

### EL Inspection Systems for PV Module Production

**pi4** is supplying the most advanced EL inspection systems for inline PV panel inspection on the market. EL Images are evaluated fully automatic by comprehensive algorithms.

The EL Efficiency systems are designed for installation in an automated production line as well as for use offline. Inspection may be implemented before or after lamination.

AEVAL (Advanced EVALuation) selects the defects or defect combinations defined in your quality guide-lines.

On top "Power Loss Estimation" calculates the worst case loss of power for each cell and the entire module. This saves cost in repair labor and material.

**„...the most advanced EL inspection systems on the market.“**

The Software "Repair Station Manger" is a tool to effectively aid your personal at pre lamination repair to identify the cells to be replaced. Service messages will help to identify issues in upstream machines, stringer and busing.

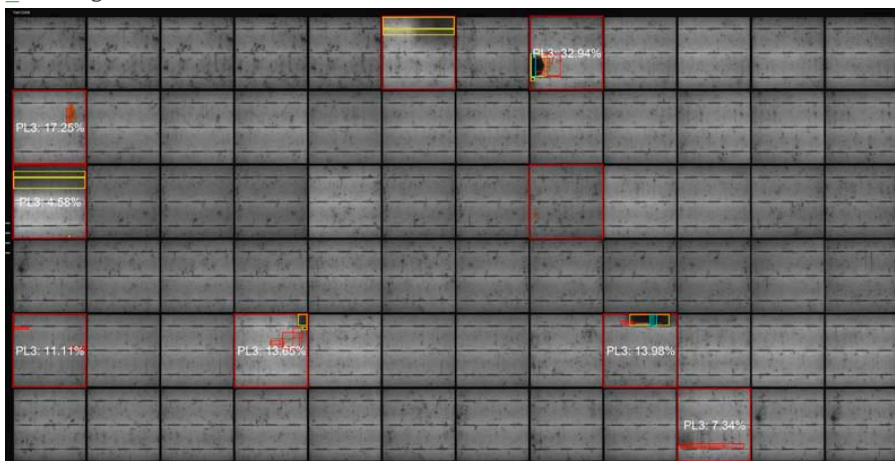
#### EL Efficiency



#### features

Inline or Offline Systems	Fully automatic or manually loading and contacting
Application	Before or after lamination, laminates or framed modules
Software Packages	Fully automatic identification of defects, like micro cracks, broken grid fingers, dark spots and inefficient cells. Automatic inspection with AEVAL to classify according to customer quality guide lines. Power loss estimation calculates the worst case loss of power generation ability of cells and modules.
Adjustable to Module Size	990x660mm to 2000x1050 mm
Low Conveyor Level	adjustable 950mm
Module Feeding	Short or long edge leading available
High Optical Resolution	up to 72 Mpixel (72 cells)

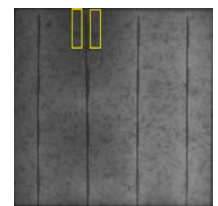
#### EL image of entire solar module



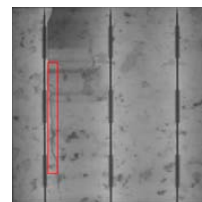
#### Sample images



Inactive Area



Ribbon Off Busbar



Micro Crack



## Efficiency EL Module Inspection Systems Overview

<i>pi4_EL_efficiency Systems</i>					
	EL Efficiency High Speed	EL Efficiency	Flasher integrated EL	EL Panelvision	EL Basic
System Design for Application	In-line	In-line/off-line	In-line integrated in existing tunnel or tower	In-line/off-line	off-line
Item No for module entering short edge leading	PBAES-S-MD0268	PBAES-S-MD0266	--	--	PBAES-S-MD0144
Item No for module entering long edge leading	PBAES-S-MD0269	PBAES-S-MD0267	PBAES-S-MD0247	PBAES-S-MD0235	--
Module Size max.	2000 x 1050 mm	2000 x 1050 mm	2000 x 1050 mm	2000 x 1000 mm	2000 x 1050 mm
Module Size min.	990 x 660 mm	990 x 660 mm	990 x 660 mm	1000 x 670 mm	1000 x 645 mm
Optical Resolution per module	72 Mpixel	72 Mpixel	72 Mpixel	31 Mpixel	6.1 or 9.7 Mpixel
$\mu\text{m}$ per pixel	170 $\mu\text{m}/\text{pixel}$	170 $\mu\text{m}/\text{pixel}$	170 $\mu\text{m}/\text{pixel}$	400 $\mu\text{m}/\text{pixel}$	525 or 454 $\mu\text{m}/\text{pixel}$
Smallest defect detectable	> 0.3 mm <sup>2</sup>	> 0.3 mm <sup>2</sup>	> 0.3 mm <sup>2</sup>	> 1.4 mm <sup>2</sup>	> 2.5 mm <sup>2</sup>
Cycle Time 72 cell module (including loading and unloading modules)	19 s	26 s	depends on loading/unloading speed	<60 s or <45 s option	<40 s
Cycle Time (inspection only)	11s	18s	10s to 20s	20s	3s
Number of special EL-cameras (moving on axis)	6	3	3	2	3 or 6 fixed
<i>Software packages:</i>					
Visual Inspection by Operator PBAES-S-MD0146	included	included	included	included	included
Fully Automatic Inspection PBAES-S-MD0148	X	X	X	--	--
Automatic Inspection with AEVAL Classification PBAES-S-MD0219	X	X	X	--	--
<i>Options:</i>					
Data Base	included	included	included	--	--
In-line code reader	X	X	X	X	X
UL-certified components	X	X	X	--	--
Repair Station Manager Software	X	X	--	--	--
Quality Manager with DiffViewer	X	X	X	--	--