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SILCOPAC



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DC DRIVES

SILCOPAC

AC/DC THYRISTOR POWER CONVERTERS

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Silcopac is a high performance compact three-phase AC/DC thyristor converter. Its two or four quadrant operation, high, dynamic response, ease of customization and fully digital control make **Silcopac** the ideal solution for any type of industrial DC application, from the most simple to the most complex. **Silcopac** has been designed for use in industrial environments and is the response to application requirements in the steel, paper, cement, naval and industrial sectors.

AVANT-GARDE ELECTRONICS TO PROTECT THE ENVIRONMENT.



WE STRIVE TO DEVELOP TECHNOLOGY BY OFFERING AVANT-GARDE SOLUTIONS. WE ARE DYNAMIC IN OUR QUEST TO ACHIEVE EXCELLENCE. RESPECTING THE ENVIRONMENT IS IN OUR NATURE.

MISSION

ANS like **ANSALDO**. Experience and structural competence.

The vast experience and versatility of an organised structure guarantee top quality performance. We strive to create customised avant-garde technological solutions to satisfy our customers' every need and expectation thanks to the EN ISO 9001:2000 Global Quality Management System.

W like **WORLDWIDE**. Ambitions beyond all boundaries.

The company aims at achieving the quality required by the international industrial automation market: our distribution network is worldwide.

Our Just-in-time policy makes sure that each product reaches the right destination at the right time.

E like **ENERGY**. By nature, we protect nature.

Energy-saving products and the use of alternative energy: implementation of an Environment Management System in compliance with ISO 14001 makes it possible to operate in complete harmony with the environment and respect for nature.

R like **RENEWAL**. Tailored innovative solutions.

The company as a source of ideas to create and market new products, aims at stimulating, absorbing and sustaining innovation, thanks to a team of professionals in the R&D division.

These are the targets of a dynamic company that has always been customer and global quality-oriented, at the same time respecting the ecosystem.



MARKETS AND APPLICATIONS

PERFORMANCE AND CONTROL FOR A WIDE VARIETY OF APPLICATIONS

The proven control strategy and consolidated thyristor technology make **Silcopac** the ideal solution for any type of industrial DC application, from the simplest to the most complex.

SPDM firmware provides functions that are standard for several important applications, such as:

- Helper for load sharing between two motors mechanically coupled
- Pope for paper production plants
- ADP for angular speed adjustment in relation to diameter
- Winder for direct or indirect tension control of axial or peripheral rolls
- Load weighing and torque-proofing devices for lifting systems
- Step load compensator for rolling mills, etc.

APPLICATIONS

- STEEL MILLS AND TREATMENT LINES
- PAPER MILLS
- EXTRUDERS AND MIXERS
- MATERIAL HANDLING
- RUBBER AND PLASTIC
- MACHINE TOOLS
- CHEMICAL INDUSTRY
- CEMENT



MATERIAL HANDLING

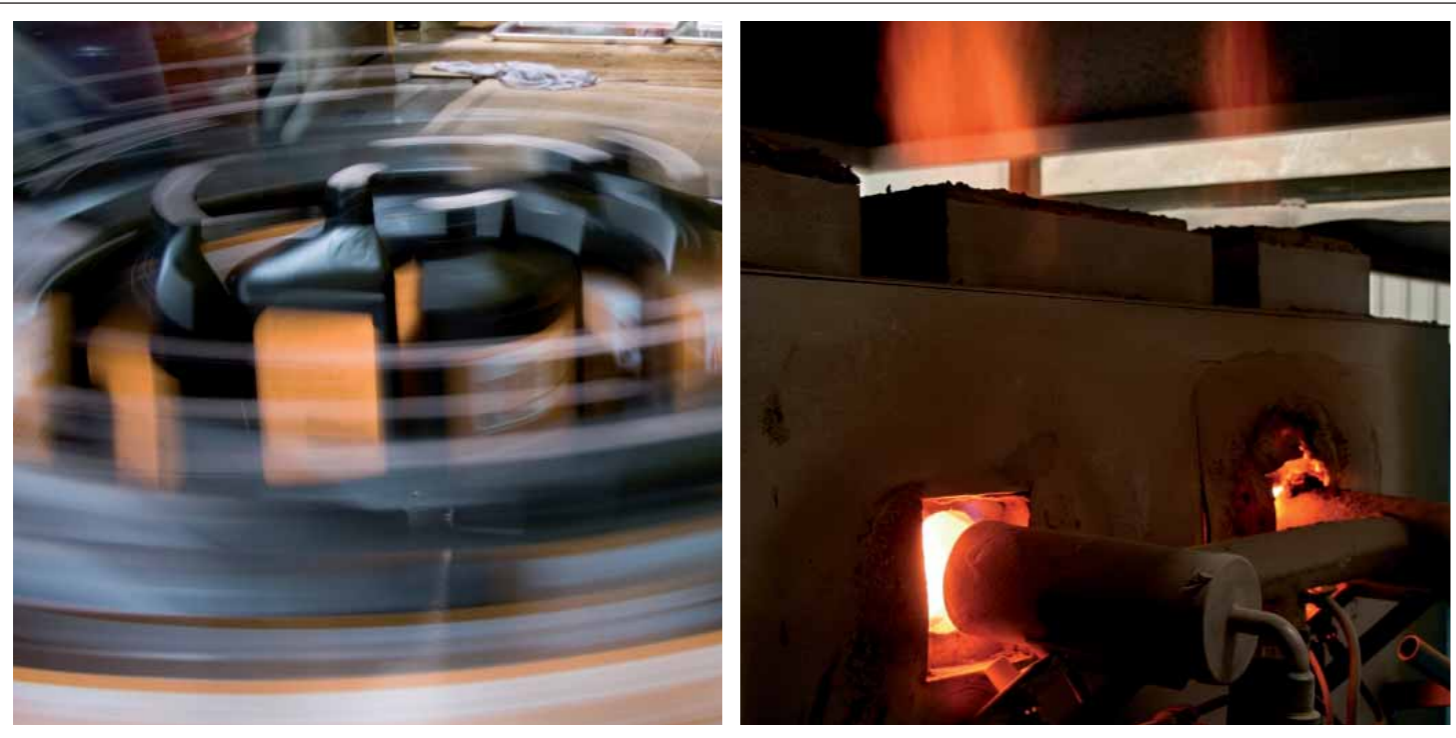
The SPDM guarantees a high degree of control and safety during manoeuvres in lifting systems and allows easy operation

The "crane" macros allow:

- Soft and controlled manoeuvres that reduce the need for maintenance
- Mechanical brake control with verification of the torque during brake opening, to guarantee sufficient torque (torque-proof function)
- Maximum speed according to the load, thanks to the weight-load function
- Regenerative braking

APPLICATIONS

- PACKAGING LINES
- CONVEYOR BELTS
- LIFTING SYSTEMS
- MAGNETIC PLANTS



RUBBER AND PLASTIC

A considerable number of applications require a high starting torque.

The requirements of the most critical applications can be met thanks to the thyristor overload capacity (overload rate) and accurate speed/torque control.

The options and communication characteristics allow critical processes to be monitored and kept under constant control.

APPLICATIONS

- MIXERS
- EXTRUDERS
- CALANDERS

CEMENT

The SPDM optimises the production processes, reducing plant maintenance and downtimes, improving quality and increasing production output.

Improvement in process control and reduction in the wear of mechanical parts contribute to extending plant life.

Moreover, the overload capacity and accurate speed/torque control allow accurate control of the furnace, which is the core of the production process, optimising fuel consumption and production flow.

APPLICATIONS

- FURNACES
- SEPARATORS
- MILLS
- PRIMARY AND SECONDARY FANS
- EXHAUST SYSTEMS



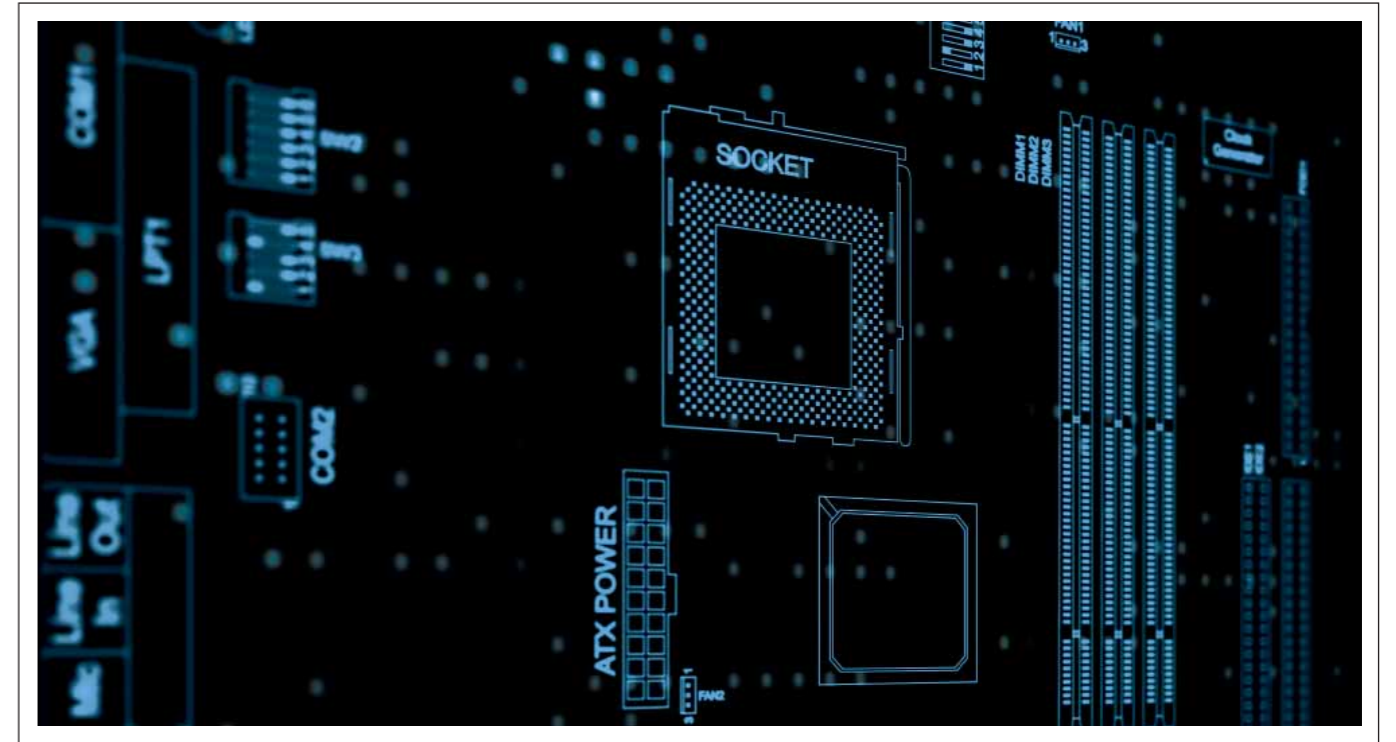
METALLURGY

The high overload capacity and accurate speed/torque control make the SPDM the ideal converter in steel mills. The options and communication characteristics allow the critical processes to be monitored and kept under constant control

Answer Drives has been supplying the steel sector for over forty years and has drives installed in more than 700 systems throughout the world.

APPLICATIONS

- HOT ROLLING MILLS
- COLD ROLLING MILLS
- PROCESS LINES
- ROLLING MILLS FOR NON-FERROUS MATERIALS
- FUME DEDUSTING PLANTS
- STIRRERS



CHARACTERISTICS

Silcopac converters are user-friendly and offer:

- insensitivity to network frequencies and input phase rotation
- checking of the status of the drive at power on and tachogenerator connections
- converter configuration without the use of special tools
- automatic calibration, thanks to the auto-tuning function
- display of main variables and faults
- recording of main variables.

Both the hardware and software of the **Silcopac** converters can be configured to respond to the requirements of the system. Namely, the software is available for standard and special applications:

- **E**: advanced version for standard applications
- **S-L-M-R-F**: for special applications such as
 - Ward-Leonard
 - Spindle
 - Accurate slip

Among the hardware options available, the man-machine interface, communication between the systems and motor field exciters are worthy of mention



- 1 ENTER= KEY TO CONFIRM SELECTION
- 2 KEYS TO SELECT AND MODIFY PARAMETER VALUES
- 3 7 SEGMENT LED AND LCD DISPLAY
- 4 MODE= KEY TO SELECT PARAMETER GROUPS

HARDWARE

STANDARD VERSION

16 bit, 16 MHz microcontroller

Four-layer control circuit board

based on SMD technology

6 analog inputs, 4 of which are programmable

4 analog outputs, 3 of which are programmable

9 optoisolated digital inputs

2 optoisolated programmable digital outputs

1 stabilised 10 V, 5 mA output

2 output relays (zero speed, converter ready)

Optoisolated interface

for 2-channel encoder with marker

High impedance DC voltage

differential transducer

Possibility of parallel connection

with RTT series power modules

Man-machine interface:

7 segment LED on control board

Communication between systems:

RS232 interface towards PC,

38.4 kbit/s

HARDWARE

OPTIONS

SPDIO Digital input (4) and output (4) expansion board (internal installation)

Man-machine interface

SPDI1 LCD 16x2, 4 button LCD display, removable for remote control (max. 2 m)

SPDI2 LCD 16x2, 4 button LCD display and Centronics printer interface, removable for remote control (max. 2 m)

Communication between systems

SPPB2 Profibus DP 12 Mbit/s interface KIT (internal installation)

Field supplies

SPAEO Single-phase diode rectifier, 380-415VAC, 10 A DC (internal installation)

SPAEO Single-phase diode rectifier, 380-415VAC, 10 A DC (internal installation)

SPAEB Current regulated thyristor/diode single-phase bridge converter, 380-415Vac, 12 A DC (external installation)

SPAM Current regulated thyristor/diode single-phase bridge converter 380-415Vac, 16-35 A DC (external installation)

SPATE Three phase two quadrant converter 30-600A

SPDME Three phase 2 or 4 quadrant converter with digital control 30-600 A

SILCOPAC . GENERAL TECHNICAL DATA

STANDARDS	<ul style="list-style-type: none"> IEC 60146.2 Low Voltage Directive 2006/95/EC Directive EMC 89/336/EEC modified by directive 93/68/EEC
ENVIRONMENTAL CONDITIONS	<ul style="list-style-type: none"> Operating temperature: +40°C. Decrease rated current by 1.2% for each °C between 40°C and 65°C Storage temperature: -20°C - +70°C Relative humidity: 95% (without condensation) Altitude: 0-1000 m a.s.l. Decrease rated current by 1% every 100 metres within the range of 1000 and 4000 m Cooling: forced-air with internal fan
ELECTRICAL DATA	<ul style="list-style-type: none"> Power supply voltage: 230-950 VAC ±10% Frequency: from 45 to 65 Hz Output voltage: 400-950 VDC Output current: 30-4000 A Control circuit power supply: 380 V ±15%; 400 V +10% -20% (30 VA)
CONTROL CHARACTERISTICS	<ul style="list-style-type: none"> Analog inputs: -10 V +10 V or 0 V +10 V Digital inputs: +24 V (external supply)
Easy start-up	<ul style="list-style-type: none"> Self-diagnosis at power on and resetting Auto-tuning of current, speed and back.e.m.f. loops
Powerful diagnostics	<ul style="list-style-type: none"> Multi-channel recorder dedicated to the current regulator (thyristor trace) and speed and e.m.f. regulator (drive trace)
Speed regulator	<ul style="list-style-type: none"> Tacho generator, encoder, armature voltage feedback Speed static accuracy: tachometric feedback 0.1%, encoder feedback 0.01%, voltage feedback 2% Two programmable acceleration/deceleration ramps Two programmable jog speeds Drooping Anti-reverse-turning on zero speed without overshoot Duplication of acceleration/deceleration ramp rates, two jog speeds, current limits and speed and current regulator gains by means of digital input
Current regulator	<ul style="list-style-type: none"> Current limits from analog input Adjustable current rate limits Predictive inversion and compensation for operation with discontinuous current Helper function that controls the load sharing between two motors mechanically coupled Current limits as speed function Bumpless restart Multi-poles Filter to prevent torsional oscillations

SILCOPAC . GENERAL TECHNICAL DATA

Back e.m.f. regulator	<ul style="list-style-type: none"> PI and feed-forward Field saving
Auxiliary functions	<ul style="list-style-type: none"> Programmable ramp, enabled from terminal board input Programmable start/stop at zero speed and current Digital motopotentiometer Operating continuity using armature voltage feedback in case of speed transducer failure Load weighing, torque-proof (hoisting and lifting) Pope: inertia and mechanical losses compensation (paper machines) Step load increase compensation (rolling mill) Angular position regulator ADP angular speed regulator as function of diameter to maintain constant peripheral speed Winder function to directly or indirectly control axial or peripheral rolls tension. Provides compensation of inertia, fixed and variable friction, calculation of coil diameter, stand still tension, etc.
Protections	<ul style="list-style-type: none"> Microcontroller fault Maximum speed Stalled motor Over-temperature Instantaneous overcurrent Maximum motor voltage Motor field loss Serial communication failure Tacho generator inversion or failure Network failure or voltage out of tolerance Motor and converter thermal image
SPECIAL SOFTWARE VERSIONS	Offers the following advantages:
P= 12 impulse operation (parallel bridges)	<ul style="list-style-type: none"> Reduction of the effects produced by power converters on the power network (harmonics and voltage distortion) Large output current: doubles the output current due to parallel connection of six-pulse converters to obtain a twelve pulse configuration Improvement of output current ripple and torque pulse Requires: Dd0/Dy11 double secondary transformer with minimum leakage reactance of 6% and interphase reactor
M= Spindle	Manages change in range, C axis and positioning. Allows commutating of acceleration/deceleration time, current limits and speed regulator gain in relation to the range inserted (max. 4)
S= Accurate shift	Controls servo-speed between two or more drives (max. 6) with drift free and with high resolution
L= Ward-Leonard	Allows updating large Ward-Leonard with modern equipment. Controls and adjusts the dynamo and motor(s) excitation for speed and torque control
SPECIAL CONVERTER VERSION: SPDMR SERIES	This is a special Silcopac converter hardware and software version that has been designed to supply inverters connected in DC Bus. It allows recovery of load regenerated power in the network and considerable energy saving in applications characterised by high braking power. The SPDMR consists of 2 power bridges in anti-parallel connection: it requires an auto-transformer on the recovery bridge and a reactor on DC side.

SILCOPAC . GENERAL TECHNICAL DATA

2 QUADRANT		OUTPUT CURRENT	INPUT VOLTAGE						DIMENSIONS			
MODEL	FRAME		A	AVAILABLE= •						L	H	P
			400 - 500 V	600 V	690 V	750 V	850 V	950 V	mm	mm	mm	Kg
SPDM030U	I	30	•	•					230	320	168	4
SPDM060U	I	60	•	•					230	320	220	7
SPDM080U	I	80	•	•					230	320	220	7
SPDM110U	I	110	•	•					230	320	220	10
SPDM160U	II	160 (1)	•	•					230	420	240	13
SPDM200U	II	200 (1)	•	•					230	420	240	13
SPDM260U	II	260 (1)	•	•					230	420	240	13
SPDM350U	II	350 (1)	•	•					230	420	240	14
SPDM450U	III	450 (1)	•	•					230	570	262	18
SPDM500U	III	500 (1)			•				230	570	262	21
SPDM600U	III	600 (1)	•	•					230	570	262	21
SPDM850U	IIIL	850 (1)	•	•	•				230	875	350	46
SPDM1M0U	IIIL	1000 (1)	•	•					288	875	390	47
SPDM1M1U	IIIL	1100 (1)	•	•					288	875	390	47
SPDM1K5U	IV	1500 (2)			•	•	•	•	484	1100+212	420	100
SPDM1K6U	IV	1650 (2)	•						484	1100+212	420	100
SPDM1K7U	IV	1700 (2)	•		•	•	•	•	484	1100+212	420	100
SPDM2K1U	IV	2100 (2)	•						484	1100+212	420	100
SPDM2K2U	V	2200 (2)	•		•	•	•	•	560	875+300	563	150
SPDM2K5U	V	2500 (2)	•		•	•	•	•	560	875+355	563	150
SPDM3K1U	V	3100 (2)	•		•	•	•	•	560	875+355	563	180
SPDM3K6U	V	3600 (2)	•		•	•	•	•	560	875+355	563	230
SPDM4K0U	V	4000 (2)	•		•	•			560	875+355	563	230

4 QUADRANT		OUTPUT CURRENT	INPUT VOLTAGE						DIMENSIONS			
MODELLO	TAGLIA		A	AVAILABLE= •						L	H	P
			400 - 500 V	600 V	690 V	750 V	850 V	950 V	mm	mm	mm	Kg
SPDM030R	I	30	•	•					230	320	168	5
SPDM060R	I	60	•	•					230	320	220	8
SPDM080R	I	80	•	•					230	320	220	8
SPDM110R	I	110	•	•					230	320	220	11
SPDM160R	II	160 (1)	•	•					230	420	240	15
SPDM200R	II	200 (1)	•	•					230	420	240	15
SPDM260R	II	260 (1)	•	•					230	420	240	15
SPDM350R	II	350 (1)	•	•					230	420	240	17
SPDM450R	III	450 (1)	•	•					230	570	262	20
SPDM500R	III	500 (1)			•				230	570	262	26
SPDM600R	III	600 (1)	•	•					230	570	262	26
SPDM750R	IIIL	750 (1)			•				230	875	350	57
SPDM850R	IIIL	850 (1)	•	•					230	875	350	57
SPDM1M0R	IIIL	1000 (1)	•	•					288	875	390	58
SPDM1M1R	IIIL	1100 (1)	•	•					288	875	390	58
SPDM1K5R	IV	1500 (2)			•	•	•	•	484	1100+212	420	125
SPDM1K6R	IV	1650 (2)	•						484	1100+212	420	125
SPDM1K7R	IV	1700 (2)			•	•	•	•	484	1100+212	420	125
SPDM2K1R	IV	2100 (2)	•						484	1100+212	420	125
SPDM2K2R	V	2200 (2)			•	•	•	•	560	875+355	563	200
SPDM2K5R	V	2500 (2)	•		•	•	•	•	560	875+355	563	200
SPDM3K1R	V	3100 (2)	•		•	•	•	•	560	875+355	563	270
SPDM3K6U	V	3600 (2)	•		•	•	•	•	560	875+355	563	320
SPDM4K0U	V	4000 (2)	•		•	•			560	875+355	563	320

(1)= With 1x230V, 50/60Hz fan- (2)= With 3x380V-50Hz/440V-60Hz fan- Higher power on request with the use of RTT modules.