

## MELI Mobile PV test center

Our MELI utilizes Electroluminescence, thermal imaging, and an IV curve measurement system, which ensures that current faults as well as future faults can be detected. This means you have a state of the art mobile laboratory which can be used in the field as well as indoors.

For the convenience of our customers the MELI system can be implemented in one of the following ways. Container based which has the advantage of being small enough to fit into the back of a van. Or the trailer option, which has the advantage of being a stand-alone laboratory which is already setup with all relevant control systems such as:

- LED sun simulator system
- EL imaging system
- IR camera
- 1.5KW power supply
- Air-conditioning temperature control to ensure STC
- Control unit to manage all the instruments
- 2d barcode scanner
- Power generator
- Printer for on-site report printing
- Integrative software solution including measurement database available upon request

**All metrological units can be demounted and utilized in the field. This enables our client to also quickly assess the health of modules without needing to demount said module.**

### *NightSy EL imaging system*

Electroluminescence is currently the most accurate method for analyzing the condition of solar panels. Faults and breakages can be detected using electroluminescence where conventional methods such as thermal imaging cameras as well as IV curve measurement systems fail.

The faults detected using the Electroluminescence can be detected before they cause a loss in power of the module.

With the use of Electroluminescence the following faults can be found:

- ♦Micro-cracks ♦Cell cracks ♦Faulty cell edge insulation ♦Contact breakages ♦Hotspots
- ♦Short circuited cells ♦Short circuits in string ♦Series resistance problems ♦Parallel resistance problems ♦Broken fingers ♦Broken busbars ♦PID

Not only the faults can be detected but by the damage structure causes for the damages can be determined:

- ♦Production problems ♦Transport damage ♦Installation damage ♦Handling damage ♦Environmental damage ♦Degradation

Optionally an age detection system may be integrated. This allows the for distinction of crack age into two categories: younger than 3 months and older than 3 months.

The NightSy EL imaging system contains a modified EVIL CMOS camera. This enables the camera to capture and record electroluminescence images. Different types of modules are supported in the use of this camera such as c-Si, CIGS, and CdTe.

The camera has a very high resolution enabling precise and accurate images with very low noise.

**This mobile EL camera can be demounted and utilized in the field, too. This enables our client to also quickly assess the health of modules without needing to demount the module.**

### ***Mobile LED flasher unit***

The LED Flasher is a near perfect simulation of the sun's spectrum, which facilitates highly accurate solar module efficiency measurements. Optionally the flasher utilizes battery power to make the system independent of generators.

High luminosity efficiency brings minimal power dissipation and the possibility of impulses of customized duration as well as frequency.

Measurement time is between 2-3 seconds. No need for recharging time between tests.

**This mobile LED flasher can be removed from the container easily, and can be placed on rack-mounted modules. The used LED Flasher is ideal for outdoor field conditions, which enables cost efficient testing without needing to demount the module.**

### ***Thermal imaging system***

The IR camera allows for additional information to be gathered about the health of a module. This includes the insight into possible hotspots.

The IR camera is extremely intuitive in its functions and perfectly suited and able to perform advanced analysis including spots, lines and areas on each image.

♦ Optionally the IR camera can be used to monitor module temperature distribution during measurement.

**This mobile thermal camera can be demounted and utilized in the field, too. This enables our client to also quickly assess the health of modules without needing to demount the module.**

### ***Control unit***

A control unit is situated within the MELI. Said control unit is used to control Flasher, Camera and as a data acquisition device.

**The control unit can be a rugged laptop ensuring that it is best suited for all mobile field applications.**

## MELI: Mobile PV Test Center Component Description

### MELI: Mobile PV test center

MELI can be equipped with the following components.

1. NightSy EL imaging system
2. LED sun simulator system
3. Thermographic imaging system

System is trailer or container based.

#### Option 1: Trailer

Dimensions: L 3,8m x W 1,8m x H 2,1m  
 Total Weight: 1300 kg  
 Throughput: 30-60 Modules/h  
 Other dimensions are available upon request

#### Option 2: Container:

Dimensions: L 2,2m x W 1,4m x H 1,4m  
 Weight: 500 kg  
 Throughput: 30-60 Modules/h  
 Other dimensions are available upon request

#### Specifications:

- 12 Megapixel Si-CMOS EL imaging camera
- Electronic PSU 1.5kW (range 0-150V 0-10A)
- AAA+ LED sun simulator with 1.2m x 2.0m illuminated area
- Thermal camera for IR inspection
- PV module holding rack enabling different sized modules to be tested.
- Can be utilized for several PV technologies: c-Si, CIGS, and CdTe



Fig. 1: MELI Trailer based mobile PV test center



Fig. 2: MELI container version for custom setup either in trailer or van.

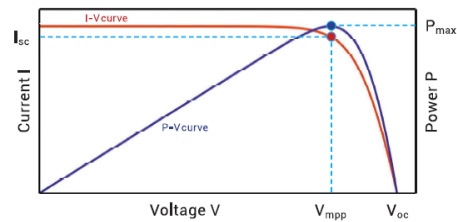


Fig. 3: Built-in LED flasher type AAA allows for highly reliable and fast STC module power output inspection at 25°C.

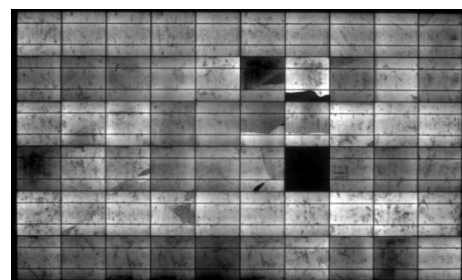


Fig. 4: High resolution EL imaging of PV modules

**NightSy EL camera**

- EVIL CMOS camera
- 12 M Pixel
- Can measure: c-Si, CIGS, and CdTe.

Optionally the camera can be dismounted for mobile field use with the following accessories:

- 50 mm fixed focal lens (2,8m distance for a 2m x1m Module)
- Rugged transport case



Fig. 5: NightSy EL camera

**Power supply 1.5KW**

The power supply is a programmable switching power supply that provides high power density, low ripple and a complete set of user-friendly interfaces. The wide range input is not just dual range, but continuously variable from 85-265VAC, single phase, 50/60Hz.



Fig. 6: 1.5kW PSU (range 0-150V 0-10A)

**Output Characteristics**

- Regulation: 0.01% + 2mV line/load (cv)
- 0.01% + 2mA line (cc)
- 0.01% + 5mA load (cc)

**AC Input**

- All models: 85-265 VAC continuous single phase, 47-63 Hz
- AC Line Current (100/200VAC):
- 1500W - 21A/11A
- Active PFC (0.99)

**Mobile LED flasher unit**

- Pyranometer sensor to read the light power
- Sensor controlled module temperature
- 1200 W/m<sup>2</sup> stable irradiance level
- Spectrum in A class 12,5%
- Both for crystalline and thin film modules
- Certified in triple class A by TÜV Intercert
- Spectral Match Class A+
- Non-uniformity of irradiance Class A
- Short-term instability (STI) Class A
- Long term instability (LTI) Class A+
- Uniformity constant over LED source life time
- LED source life time more than 35.000 hours



Fig. 7: LED flasher type AAA allows highly reliable and fast STC module power output inspection

- 2x 1,2m illuminated area
- Suitable for 60-72 cell Modules

***Thermal imaging system***

- IR camera 384x 288px at 50Hz
- Manual focus
- Temperature range: -20°C to 400°C
- Dedicated software for thermal analysis
- Additional visible camera
- Integrated illuminator
- 8 color standard palette
- Selectable emissivity values
- TFT touch display 3.5"
- 2 Lithium ion Battery packs

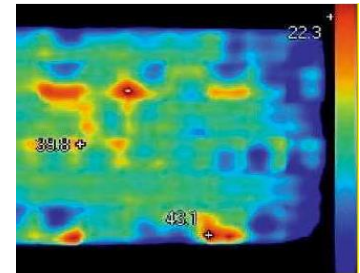


Fig. 8: IR inspection

***Control unit***

A control unit is situated within the MELI. Said control unit is used to control Flasher, Camera and as a data acquisition device.

Optionally: The control unit can be a rugged laptop ensuring that it is best suited for all mobile field applications.



Fig. 9: Laptop control unit

***Bar code scanner***

A wireless 2d barcode scanner ensures a quick and easy PV module identification and documentation.

- Signal range of up to 10m
- Integrated 1500mAh Li-Ion ensures continuous use for more than 1 week straight.



Fig. 10: 2D barcode scanner for easy PV module identification

***Temperature control unit***

Extremely quiet and energy efficient air-condition. Guaranteeing the room is kept at constant temperature and cooled to 25°C as fast as possible.

- Remote controlled
- Evenly distributed cooling
- 2,9KW cooling power
- Quieter than 43dB



Fig. 11: Temperature control unit

***Generator***

Very light portable petrol generator which is very quiet. The generator manages to produce 3kVA, which is able to power all electrical appliances used within the MELI.

- Power output of 3.0KVA
- Smooth output for sensitive electronics such as measurement equipment and laptops
- Runtime between 3, 6 and 10 hours.



Fig. 12: Generator

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## List of services

### *Training*

With any sold system the Solarzentrum Stuttgart GmbH offers a two (2) day training session in combination with the factory acceptance test. If the training is to be performed at the customer's location the customer is responsible to provide and prepare all specified materials and equipment stated by the Solarzentrum Stuttgart beforehand. In this case, customer will be charged with travelling expenses at extra cost.

### *Installation and start-up*

Upon request, the installation and start-up can be provided by SZS service personnel. Therefore, the customer's factory has to be equipped to SZS requirements prior to arrival of SZS personnel. In this case, customer will be charged with travelling expenses at extra cost

## Warranty

This Solarzentrum Stuttgart GmbH product is warranted against defects in materials and workmanship for a period of one year from date of shipment .During the warranty period, Solarzentrum Stuttgart GmbH will, at its option, either repair or replace products which prove to be defective.

### LIMITATION OF WARRANTY

The warranty shall not apply to defects resulting from improper or inadequate usage or maintenance by the buyer, buyer supplied products or interfacing. The warranty shall not apply to defects resulting from unauthorized modifications or from operation exceeding the environmental specifications of the product or if the QA seal has been removed or altered by anyone other than Solarzentrum Stuttgart GmbH authorized personnel. Solarzentrum Stuttgart GmbH does not warrant the buyer's circuitry or malfunctions of Solarzentrum Stuttgart GmbH products resulting from the buyer's circuitry. Furthermore, Solarzentrum Stuttgart GmbH does not warrant any damage occurring as a result of the buyer's circuitry or the buyer's - supplied products.

### WARRANTY SERVICE

This product must be returned to an authorized Solarzentrum Stuttgart GmbH service facility for repairs or other warranty service. For products returned to Solarzentrum Stuttgart GmbH for warranty service, the buyer shall prepay shipping charges to Solarzentrum Stuttgart GmbH and Solarzentrum Stuttgart GmbH shall pay the shipping charges to return the product to the buyer.