternative supply's waveform therefore minimising inrush to supply sensitive loads such as transformers, drives and motors.

Thycon STSt

The Thycon STSt uses thyristor switch technology that can:

- switch supplies in typical conditions in less than 5ms (1/4 power cycle)
- switch supplies to the same point of the alternative supply's waveform
- switch with up to ±15 degrees phase shift between supplies (user defined)

This proven, robust technology uses large safety factors, achieves high reliability and longevity and is very economical. Today, single thyristors can switch in excess of 5000A and 10,000V.

Thycon STSi

The Thycon STSi uses IGCT (Integrated Gate Commutated Thyristor) switch technology which can:

- switch supplies in less than 0.5ms under any fault condition
- switch with up to ±180 degrees phase shift in supplies without feeding or damaging the overtaking supply or load

Today, a single IGCT can switch in excess of 4000A and 6000V.

Like the Thycon STSt this technology also uses large safety factors, is proven to achieve high reliability and longevity but is higher in cost.

STSt can have break times of 5 milliseconds under fault conditions as thyristors naturally turn off at zero current crossovers or by external commutation. In certain fault conditions, these break times can take in excess of 10 milliseconds. An IGCT however, will guarantee turn-off within microseconds and ensure a break time of approximately 500 microseconds.

Technology Comparison

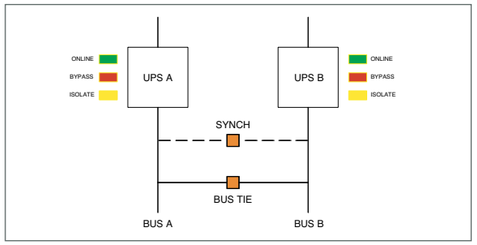
Parameter	Bi-directional Thyristor Static Transfer Switch - STSt	Integrated Gate Commutated Thyristor Static Transfer Switch - STSt
Rating range	200 - 2800 amps	300 - 2000 amps
Efficiency	99%	98.6%
Fault capacity	up to 100kA	up to 30kA
Over load capability at 150%	120s	120s
Over load capability at 1000%	1000ms	500ms
Allowable crest factor	< 5ms	< 5ms
Device safety margin (typ)	1000%	500%
Manual transfer time (asynchronous)	0 - 1s	0 - 1s
Fault transfer time	< 5ms	< 1ms
Fault detection time	0.5ms	0.5ms
Operation during load fault	Remains online until protection activates OR disconnects output to protect weak source (< 5ms)	Remains online until protection activates OR disconnects output to protect weak source (< 1ms)
Failure mode	Short circuit	Short circuit
Operational reliability facto	0.999	0.995
MTBF	250,000 hrs	200,000 hrs
MTTR	1 hr	1 hr
Transfer mode	Break before make	Break before make
Make/break	< 0.1ms	< 0.01ms
Remote transfer capability	Yes	Yes
Voltage protection	Yes	Yes
Protection method	Thermal/magnetic circuit breaker	Thermal/magnetic circuit breaker

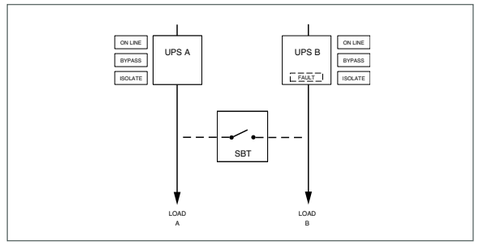
Specifications are subject to change without notice

Designed and Published by Thycon.

Static Bus Tie

SBT 100–3000 A





Independent mode

Concept

Static Bus Ties (SBT) are essential for achieving highly reliable independent, stand-by, parallel or redundant supply to critical systems.

Bus ties are fully automatic. Once set, they ensure that critical loads are supplied in case of supply failure or during maintenance procedures.

Applications

The SBT configuration is ideal for implementing dual cord AC distribution systems or independent load applications where loads must be supplied independently while the supplies are operating normally.

A typical application is described opposite.

The front panel and LCD layout are shown.

The three LEDs adjacent to each UPS symbol indicate the operating state of each UPS and are labelled and coloured as follows:

ONLINE: green
UPS is online / normal

BYPASS: red
UPS is offline / in bypass

ISOLATE: yellow
UPS output is isolated from the load

LEDs also indicate when the bus tie is on and when the UPS equipment is not in synchronism.

Principle of operation

Automatically operated, the SBT operates on the basis of each supply's performance. Sensing of each supply determines when it should go offline and when the SBT is to be activated.

When restoring the units to online status, the operator merely initiates an ONLINE request from the operator control panel at the offline supply. The make-before-break transition is transparent to the load. Similarly, should maintenance be required on a supply the operator issues an OFFLINE command from the supply control panel.

The SBT enables two independent supplies to operate in one of four modes.

- independent
- redundant
- stand-by
- parallel

Each supply provides static or electromechanical isolation. Push buttons are used to select the mode of operation. Once selected, operation is fully automatic.

Independent mode

This is used where:

- the requirement of either load exceeds half the rating of either supply (i.e. where redundancy is impossible to achieve)
- each UPS is to operate separately (i.e. as if the bus tie was not present)
- maintenance is being performed

  In this mode, all automatic functions are disabled and the SBT is always open

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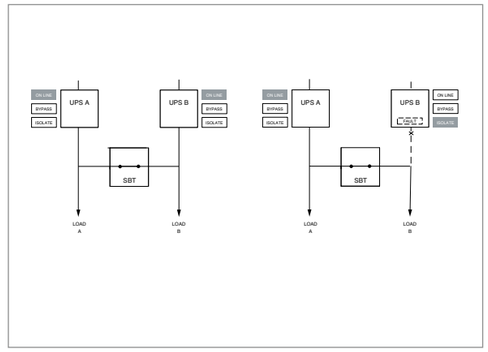
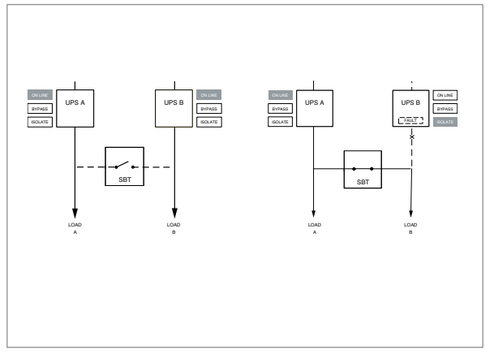
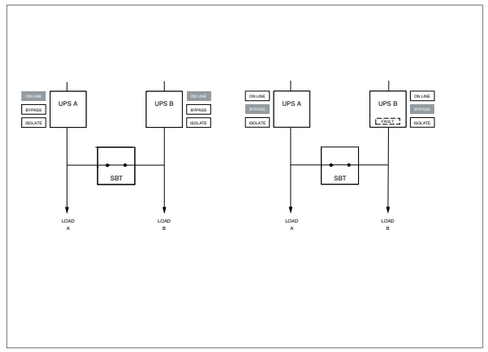


Redundant mode



Standby mode



Parallel mode

Redundant mode

This mode provides full parallel redundant operation, as long as the combined load on the two UPS equipments does not exceed the rating of one UPS (i.e. each UPS should have a load of less than half the unit rating). Normally both units operate online in parallel with the SBT closed. If one UPS fails, then the unit isolates from the output bus. In this set-up the SBT is normally closed and the failed unit is isolated, leaving the remaining unit to supply both loads via the SBT, which does not operate until there is a mode change to *Independent* or *Stand-by.*

Stand-by mode

This mode provides a redundant capability, as long as the combined load on both UPS equipments does not exceed the rating of one UPS (i.e. each UPS should have a load of less than half the unit rating). Normally both units operate independently online, with the SBT open. If one UPS fails, then the SBT is closed and the failed unit is isolated, leaving the remaining unit to supply both loads. Once transferred, the critical load is supplied by the remaining online unit, in this case A, and the bus tie remains closed.

Parallel mode

This is used where the load exceeds the capacity of a single unit and redundancy can no longer be provided. In this mode the bus tie is always closed and both UPS operate as one.

Designed and Published by Thycon.

Active Power Factor Regulator

APR-L 100kVA - 1600kVA

APR-H 1 - 10MVA

Concept

New sophisticated technologies require a quality power supply and businesses today cannot afford to have their productivity diminished by even occasional outages. Poor harmonic distortion, including voltage notching, flicker and short-term sagging are no longer acceptable reasons for productivity down time. A poor power factor also results in unnecessary penalty electricity rates that add to the operating costs of business.

Thycon Active Power Factor Regulators (APR) accurately and continuously regulate power factor and minimise harmonic distortion of the power supply to increase your business productivity.

At higher power levels, APRs can also provide substantial energy saving and improved power network availability for existing power distribution infrastructure.

Applications

APRs are suitable for any power quality application where accurate power factor regulation, harmonic voltage distortion mitigation (including voltage notching, flicker and short term sagging) or maximisation of existing power distribution infrastructure is required.

Beneficial applications of an APR include:

- minimised disturbance notching and flicker caused by heavily switched loads
- minimised electricity supply bill penalty costs
- increased power distribution network availability of up to 30%

Technical data 100KVAr - 1600KVAr

	APR-L100	*APR-L200*	*APR-L300*	*APR-L400*	*APR-L600*	*APR-L800*
Reactive power rating	100kVAR at 415V 50Hz	200kVAR at 415V 50Hz	300kVAR at 415V 50Hz	400kVAR at 415V 50Hz	600kVAR at 415V 50Hz	800kVAR at 415V 50Hz
Rated voltage	415VAC	415VAC	415VAC	415VAC	415VAC	415VAC
Voltage operating range	415VAC ± 20%	415VAC ± 20%	415VAC ± 20%	415VAC ± 20%	415VAC ± 20%	415VAC ± 20%
Supply unbalance withstand	2% continuous	2% continuous	2% continuous	2% continuous	2% continuous	2% continuous
Temporary power frequency overvoltage	1.8pu for 3s	1.8pu for 3s	1.8pu for 3s	1.8pu for 3s	1.8pu for 3s	1.8pu for 3s
Frequency - operating range	50Hz ± 5Hz	50Hz ± 5Hz	50Hz ± 5Hz	50Hz ± 5Hz	50Hz ± 5Hz	50Hz ± 5Hz
Current RMS	139A	277A	416A	556A	833A	1111A
Overload current 150%	30s	30s	30s	30s	30s	30s
Overload current 120%	10 min.	10 min.	10 min.	10 min.	10 min.	10 min.
THVD*	<1%	<1%	<1%	<1%	<1%	<1%
Reactive compensation	100kVAR leading to 100kVAR lagging	200kVAR leading to 200kVAR lagging	300kVAR leading to 300kVAR lagging	400kVAR leading to 400kVAR lagging	600kVAR leading to 600kVAR lagging	800kVAR leading to 800kVAR lagging
Regulation time constant	Subcycle	Subcycle	Subcycle	Subcycle	Subcycle	Subcycle
Insertion loss	2.5kW	5kW	7.5kW	10kW	15kW	20kW
Audible noise level	<65dB(A)	<65dB(A)	<65dB(A)	<65dB(A)	<65dB(A)	<65dB(A)
Permissible ambient temp	0 to 45ºC	0 to 45ºC	0 to 45ºC	0 to 45ºC	0 to 45ºC	0 to 45ºC
Protection type	IP20	IP20	IP20	IP20	IP20	IP20
Dimensions w x d x h (mm)	600 x 800 x 1200	600 x 1000 x 1800	600 x 1000 x 1800	600 x 1000 x 1800	1200 x 1000 x 1800	1200 x 1000 x 1800

Specifications are subject to change without notice

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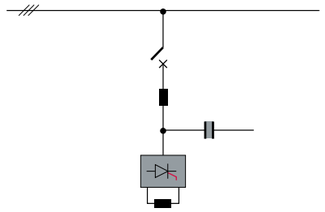
Converter



APR single line diagram

Technical data 5MVAr - 10MVAr

	APR-H05M	*APR-H07M*	*APR-H10M*
Reactive power rating	5MVAr at 22kV, 50Hz	7MVAr at 22kV, 50Hz	10MVAr at 22kV, 50Hz
Rated voltage	22kV	22kV	22kV
Maximum continuous voltage	26.4kV	26.4kV	26.4kV
Voltage operating range	22kV ± 20%	22kV ± 20%	22kV ± 20%
Supply unbalance withstand	2% continuous	2% continuous	2% continuous
Temporary power frequency overvoltage	1.8pu for 3s	1.8pu for 3s	1.8pu for 3s
Power frequency insulation withstand voltage	50kV for 1 min	50kV for 1 min	50kV for 1 min
Impulse withstand voltage	125kVp, 1/50_s (150kVp optional)	125kVp, 1/50_s (150kVp optional)	125kVp, 1/50_s (150kVp optional)
Frequency - operating range	50Hz ± 5Hz	50Hz ± 5Hz	50Hz ± 5Hz
Source impedance - operating range	Not critical	Not critical	Not critical
Current RMS	131A	183A	262A
Short-time current withstand	10kA for 3s	10kA for 3s	10kA for 3s
Overload current 150%	30s	30s	30s
Overload current 120%	10 min.	10 min.	10 min.
Auxiliary voltage supply	240/415V ac and 24 - 125V dc	240/415V ac and 24 - 125V dc	240/415V ac and 24 - 125V dc
THVD*	<1%	<1%	<1%
Reactive compensation	5MVAr leading to 5MVAr lagging	7MVAr leading to 7MVAr lagging	10MVAr leading to 10MVAr lagging
Regulation time constant	Subcycle	Subcycle	Subcycle
Insertion loss	125kW	175kW	250kW
Audible noise level	<70dB(A	<70dB(A	<70dB(A
Permissible ambient temp	-5 to 45ºC	-5 to 45ºC	-5 to 45ºC
Protection type	IP54	IP54	IP54
Dimensions w x d x h (mm)	9000 x 2500 x 2500	10000 x 2500 x 2500	9000 x 5000 x 2500

Specifications are subject to application

Designed and Published by Thycon.

Battery Data Logger
BACS

BACS Active Equalisation and Monitoring System

The THYCON BACS Active Equalisation and Monitoring System represents the next generation of automatic battery logging systems.

Unlike traditional BDLs, the BACS system actively monitors and corrects individual battery block voltages to ensure long term equalisation and charging of the battery bank.

The BACs system utilises individual BACS Measurement and Equalisation modules to monitor and maintain each individual battery.

The system monitors the following parameters:

- Individual Battery Block DC Voltage
- Individual Battery Block Impedance
- Individual Battery Block Temperature
- Individual Battery String Currents
- Room Ambient Temperature

The BACS unique active equalisation capability, matches the impedance of all batteries in the string to maintain perfect charge equalisation and hence avoid battery gassing/drying out due to over-charging or sulphation due to undercharge.

The adjacent chart shows the battery equalisation process after the equalisation feature is turned on.

Depending on the size of the battery, the initial voltage matching may take several hours or days.

The BACS system may be monitored from remote PC using the BACS viewer software, via Modbus, or via a voltage free alarm contact.

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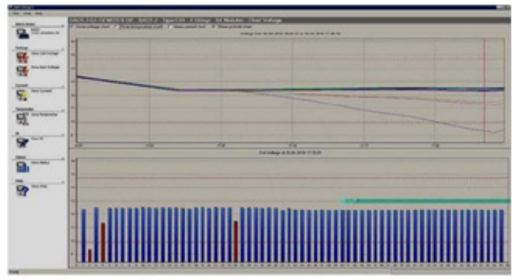
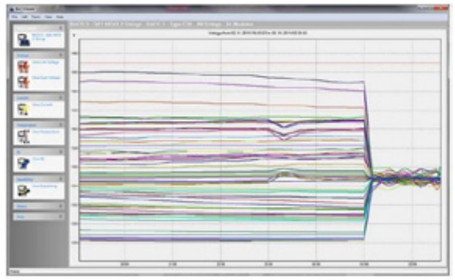




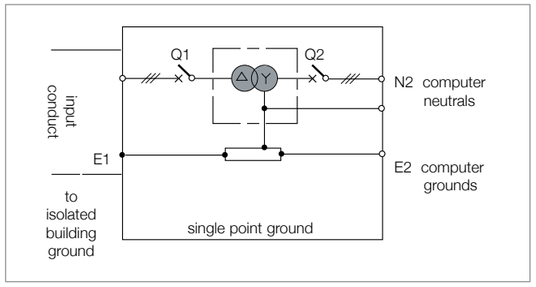
BACS Features

- Patented Equalizing/Balancing Process
- Regulated charging progress
- Measurement and evaluation of battery state of charge
- Single battery monitoring of temperature, internal resistance and voltage from 1.2 V to 16 V
- Simplified optimized maintenance of battery systems through remote monitoring (Charge/ Discharge, battery seperation etc.)
- Complete battery history and praphical analysis of all batteries
- Alert system with integrated web server and alert output contacts
- Signaling corrosion, coating forming and overheating
- Identification; Early warning and automatic reaction on possible Thermal Runaways
- Options: Monitoring room temperature, acid level, hydrogen gas concentration, direct current and voltage meassurement, alternating current, humidity etc.
- SNMP, MODBUS interface, optional BACnet and Profibus
- Prevention of unexpected battery failures
- Avoidance of over/undercharge, sulfation, gas and dehydration
- Extended battery capacity up to 20%
- Extened battery life (up to 50%)
- Manufactured in Germany, Brazil and USA by UL 60950 and CSA Standard

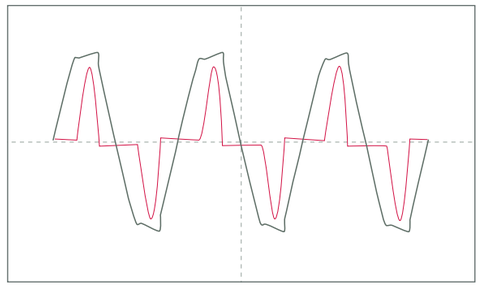
Designed and Published by Thycon.

Triplen Transformers

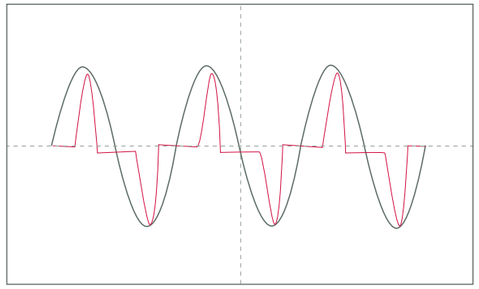
TPL 10 – 1000kVA



Triplen single line diagram



Waveform without the Triplen limiter



Waveform with the Triplen limiter

Concept

The Triplen is a self-contained power conditioning system designed to provide your computer centre with reliable computer grade power, while trapping system harmonic currents that could seriously overload the building cables.

Applications

Thycon Triplen transformers are suitable for applications requiring:

- 3rd harmonic elimination
- isolation
- voltage transformation

Computer grade power

In addition to keeping your building power supply free from damaging harmonic currents, the Triplen restores voltage to computer grade quality, provides galvanic isolation between the building power supply and computers, and blocks RFI, EMI, common-mode noise and spikes.

Single point grounding

Effective grounding of computer equipment is essential in any computer centre in order to ensure operator safety and accurate information processing. A single point is established at installation as a dedicated earth. The neutral may be isolated and earthed separately from the computer cabinet.

Foil wound transformers

Thycon foil wound transformers produce a better power supply quality and better shielding at reduced cost. Transformer dimensions are also reduced because hot spots, common in wire wound transformers, are non-existent with foil. The use of foil also makes vertical clamping of coils unnecessary as axial forces are not present.

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Technical specifications TPL50 - TPL300

	TPL50	*TPL100*	*TPL150*	*TPL200*	*TPL300*
***Input** - three phase, three wire*					
Voltage	415 V	415 V	415 V	415 V	415 V
Voltage tolerance	+10% - 15%	+10% - 15%	+10% - 15%	+10% - 15%	+10% - 15%
Frequency	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%
Phase current	75 A RMS	150 A RMS	225 A RMS	300 A RMS	450 A RMS
Inrush current (maximum)	<150 Apeak	<300 Apeak	<450 Apeak	<600 Apeak	<900 Apeak
***Output** - three phase, four wire*					
Voltage	415/240V	415/240V	415/240V	415/240V	415/240V
Rating	50kVA	100kVA	150kVA	200kVA	300kVA
Phase current	100 A RMS	200 A RMS	300 A RMS	400 A RMS	600 A RMS
Output impedance	<1.5%	<1.5%	<1.5%	<1.5%	<1.5%
Noise attenuation: (electrical at 10kHz)					
Common mode	>55dB	>55dB	>55dB	>55dB	>55dB
Common/transverse mode	>80dB	>80dB	>80dB	>80dB	>80dB
Transient suppression (minimum energy absorption):	200 joules	200 joules	200 joules	200 joules	200 joules
Filters (optional) 5th and 7th harmonic	25A RMS	50A RMS	75A RMS	100A RMS	150A RMS
Ambient audible noise at 1 metre	<60dB	<60dB	<60dB	<60dB	<60dB
Ambient temperature	<35degC	<35degC	<35degC	<35degC	<35degC
***Dimensions** - UPS system* h (mm)	600 x 800 x 1200	600 x 800 x 1200	600 x 800 x 1600	600 x 800 x 1600	600 x 800 x 1600

Specifications are subject to change without notice

Technical specifications TPL400 - TPL800

	TPL400	*TPL500*	*TPL600*	*TPL800*
***Input** - three phase, three wire*				
Voltage	415 V	415 V	415 V	415 V
Voltage tolerance	+10% - 15%	+10% - 15%	+10% - 15%	+10% - 15%
Frequency	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%
Phase current	600 A RMS	750 A RMS	900 A RMS	1200 A RMS
Inrush current (maximum)	<1200 Apeak	<1500 Apeak	<1800 Apeak	<2400 Apeak
***Output** - three phase, four wire*				
Voltage	415/240V	415/240V	415/240V	415/240V
Rating	400kVA	500kVA	600kVA	800kVA
Phase current	800 A RMS	1000 A RMS	1200 A RMS	1600 A RMS
Output impedance	<1.5%	<1.5%	<1.5%	<1.5%
Noise attenuation: (electrical at 10kHz)				
Common mode	>55dB	>55dB	>55dB	>55dB
Common/transverse mode	>80dB	>80dB	>80dB	>80dB
Transient suppression (minimum energy absorption):	200 joules	200 joules	200 joules	200 joules
Filters (optional) 5th and 7th harmonic	200A RMS	250A RMS	300A RMS	400A RMS
Ambient audible noise at 1 metre	<60dB	<60dB	<60dB	<60dB
Ambient temperature	<35degC	<35degC	<35degC	<35degC
***Dimensions** - UPS system* w x d x h (mm)	600 x 800 x 1600	600 x 1000 x 1600	1200 x 800 x 1600	1200 x 800 x 1600

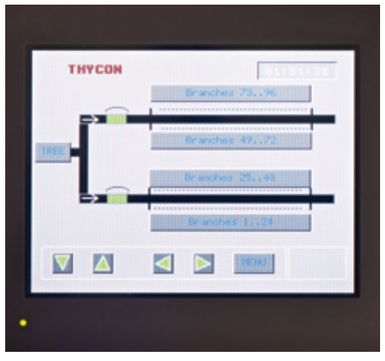
Specifications are subject to change without notice

Designed and Published by Thycon.

Multi Circuit Monitor

10kVA – 1 MVA

Current Monitoring Transducers



Optional Display

Concept

The Thycon Multi Circuit Monitor (MCM) is the ideal product for data centre managers, engineers and operational personnel who are responsible for delivering efficient and reliable power to critical applications.

With the Multi Circuit Monitor (MCM) installed into Power Distribution Units (PDU), data centre operators are able to optimise the critical power infrastructure to meet the demands of continuous availability.

The MCM is flexible in it's implementation by the fact that the circuit monitoring modules, while they are 24 circuit as standard, can be 6 circuit, 12 circuit & 18 circuit if required. As well as being configured to work in any combination of distribution trees available, they can also be placed under computer floors within their own enclosures and connected via cat 5 cable to an Ethernet hub then from there to the Monitoring Module Interface that can be located where required.

Features

The MCM unit measures the PDU voltages and currents and calculates the following parameters:

- L-L RMS voltages
- L-N RMS voltages
- RMS currents
- Peak RMS voltage for each of the 3 L-N phases
- Peak RMS current for each circuit
- P(W) and S(VA) for each circuit
- Demand values kWH and kVAH for each circuit
- THD and harmonics analysis for each circuit and each L-N voltage
- Power factor for each circuit
- Crest factors for L-N voltages and circuit currents

Applications

Ideal for data centres, industrial facilities and IT facilities where monitoring of power distribution is required for:

- allocating energy costs
- tracking power usage
- avoiding outages through proper power monitoring
- optimising existing power infrastructure
- improving efficiency in the distribution of power
- enabling accurate sub-billing of power usage

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Technical data

Metering (per circuit)	*Mains Metering (per phase)*
RMS current	L-L RMS voltages
Maximum current	L-N RMS voltages
THD of current	Maximum L-L RMS voltages
Current harmonics	Minimum L-L RMS voltages
Power factor	Maximum L-N RMS voltages
kW	Minimum L-N RMS voltages
kVA	THD of each L-N
Maximum kW	Harmonics of each L-N
Maximum kVA	Crest factor of each L-N
Demand kWh	Frequency
Demand kVAh	Total kW, kVA
Current crest factor	Total current
Alarms	*Metering Accuracy*
Over current detection	Current : 1% of full scale Voltage : 1% of full scale
Communication	Powder coated steel
MODBUS/TCP protocol over Ethernet	Current to 100A using 100A CT
MODBUS RTU over RS-485	Voltage 90..300 V L-N using appropriate voltage interface

Specifications are subject to change without notice

Designed and Published by Thycon.

Triplen Power Distribution Unit

TPDU 10 – 1600kVA

TPDU 500

Network Server Room

Multi Circuit Monitor Display

Concept

The Thycon Triplen Power Distribution Unit (TPDU) is designed to correct any third harmonic content on the current waveform while providing electrical isolation, voltage transformation and extensive monitoring of the load.

TPDU Features and benefits

- 24/7 detailed monitoring of individual branch circuits
- treading and load profiling for effective management and planning
- local and remote monitoring
- optimised power utilisation
- optimised availability
- 3rd harmonic elimination
- single point grounding
- Australian made

Principle of operation

The Triplen PDU is a self-contained power conditioning system that provides reliable computer grade power and single point grounding, while simultaneously trapping system harmonic currents and providing extensive monitoring of the load.

Harmonic currents are produced by any non-linear load, and especially by switch-mode power supplies as are used in computers. These currents add arithmetically in the neutral cable of the building power supply to 240% or more of the rated phase-current value. The neutral cable is frequently rated to the same value as the phase cables at best, and as the cable losses are proportional to the square of the current, the additional losses in the neutral conductor can be five times greater than the conductor rating. Since neutral cables are not normally fused or otherwise protected against overloads, thermal cable destruction and electrical fire can result.

On a balanced three-phase system, the Triplen PDU harmonic current limiter reduces the third harmonic currents (which typically constitute 80% of the total content) and consequently the neutral currents to near zero. The removal of the third harmonic current means that all other harmonic currents that are a multiple of three are also cancelled.

Other generated harmonics are many times smaller than the third and can frequently be disregarded. Optional filters, or a Thycon APR, can be fitted to the Triplen PDU to reduce these harmonics if required.

In addition to the elimination of harmonics, the Triplen PDU restores voltage to computer grade quality, provides galvanic isolation between the building power supply and computers and blocks RFI, EMI, common-mode noise and spikes.

The Triplen PDU monitors the 3-phase supply voltage and each of the individual output branch line currents.

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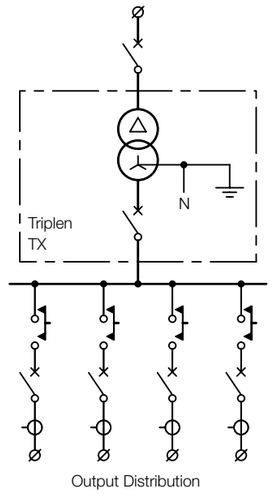

Output Distribution

The following parameters are available via the Multi Circuit Monitor and the high level interface:

Instantaneous values

- Voltages (L-L and L-N)
- Line current
- Real power (1 and 3-phase as appropriate)
- Apparent power (1 and 3-phase as appropriate)
- Power factor, including lead/lag indication
- Voltage distortion (both THD and individual harmonics to the 25th harmonic)
- Current distortion (both THD and individual harmonics to the 25th harmonic)

Peak demand values

- Voltages (L-L and L-N)
- Line current
- Real power (1 and 3-phase as appropriate)
- Apparent power (1 and 3-phase as appropriate)

Energy values

- kWh
- kVAh

	TPDU400	***TPDU500***	***TPDU600***	***TPDU800***
Input - *three phase, three wire*				
Voltage	415 V	415 V	415 V	415 V
Voltage tolerance	+10% - 15%	+10% - 15%	+10% - 15%	+10% - 15%
Frequency	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%
Phase current	600 A RMS	750 A RMS	900 A RMS	1200 A RMS
Inrush current (maximum)	<1200 Apeak	<1500 Apeak	<1800 Apeak	<2400 Apeak
Output - *three phase, four wire*				
Voltage	415/240V	415/240V	415/240V	415/240V
Rating	400kVA	500kVA	600kVA	800kVA
Phase current	800 A RMS	1000 A RMS	1200 A RMS	1600 A RMS
Output impedance	<1.5%	<1.5%	<1.5%	<1.5%
Noise attenuation:				
(electrical at 10kHz)				
Common mode	>55dB	>55dB	>55dB	>55dB
Common/transverse mode	>80dB	>80dB	>80dB	>80dB
Transient suppression	200 joules	200 joules	200 joules	200 joules
(minimum energy absorption):				
Filters (optional)	200A RMS	250A RMS	300A RMS	400A RMS
5th and 7th harmonic				
Ambient audible noise at 1 metre	<60dB	<60dB	<60dB	<60dB
Ambient temperature	<35degC	<35degC	<35degC	<35degC
Dimensions				
w x d x h (mm)	1200 x 1000 x 1800	1200 x 1000 x 1800	1400 x 1000 x 1800	1400 x 1000 x 1800

Specifications are subject to change without notice

Designed and Published by Thycon.

MAG

Dry-type Power Transformers and Reactors

2.5MVA power transformer installation

Thycon Transformers

Thycon manufacture a wide range of transformers including:

- auto-transformers
- tap-changers
- phase-shifters
- “triplen” attenuators

Thycon transformers may be used in a variety of applications including:

- rectifiers
- traction sub-stations
- metal-refining
- motor drives

Thycon Reactors

Thycon reactors are available for:

- VAR compensation
- filters and de-tuning
- notch and THD reduction
- arc suppression
- DC smoothing
- fault and di/dt limitation
- EMC (differential and common mode).

Thycon exploits two basic technologies for magnetic components:

- cast resin (CR)
- vacuum/pressure impregnation (VPI)

Cast Resin type

Cast Resin magnetics are virtually maintenance-free. The coils are embedded in resin which is vacuum cast in a cylindrical shape to accommodate the radial forces during short-circuits, thus ensuring the highest surge withstand capability. The low voltage winding is not normally cast resin but is wound in a preimpregnated insulating material and coated in the same resin.

The windings can be made from copper or aluminium, though aluminium is typically preferred in resin casts for having a thermal expansion coefficient closer to that of the resin to avoid the long-term appearance of surface cracks in the casting.

The LV winding is wound using foil which allows a uniform temperature distribution across the winding whereas the HV winding may be either foil or wire, depending on voltage, and is positioned on the outside around the LV winding, away from the core.

Vacuum Pressure Impregnated (VPI) types

This technique applies the varnish coating in alternating cycles of pressure and vacuum. The VPI process uses polyester resin which is then oven-cured. This process allows better penetration of the varnish into the coils offering increased resistance to corona discharge. The absence of a resin cast makes them easier to cool and allows a higher level of temperature excursions for cyclic loads.

Thycon VPI transformers use NOMEX® paper insulation on both the primary and secondary coils which gives our transformer’s a V0 rating. Additionally, our transformers are rated at thermal index class R, allowing a withstand temperature of 220°C (though the transformers themselves are rated to 180°C).

THYCON

Bifilar transformer foil and strip winding machine

Magnetic Cores

High permeability grain-oriented silicon steel is used as standard for most line-frequency power transformers but specialty steels are used in particular cases, especially where the capitalised cost of no-load loss is high or the frequency is high (e.g. 400Hz applications for the aeronautic industry).

Both UNICORE and stamped sheet core techniques are used depending on the size and application and these are individually coated with high temperature inorganic insulating material.

Specialty Magnetics

These are manufactured with the same technologies already outlined for standard products but may be custom-made for particular applications. Examples of this are five-limb transformers which may be specially made for reduced height and/or low zero-sequence impedances. “Triplen transformers” are a typical example.

General Specifications

- From 50kVA to 10 MVA
- Primary and secondary voltages up to 35kV
- Environmental temperature from -60 to +55°C
- Relative humidity (highest value) at environmental temperature +35ºC: up to 93%.

Standards

All Thycon magnetic components are designed and manufactured to:

- IEC 60076
- EN 50541-1
- IEC 61378-1
- ISO 9001:2008
- ISO 14001:2004

They meet the following application classes:

- Fire behaviour F1
- Environmental class E2
- Climatic class C2
- Partial discharge is less than 10 pC
- IP21 (other IP ratings on request)

Accessories

Thycon transformers and reactors may be supplied alone or in galvanised steel or stainless-steel cubicles.

Common options include:

- forced ventilation,
- circuit breakers or fuses,
- temperature sensors,
- tap changers,
- vibration dampers

Thycon transformers may be supplied as part of an integrated assembly including power electronic equipment such as VAR compensation and voltage regulation.

Designed and Published by Thycon.

High Current Rectifier

HCR 5kA – 50kA

3 phase 5MVA thyristor converter

5MVA thyristor converter arm

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%

Thycon HCR are available as full bridges or double half-bridges (6-pulse) and as variants of both in 12, 24 and 48-pulse arrangements.

High pulse-count systems are generally used for the largest HCRs and half-wave configurations are reserved for low-voltages and high currents because of the low voltage drops that these arrangements allow.

LCRs are typically proposed as naturally air-cooled, fuseless types because of their extremely low maintenance needs, making them ideally suited for use in remote locations. Higher currents inevitably need more cooling and then either forced air or water-cooling is employed and the higher fault levels encountered in HCR installations make fusing necessary.

Type	Range	Characteristics
Low Current (LCR)	< 25 kA	Natural or forced air-cooled, fuseless, 3" thyristors
Medium Current (MCR)	25 – 100 kA	Forced air or water-cooled, fused, 3 or 4" thyristors
High Current (HCR)	100 – 400 kA	Water cooled, fused, 4" thyristors, parallel-connected rectifiers in multi-pulse configurations

THYCON

Specifications

	LCRs:	MCRs:
General Data		
Power (MW)	0.5, 1, 2, 4	3, 6, 12, 25
Input voltage (VRMS)	220, 380, 400, 415	400, 480, 560
Input frequency (Hz)	50/60Hz	50/60Hz
Output (VDC)	up to 15kA at up to 50V up to 8kA at up to 500V	up to 100kA at up to 250V up to 30kA at up to 800V
Control	0 to 100% of I_n or U_n	0 to 100% of I_n or V_n
Ripple (% of I_n)	< 5	< 5
Pulses	6 or 12	6 or 12
Efficiency (%)	> 98	> 98
Environmental, Housing and cooling		
Temperature (°C)	-10 to 40	-10 to 40 (air) or +2 to 40 (water)
Humidity	max. 90%	max. 90%
Altitude	max. 1000m above sea level	max. 1000m above sea level
Enclosure	IP20	IP20 (air-cooled), IP54 (water-cooled)
Cooling	natural convection or forced air	forced air or water
Control	Thycon digital controller	Thycon digital controller
Standards	IEC146	IEC146
Monitoring and Control		
Meters	Analogue Current/Voltage	Analogue Current/Voltage
LED indicators	Ready, On, Off, Trip, Alarm	Ready, On, Off, Trip, Alarm
Switches	On/Off, Reset, Emergency Stop	On/Off, Reset, Emergency Stop
Control	I_{REF} or V_{REF}	I_{REF} or V_{REF}
Panels	Local Operator Panel	Local Operator Panel
Control accuracy (current) (%)	± 1	± 1
Dynamic response (ms)	< 20	< 20
Dimensions		
Depth (mm)	1000	1000
Height (mm)	1800	1800
Width (mm)	1200 (0.5MW), 1800 (1MW), 2400 (2MW), 3600 (4MW)	2700 (3MW), 4000 (6MW), 6000 (12MW), 9000 (25MW)

Specifications are subject to change without notice

Designed and Published by Thycon.

Static Frequency Converter

SFC 10kVA–10 MVA

Concept

Thycon Static Frequency Converters (SFC) convert supply frequency to load requirement frequency. Typical applications are 50 to 60Hz conversion for naval and 50 to 400Hz conversion for aviation applications, although conversion from and to any frequency are available on request.

Applications

Typical SFC industry applications include:

- aviation industry
- computer installations
- communications
- military installations
- dockyards

Principle of operation

Thycon SFC use double conversion methods. A rectifier converts the input frequency to DC and an inverter converts the DC to the required output frequency. Capacitors or a battery bank can be connected to the DC to achieve availability of power during short or long-term supply disturbances. Thycon's Static Flywheel Technology achieves high current capacity, storage efficiency and reliability with lower mean time to repair and running costs than traditional rotary technology.

Thycon SFCs meet MIL-STD-704E, MIL-STD-461D and AS wiring rules

Installation and testing

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

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

THYCON

Technical specifications 90kVA - 200kVA

	SFC-90	*SFC-120*	*SFC-150*	*SFC-200*
***Input** - three phase, three wire & ground*	***90kVA***	***120kVA***	***150kVA***	***200kVA***
Voltage	415 VAC	415 VAC	415 VAC	415 VAC
Voltage tolerance	+10% - 15%	+10% - 15%	+10% - 15%	+10% - 15%
Phases	3 + neutral	3 + neutral	3 + neutral	3 + neutral
Power walk-in	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%
***Output** - three phase, four wire*	15s	15s	15s	15s
System rating	90kVA / 72kW	120kVA / 96kW	150kVA / 120kW	200kVA / 160kW
Power factor range (within rated kW)	0.7 lag to 0.8 lead	0.7 lag to 0.8 lead	0.7 lag to 0.8 lead	0.7 lag to 0.8 lead
Overload capacity 125% / 150%	12min. / 2min.	12min. / 2min.	12min. / 2min.	12min. / 2min.
Voltage	415V / 240VAC	415V / 240VAC	415V / 240VAC	415V / 240VAC
Voltage regulation: Balanced load 100% unbalanced load	± 1% ± 3%	± 1% ± 3%	± 1% ± 3%	± 1% ± 3%
Voltage adjustment	± 5%	± 5%	± 5%	± 5%
Voltage transient performance:				
50% full load step	± 5%	± 5%	± 5%	± 5%
Maximum recovery time	20ms	20ms	20ms	20ms
Phase displacement:				
Balanced load	120° ± 1°	120° ± 1°	120° ± 1°	120° ± 1°
100% unbalanced load	120° ± 3°	120° ± 3°	120° ± 3°	120° ± 3°
Frequency	60Hz / 400Hz	60Hz / 400Hz	60Hz / 400Hz	60Hz / 400Hz
Frequency regulation	± 0.1%	± 0.1%	± 0.1%	± 0.1%
Frequency tracking rate	10Hz / s	10Hz / s	10Hz / s	10Hz / s
THD	<4% non-linear loads	<4% non-linear loads	<4% non-linear loads	<4% non-linear loads
Efficiency	89%	90%	91%	92%
Environmental				
Ambient temperature range	0 to 40ºC	0 to 40ºC	0 to 40ºC	0 to 40ºC
Heat dissipation at full load	10 kW	12 kW	14 kW	18 kW
Audible noise at 2 metres	<70 dBA	<70 dBA	<70 dBA	<70 dBA
Dimensions w x d x h (mm) 60Hz w x d x h (mm) 400Hz	 600 x 1000 x 2000 600 x 1000 x 2000	 1200 x 1000 x 2000 1200 x 1000 x 2000	 1200 x 1000 x 2000 1200 x 1000 x 2000	 1800 x 1000 x 2000 1800 x 1000 x 2000

Specifications are subject to change without notice

Designed and Published by Thycon.

Technical specifications 300kVA - 600kVA

	SFC-300	*SFC-400*	*SFC-500*	*SFC-600*
***Input** - three phase, three wire & ground*	***300kVA***	***400kVA***	***500kVA***	***600kVA***
Voltage	415 VAC	415 VAC	415 VAC	415 VAC
Voltage tolerance	+10% - 15%	+10% - 15%	+10% - 15%	+10% - 15%
Phases	3 + neutral	3 + neutral	3 + neutral	3 + neutral
Power walk-in	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%
***Output** - three phase, four wire*	15s	15s	15s	15s
System rating	300kVA / 240kW	400kVA / 320kW	500kVA / 400kW	600kVA / 480kW
Power factor range (within rated kW)	0.7 lag to 0.8 lead	0.7 lag to 0.8 lead	0.7 lag to 0.8 lead	0.7 lag to 0.8 lead
Overload capacity 125% / 150%	12min. / 2min.	12min. / 2min.	12min. / 2min.	12min. / 2min.
Voltage	415V / 240VAC	415V / 240VAC	415V / 240VAC	415V / 240VAC
Voltage regulation: Balanced load 100% unbalanced load	± 1% ± 3%	± 1% ± 3%	± 1% ± 3%	± 1% ± 3%
Voltage adjustment	± 5%	± 5%	± 5%	± 5%
Voltage transient performance:				
50% full load step	± 5%	± 5%	± 5%	± 5%
Maximum recovery time	20ms	20ms	20ms	20ms
Phase displacement:				
Balanced load	120º ± 1º	120º ± 1º	120º ± 1º	120º ± 1º
100% unbalanced load	120º ± 3º	120º ± 3º	120º ± 3º	120º ± 3º
Frequency	60Hz / 400Hz	60Hz / 400Hz	60Hz / 400Hz	60Hz / 400Hz
Frequency regulation	± 0.1%	± 0.1%	± 0.1%	± 0.1%
Frequency tracking rate	10Hz / s	10Hz / s	10Hz / s	10Hz / s
THD	<4% non-linear loads	<4% non-linear loads	<4% non-linear loads	<4% non-linear loads
Efficiency	92.5%	93%	94%	94%
Environmental				
Ambient temperature range	0 to 40ºC	0 to 40ºC	0 to 40ºC	0 to 40ºC
Heat dissipation at full load	24 kW	26 kW	28 kW	35 kW
Audible noise at 2 metres	<70 dBA	<70 dBA	<70 dBA	<70 dBA
Dimensions				
w x d x h (mm) 60Hz	1800 x 1000 x 2000	2400 x 1000 x 2000	2400 x 1000 x 2000	3000 x 1000 x 2000
w x d x h (mm) 400Hz	1800 x 1000 x 2000	2400 x 1000 x 2000	2400 x 1000 x 2000	2400 x 1000 x 2000

Specifications are subject to change without notice

THYCON

Technical specifications 800kVA - 1600kVA

	SFC-800	*SFC-1200*	*SFC-1600*
***Input** - three phase, three wire & ground*	***800kVA***	***1200kVA***	***1600kVA***
Voltage	415 VAC	415 VAC	415 VAC
Voltage tolerance	+10% - 15%	+10% - 15%	+10% - 15%
Phases	3 + neutral	3 + neutral	3 + neutral
Power walk-in	50 Hz ± 5%	50 Hz ± 5%	50 Hz ± 5%
***Output** - three phase, four wire*	15s	15s	15s
System rating	800kVA / 640kW	1200kVA / 960kW	1600kVA / 1280kW
Power factor range (within rated kW)	0.7 lag to 0.8 lead	0.7 lag to 0.8 lead	0.7 lag to 0.8 lead
Overload capacity 125% / 150%	12min. / 2min.	12min. / 2min.	12min. / 2min.
Voltage	415V / 240VAC	415V / 240VAC	415V / 240VAC
Voltage regulation: Balanced load 100% unbalanced load	± 1% ± 3%	± 1% ± 3%	± 1% ± 3%
Voltage adjustment	± 5%	± 5%	± 5%
Voltage transient performance:			
50% full load step	± 5%	± 5%	± 5%
Maximum recovery time	20ms	20ms	20ms
Phase displacement:			
Balanced load	120º ± 1º	120º ± 1º	120º ± 1º
100% unbalanced load	120º ± 3º	120º ± 3º	120º ± 3º
Frequency	60Hz / 400Hz	60Hz / 400Hz	60Hz / 400Hz
Frequency regulation	± 0.1%	± 0.1%	± 0.1%
Frequency tracking rate	10Hz / s	10Hz / s	10Hz / s
THD	<4% non-linear loads	<4% non-linear loads	<4% non-linear loads
Efficiency	94.5%	95%	95%
Environmental			
Ambient temperature range	0 to 40ºC	0 to 40ºC	0 to 40ºC
Heat dissipation at full load	40 kW	55 kW	72 kW
Audible noise at 2 metres	<70 dBA	<70 dBA	<70 dBA
Dimensions			
w x d x h (mm) 60Hz	3600 x 1000 x 2000	4200 x 1000 x 2000	4800 x 1000 x 2000
w x d x h (mm) 400Hz	3000 x 1000 x 2000	3600 x 1000 x 2000	4200 x 1000 x 2000

Specifications are subject to change without notice

Designed and Published by Thycon.

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.

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.

THYCON

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:	-40ºC to +55ºC							
Operational humidity:	Up to 95%							
Altitude:	0 to 2000 meters above sea level							
Rating kW:	3	5	7.5	10	15	20	25	30
Dimensions:								
Height (mm):	(1400)							
Width (mm):	(520)							
Depth (mm):	(800)							

- Mechanical dimensions have been standardized. Other dimensions on request.
- 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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High Speed Electronic Fuse

HSEF 600–4000A

Introduction

The Thycon High Speed Electronic Fuse is a fast-acting fail-safe fuse which allows the speed of a fuse to be greatly increased while avoiding the usual aging problems of fuses.

The fuse is the only truly fail-safe over-current protection system since all other interruption methods require detection and triggering; functions which, whether, electrical, electronic, thermal, magnetic, mechanical or pyrotechnic, have a non-zero probability of failure.

The fuse however has a serious limitation which is that, for it to be able to rupture quickly, it must be close to failure in normal operation or the difference between its continuous current and that of its rupture current will be too large resulting in high levels of I2t let-through, large fault currents and long clearing times. There are two techniques available for circumventing this limitation:

A. A fuse with a low current-carrying capacity is by-passed by a mechanical breaker which handles rated current and normal overloads. When a fault is detected, the mechanical breaker is blown-open by a pyrotechnic charge and the current diverted to the fuse which rapidly melts, creating an arc and limiting the current. To reset the interrupter, both the fuse and the pyrotechnic charge are replaced. This type is known as the ABB IS-limiter.

B . A fuse with a high current carrying capacity carries the rated current and normal overloads. When a fault is detected, a current pulse is added to the fuse from a discharge circuit which causes the fuse to see far more current than the fault represents at the instant of detection, thus rupturing the fuse long before the prospective current can be reached. The fuse is then replaced. This is known as the THYCON HSEF.

The advantage of the THYCON HSEF is that, necessarily, a fuse is always present and in the event of a failure of the detection or trigger function, interruption will occur, albeit at a higher fault level than normal, in stark contrast to the pyrotechnic approach where there will be no fault protection in the event of a malfunction of the control system.

The use of a fuse inevitably means that both of these systems are non-resetting.

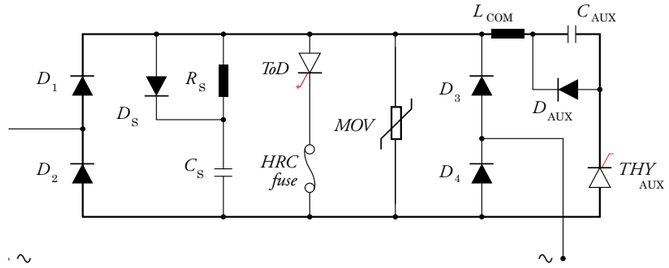

Fig. 3 – Combined THYCON SSB and HSEF

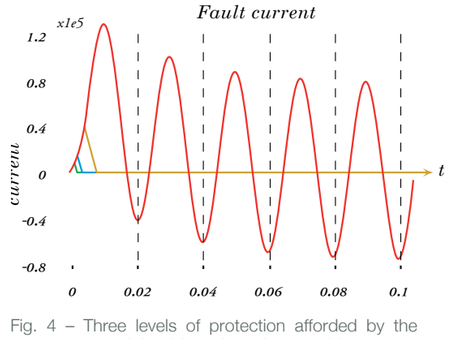

Fig. 4 – Three levels of protection afforded by the combined THYCON SSB/HSEF. Green = SSB; Blue = HSEF; Orange = Fuse alone; Red = 100ms mechanical breaker.

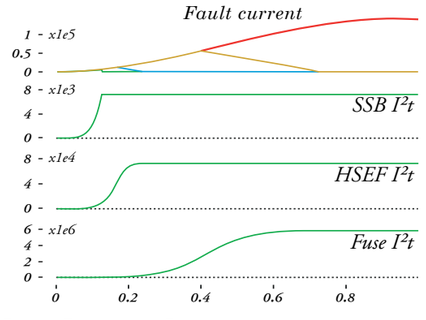

Fig. 5 – Expansion of Fig. 4 and I2t let-through values.

	I²t Let - through (A²s)	
	Up to peak current	Total Let through
SSB	6,730	7,140
HSEF	51,580	73,650
Fuse	2,700,000	6,000,000

Relevant Standards

All THYCON breaker and limiters are designed and perform in conformance with AS 60269.1 2005 for Low Voltage Fuses, AS 60947.1—2004 for low-voltage switchgear and control-gear, with IEC 60071-1 for dielectric tests, AC withstand voltages and lightning impulses.

Summary and Conclusions

The THYCON HSEF is specifically designed for fast failsafe protection in LV networks. Unlike the pyrotechnic types, the THYCON system has no moving parts and relies on the same fusible element for failsafe back-up. Pyrotechnology may have advantages at high voltage because of the cost of employing seriesed semiconductor stacks at many kilovolts but at LV, electronic controls are faster, more precise and more cost-effective and there is no explosive cartridge to replace after each event.

Furthermore, the THYCON HSEF has the unique advantage of being readily combined with THYCON SSB technology, allowing very fast, resettable protection with two levels of contingency.

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Fault Current Limiter

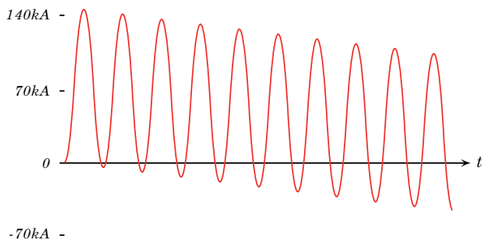

Fig. 1 – 50kARMS fault occurring at zero volts such that the 71kA peak also has a 71kA exponential offset, resulting in an initial 142kA peak

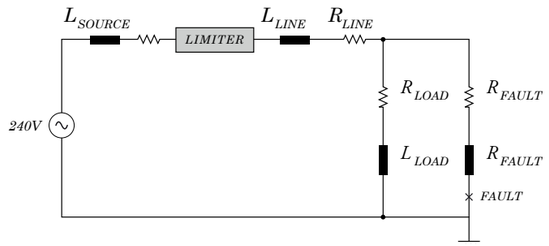

Fig. 2 – A limiter in its environment

Introduction

There are many forms of electrical circuit protection including breakers and fuses but one attractive approach is limitation. Limitation, as opposed to breaking, involves the spontaneous increase of a pre-existing but negligible impedance which immediately limits the fault current to a defined and innocuous level. This can be achieved instantaneously with no delay, in contrast to breakers which have limited response times during which time the fault current may increase to the full value of the Prospective Asymmetric Peak. Breakers, when correctly designed and installed, will ultimately clear these currents but the faulted circuits and any included switch gear will inevitably be exposed to the fault current prior to opening and clearing. Fig. 1 illustrates this for a 50kARMS fault with a 142kA peak.

Operation of the TFCL

Under normal conditions, the TFCL allows the load current to pass from the supply to the load unhindered. Under fault current conditions, when the AC current increases in magnitude beyond full load conditions. The FCL begins to act as a high impedance such that the peak asymetric pulse is completely eliminated and the steady-state RMS current value is below the prospective RMS value.

The TFCL allows design flexibility and can be adapted to meet different application requirements. In particular, the initial peak current, the steady state current, as well as the time taken to reach these two values, are design variables.

Benefits of the TFCL:

- Elimination of the peak asymmetric fault current, similar to Solid State Breakers
- Fast response of SSB but at much lower cost
- Limitation of let-through energy (similar to fuse)
- Self-limiting: no detection or control circuitry required
- System is based only on passive and non-active components
- Suitable for both LV and MV as well as single or three phase networks
- Protection can be co-ordinated with existing or supplemental breakers
- Optional “self test” functionality

Application Areas

The general area of application is that of fast fault limitation where breakers are already installed but unable to intervene with sufficient speed.

These situations occur where existing installations are retro fitted with additional energy resources as can be the case of co-generation or “renewables”. An example of such a retrofit is shown in Fig. 4.

In Fig. 4, an existing grid (shown in black) is protected by a breaker designed originally to protect the distribution switchboard from bolted shorts of amplitude VGRID/(ZGRID). The addition of a co-generation plant (shown in blue) will add a prospective fault current of VGEN/(ZGEN) which will exceed the allowable fault rating of the switchboard. A TFCL is therefore added in series with the co-generator to eliminate the asymmetric peak of Fig. 3, thus preserving the existing switchboard installation without any modifications

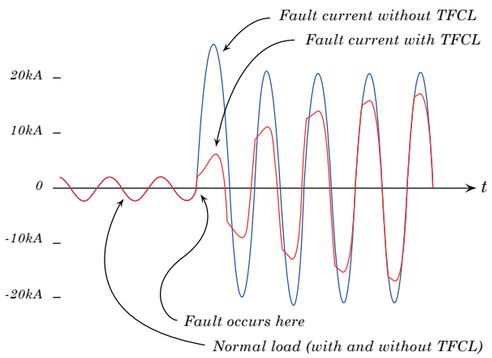

Fig. 3 – Fault currents with TFCL (red) and without (blue) in a faulted 50Hz network (10kA/div)

This situation is common in any distribution grid because protection must be tightly co-ordinated with the network’s prospective faults to ensure rapid response of mechanical breakers. Any subsequent power capacity added to the grid upsets this co-ordination.

These problems can be solved by the introduction of Solid State Breakers (SSBs) which react within microseconds and allow additional generating capacity to be added with impunity. However, such installations are resettable but costly.

Fuses, though clearing more quickly than mechanical breakers are, of course, not resettable and will not usually limit the asymmetric peak.

In cases where SSBs were deemed too costly, the fall-back solution frequently became the insertion of current limiting chokes which might, in turn, necessitate power factor correction. The TFCL allows the addition of power capacity without any changes to the existing installation and without the cost of sophisticated electronic breakers.

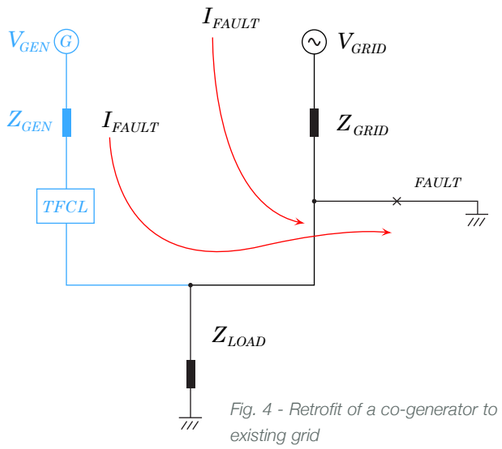

Fig. 4 - Retrofit of a co-generator to an existing grid

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Solar Power Inverter

SPI 100 – 1600kVA

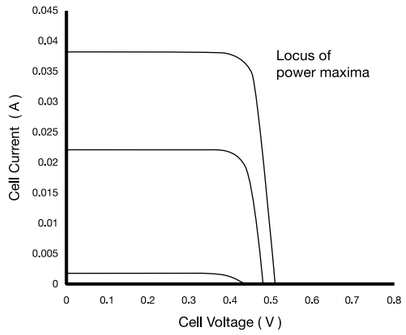

Fig. 1 – Thycon MPPT

Introduction

As a pioneer in photovoltaic, Thycon aims to provide institutional owners of solar power plants with optimal yields and seamless supply to the public grid with maximized profitability thanks to its low-loss solar inverter, maximal power-point tracking and peak power support (peak power booster).

Inverter Technology

Whereas many inverter manufacturers rely on the conventional voltage source inverter (VSI) for transforming the PV panel's DC output to AC power for the grid, the, Thycon Solar Power Inverter (SPI) uses its patented current-source technology (CSI). VSIs need to operate at a DC voltage high enough to drive power into the AG grid, which in low-sunshine, is not always possible. To overcome this, VSIs use an additional converter or "boost chopper" to raise the PV output to a suitable level, thus necessitating at least two conversion stages, which is not required with the current source systems; eliminating one power conversion stage reduces losses and increases reliability.

Thycon's world-leading Static Flywheel Technology provides an efficient and robust Inverter power solution. Our system approach highlights high fault current clearing capacity, efficiency, reliability and low mean time to repair. Combining our proprietary technology with the high efficiency switching means of our converters ensures very low harmonic voltage distortion, current distortion and power loss.

Maximum Power Point Tracking

PV cells have a single operating point where the values of the current (I) and Voltage (V) of the cell result in a maximum power output. A PV cell has an exponential relationship between current and voltage, and the maximum power point (MPP) occurs at the knee of the curve (Fig. 1). The Thycon MPP trackers utilises a patented algorithm to search for this point and thus to allow the converter circuit to extract the maximum power available from the cells.

When used in combination with the Peak Lopping Inverter (PLI), the MPPT manages the inverter to supply to the grid, the maximal desired/allowed power, while diverting any surplus energy to an energy storage system, where allowed.

Power Limiter

The solar inverters have a programmable power limit adjustable from 0 to 100%. The operator can determine the absolute maximal power that an array can supply (to the inverter's maximal rating).

Power Factor Control

For enhanced grid stability, the Thycon Solar Inverter can supply leading or lagging power.

THYCON

Peak Regulation

Used in combination with a Peak Lopping Inverter (PLI), power demands which exceed the available solar power, can be met from an energy storage system (usually batteries) to support the grid in riding-through a potential voltage sag, thus stiffening the network and maintaining the solar arrays connected to the grid as instantly available once the peak has passed. This (optional) technology also allows the solar farm to operate seamlessly during short cloud-cover conditions, avoiding the crash starting of stand-by generators for transient "PV dips".

SPI Solar Power Inverter

AC Output	*SLI-140*	*SPI-280*	*SPI-320*	*SPI-560*
Nominal power	140kW	280kW	320kW	560kW
Operating voltage - VAC	240/415VAC	240/415VAC	240/415VAC	240/415VAC
Voltage range - deltaV	-10% +10%	-10% +10%	-10% +10%	-10% +10%
Operating frequency - Hz	50Hz	50Hz	50Hz	50Hz
Frequency range - delta Hz	+/- 5Hz	+/- 5Hz	+/- 5Hz	+/- 5Hz
Power factor	0.99	0.99	0.99	0.99
THD of output current	<5%	<5%	<5%	<5%
DC voltage range	300/600VDC	300/600VDC	300/600VDC	300/600VDC
Efficiency Euro / Peak	95.5 / 98.1%	96.4 / 98.5%	96.6 / 98.6%	96.9 / 98.7%
Cooling	Fan forced	Fan forced	Fan forced	Fan forced
Ambient temp range	-20 deg C. + 50 deg C	-20 deg C. + 50 deg C	-20 deg C. + 50 deg C	-20 deg C. + 50 deg C
Relative humidity (non-condensing)-RH	95%	95%	95%	95%
Enclosure IP rating (indoor/outdoor)-IP	IP 20/55	IP 20/55	IP 20/55	IP 20/55
Enclosed material	Powder coated steel	Powder coated steel	Powder coated steel	Powder coated steel
Dimensions w x h x 1800	600x1000	1200x1000	1200x1000	1800x1000

Specifications are subject to change without notice

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Peak Lopping Inverters

PLI 100–1600kVA

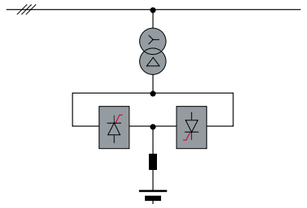

Fig. 1 – Thycon peak lopping system

Concept

"Peak Lopping", "Peak Shaving" or "Load Shifting" are terms used to describe electric power management systems which "lop off" the top of a user's exceptional peak power consumption curve, either by restricting the amount of power he uses or by supplying the peak requirements from an alternate source.

Domestically, peak lopping refers to the first approach where non-critical loads are shed or delayed (dish washers, washing machines) to prioritise the consumers' preferences (lighting, heating, cooking).

Industrially, peak-shaving invariably refers to the provision of an alternate power source of which there are many choices, depending on the application, as described.

In either case, the motivation for this kind of equipment is either economical (the utility penalises consumers who exceed a given rating – sometimes by charging up to 100 times more per kWh) or practical, the normal supply simply cannot provide more power. A special case of the latter can be found in solar farms not connected to a power grid such that each passing cloud might necessitate the (brief) activation of an alternate source (e.g. a diesel generator-set).

In general terms, whatever the motivation for peak "lopping" or "shaving", the technology falls into the category of power regulation in networks increasingly supplied by intermittent resources such as wind and solar power.

The principle of Thycon power electronics for peak lopping is illustrated in Fig. 1. The battery is the usual storage system but alternatives are also possible. Unlike an Uninterruptible Power Supply (UPS), the full power does not flow through the system but directly to the intended load. The Peak Lopper operates in parallel and assists the source when the demand exceeds its capacity.

Typical Energy Storage System

Two or more approaches, generally combined, may be used for the alternate source(s): the storage of electrical energy from the prime supply (e.g. Utility, Solar Panel) and the independent generation of power from a tenable (stored) resource (e.g. diesel). The Power Management System oversees the requirements and switches the alternate sources in and out according to availability and economics.

The economics are partly determined by the nature of the alternate source: where this, typically, is a diesel engine, it is undesirable to make frequent and rapid starts as the life expectancy and service requirements of such machines depends on the number of cold starts that they make, so the activation of stand-by generators is always avoided for short peak requirements which are best met by battery or other energy storage systems and offer the added advantage that they can "start" within milliseconds as opposed to the tens of seconds required to bring a diesel engine or gas turbine up to operating speed. The generator set is thus used for long-duration power peaks or overloads, while the battery system provides short-duration peaks and avoids the more cumbersome starting of the generator sets, except when really needed.

Batteries

The most common tenable electric energy is secondary cell storage. Common battery technologies include lead-Acid, Nickel-Cadmium, Sulphur-Sodium, Lithium Ion and Vanadium Redox. Such systems cover a wide range of possible powers from a few hundred kilowatts up to 40MW or more, for periods of up to 15 minutes. Longer periods at lower powers are always possible but the 15 minute reference is based on the assumption that peak or "over" loads cannot last longer than this (or they can no longer be considered "exceptional").

The choice of battery depends on usage: discharge depth, number of cycles, ambient temperature, peak power/duration and allowable recharge time. All these parameters will affect the choice of battery and in particular, its life expectancy which can lie between 3 and 15 years for lead-acid types. Limiting the discharge depth greatly extends battery life but also increases the capital costs as the depth is a function of nominal capacity. The application therefore needs to be clearly specified by the prospective user to ensure an optimal service life for given battery capacity.

PLI Peak Lopping Inverter

AC Output	***PLI-400***	***PLI-800***	***PLI-1200***	***PLI-1600***
Nominal power	400kW	800kW	1200kW	1600kW
Operating voltage - VAC	240/415VAC	240/415VAC	240/415VAC	240/415VAC
Voltage range - deltaV	-10% +10%	-10% +10%	-10% +10%	-10% +10%
Operating frequency - Hz	50Hz	50Hz	50Hz	50Hz
Frequency range - delta Hz	+/- 3Hz	+/- 3Hz	+/- 3Hz	+/- 3Hz
Power factor	0.99	0.99	0.99	0.99
THD of output current	<5%	<5%	<5%	<5%
DC voltage range	477VDC	477VDC	477VDC	477VDC
Efficiency	97.50%	97.50%	98%	98%
Cooling	Fan forced	Fan forced	Fan forced	Fan forced
Ambient temp range	+50 deg C	+50 deg C	+50 deg C	+50 deg C
Relative humidity (non-condensing)-RH	95%	95%	95%	95%
Enclosure IP rating (indoor/outdoor)-IP	IP 20/55	IP 20/55	IP 20/55	IP 20/55
Enclosed material	Powder coated steel	Powder coated steel	Powder coated steel	Powder coated steel
Dimensions w x h x 1800	1200x1000	1800x1000	2400x1000	2400x1000

Specifications are subject to change without notice

Designed and Published by Thycon.

Micro Grids

50kW – 10MW

Solar-farms in Micro-grids

Solar farms exist in various sizes ranging from stand-alone utility-scale installations to small community or domestic systems. Thycon offers a wide range of PE equipment either for connecting solar-farms to the national grid or integrating them into micro-grids. Fig. 1 shows an example of a micro-grid with the various equipment required for Power Quality.

Peak-lopping: Thanks to the DC distribution network, excess energy can be stored in batteries and supplied to the grid at times of excessive demand or temporary drops in irradiation. The batteries are typically housed centrally along with the Solar Inverter. Thycon Peak Loppers can also be retro-fitted to existing solar farms even if based on AC intra-grid distribution (not shown).

Power Factor Correction: The Thycon Solar Inverter operates at unity PF and can compensate for inductive lines at the PCC. Where the line is operated at a particularly poor PF, additional compensation can be optionally provided at the PCC using a Thycon APR (active power regulator) or TCR-FC (thyristor controller reactor and fixed capacitor – see Fig. 1) both of which allow seamless leading and lagging power factor control.

Harmonic Attenuation: The inherent PF correction of the Thycon Inverter also attenuates harmonics. Where excessive harmonic levels are present at the PCC caused by grid-connected loads, passive harmonic

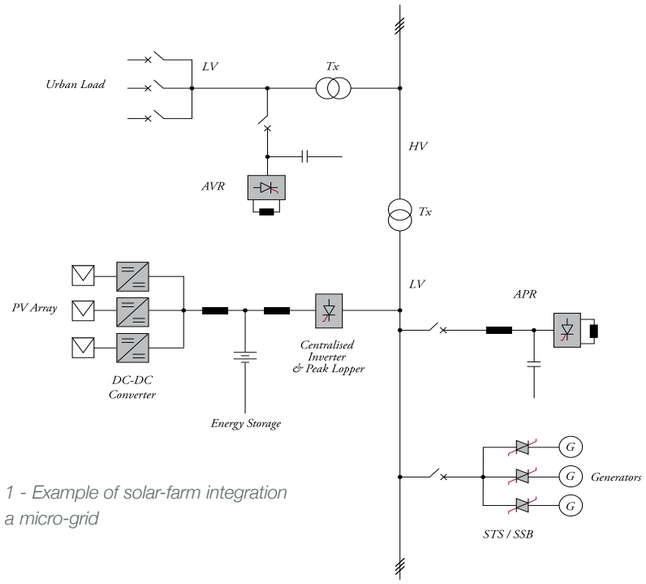

Fig. 1 - Example of solar-farm integration into a micro-grid

filters are optionally available (not shown).

Solid State Switches: These are various types of switches based on semiconductors as opposed to mechanical contacts. They include:

- SSI (Solid State Interrupter)
- SSL (Solid State Limiter)
- SSB (Solid State Breaker)
- SST (Solid State Transfer switch)
- HSEF (High Speed Electronic Fuse)
- SEBF (High Speed Electronic Breaker and Fuse).

SSBs, for instance, can clear faults in fractions of a millisecond as opposed to the 100ms required by mechanical breakers thus reducing the prospective fault currents to one tenth of the normal levels which can significantly impact the cable sections required and hence installation costs. Because of the reduction of fault levels and the absence of arcing, solid state switches require no maintenance.

Redundant Solar Inverters: the main SI can be optionally backed up by a second inverter with a separate controller for additional security.

Power Limiter: The solar choppers have a programmable power limit adjustable from 0 to 100%. The operator can determine the absolute maximal power that any array can supply (to the chopper's maximal rating).

Monitoring: All Thycon power conditioners have an RJ45 interface allowing optional remote SCADA monitoring of the following parameters:

- string power and currents
- total TSI o/p power (active and reactive)
- grid voltage and frequency
- battery voltage, temperature and state of charge
- ambient and heat-sink temperatures.

Technical data

DC-DC CONVERTER

Input power	40kW	80kW	120kW
Input current	100A	200A	300A
MPPT voltage range		300-600VDC	
Ripple		<3%	
Output voltage		<806VDC	
Efficiency (%)			
Peak	98.2	98.4	98.4
CEC	97.7	98.1	98.1
Euro	97.1	97.6	97.7
MPPT		99	
Environmental			
Ambient temperature		-20 to +60dC	
Protection category		IP55	
Relative humidity		98%	
Cooling		Fan forced (temperature dependant)	
Cubicle finish		Powder coated (Stainless steel opt.)	
Cubicle colour		RAL 7035	
Mounting		Wall/Pole/Pad	
Galvanic isolation		Optional	
Communication		Modbus/Jbus protocol over RS232 & RS482/485 Modbus TCP/IP over ethernet	
Monitoring		Earth fault	
Compliance		UL1741, IEEE1547, EN61000-6-2, EN61000-6-4	
Dimensions (w x d x h) (mm)	500 x 210 x 500	600 x 210 x 600	760 x 300 x 760
DC-AC INVERTER			
Input			
Input power	1MW	1.5MW	3MW
DC voltage		<806VDC	
Output			
Frequency		50Hz	
Frequency variation		+/- 3Hz	
Power factor		>0.98	
THID		<5% of input power	
Efficiency			
Peak	99.2	99.2	99.4
CEC	98.8	98.8	99.1
Euro	98.2	98.4	98.7
Environmental			
Ambient temperature		-20 to +60dC	
Protection category		IP22	
Relative humidity		98%	
Cooling		Fan forced	
Cubicle finish		Powder coated	
Cubicle colour		RAL 7035	
Galvanic isolation		Optional	
		Modbus TCP/IP over ethernet	
Communication		Modbus/Jbus protocol over RS232 & RS482/485	
Compliance		UL1741, AS4777, IEEE1547, EN61000-6-2, EN61000-6-4, IEEE519	
Dimensions (w x d x h) (mm)	1800 x 1000 x 2000	1800 x 1000 x 2000	3000 x 1000 x 2000

Specifications are subject to change without notice

Designed and Published by Thycon.

THYCON

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