Pulsed Solar Simulator System

PSL 8

Load and Measuring Device

Operating Manual

PC controlled load simulation and IV curve measurement for solar modules

BERGER Lichttechnik

Revision 2.5

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Operating Manual Remarks

Dear Customer,

This manual is designed to teach you how to operate the PC controlled load simulation and IV curve measuring device type PSL 8 of your BERGER system.

Please read this manual carefully and follow the instructions, as the system can only operate properly and reliably if the PSL 8 is installed and used correctly.

Make this manual available to all personnel involved in operating the unit and keep it available for future reference.

The unit must only be operated by trained and qualified personnel and in observance of the technical instructions given by BERGER Lichttechnik.

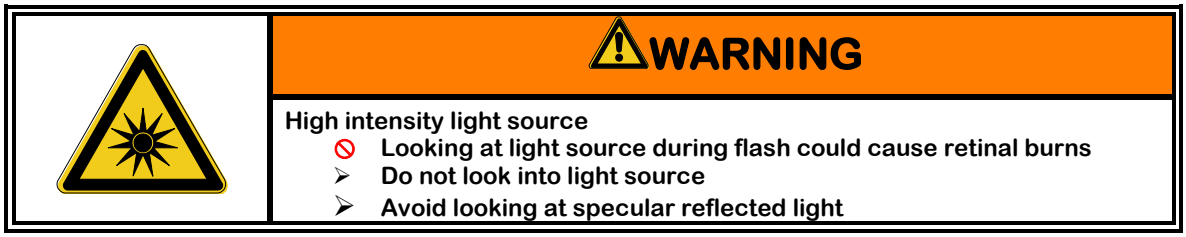
The manufacturer accepts no liability for any damage or personnel injury resulting from incorrect use or not following the instructions and warnings given in this manual.

Notes, Notices, and Warnings

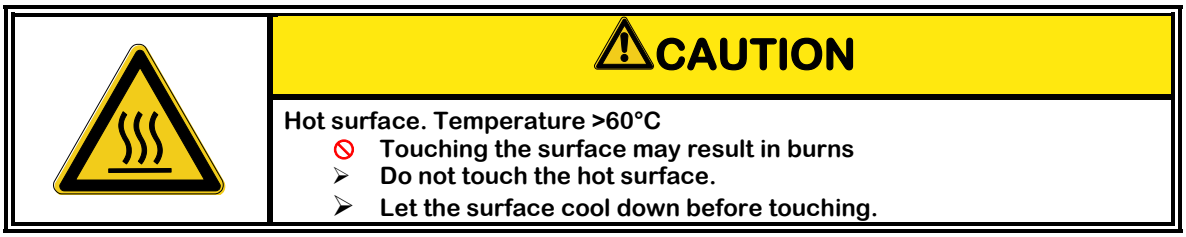
Throughout the manual the following types of warning notices will be used:

[The signs shown here are examples and do not represent hazardous situations which may arise during the usage of the unit]

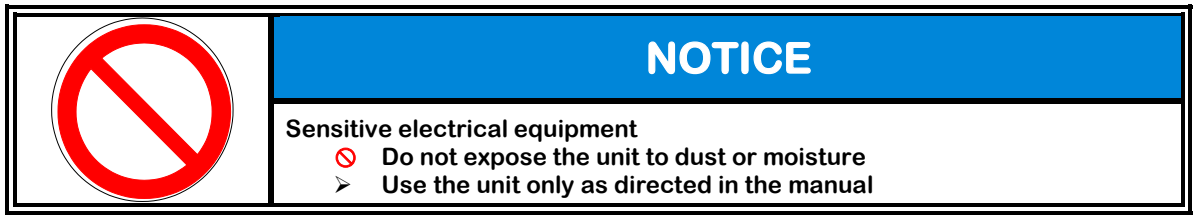
DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.



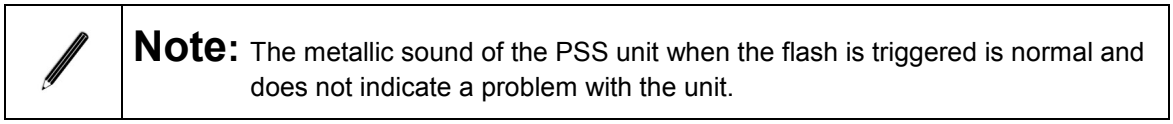
WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.



NOTICE indicates a situation which, if not avoided may result in property damage.



A NOTE indicates important information that helps you make better use of the BERGER System.

Introduction

The PSL 8 is the standard unit for module production and off – line measurement. It can be easily integrated into automatic and semi – automatic handling systems by automatization suppliers. Customized versions for Research & Development are available on request.

The load to the module during the measurement is fully passive, so a high repeatability is achieved. The standard measurement range is 15 / 30 / 60 / 90 / 120 V and 6 / 12 / 18 A. This measurement range can be customized to the specifications of the customer. The specific measurement range of your PSL 8 unit is given in the calibration documentation of the unit.

The unit supports pulsed as well as continuous light measurements.

Figure 1: Picture of the PSL 8 unit

General Safeguards

This unit is manufactured and tested according to the safety regulations for electronic measuring devices. Faultless operation and safety of the unit can only be guaranteed if all usual safety precautions as well as the specific safety regulations in this manual are observed when operating the unit.

Use

WARNING

Incorrect power supply voltage

- **Possibility of electrical shock and damage to the system**
- **Make sure that the voltage stated on the unit and the power supply voltage match.**

Power Sources

The system must be operated only with the type of power sources indicated on the marking label of the respective unit. A wrong connection may cause damage to the unit / system and hazardous voltages may occur on the unit.

Overloading

Do not overload wall outlets, extension cords or convenience receptacles beyond their capacity, since this can result in fire and / or electrical shock.

Object and Liquid entry

Never push objects of any kind into the unit through openings as they may touch dangerous voltage points or short out parts that could result in a fire, electrical shock and / or will damage the unit. Never spill liquid of any kind on the unit.

Attachments

Do not install and use attachments not recommended by the manufacturer, as they may cause hazards.

Cleaning

Unplug the whole system before cleaning any of the accessible parts. Do not use liquid cleaners or aerosol cleaners. Use a cloth lightly dampened with water for cleaning the exteriors of the system.

Damage

If you can assume that the unit can no longer be operated safely it is to be decommissioned and marked appropriately so it will not be used again.
The operator's safety can be affected by the unit if the unit i.e.:

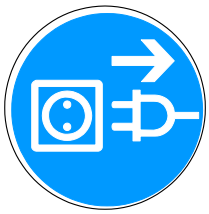
- shows visible damages
- does not work as specified anymore
- has been stored under inappropriate conditions for any length of time

In case of doubt generally send in the unit to the manufacturer for repair or maintenance.

WARNING

Electrical connections

- **Possibility of electrical shock and damage to the system**
- **Make sure that the system is not plugged into the main grid.**
- **Protect the system against accidental activation.**



Power-Cord Protection

Route the power cords so that they are not likely to be walked on or pinched by items placed upon or against them. Pay particular attention to the plugs, receptacles, and the points where the cords exit from the respective units.

NOTICE

Fiber optic cable

- **Sharp bending may damage the fiber optic cable**
- **Make sure that a bending radius of not less than 15 cm is used.**
- **Pay attention to the bending angles at the converter and the plugs.**

Optical Fiber Cable Protection

Route the fiber optic cables so that they are not likely to be walked on or pinched by items placed upon or against them.

Condensation

Rapid changes in the ambient temperature may cause condensation water to form in the unit. This can result in fire or electrical shock and may damage the unit.

Wait an adequate amount of time for the unit to reach thermal equilibrium with the ambiance.

Ventilation

The slots and openings in the unit are provided for necessary ventilation. To ensure reliable operation of the unit, and to protect it from overheating, these slots and openings must never be blocked or covered.

Installation location

The unit is designed to be used in closed rooms. Any kind of electromagnetic field or disturbance in the power supply can influence the measurement or render it useless.

Service

For questions regarding problems with the operation of the unit contact the manufacturer at:

BERGER Lichttechnik GmbH & Co. KG
Wolfratshauser Str. 150
82049 Pullach – Germany
Phone: +49 (0)89 / 79355266
Fax : +49 (0)89 / 79355265
Email: info@bergerlichttechnik.de

Annual Calibration and Service Check

According to ISO 9000 it is recommended to send the PSL 8 unit back to BERGER Lichttechnik for an annual calibration and service check. Without this annual calibration and service check you will not have a valid calibration certificate for the PSL 8 unit.
It is possible to obtain a loaner PSL 8 unit which can be used for the time needed for shipment to and from the BERGER Lichttechnik facility and calibration. With this arrangement the down time of your production line is reduced to a minimum.

Connections on the PSL 8 unit

Front panel connectors:

CURRENT	2x 4 mm laboratory plug sockets for cell current measurement (black socket= negative pole)
VOLTAGE	2x 4 mm laboratory plug sockets for cell voltage measurement (black socket= negative pole)
REF	2x 4 mm laboratory plug sockets for monitor cell connection (black socket= negative pole)
PSS	Fiber optics connection to the Pulsed Solar Simulator (PSS)
PC	Fiber optics connection to the PC
Power	DC socket for external mains adaptor

Back panel connectors:

The BNC connections on the back of the unit are designed for testing purposes and checks and should not be used during regular operation.
The following signals can be represented using a suitable oscillograph (inputs each 1MΩ / 15 pF)

Takt	Measurement cycle TTL; rising flank corresponds to start of conversion by the A/D Converters
Ref.	Analogue output of the monitor voltage (0 – 2,5 V)
U	Analogue output of the cell voltage (0 – 2,5 V)
I	Analogue output of the cell current (0 – 2,5 V)

	**Note:** The BNC outputs are not calibrated.

Assembly

If you are installing the PSL 8 unit in a new system you can skip the following part named *Shutdown procedure* of the installation manual and go directly to the part named *Installation procedure for a PSL 8 system.*
If you have to exchange the PSL 8 unit in a system that is already in use, follow the instructions in the chapter named *Shutdown procedure*.

Shutdown procedure

This procedure describes the steps to shutdown the BERGER system for installation of the PSL 8 unit. This is **not** a complete shutdown of the production system. **Only** the BERGER system is affected by this procedure. If there are other systems like conveyors, etc. they have to be shutdown according to their respective instruction manuals if it is necessary during the installation of the PSL 8 unit.

WARNING

High intensity light source

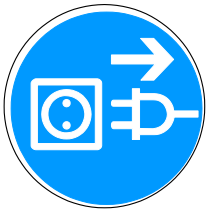
- **Looking at light source during flash could cause retinal burns**
- **Do not look into light source**
- **Avoid looking at specular reflected light**

To install the PSL 8 unit you should switch the generator off to prevent an accidental flash.
In the first step you have to switch off the generator by pressing the red button labeled **"Emergency Stop"** on its front. After these steps remove the mains plug to prevent the system from being turned on accidentally. These steps will prevent an accidental flash.

WARNING

Electrical connections

- **Possibility of electrical shock and damage to the system**
- **Make sure that the system is not plugged into the main grid.**
- **Protect the system against accidental activation.**



Installation procedure for a PSL 8 system

The sketch below shows the sequence of the fiber optic connections.

The pictures in figure 2 to 4 show the correct connection of the fiber optic cables for a PSL 8 unit. Mind the labels on the fiber optic cables (see figure 5). You always have to connect the red “IN” connector with the corresponding “OUT” socket and the black “OUT” connector with the corresponding “IN” socket on the unit.

Figure 2 Fiber optic cable connections at the PT100 unit

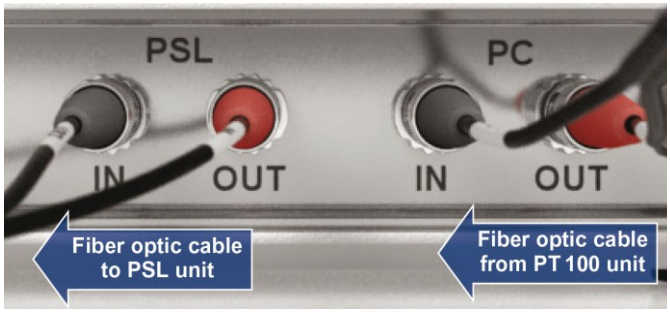


Figure 3 Fiber optic cable connections at the IR Sens unit

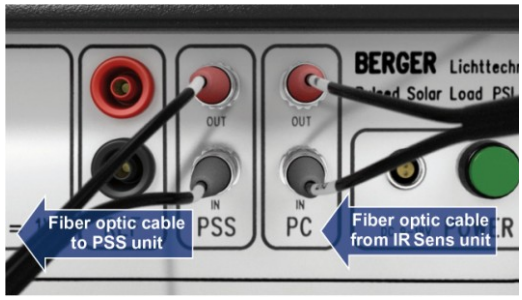


Figure 4 Fiber optic cable connections at PSL unit

Figure 5 Fiber optic cable labels

After connecting the fiber optic cables, connect the module measuring cables with the PSL 8 unit. Keep in mind that the black ports on the PSL 8 unit are for the negative pole of the solar module.
Plug the jack of the monitor cell into the sockets marked REF on the PSL 8 unit. The jack of the monitor cell has a small bump on it which is marked GND. The pin on the side with the bump has to be connected with the black socket on the PSL 8.

Afterwards plug the power plug into the front socket of the PSL 8 and connect the unit to the main grid using the mains adapter.

After connecting all parts of the Berger system switch all units on (including the PC) and start the software on the PC.

Software Setup

For installation of the software refer to the software manual.

To setup the PSL 8 unit in the software you have to check the RS232 PSL settings. First you have to change from operator mode to manager mode by clicking “Settings” then “Operating mode…”. (See figure 6).

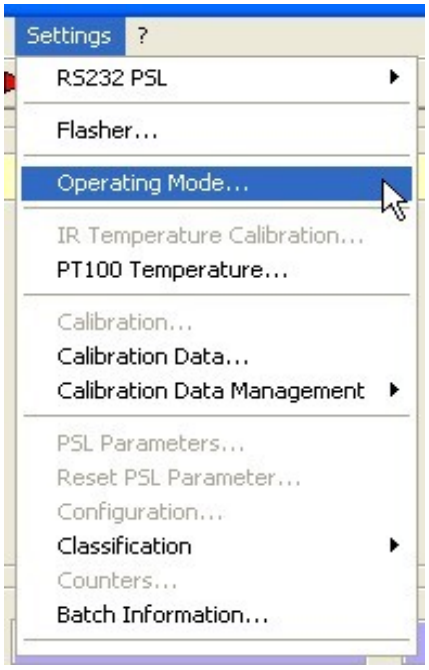


Figure 6

After entering the manager mode password go to the “RS232 PSL” item in the settings menu and choose settings. (See figures 7 and 8).

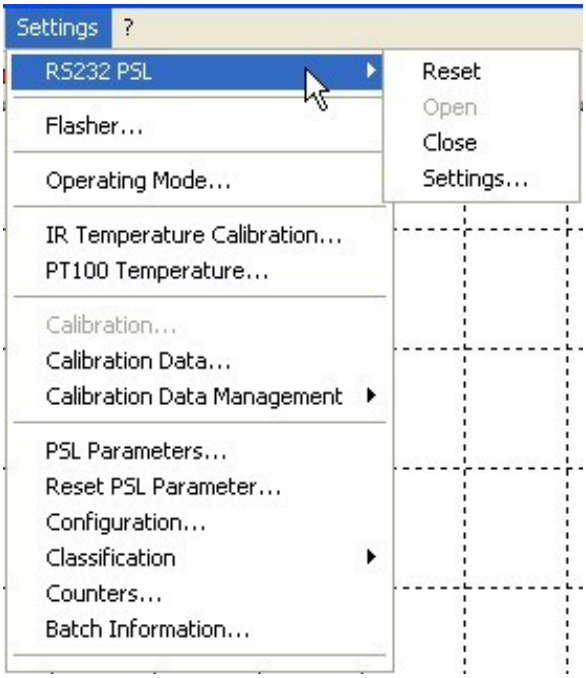


Figure 7

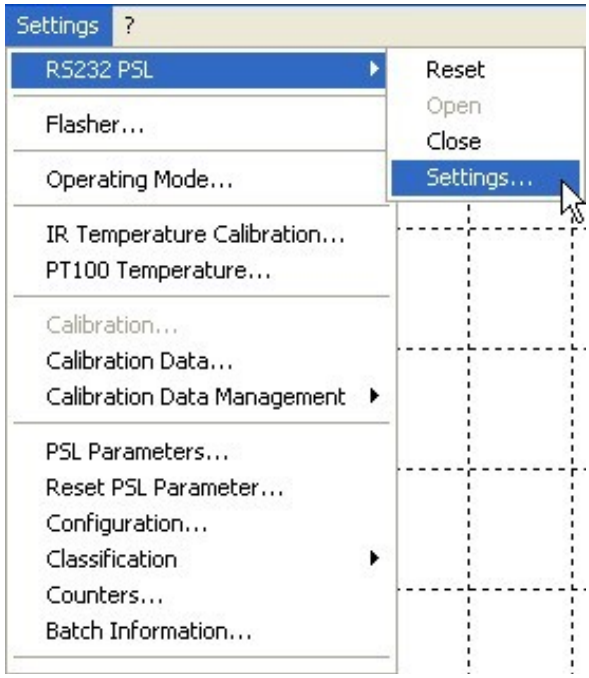


Figure 8

The following setup window for the RS232 connection of the PSL 8 will pop up:

Figure 9

Check that the COM port number in the window corresponds to the COM port you have connected the fiber optic cable via the converter from the PSL 8 unit to. If necessary change the number. Then press “OK”. The window with the COM port settings will open.

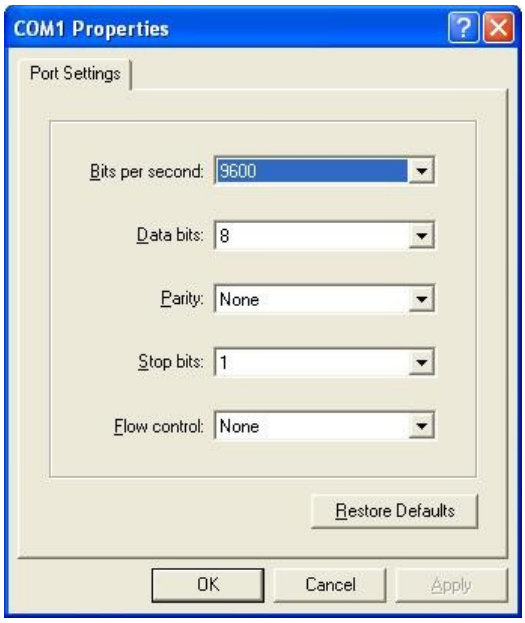


Figure 10

Check that the Baud rate (Bits per second) in the settings is the same as the Baud rate given on the label on the PSL 8 unit. If it does not match you have to change the value in the software.
After pressing “OK” the PSL 8 unit is ready for measurement.

Technical Data

Basic Device

Power Supply:	12 V /DC (external mains adaptor 100 – 240 V, 50 / 60 Hz)
Capacity:	approx. 10W
Protection Class:	Protection Class III (SELV)
Communication:	Beam waveguide system 660 nm, PFO+^
Code:	RS 232, 9200 Baud, 1 Stop bit, no parity
Dimensions:	Housing metal (HxWxL) 80x260x330 mm
Relative Humidity:	0 to 80 % r.F. (non-condensing)
Working Temperature:	0 to 45°C
Nominal Temperature:	25°C

Measurement Range

Module Voltage:	15 / 30 / 60 / 90 / 120 V[1]
Module Current:	6 / 12 / 18 A[1]
Monitor Cell Voltage:	80 mV[1]
A/D Converters:	3 x 12 Bit unipolar
Max. number of measuring points:	255
Accuracy per range:	< 0,1%
Load Range:	0 – 800 Ω; steps of 50 mΩ; deviation ±2 steps

General Specifications

Mains Adaptor:	Type FRIWO® MPP30 with suppressor choke
Voltage:	100 – 240 V, 50 / 60 Hz
Current:	1,25 A
Relative Humidity:	0 to 80 % r.F. (non-condensing)
Working Temperature:	0 to 45°C
Nominal Temperature:	25°C

Customer requested Measurement Range (if applicable)

Voltage:

Current:

[1] Measuring range can be adjusted to customer request. The measuring range of your PSL 8 unit can also be found in the calibration documentation of the unit.

KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY / DÉCLARATION DE CONFORMITÉ

entsprechend / in accordance with / selon ISO/IEC 17050-1/-2:2004

EG EMV Richtlinie / EMC directive / Directive EMC: 2004 / 108 / EC
EG Niederspannungsrichtlinie / EC Low voltage directive / Directive Basse Tension 2006 / 95 / EC

Hersteller / Supplier / Fournisseur:	BERGER Lichttechnik GmbH & Co. KG Wolfratshauser Str. 150 D – 82049 Pullach
Produkt / Product / Produit:	**Typ: / Type: / Type:** **PSL 8** **Seriennr.: / Serial No.: / Numéro de Série:** **XXXX**

Das oben beschriebene Produkt ist konform zu: / The product described above is in conformity with: / Le produit décrit ci-dessus est conforme à:

Dokument Nr. / Document No. / Document Numéro	Titel / Titel / Intitulé	Edition - Datum Edition - Date Édition - Date
IEC 61010-1 ed. 3	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte Teil 1: Allgemeine Anforderungen Safety requirements for electrical equipment for measurement, control and laboratory use Part 1: General requirements Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire Partie 1: Exigences générales	2010-06
DIN EN 55014-1	Elektromagnetische Verträglichkeit - Anforderungen an Haushaltgeräte, Elektrowerkzeuge und ähnliche Elektrogeräte – Teil 1: Störaussendung Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission – Product family standard Compatibilité électromagnétique – Exigences pour les appareils électrodomestique, outillages électriques et appareils analogues – Partie 1: Emission – Norme de famille de produits	2010-02
DIN EN 55014-2	Elektromagnetische Verträglichkeit - Anforderungen an Haushaltgeräte, Elektrowerkzeuge und ähnliche Elektrogeräte – Teil 2: Störfestigkeit - Produktfamiliennorm Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 2: Immunity – Product family standard Compatibilité électromagnétique – Exigences pour les appareils électrodomestique, outillages électriques et appareils analogues – Partie 2: Immunité – Norme de famille de produits	2009-06

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Pullach, 2012

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Ort und Datum der Ausstellung
Place and date of issue
Endroit et date d'émission

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D. Berger
Managing Director