

Touch DIMMER for Mid Power LEDs

Features

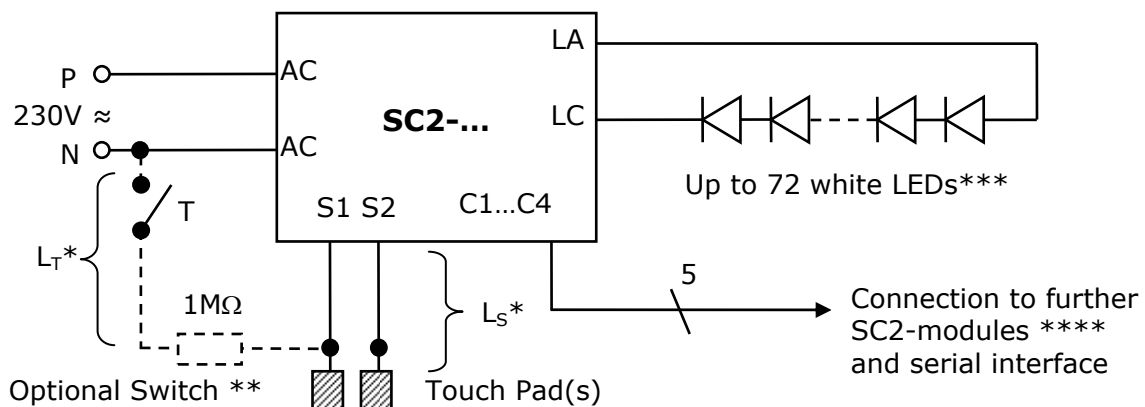
- Control of LED power via touch sensor for DIMMER function and ON/OFF
- Operation of 72 white Mid Power LEDs directly from mains voltage (230V \approx)
- Digital storage of DIMMER value (*Flash-Version*)
- No transformer or power adaptor needed
- Soft ON/OFF control (optional)
- Integrated noise filter to guarantee relevant noise specifications
- Current und voltage supervision of LED
- Low power consumption – high efficient switch mode controller
- Automatic adaptation to optimum operating conditions
- Connection via reliable terminal clamps
- *Master-Slave-Interface* for synchronization of DIMMER modules
- Optional *SPI-interface* – prepared for DMX and DALI operation
- Operating class IP20 (dry ambient)



Application

- Control of LED lamps
- „Touch-Me“-lamps (controlling of light when touching the lamp)
- Driving of up to 72 white mid power LEDs
- Suitable for mid power LEDs with up to 100mA drive current

Circuit



*) Maximum wire length L_T and L_S is approx. 0.5m, for extension see page 4

***) Switch (dotted line) must be connected (for safety reasons) only to grounded power line (N) or protective earth conductor. A 1M Ω resistor is recommended close to the switch.

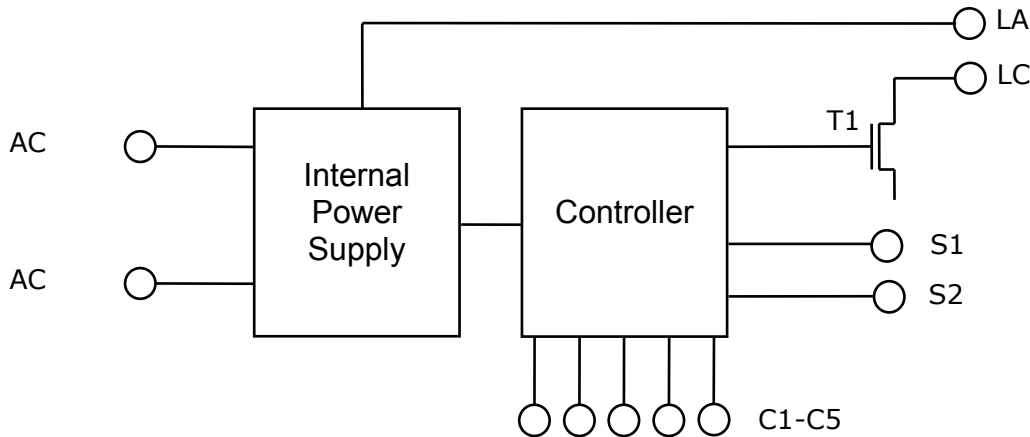
****) or accordingly higher number of LEDs with lower forward voltage

*****) Master-Slave connection (according application circuit on page 9) or serial interface

Caution!

Set up should be done by skilled personnel only!
All circuit parts including LEDs are connected to mains supply (230V AC)!
Please read carefully the instructions on last page.

1 Overview



The DIMMER module can be connected directly to mains voltage (AC 230V, 50Hz) without using a transformer. It can drive up to 72 white LEDs at a current up to 100mA. The LED power is controlled via the touch pads (S1, S2) or the control pins (C1 ... C5). A Sensor Pad is a simple metal surface electrically connected to S1/S2. The controller incorporates DIMMER and ON-/OFF operation.

As shown in figure above the module consists of an internal power supply, the controller as well as the driver transistor (T1, operating as switched mode LED supply). The power supply generates the controller supply as well as the DC supply for the LED switch mode controller from mains voltage. Only 0.4W are consumed during stand-by-operation (LED power off) which accumulates to only 1.7kWh per year and fulfils the EU directive *EuP 2005/32/EG (ECO Design of Energy Using Products)*. The Master signal is available at a control output and showing a 1kHz-signal when the light is switched on (see description of Master-Slave-operation). Furthermore versions with serial SPI interface are available.


The controller monitors the touch pads and controls the switch mode controller generating the LED current. During DIMMER operation the average DC LED current can be varied from minimum to maximum current (up to 100mA, the maximum current depends slightly on the number of connected LEDs).

2 Description of Main Versions

2.1 Normal Version (-NYYY-)

The normal version is controlled via **one touch sensor** in the following way:

- **Short touch (0.1 to 0.4 seconds):**
 - Switching ON the LEDs to maximum current if the LEDs have been switched OFF before.
 - Switching OFF the LEDs if the LEDs have been switched ON before. It doesn't matter whether the LEDs have been in ON mode or in DIMMER mode before.
 - Touching shorter has no effect; i. e. noise is filtered out (debouncing effect).
- **Long touch (longer than 0.5 seconds):**
 - Starting DIMMER operation: If the LED are OFF they are switched to minimum current and the current is increased slowly as long as the sensor is touched. If the maximum current is reached the LED current is reduced again. If the minimum is reached it is increased again.

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			Mid Power Touch DIMMER for LEDs Rev. 1.4 - 06/2012

- If the LEDs have been switched ON before the LED current is decreased or increased depending on history. If the previous operation was increasing the current, the minimum current was reached or the LED was OFF the current is increased. If the previous operation was decreasing the current or maximum was reached the current is decreased.

The normal version has either a Master output or a LED-OFF-Indicator output.

2.2 Master Version (-MYY_-)

The **Master Version** operates from two touch sensors. Sensor S1 is used only for switching on to recently adjusted dimm value and off while sensor S2 is used for dimming and on/off (as S1 in normal version).

The module offers a so called *Master-Slave-Output* signal (1kHz, 3V_{PK-PK}) at the terminal M/S OUT when the LEDs are switched ON. This signal may be used to control Slave DIMMER-Modules. The output includes an appropriate reference terminal M-GND. Both outputs are coupled via capacitors suitable for a maximum voltage difference up to 50V referred to the internal signal ground. For this reason only Lumi-Con DIMMER-Modules are to be connected to these nodes. **Interconnected modules (through M/S and M-GND) must be connected to the same mains voltage phase!). Note: the Master-Slave reference ground termination (M-GND) is different to the power ground or protective earth conductor.**

2.3 Slave Version (-SYY_-)

The **Slave Version** uses only sensor S2 for dimming and on/off (acc. S1 in normal version), on (to recently adjusted dimm value) and off is controlled by the slave input (M/S IN - C3) only. The slave input must be connected to the master output (M/S OUT - C3) of a master module.

2.4 Controller Version (-CY__-)

The **Controller Version** uses a serial interface for controlling the modules.

3 Available Sub Versions

3.1 Flash-Version (-YFYY-)


The **Flash Version** is able to store the actual dimmer value in a non volatile memory (flash). Thus the DIMMER module "remembers" the latest driving conditions when disconnected from mains voltage. This latest driving condition is configured again after reconnecting to mains voltage. This module is therefore suitable for lamps which are switched with „normal“ AC-switches while the DIMMER value is configured initially (for example to adjust the colour of a lamp). Please note that the number of LEDs must not be changed during interruption of mains supply, otherwise the circuit is reset and the DIMMER is in OFF-state after power on (due to necessary new initialization).

3.2 SOFT-ON/OFF (-YYSY-)

Modules with **Soft-ON/OFF-Function** are switching the light slowly on and off. The time of the ramp is about 1 second. All other functions are working as described as above.

3.3 LED-OFF-Indicator (-NYYL-)

The **LED-OFF-Indicator** output is available for the normal version. A low power LED (approx. 1mA drive current) can be connected to the pins C3, C4 of this version. This LED is switched on

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	Mid Power Touch DIMMER for LEDs Rev. 1.4 - 06/2012			

when the Lamp is off. This function can be used as a night light. The master output is not available at this version.

4 Packaging

All versions are deliverable as packaged ("-G-") or board version ("-B-"). Please note that appropriate isolation must be used if the board version is mounted into custom environment.

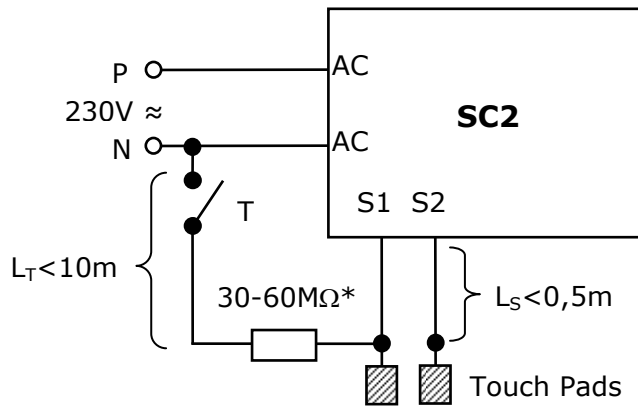
5 Current and Voltage Supervisor

The module contains an automatic current and voltage supervisor. It is guaranteed that the referred maximum current depending on number of LEDs connected is not exceeded. In addition the current is adjusted (regulated) to maximum current if the LED is in ON-mode (at the 100% level).


A voltage supervisor guarantees the correct operating mode or shuts down the module if the respective maximum voltage level is exceeded. The module is reset in this case and starts a new initialization adapting to the new LED count. If the absolute maximum voltage level (about 250V at terminals LA-LC) is exceeded the module will not turn on.

6 Operation with Switch and Larger Distance to Dimmer

If a larger distance to DIMMER is necessary **and** a switch or push button (T) is used a 30...60 MΩ resistor must be implemented to decouple the line-capacitance. The switch T must be connected to neutral line.



*) Depends on length of L_T and line capacitance.

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7 Operating Conditions and Electrical Data

		*	Min	Typ	Max	Note
Operating ambient temperature	T	°C	0		40	
Relative humidity	RH	%			90	1
Input / supply voltage at AC-AC	V _{AC230}	V _{eff}	200		250	
Periodic peak reverse voltage at AC-AC	V _{AC-PK}	V _{PK}			800	2
Supply (AC-AC) current (active current)	I _{AC-ACT-0}	mA _{eff}		1,7		3
Supply (AC-AC) current (wattless current)	I _{AC-WATTL-0}	mA _{eff}		24		3
Maximum supply current (AC-AC)	I _{AC-100}	mA _{eff}		120		4
Forward voltage of the LEDS	U _{F-LED}	V	30		250	5
Maximum LED drive current, 100%-value,	I _{LED-MAX-3}	mA		100		6
Minimum DIMMER output power		%	1		5	7
Input resistance at S1, S2	R _{IN}	MΩ		10		
External capacitance at S1, S2 to GND	C _{IN}	pF			20	8
Timing limit for ON, OFF	t _{ON-OFF}	sec	0,1		0,4	
Timing limit for entering DIMMER mode	t _{DIMM_ON}	sec	0,5			9
Timing limit for stopping DIMMER mode	t _{DIMM_OFF}	sec	0,5			10
Duration of DIMMER Ramp	t _{DIMM_DUR}	sec		8		11
Master-Slave-Output: amplitude	U _M	V		3		
Master-Slave-Output: source resistance	R _{M-OUT}	KΩ		27		
Master-Slave-Output: coupling capacitor	C _{MS}	nF		22		13
Master-Slave-Output: frequency	f _M	kHz		1		
Master-Slave-Terminals: maximum voltage	U _{M-MAX-PK}	V			50	14
LED-OFF-Indicator current	I _{OFF-IND}	mA		1		15

Notes:

- 1) Operation only in dry ambient; condensing ambient not allowed (operating class IP20).
 - 2) An additional surge protection for a limited number of surges up to 1000V is included.
 - 3) LEDs are OFF; active power supply current of the modules, approximately 0,4W; an additional wattless power is consumed due to the noise reduction capacitor (approx. 24mA).
 - 4) The current consumption depends on the number of connected LEDs as well as on the DIMMER adjustment; it includes wattless power.
 - 5) At maximum operating current (100mA); if a voltage higher than 250V applies at LA-LC (e.g. no LEDs connected) the module will not switch on; if less than 12 white LEDs are connected, a higher drive current may occur initially at the output.
 - 6) Independent on the number of connected LEDs, for 72 LED approx. 80mA.
 - 7) Depending on the number of connected LEDs
 - 8) Refers to a wire length of about 0.5m, significant parameter is however the external capacitance referred to GND (grounded mains conductor or protective earth conductor)
 - 9) If the sensor S1 is touched longer than 0.5sec DIMMER operation is started. The current is slowly increased respectively decreased as long as the sensor S1 is touched.
 - 10) If the sensor S1 is not touched for 0.5sec DIMMER operation is stopped.
 - 11) Duration of DIMMER ramp, current increase or decrease from 0% to 100% or from 100% to 0%.
 - 12) Only Soft-ON-OFF version
 - 13) Coupling capacitance on terminal M/S and M-GND.
 - 14) Peak voltage for both M/S and M-GND terminal, referred to internal circuit ground (see board dimensions drawing, page 6).
 - 15) For a white or blue LED.
- *) All current and voltage values are mean square root values if not otherwise noted.

8 Terminal Assignment

Part Number	S1	S2	C1	C2	C3	C4	C5	Remarks
Mid Power DIMMER								
SC2-230-X-M-NYY_	√	--	GND	M-GND	M/S OUT	VDD	--	Normal-Version
SC2-230-X-M-MYY_	√	√	GND	M-GND	M/S OUT	VDD	--	Master-Version
SC2-230-X-M-SYY_	--	√	GND	M-GND	M/S IN	VDD	--	Slave-Version
SC2-230-X-M-NYYL	√	--	GND	(M-GND)	LED-Cath	VDD		LED-OFF Indicator
SC2-230-X-M-C2 *	DIN	CLK	GND	M-GND	M/S OUT	VDD	--	SPI Version
SC2-230-X-M-C3 *	DIN	CLK	GND	M-GND	M/S OUT	VDD	EN	SPI Version

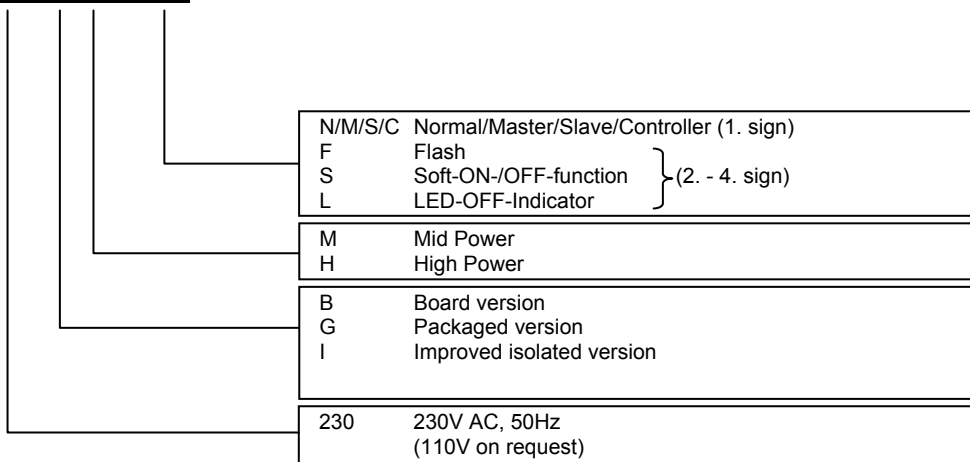
Explanation of the Part Number

- a. SC2: Dimmer type
- b. 230: Mains voltage (external supply voltage, 110V on request)
- c. X: B/G: Board or package version
- d. H/M: High Power or Mid Power (siehe data sheet)
- e. Controller version (Y1Y2Y3Y4= [N/M/S]:L:S:F)
 - i. Y1=N: Normal Version
 - ii. Y1=M: Master Version
 - iii. Y1=S: Slave Version
 - iv. Y1=C2: SPI 2-wire interface, DIN = SPI Slave in
 - v. Y1=C3: SPI 3-wire interface
 - vi. Y2=F: Flash (storage of actual DIMMER-value)
 - vii. Y3=S: SOFT-ON/OFF
 - viii. Y4=L: LED-OFF-INDICATOR (pin for external low power LED, connected to C1-C4)

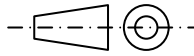
Available versions (package versions „X“ not mentioned):

Normal version	Master-/Slave version	Controller-version
SC2-230-X-M-N	SC2-230-X-M-M	SC2-230-X-M-C2F
SC2-230-X-M-NF	SC2-230-X-M-MF	SC2-230-X-M-C2FS
SC2-230-X-M-NFS	SC2-230-X-M-MFS	SC2-230-X-M-C2S
SC2-230-X-M-NFL	SC2-230-X-M-MS	SC2-230-X-M-C3F
SC2-230-X-M-NFSL	SC2-230-X-M-S	SC2-230-X-M-C3FS
SC2-230-X-M-NS	SC2-230-X-M-SF	SC2-230-X-M-C3S
SC2-230-X-M-NSL	SC2-230-X-M-SFS	
SC2-230-X-M-NSL	SC2-230-X-M-SS	
SC2-230-X-M-NL		

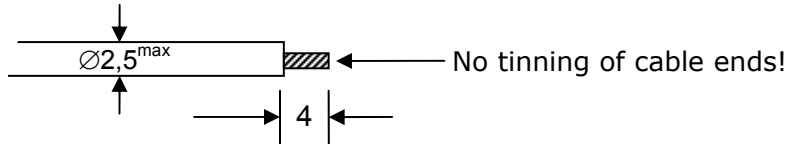
SC2-230-X-M-XXXX



9 Dimensions



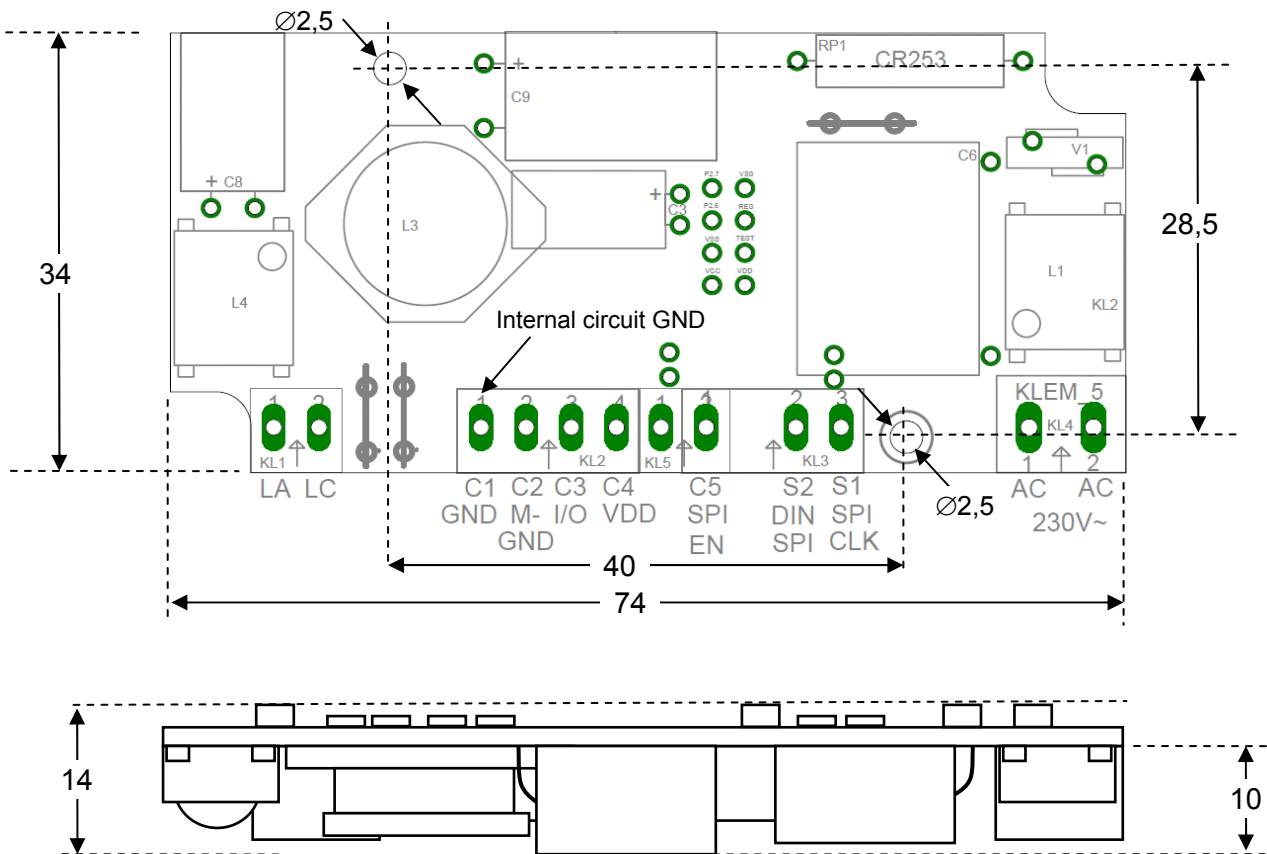
9.1 Cable Preparation



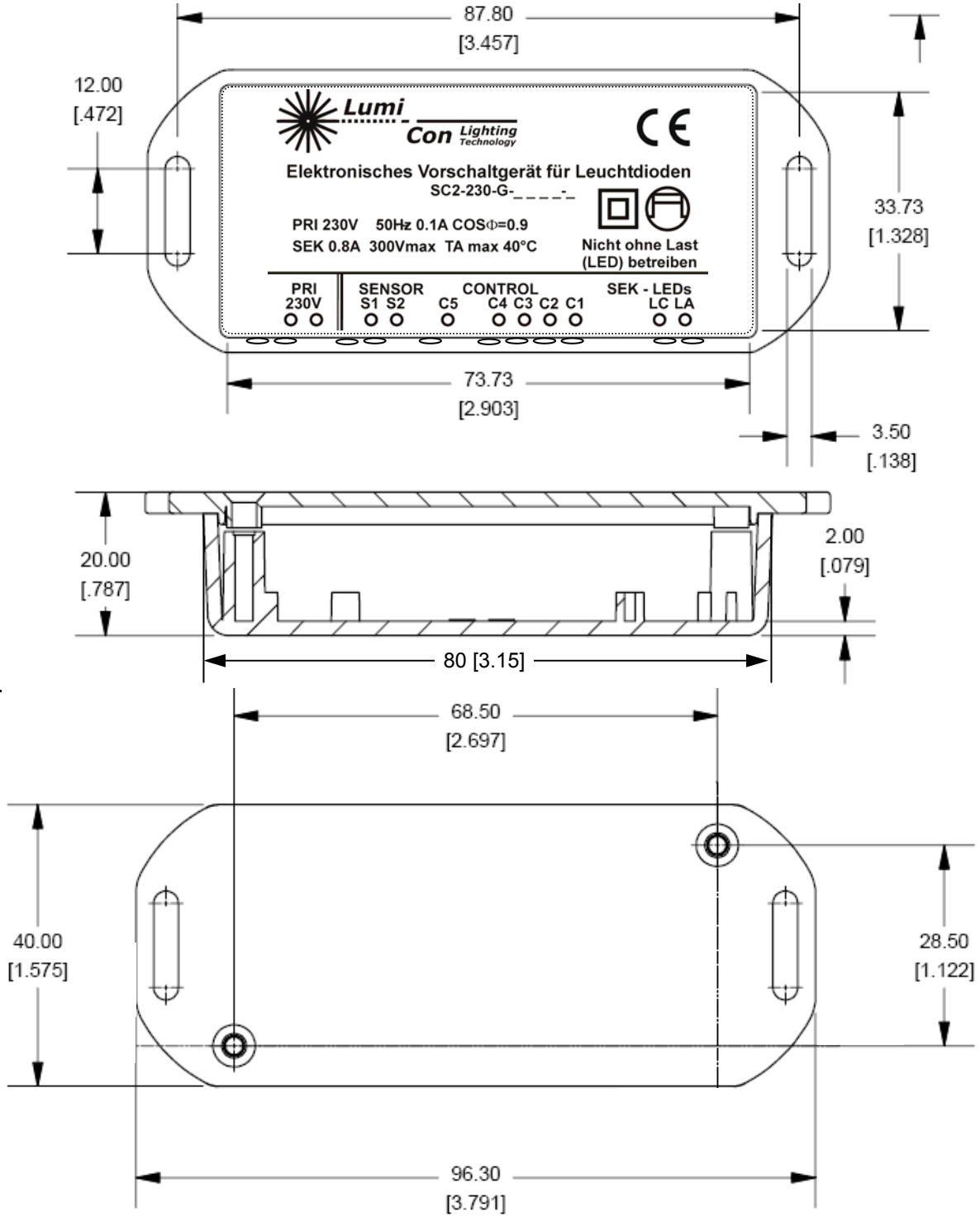
Maximum cross section for AC terminal clamps (230V) is 2.5 mm², for all others 1mm²; maximum outer cable diameter is 2.5mm. The terminal clamps have a wire protection mechanism. It may be necessary to re-bend the protection mechanism when repeatedly connected.

9.2 Board Version

(This drawing shows also the pinning for the packaged version, view into open package)

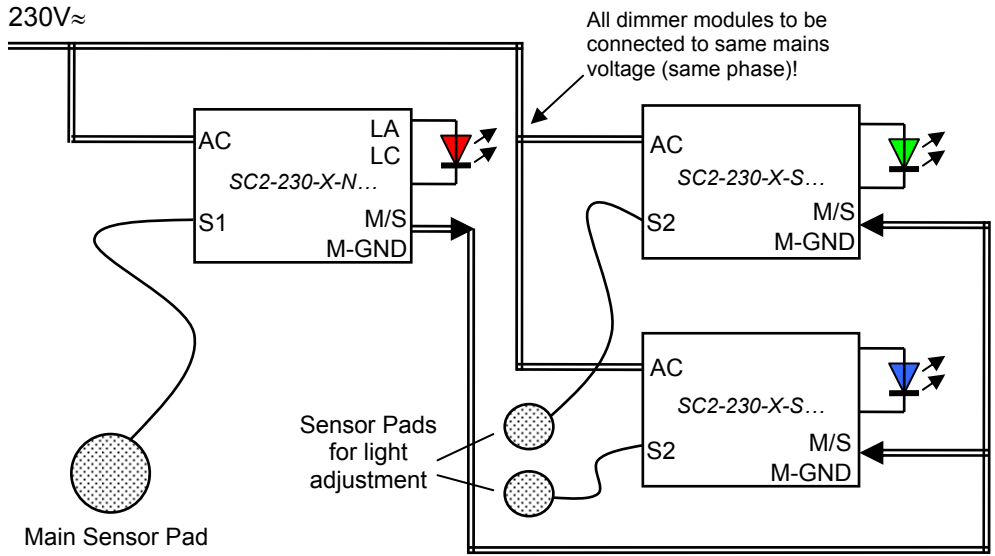


9.3 Package Version



Dimensions in mm [inch];

10 The Lumi-Con Master-Slave Interface – Synchronization of Three Dimmers



Lumi-Con dimmers (Normal and Master version) provide a 1kHz signal at the Master output (M/S OUT) with an amplitude of about 3V when the light is switched on. This signal is able to switch on a Slave module (SC2-230-X-S...). Maximum two Slave modules can be driven from a Master module. **All DIMMER-Modules interconnected through M/S and M-GND must be attached to the same mains supply (same phase).**

11 Installation and Precautions



The module is normally directly connected to mains voltage (230V \approx). Before you connect to mains voltage (initially) please make sure that all necessary connections are correct – never operate the DIMMER with no LEDs connected. Assure that you have **protection against contact** for all wires including the circuit, mains voltage wires, wires and LEDs thus no occasional contact can happen (exception: sensor inputs S1, S2). The module must not be operated in wet ambient or outside except it is protected accordingly.



The whole circuit including the attached components (e. g. the LEDs) and wires may show up to 350V peak voltage referred to ground. **Please do not touch the circuit and the connected components including the LEDs** if the circuit is powered up. In case of failure please switch of or separate from mains voltage immediately. Do not try to repair the module even it seems simple; this includes also broken fuses.

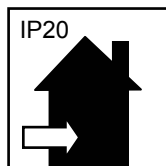
If you use switches please do only connect to protective earth conductor or to the grounded conductor (as shown in the figure on 1st page).

To measure the circuit (for example the LED current) you need isolated or battery operated instruments or eventually an isolating transformer for the module mains voltage. **Caution:** During power up an isolating transformer may generate high voltage peaks which can destroy the circuit. Hence, first switch on the isolating transformer, then connect the circuit to it.

After disconnecting the module from mains voltage the onboard capacitors are charged to high voltages. Hence please **wait a minute** until capacitors are discharged before you touch the circuit and the connected components (LEDs).



The modules fulfil the *EC Low Voltage Directive 2006/95/EC*, the *EC EMC Directive 2004/108/EC* as well as the RoHS compliancy (*EC Directive 2002/95/EC*). In addition they are compliant to *EuP Directive 2005/32/EG: Eco-Design of Energy Using Products*.



Attention please!

The information herein is given to describe certain components and shall not be considered as warranted characteristics. Terms of delivery and rights to technical change reserved.

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