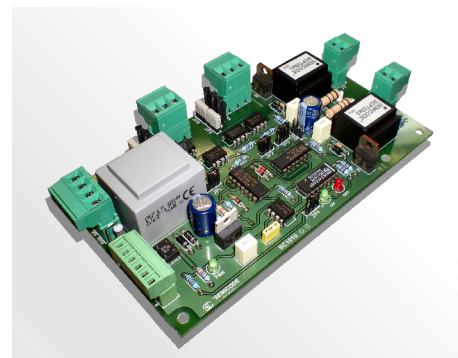


PRELIMINARY TECHNICAL INFORMATION
HIGHLIGHTS

- Zero-crossing voltage network detection.
- Up to 700 V_{RMS}
- Enable & disable state control LED indication.
- Configurable trigger mode.
- Modular system.
- Ready to use.



non-contractual photo

GENERAL DESCRIPTION

SC1010 is a solid state relay controller card. It is intended to be used in applications where high reliability is needed. This card is configurable to trigger SCR's with pulse trains synchronized with mains voltage, or in permanent mode. It can be configured to start at zero crossing or random phase. Control signal can be a logic level referred to card reference (high input impedance) or floating optocoupled input (low input impedance). Built-in power supply is feed directly from the mains, either 230 V_{AC} or 400 V_{AC}, 50/60 Hz.

ABSOLUTE MAXIMUM RATINGS

Description	Symbol	Notes / Test conditions	Min	Typ	Max	Units
Continuous working AC voltage	V _{K1K2}				700	V _{AC}
Maximum AC peak voltage	V _{K1K2 peak}				1800	V _{PEAK}
Control trigger voltage	V _{CTL}	See CONTROL SIGNAL & VOLTAGE LEVELS (page 5)				
Zero-cross signal voltage	V _{ZC}	See SYNCHRONISM SIGNALS (page 5)				
Synchronism voltage	V _{SYNC}	See SYNCHRONISM SIGNALS (page 5)				
Control to output isolation voltage	V _{ISO}			4000		V _{AC}

RECOMMENDED OPERATION CONDITIONS

Description	Symbol	Notes / Test conditions	Min	Typ	Max	Units
continuous working AC voltage		network freq. 42 to 63Hz Jumper adjustment	30		700	V _{AC}
control trigger voltage	V _{CTL}	Optocoupled mode & logic level mode		12		V
control current consumption	I _{CTL}	Optocoupled mode			6	mA

MECHANICAL SPECIFICATIONS

Description	Symbol	Units
dimensions	HxBxT	151x84x29 mm
Weight	W	215 gr
control and power terminals		extractable plug (pitch 5 mm)
module fixation		6 Holes Ø4mm

ENVIRONMENTAL SPECIFICATIONS

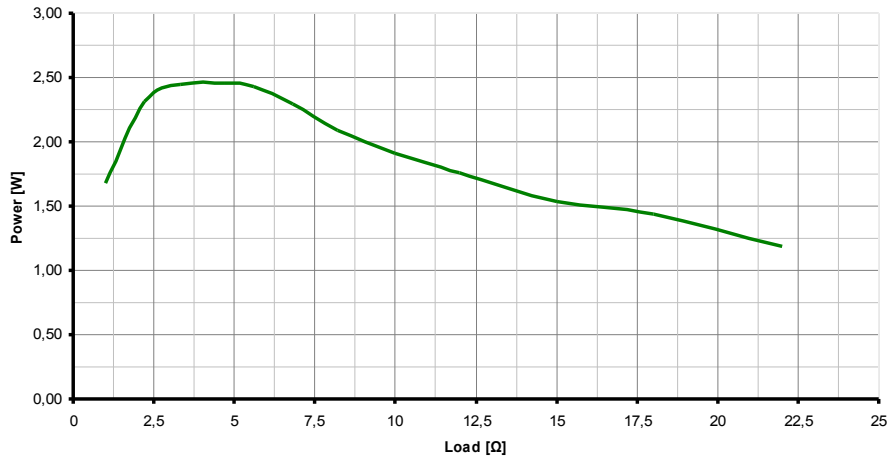
Description	Units
protection grade	IP-00
maximum humidity	50% Rh @ 35°C / 70% RH @ 20°C
pollution grade	II

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OUTPUT FIRING PULSE TRAIN

Description	symbol	notes/test conditions	Min	Typ	Max	Units
Thyristor triggering current	I_{OUT}	$V_{out} = 5V$			600	mA
Maximum output voltage	$V_{OUT\ max}$				6	V
Max. transferred power peak to load	$P_{OUT\ max}$				2.4	W
Output firing train frequency	f_{OUT}			8		kHz
Output firing train duty cycle	Dc_{OUT}			20		%

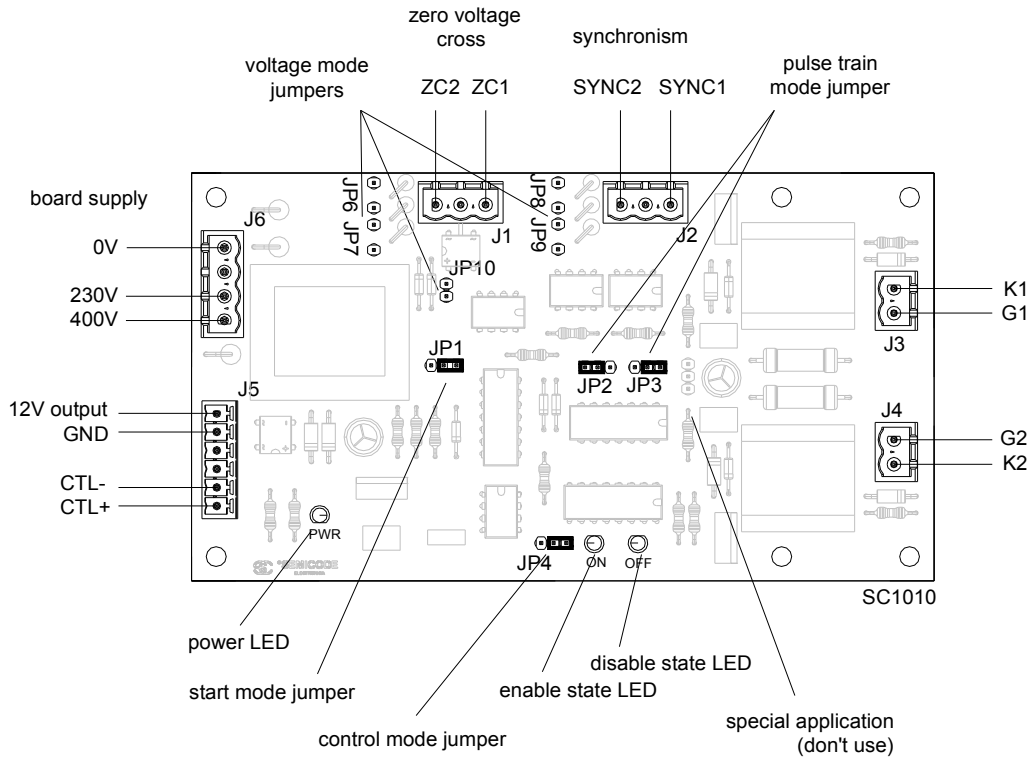
OUTPUT POWER vs. LOAD



CONFORMALS

Conformal coating	MIL-1-46058, Type UR
Security	EN60950-1, UL60950-1

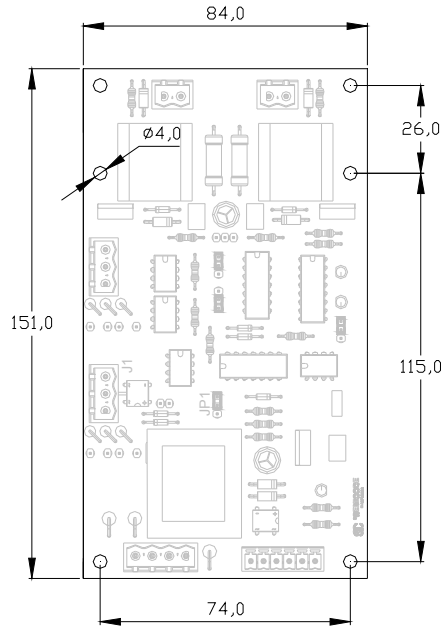
ELECTRICAL CONNECTIONS



connector	designation	function
J1	ZC1	positive pin for zero cross voltage detection
	ZC2	negative pin for zero cross voltage detection
J2	SYNC1	positive pin for current synchronism through thyristor
	SYNC2	negative pin for current synchronism through thyristor
J3	G1	thyristor 1 gate connection
	K1	thyristor 1 cathode connection
J4	G2	thyristor 2 gate connection
	K2	thyristor 2 cathode connection
J5	CTL+	negative control signal
	CTL-	positive control signal
	24V AC IN 1	AC/DC direct supply input
	24V AC IN 1	AC/DC direct supply input
	12V	12 V output
J6	GND	ground for control signal
	0V	0 V supply voltage connection
	230V	230 V _{AC} supply voltage connection
	400V	400 V _{AC} supply voltage connection

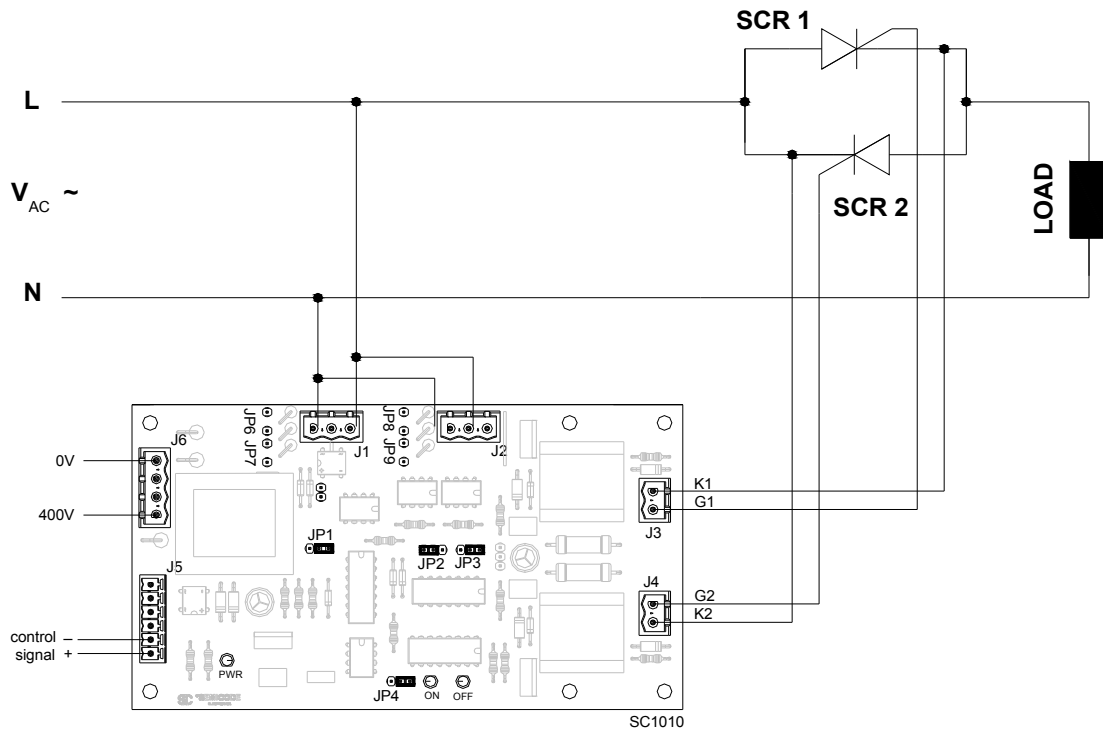
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DIMENSIONS DRAWING



(all dimensions in millimeters)

TYPICAL APPLICATION



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CONFIGURATION

GATE SIGNAL MODE

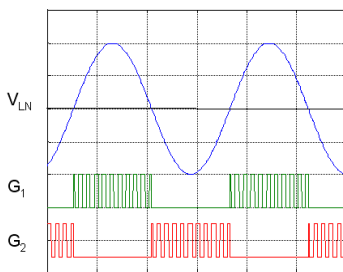
Regarding gate signals, the board can operate in two different modes; «Synchronous Pulse Train» or «Permanent Pulse Train». Operation mode is jumper selectable by means of JP1 and JP2.

- Synchronous pulse train mode (JP2 right connected; JP3 left connected)

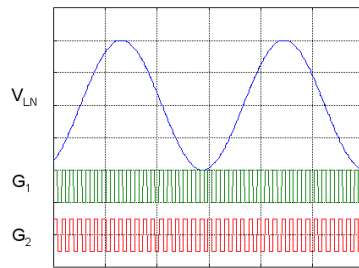
In synchronous pulse train mode the board produces synchronized pulse trains and in phase with the mains voltage for each SCR. This operation mode is recommended since commutation and gate losses are reduced.

- Permanent pulse train mode (JP2 left connected; JP3 right connected)

In permanent pulse train mode the board produces a pulse signal for each SCR. Gate losses are higher than for «synchronous pulse train» mode.



gate pulses in synchronous pulse train mode



gate pulses in permanent pulse train mode

JP2 JP3 synchronous pulse train mode

JP2 JP3 permanent pulse train mode

START MODE

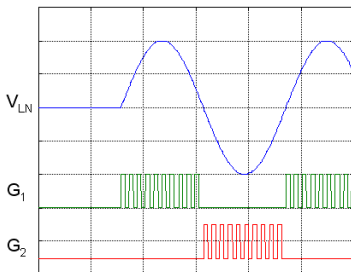
Regarding the start up, the board can operate in two different modes; «zero-cross start» or «random phase start». Start mode is jumper selectable by means of JP1. Starting mode only affects at the first cycle after a start control signal is applied.

- Zero-cross start mode.

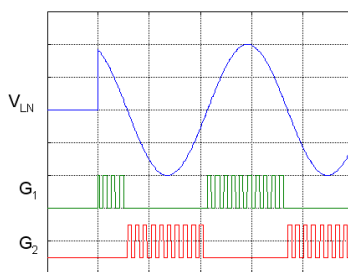
In zero-cross start mode, first cycle of load voltage always start at zero cross of the mains voltage.

- Random phase start mode

In random phase start mode, voltage is applied to the load at the moment that control signal is applied.



gate pulses and load voltage in «zero crossing start» mode



gate pulses and load voltage in «random phase start» mode

JP1 zero crossing start

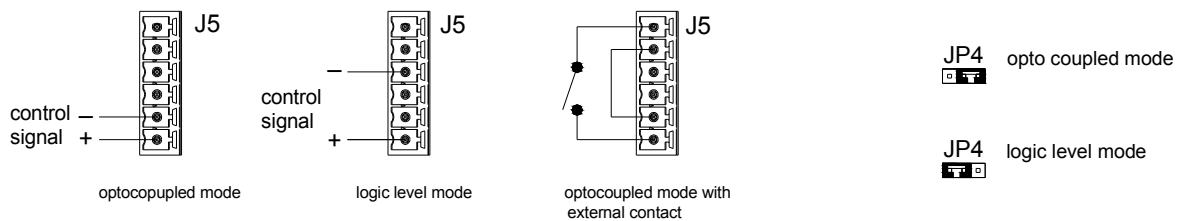
JP1 random phase start

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CONTROL SIGNAL & VOLTAGE LEVELS

Input type of control signal is jumper selectable between «logic level» or opto-isolated. Logic level input is intended to be controlled directly from a logic signal source (PLC, microcontroller, etc.). It is advised logic level circuits are high impedance, so attention must be paid to avoid undesirable interference. Shielded lines must be used for control signals. Opto-isolated mode requires a control signal source capable of deliver at least 5 mA at 15 V. In this mode 5.22 kΩ input impedance helps to prevent interference influence, nevertheless shielding is suggested.

A mechanical external switch can be used but opto-coupled input mode must be selected since a high impedance open circuit can produce undesirable operation. Since the switch is fed from internal power supply, isolation is not achievable in this mode.



control signal	optocoupled mode	logic level mode
enable	6-30V	9-12V
disable	0-3V	0-3V

SYNCHRONISM SIGNALS & VOLTAGE RANGE OF OPERATION

The SC1010 card uses 2 signals for synchronize the gate pulses with the network.

- Zero voltage cross

This signal is used to determine the time when the voltage across the thyristors is zero (zero crossing). When the SC1010 is enabled by control signal, the first of the gate pulse trains not appears in the output until this signal isn't in zero crossing. This way the thyristor always turns-on at zero voltage (It not applies in random start mode).

- Synchronism and voltage range of operation

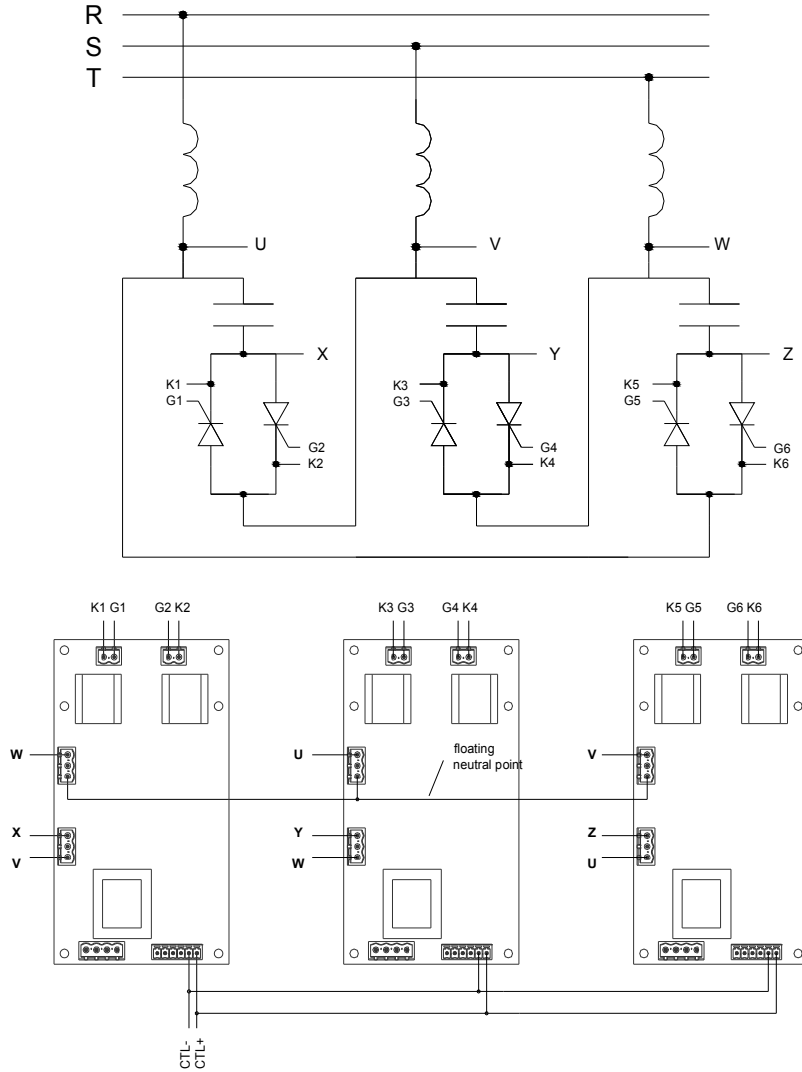
This signal is used to synchronize the width and timing of gate train pulses with the current through the thyristors (it not applies in permanent pulse train mode). According the jumper configuration this output can work in three different voltage range:

Voltage range	JP6	JP7	JP8	JP9	JP10
30 – 100 V _{RMS}	ON	ON	ON	ON	ON
100 – 400 V _{RMS}	OFF	ON	OFF	ON	OFF
400 – 700 V _{RMS}	OFF	OFF	OFF	OFF	OFF

Note that in resistive loads, the current and the voltage waves are in phase, then the ZC and the SYNC signals are the same. Also in applications where the $\cos \Phi$ is near 1 (motors, inductive loads) the same signal for ZC and SYNC could be used. For applications where the voltage and current are strongly out of phase, then different signals for ZC and SYNC should be used, for example in reactive compensation (LC filtering) applications (see REACTIVE COMPENSATION page 6).

REACTIVE COMPENSATION

SC1010 may be used in reactive energy compensation control, connecting the AC switches inside the delta connection formed by capacitors. The connection of the zero-cross voltage signal (J1) and the synchronism signal (J2) should be as the following figure:



Note that for the most thyristor modules, the auxiliary cathode is galvanically united with power cathode; then it is possible to reduce the number of wires from cards SC1010 to power stack, only large wires for K and G connections from J3 and J4 are required. J1 and J2 connections may be plugged to J3 and J4 following this table.

J3/J4	J1/J2
K1	X
K2	V
K3	Y
K4	W
K5	Z
K6	U

NOTES & RECOMMENDATIONS

The card has an internal power supply, that could be supplied at 230 or 400 V_{AC}. It is mandatory that the supply of the SC1010, and of its controllers (PLC, micro-controller, etc) will be ready, almost 100 ms, before the activation of the control signals (enable). If not, a non correct working of the card could be produced. This could cause potentially dangerous failures if the power stack is supplied.

Be careful with the continuity in the supplying of the card. An interruption couldn't be permitted whenever the card is connected to power stack, and the stack is working.

The gate and cathode wires between the card and the thyristor must be twisted pair, in order to avoid external interferences. Wires must be as short as possible.

Cost Effective Products

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