

## Touch DIMMER for High Power LEDs

### Features

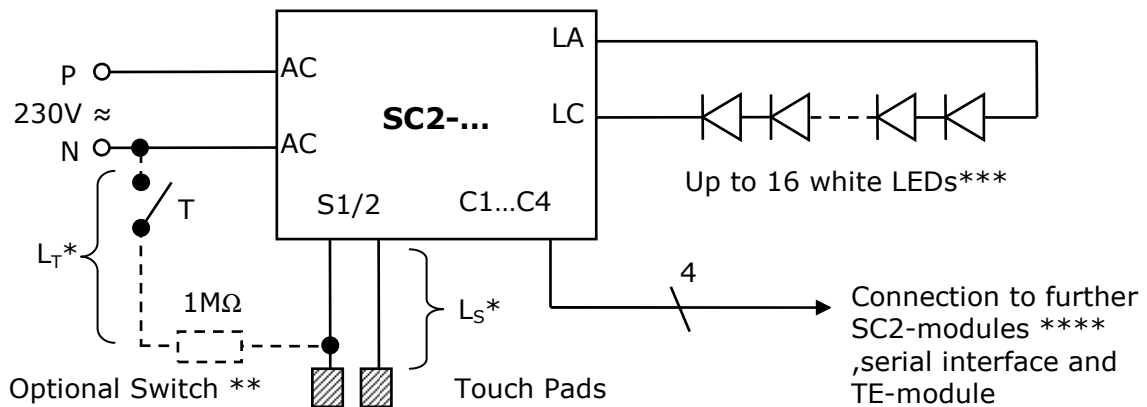
- Control of LED power via touch sensor for DIMMER function and ON/OFF
- Operation of 16 High Power LEDs directly from mains voltage (230V AC $\approx$ )
- Digital storage of DIMMER value (*Flash-Version*)
- No transformer or power adaptor needed
- Soft ON/OFF control (optional)
- Integrated noise filter to guarantee relevant noise specifications
- Current und voltage supervision of LED
- Low power consumption – high efficient switch mode controller
- Automatic adaption to optimum operating conditions
- Connection via reliable terminal clamps
- *Master-Slave-Output* for controlling further DIMMER modules (*Master-Slave-Interface*)
- Optional *SPI-interface* – prepared for DMX and DALI operation
- Operating class IP20 (dry ambient)



### Application

- Control of high power LED lamps
- „Touch-Me“-lamps (controlling of light when touching the lamp)
- Operating of up to 16 white LEDs
- Suitable for high power LEDs with up to 300mA drive current
- Touch-Extension access for longer touch pad cables

### Circuit

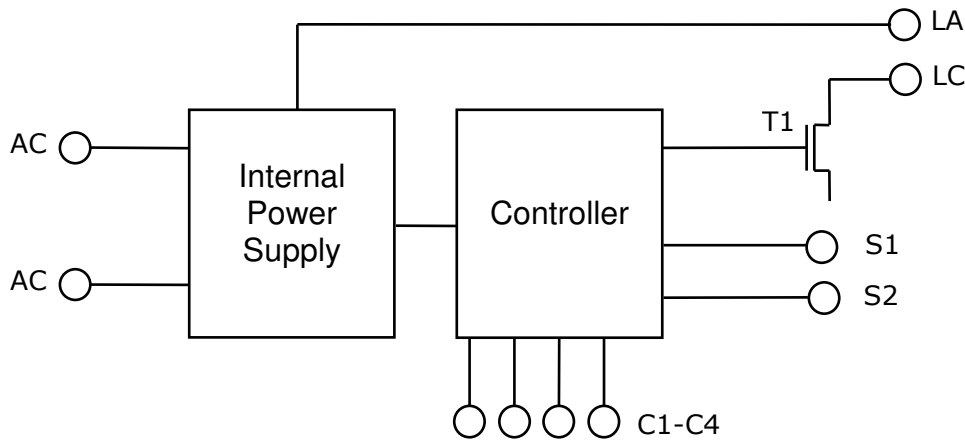


\*) Maximum wire length  $L_T$  and  $L_S$  is approx. 0.5m, for extension see page 4  
 \*\*) Switch (dotted line) must be connected (for safety reasons) only to grounded (neutral) power line (N) or protective earth conductor. A 1M $\Omega$  resistor is recommended close to the switch.  
 \*\*\*) or 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 and LED-conductors are connected to mains supply (high voltage, 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 16 white LEDs at a current up to 300mA. The LED power is controlled via the touch pads (S1, S2) or the control pins (C1 ... C4). A touch 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 T1 (operating as switched mode LED supply). The power supply generates a 3.3V supply as well as the DC supply for the LED switch mode controller from mains voltage. During stand-by-operation (LED power off) only 0.4W are consumed 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 300mA, 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.

www.lumi-con.de		LED-Lighting-Technologies	Data Sheet SC2-230-x-H-xxxx-x
			High Power Touch DIMMER for LEDs Rev. 1.5 – 04/2013

Dr. Karl Schrödinger  
Setheweg 12  
D-14089 Berlin

- 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<sub>PK-PK</sub>) 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 that 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, on and off is controlled by the slave input only. The slave input M/S IN must be connected to the master output M/S OUT 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. The dimmer operation is 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) can be connected to the pins C3, C4 of this version. This LED is switched on when the Lamp is off. This function can be used as a night light. The master output is not available for this

www.lumi-con.de		<b>Lumi-Con</b> <i>LED-Lighting-Technologies</i> Dr. Karl Schrödinger Setheweg 12 D-14089 Berlin	<b>Data Sheet</b> <b>SC2-230-x-H-xxxx-x</b>  <b>High Power Touch</b> <b>DIMMER for LEDs</b> Rev. 1.5 - 04/2013

version. Please note that LED-connection is not isolated from mains voltage (usage of 230V isolation).

### 3.4 Touch Extension Access (-NYILT-)

Touch Extension versions allows connecting a *Touch Extension Module (TE1)* to a *Normal* version. Using this technology an up to 10m long cable to the touch sensor can be attached. Both touch extension input (C1/C4) and sensor input (S1) can be used in parallel. See more details in TE1 data sheet. Optional LED indicator can also be use. See table on page 7 for pinning. Please note that TE-connection is not isolated from mains voltage (usage of 230V isolation).

## 4 Packaging

All versions are deliverable as packaged ("-G-") or board ("-B-") version.

Please note that an appropriate isolation must be kept if the board version is mounted.

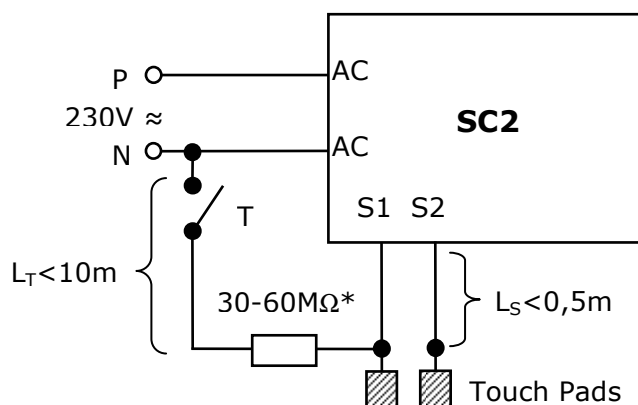
## 5 Current and Voltage Supervisor

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 (Figure 1). 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 63V 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.

## 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 <sub>AC230</sub>	V <sub>eff</sub>	200		250	
Periodic peak reverse voltage at AC-AC	V <sub>AC-PK</sub>	V <sub>PK</sub>			800	2
Supply (AC-AC) current (active current)	I <sub>AC-ACT-0</sub>	mA <sub>eff</sub>		1,7		3
Supply (AC-AC) current (wattless current)	I <sub>AC-WATTL-0</sub>	mA <sub>eff</sub>		24		3
Maximum supply current (AC-AC)	I <sub>AC-100</sub>	mA <sub>eff</sub>		90		4
Forward voltage of the LEDS	U <sub>F-LED</sub>	V	5		63	5
Maximum LED drive current, 100%-value,	I <sub>LED-MAX-3</sub>	mA		300		6
Minimum DIMMER output power		%	2		10	7
Input resistance at S1, S2	R <sub>IN</sub>	MΩ		10		
External capacitance at S1, S2 to GND	C <sub>IN</sub>	pF			20	8
Timing limit for ON, OFF	t <sub>ON-OFF</sub>	sec	0,1		0,4	
Timing limit for entering DIMMER mode	t <sub>DIMM_ON</sub>	sec	0,5			9
Timing limit for stopping DIMMER mode	t <sub>DIMM_OFF</sub>	sec	0,5			10
Duration of DIMMER Ramp	t <sub>DIMM_DUR</sub>	sec		8		11
Duration of Soft-ON/OFF ramp	t <sub>RAMP_DUR</sub>	sec		1		12
Master-Slave-Output: amplitude	U <sub>M</sub>	V		3		
Master-Slave-Output: source resistance	R <sub>M-OUT</sub>	KΩ		27		
Master-Slave-Output: coupling capacitor	C <sub>MS</sub>	nF		22		13
Master-Slave-Output: frequency	f <sub>M</sub>	kHz		1		
Master-Slave-Terminals: maximum voltage	U <sub>M-MAX-PK</sub>	V			50	14
LED-OFF-Indicator current	I <sub>OFF-IND</sub>	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 (24mA).
  - 4) The current consumption depends on the number of connected LEDs as well as on the DIMMER adjustment; includes wattless power.
  - 5) At maximum operating current (300mA); if higher voltage (i.e. more LEDs) is applied the module turns off to avoid destruction; see diagram 2, page 5. If less than 2 white LEDs are connected, a higher drive current may occur initially at the output.
  - 6) See diagram 1, page 5.
  - 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.

Figure 1: Maximum LED current depending on number of connected LEDs for the versions SC2-230-X-H-XXXXX. The diagram is valid for white high power LEDs with a typical forward voltage of 3,4V.

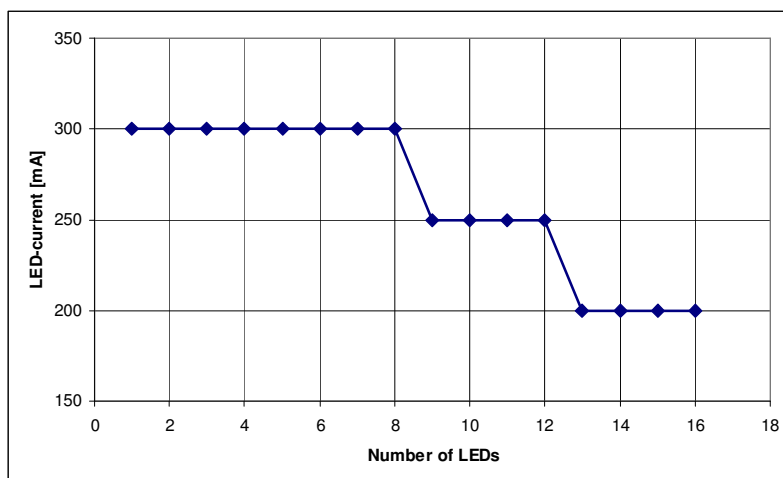
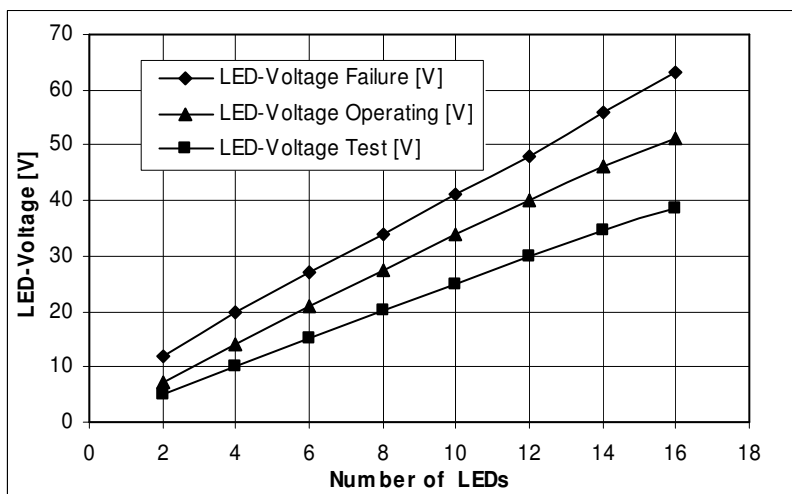


Figure 2: LED forward voltage specification, applicable at LA/LC-terminals:

“Operating”: typical LED-voltage at maximum current during operation;

“Test”: LED voltage during initialization, at low current (<10%);

“Failure”: at this voltage level during operation the module is (typically) shut down.



## 8 Terminal Assignment

Part Number	S1	S2	C1	C2	C3	C4	Remarks
<b>High Power DIMMER</b>							
SC2-230-X-H-NYY_	√	--	MGND	--	M/S OUT	VDD	Normal-Version
SC2-230-X-H-MYY_	√	√	MGND	--	M/S OUT	VDD	Master-Version
SC2-230-X-H-SYY_	--	√	MGND	--	M/S IN	VDD	Slave-Version
SC2-230-X-H-NYYL	√	--	--	--	LED-Cath <sup>1</sup>	VDD	LED-ON/OFF Indic.
SC2-230-X-H-NYYLT	√	--	GND	LED-AN <sup>2</sup>	nc ! <sup>4</sup>	TE-IN <sup>3</sup>	LED-ON/OFF, TE
SC2-230-X-H-C2-M	√	--	GND	SPI-CLK	--	SPI-OUT	SPI Master Version
SC2-230-X-H-C2-S	--	--	GND	SPI-CLK	SPI-IN	--	SPI Slave Version

- 1) Connect LED-AN to VDD (C4)
- 2) Connect LED Cath. to GND (C1)
- 3) Connect TE-GND to GND (C1)
- 4) Don't connect

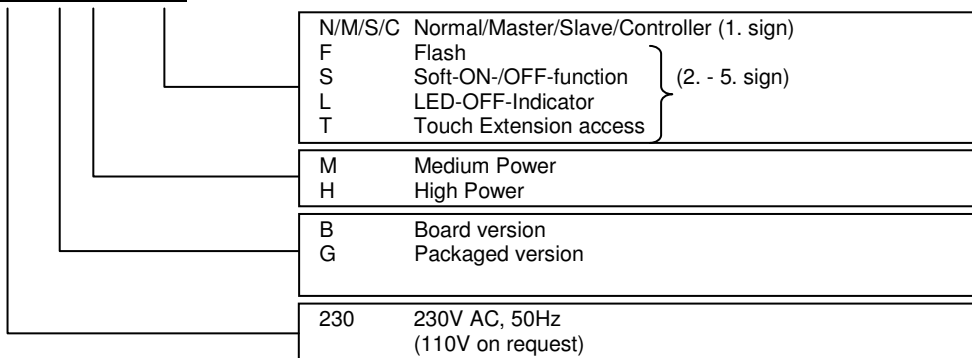
### Explanation of the Part Number

- 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 Medium Power
- 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 (DATA-IN or DATA-OUT, CLK, GND)
  - v. Y2=F: Flash (storage of actual DIMM-value)
  - vi. Y3=S: SOFT-ON/OFF
  - vii. Y4=L: LED-OFF-INDICATOR (pin for external low power LED)
  - viii. Y5=T: Touch extension access (details see TE-data sheet, for *Normal* version only)

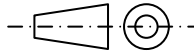
### Available versions (package versions „X“ not mentioned):

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

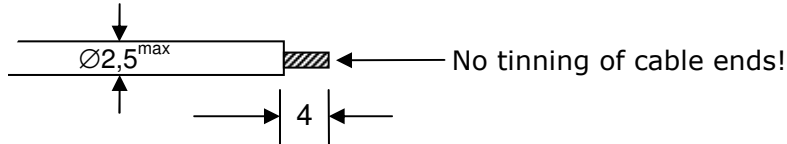
### SC2-230-X-H-XXXX



### 9 Dimensions



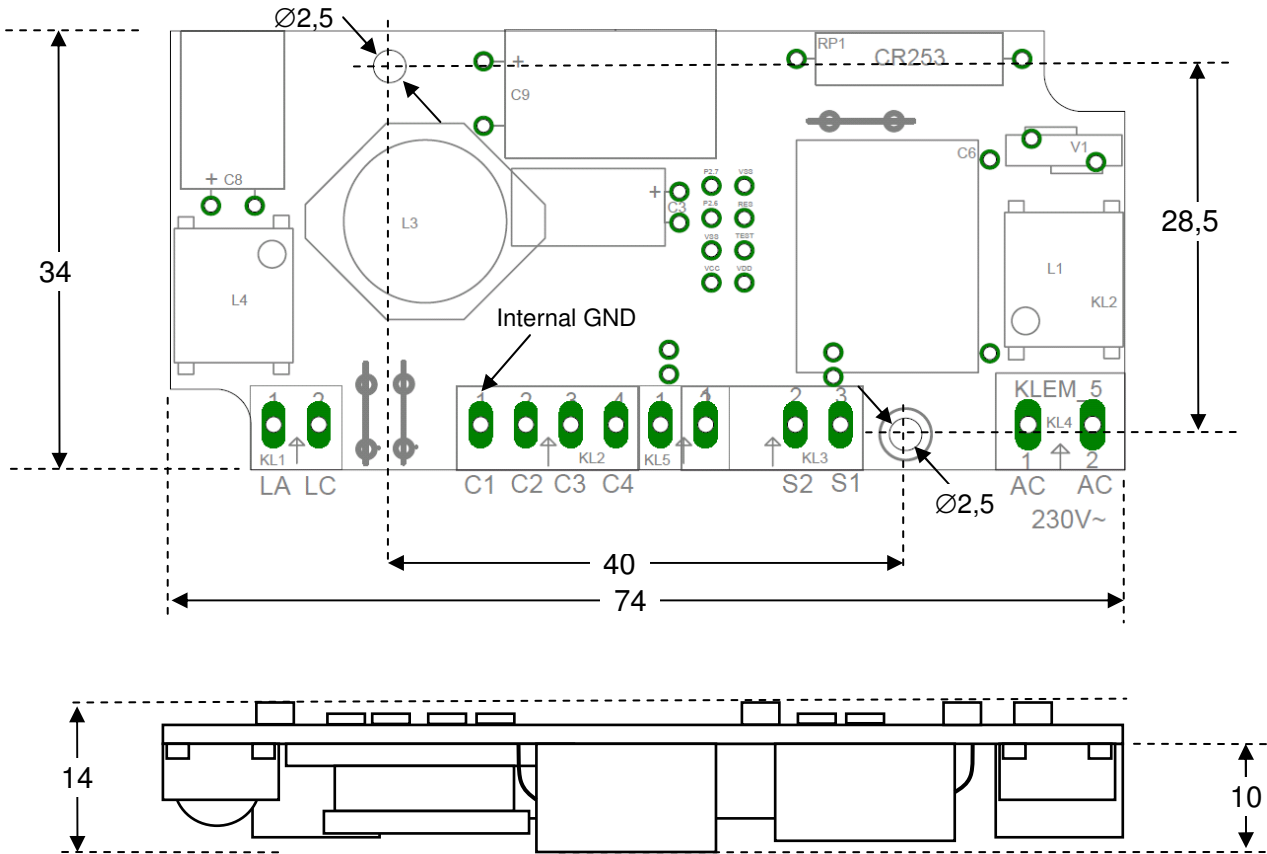
#### 9.1 Cable Preparation



Maximum cross section for AC terminal clamps (230V) is 2.5 mm<sup>2</sup>, for all others 1mm<sup>2</sup>; maximum outer 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.

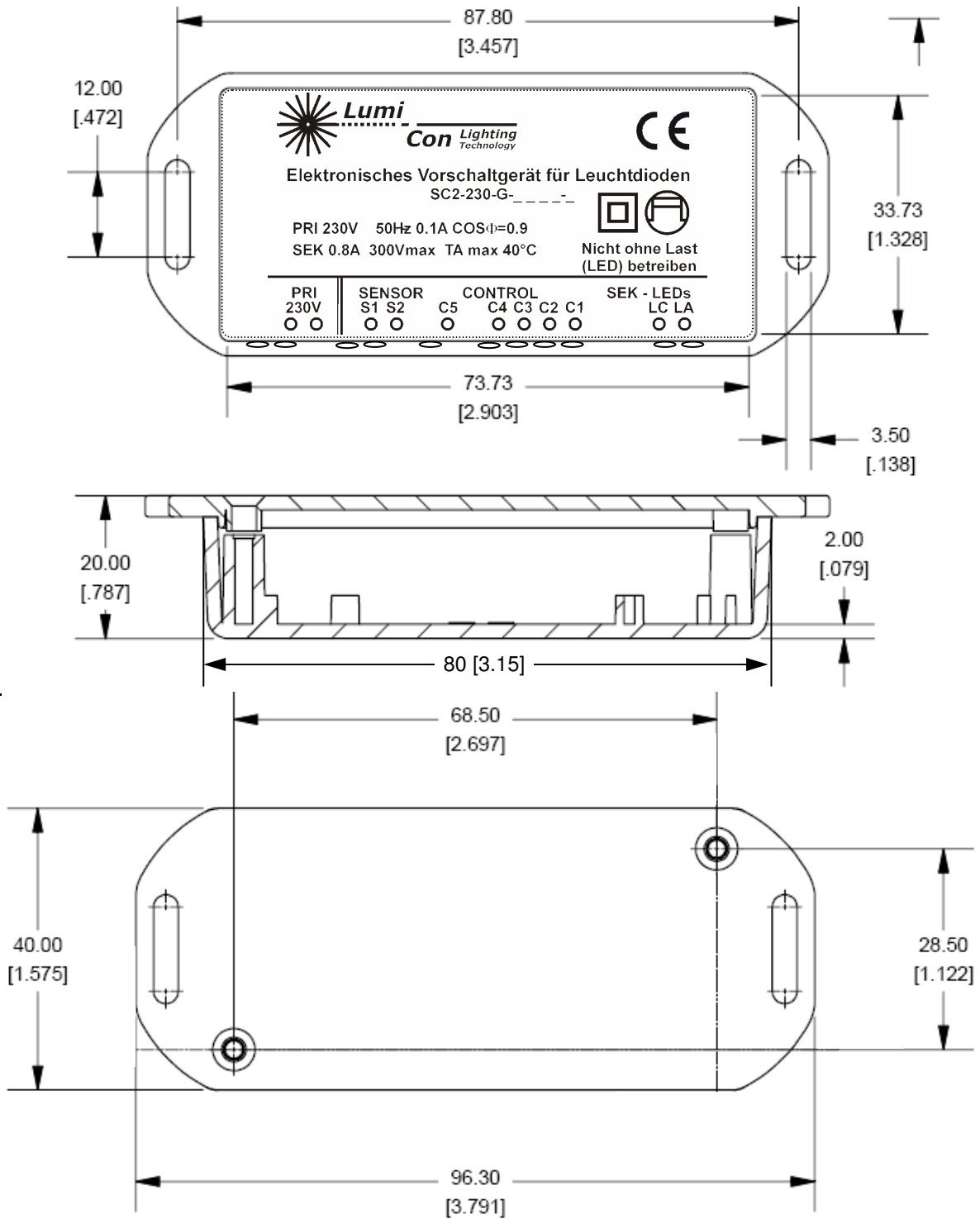
#### 9.2 Board Version

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



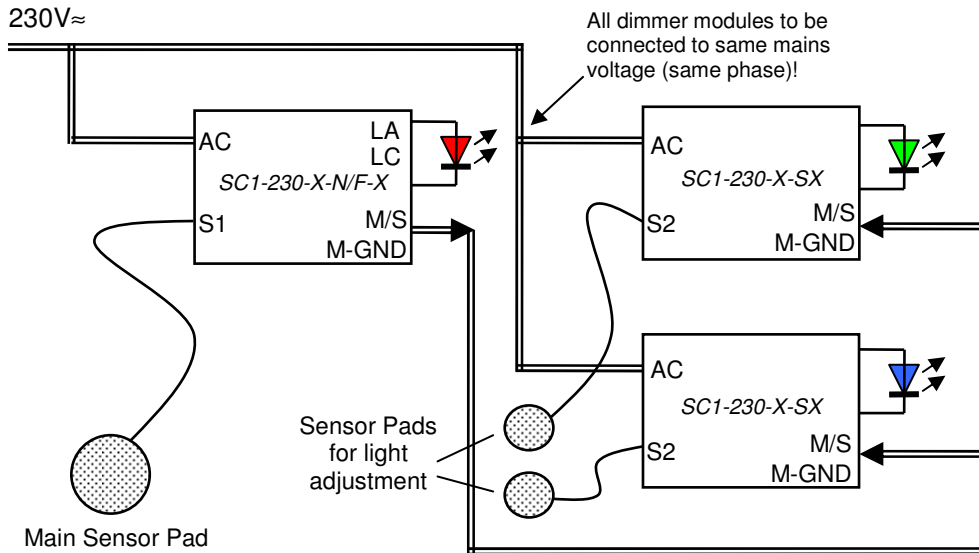


### 9.3 Package Version



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 phase of mains supply.**

## 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. Assure that you have **protection against contact** (i. e. isolation) for all wires including the circuit, mains voltage wires and wires to the LEDs thus no occasional contact can happen (exception: Sensor inputs S1, S2). The module must not be operated in wet ambient or outside, except explicitly specified.



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 off or separate from mains voltage immediately. Do not try to repair the module even it seems simple; this includes also broken fuses.

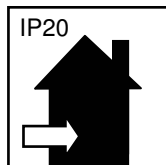
If you use **switches** please do only connect to protective earth conductor or to the grounded conductor (as shown in the figure on 1<sup>st</sup> page).

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 a 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* (former 73/23/EEC), 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.

We hereby disclaim any and all warranties, including but not limited to warranties of non-infringement, regarding circuits, descriptions and charts stated herein.

Lumi-Con components may only be used in life-support devices or systems with the expressed written approval of Lumi-Con.