Smart Dupline®
Power dimmer up to 500W with Energy Reading
Type SH2D500WE230

CARLO GAVAZZI

- Universal dimmer up to 500W for R, L, C load and LED lamps
- Automatic load detection for R, L, C loads
- Integrated heat sink for temperature dissipation
- 1 dimmable output
- Soft start/stop
- Protected against short circuit, overload and high temperature
- Minimum load 3 W
- Instantaneous variables readout: current, voltage, power
- Energy measurement: kWh
- Faulty lamp recognition

Product Description

This 500W universal dimmer is designed for DIN-rail mounting with energy measurement. Single phase variables: VLN, A, W. Energy measurement: total kWh consumed by the connected load. This universal dimmer is suitable for dimming resistive, inductive and capacitive loads and LED lamps (see LED lamps table). The maximum load of R, L, C type is 500W depending on the temperature: the reduction is described according to the trend in the diagram "derating curve".

The dimmer automatically detects if the connected load is resistive, capacitive or inductive, but if a LED lamp is to be driven, the user has to select the right curve as described below.

The dimmer is completely programmable via the smart-house tool.

The technology used enables to electrically protect the dimmer against short circuit, overload and over-temperature. Thanks to the internal bus, it can be easily connected to adjacent dimmers (see "wiring diagram") without the need of cabling the Dupline® BUS.

Futhermore, the integrated sink allows you to mount the dimmers adjacently without any reduction of the load due to the increased temperature.

Ordering Key

SH 2 D 500W E 230

- smart-house
- DIN housing modules
- Dimmer
- Maximum load
- Energy measurement
- Power supply

Type Selection

Housing	Mounting	Max. load	Output type	Supply: 115 to 240 VAC
2 DIN	DIN-rail	500W	Power mosfet	**SH2D500WE230**

Output Specifications

Maximum load	500 W for R, L, C load	**Dimming speed**	Programmable
Note: this is the maximum power supplied to the load: if an inductive transformer is used, the efficiency of about 60% has to be considered before connecting the lamps. If a capacitive transformer is used, the efficiency is about 90%.		**Types of dimmable lamps** Different types of outputs (L,C) can not be mixed	Incandescent (R) LV halogen lamps with electronic ballast (C) LV halogen lamps with conventional transformer (L) HV halogen lamps (R) 115/230V dimmable LED lamp ESL (Electron Stimulated Luminescence) lamps
Minimum load	3 W @ 230 V, 6 W @ 115V		
Protections	Overload, short circuit, thermal	**Notes:** if energy saving lamps are used, attention has to be paid to the maximum inrush current at start-up: it must not be greater than 3.5A otherwise the overload protection will be activated.	
Output type	Power mosfet		
Rated operational voltage	115/240 VAC		
Operational voltage range	115/240 VAC ±10%		
Rated operational frequency	50/60 Hz		

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Input Specifications

Key Pad	One push button on local dimmer

Dupline® Output Specifications

Voltage	8.2 V
Maximum Dupline® voltage	10 V
Minimum Dupline® voltage	5.5 V
Maximum Dupline® current	1 mA

Supply Specifications

Power supply	Overvoltage cat. II (IEC 60664-1, par. 4.3.3.2)
Rated operational voltage	115/240 VAC
Operational voltage range	115/240 VAC ±10%
Rated impulse voltage	2.5 kV
Rated operational power	1 W, 9 VA
Connection	4 x 6 mm²
Power on delay	Typ. 2 s

General Specifications

Installation category	Cat. II
Dielectric strength Power supply to Dupline® Dupline® to Output	4 KV AC for 1 min. 6 KV impulse 1.2/50µµs (IEC60664-1, TAB. A.1)
Fail-safe mode	In case of interruption of the smart-house connection, the channel will be forced into a specific optional status as described below.
Environment Degree of protection Front Screw terminal Pollution degree Operating temperature Storage temperature Humidity (non-condensing)	IP 50 IP 20 2 (IEC 60664-1, par. 4.6.2) -20° to +50°C (-4° to 122°F) -50° to +85°C (-58° to 185°F) 20 to 80% RH
LED's indication Supply ON Dupline® status Output status	1 green 1 yellow 1 red
Connection Terminal Cable cross-section Tightening torque	4 Screw-type max. 6 mm², min. 0.5 mm² 0.4 Nm / 1 Nm

Housing Dimensions Material	2 DIN module Noryl
Weight	150 g
Approvals	cRUus, according to UL60950 **UL notes:** Max room temperature: 40°C A readily accessible disconneting device shall be added in the building installation
CE Marking	Yes
EMC Immunity - Electrostatic discharge - Radiated radiofrequency - Burst immunity - Surge - Conducted radio frequency - Power frequency magnetic fields - Voltage dips, variations, interruptions Emission - Conducted and radiated emissions - Conducted emissions - Radiated emissions	EN 61000-6-2 EN 61000-4-2 EN 61000-4-3 EN 61000-4-4 EN 61000-4-5 EN 61000-4-6 EN 61000-4-8 EN 61000-4-11 EN 61000-6-3 CISPR 22 (EN55022), cl. B CISPR 16-2-1 (EN55016-2-1) CISPR 16-2-3 (EN55016-2-3)

Mode of Operation

Working mode
If the SH2D500WE230 is connected to the Dupline® bus and the bus is working properly, the dimmer is in STANDARD mode and the green LED is ON. The dimmer enters LOCAL mode if the push button is pressed or if the bus is faulty or not connected. In LOCAL mode the dimmer doesn't accept any command from the bus and the green LED will be flashing. The dimmer can go back to STANDARD mode only when the bus is ok and after one of the following events: 1) As soon as the Dupline® bus returns 2) After a timeout of 1 minute after a button press 3) After a power cycle.

Pushbutton
Bus connected
The push button can be used with a short or long pressure (>2 seconds): its pressure puts the dimmer in LOCAL mode.
Short pressure: the light is switched ON/OFF (toggle function) with the set value. Factory settings is 100%, so the first time this push button is pressed with a short pressure, the light is switched ON to 100%. If a different light scene is memorised in the module, the light is switched ON at that level.
Long pressure: once the light is ON, by keeping the key pressed for more than 2 seconds, the light will be increased up to 100% and then decreased down to 5%. This will be repeated until the key is kept pressed. Every time the button is pressed, the ramp is inverted.

Bus not connected or faulty
If the bus is not connected or faulty, the push-button overwrites the failsafe condition with the previously described behaviour.

Coding/Addressing
No addressing is needed since the module is provided with a specific identification number (SIN): the user has only to insert the SIN number in the configuration tool when creating the system configuration.

Specifications are subject to change without notice (08.05.2019)

Mode of Operation (cont.)

Faulty lamps recognition
If the measured current is lower than 20mA, the relay module gives a message of faulty load (the connected lamp might be broken). This information is sent to Sx2WEB24 that makes it available to the user via the SHtool, Webserver, email, SMS, ...

Fail/safe condition
The output status of the dimmers, when the Dupline® bus is not connected or faulty, is programmed via the SH Tool and the user can choose between the following options:
1. Output always OFF
2. Output always ON
3. The output maintains the status they had before the disconnection.
As default, output is factory set to OFF.

Energy measurement
The electrical values measured by the SH2D500WE230 are: current, voltage, power, energy. These readouts are sent to the SH2WEB24 and logged there, the instant values and the logged ones are accessible to the user by connecting to the webserver resident in the SH2WEB24, via sms, emails or modbus.

Hardware short circuit protection
As described in the "Lighting Circuit Design", if more capacitive transformers have to be connected in parallel for a total load higher than 180W @20°, the hardware short circuit protection has to be disabled.
This protection has to be disabled via the SH tool as described below in "Programming".
If the hardware short circuit protection is enabled, it is always active when the output is both on and off. If the protection is disabled, it is active only when the load is off, in this situation care has to be taken to avoid short circuits when the output is active, otherwise the dimmer will be damaged.

Programming
The dimmer SH2D500WE230 is fully programmable via the SH tool and the programmable parameters are the following ones:
1) *Ramp time*. It is the time the dimmer takes to switch the light on from 0% to 100% (and from 100% to 0%). It can be set from a minimum of 2 seconds to a maximum of 27 seconds
2) *Load type*. This dimmer can drive
- RLC load (RLC curve): e.g. incandescent, halogen lamps
- LED lamps dimmable with trailing edge curve (P1 curve)
- LED lamps dimmable with leading edge curve (P2 curve)
- LED lamps dimmable with leading edge curve and no soft start (P3 curve)
Please see LED lamp dimming paragraph for more details.
3) *Fail safe state*. The user can program the three different behaviour previously described.
- Output always off
- Output always on
- The output maintains the status it had before the disconnection.
4) *Short circuit protection*. The user can enable/disable the hardware short circuit protection.
5) *Scenario changing enabled*. With this option the user can block the changing of a dimming scenario in a dimming function (e.g. hotel, public places, …).
6) *Scenario saving enabled (unlock)*. With this option the user can block the saving of a change in a scenario in a dimming function.
7) *Soft start ramp*. Using the SH tool, the user can define a different soft start ramp for each scenario.
The soft start can be programmed from 1 to 31 seconds.
8) *Soft stop ramp*. Using the SH tool, the user can define a different soft stop ramp for each scenario.
The soft stop can be programmed from 1 to 31 seconds.

The dimmer SH2D500WE230 can also be used, coupled with any of the smart-house lux sensor, in dimming functions with constant light programming.

Electrical Values Readout

Rated values

Current	0 to 32,000 mA
Voltage	103 to 260,0 V
Power	0.1 to 6500,0 W
Energy	0.1 to 99999999.9 kWh with roll over

Error and Warning Readout

Error
Overvoltage error
High temperature error
Frequency error
Short circuit hardware protection

Warning
High current warning
Short circuit software protection

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LED Lamp Dimming

As described in "Programming", when using LED lamps, the dimmer needs to be programmed with curve P1 when the LED manufacture recommends trailing edge dimming (capacitive), P2/P3 when the LED manufacturer recommends leading edge dimming (inductive). The selection of P1, P2, P3 also implements a different response curve. This curve is the relationship between lamp brightness and the power supplied to it. LED lamps have a different curve compared to standard inductive loads.

Please see table here for manufacturer's recommen-dation. If your LED lamp is not listed, please refer to the manufacturer for advice on their preference for leading or trailing edge dimming.

If many LED lamps are connected in parallel, we suggest the following rule to define the maximum number of LED lamps, the maximum total LED lamp power ≤1/10th of dimmer's maximum rated power. The maximum load depends on the capacitive input impedance of the LED lamps, so it can vary according to the LED lamps type.

If the red LED on the SH2D500WE230 dimmer starts blinking continuous-ly as soon as the load is applied, this suggests that the total load has become more capacitive than induct-ive (the total capacitance is done by the sum of the cap-acitance of each connected LED lamp) and can not be driven anymore by the P2 curve.

The explanation of this is as follows, as previously described most LED lamps have to be dimmed as an inductive load with leading edge dimming (P2), but if more LED lamps are con-nected in parallel, the load becomes more capacitive (total capacitance is the sum of capacitance for each con-nected).

Since a capacitive load can not be dimmed with leading edge dimming (because of the currents peaks) the dim-ming curve must be set to P1. In this situation the dim-ming performance may be reduced.

A compromise between dimming performance and the total load that can be connected has to be decid-ed by the installer.

LED curve selection
www.productselection.net/manuals/uk/led_curve_selection.pdf

LEDs Indication

Red LED: Always ON: Load ON, no error

- 1 short blink every 4 seconds: High current warning (> 2.5A). The dimmer goes on working but high temperature might occur. This depends on the time the output stays on and on the room temperature.

- 2 short blinks every 4 seconds: Overvoltage error. To reset it, switch the dimmer OFF. If the error appears again, the load must be modified.

- 3 short blinks every 4 seconds: High temperature error: this error will be trig-gered if the internal temper-ature raises above 90°C. Please wait until the inside temperature goes below 70°C. The reset of the error is automatic once the tem-perature is within operating range.

- 4 short blinks every 4 seconds: Wrong frequency error. If the frequency of the power supply is correct, this error indicates a hardware failure. The reset of the error

is automatic once the fre-quency is ok.

- 5 short blinks every 4 seconds: Short circuit soft-ware protection active. Remove the short circuit and press the push button on the dimmer.

If the error is still present, the above procedure should be repeated.

Always blinking: Hard-ware short circuit protection active. To reset it, switch the dimmer OFF, remove the short circuit and switch the

dimmer ON again.

Green LED:
ON: Supply ON
OFF: Supply OFF
Blinking: LOCAL mode.

Yellow LED: if the Dupline® Bus is working properly, it is always ON.
If there is a fault on the Bus it will be flashing.
It is OFF if the Bus is OFF or not connected.

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Lighting Circuit Design

Some general rules have to be taken into consideration when designing lighting circuits.

Ferromagnetic transformers
When using halogen lighting with ferromagnetic transformers, pay attention to the output of the transformers. To maximise efficiency, load these transformers with at least 80% of their normal power. Pay attention to the output of the transformer when determining the total load of the dimmer. The transformer has to be suitable for dimming.

Electronic transformers
Electronic transformers present a capacitive load to the dimmer but if the cable between the transformer and the dimmer is significant this will introduce an additional inductive load, and the dimmer would see a combination of the two types of load (inductive and capacitive).

It is recommended that an electronic transformer is loaded to at least 75% of its maximum rated loading, this reduces the possibility of lamp flicker when dimming, as it is common with electronic transformers. Refer to the manufacturer's specifications for the electronic transformer being used.

Pay attention to the output of the transformer when determining the total load of the dimmer (average efficiency is around 90%). The transformer has to be suitable for dimming.

When a capacitive load is initially connected there may be a substantial surge of current through the primary winding called inrush current.

This inrush current may last for 2-3 seconds and can have a peak of 10 times the RMS current stated by the manufacturer of the transformer (this is also valid for CFL fittings).

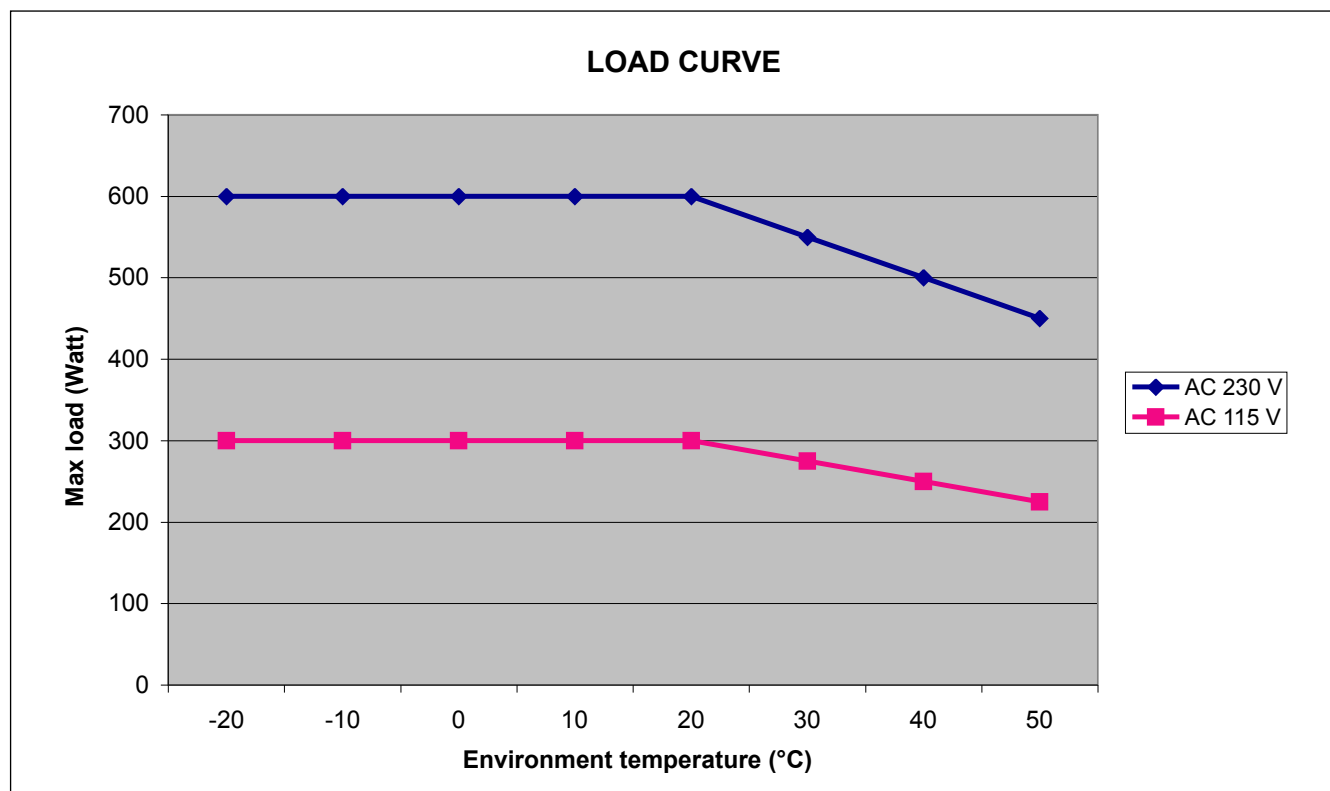If many electronic transformers are connected in parallel, the value of the total current is given by the sum of the current peaks generated by each transformer.

If the total inrush current is higher than 3.5 A, the dimmer's hardware short circuit protection will be activated.
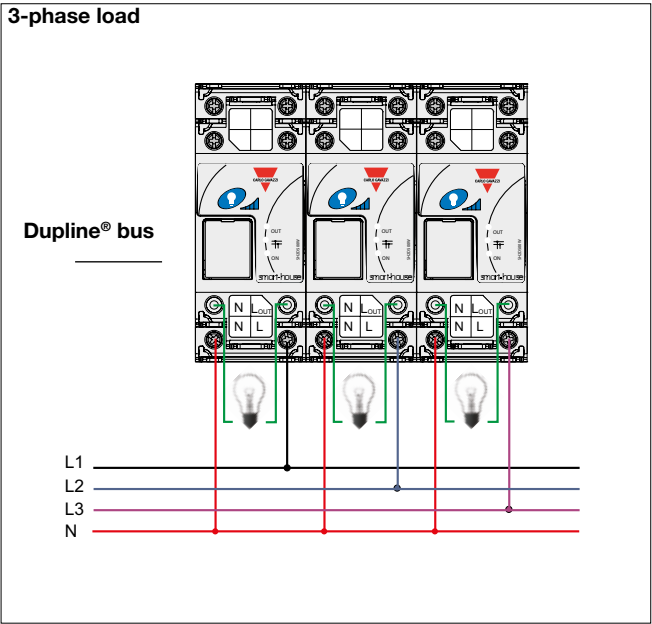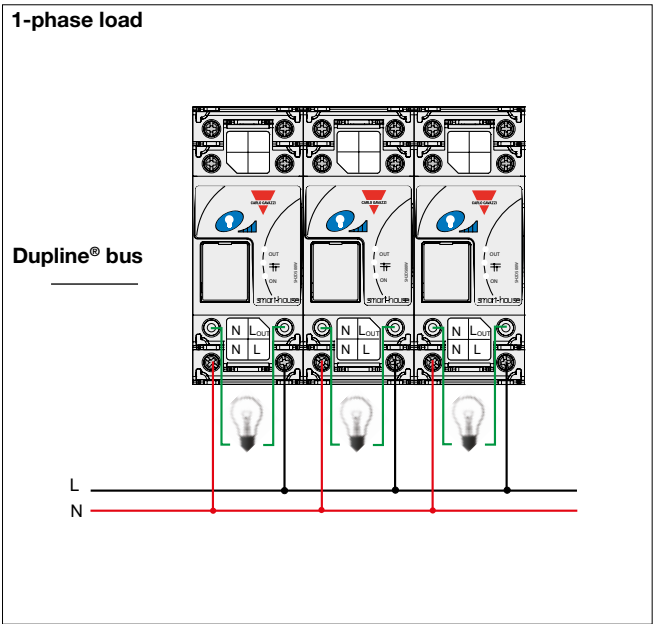
As a general rule if the short circuit protection is enabled, a total load of 30% of the nominal dimmer output power can be connected to the dimmer (180W@20°C).

If the short circuit protection is disabled, a total load of 90% of the nominal dimmer output power can be connected (540W@20°C).
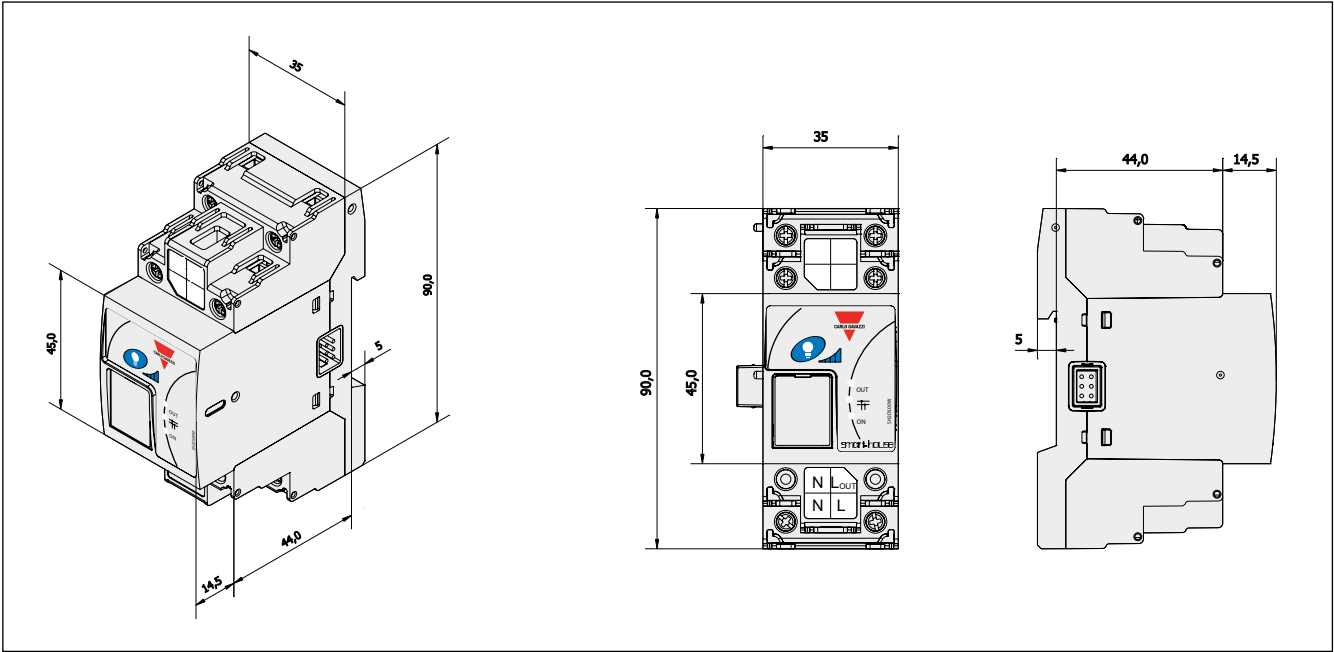
Derating Curve

LOAD CURVE

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Wiring Diagrams

1-phase load

Dupline® bus

3-phase load

Dupline® bus

L1
L2
L3
N

L
N

Note: The cable between the dimmer module and the light should not exceed 25 metres

Dimensions

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