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EN

INDIVIDUAL MODULE MONITORING IMM TECHNOLOGY



AEG
perfekt in form und funktion

SECURE YOUR
SOLAR INVESTMENT WITH
TRANSPARENCY



100% TRANSPARENCY = TOP PERFORMANCE



WHY 100% TRANSPARENCY?

With a solar energy system, anybody can produce environmentally friendly electricity.

However, things may get complicated when one of the modules is not working properly. This can happen for a number of reasons: birds leaving behind debris, trees and leaves casting shadows on the installation or issues that have built up over time but may go easily undetected with common inspections.

Thanks to AEG Individual Module Monitoring Technology (IMM) these problems are easily identified.

WHAT IS IMM?

Operation and Maintenance (O&M) with IMM Technology is pv plant monitoring managed by artificial intelligence, allowing you to detect even smallest errors, optimizing the performances of your power plant and reducing your O&M costs.

100% TRANSPARENCY, TOP PERFORMANCE

Factors affecting the performance of the solar power plant can be both external and internal, such as:



Pollution - Soot from exhaust fumes, dust and pollen settle on the surface of the module. As a result, light can no longer reach the cells.



Weather - Extreme temperatures, high snow levels and hail can lead to glass breakage.



Animals - Martens chew through cables at night; birds soil modules with droppings.



Installation errors - Modules can be setup incorrectly and plugs forgotten; erroneous connections can cause dangerous electrical arcs.



Production defects - Soldered connections become brittle causing hot spots; PID starts to affect modules; etc.



IMM recognizes and locates defects immediately and for each individual module. We call this

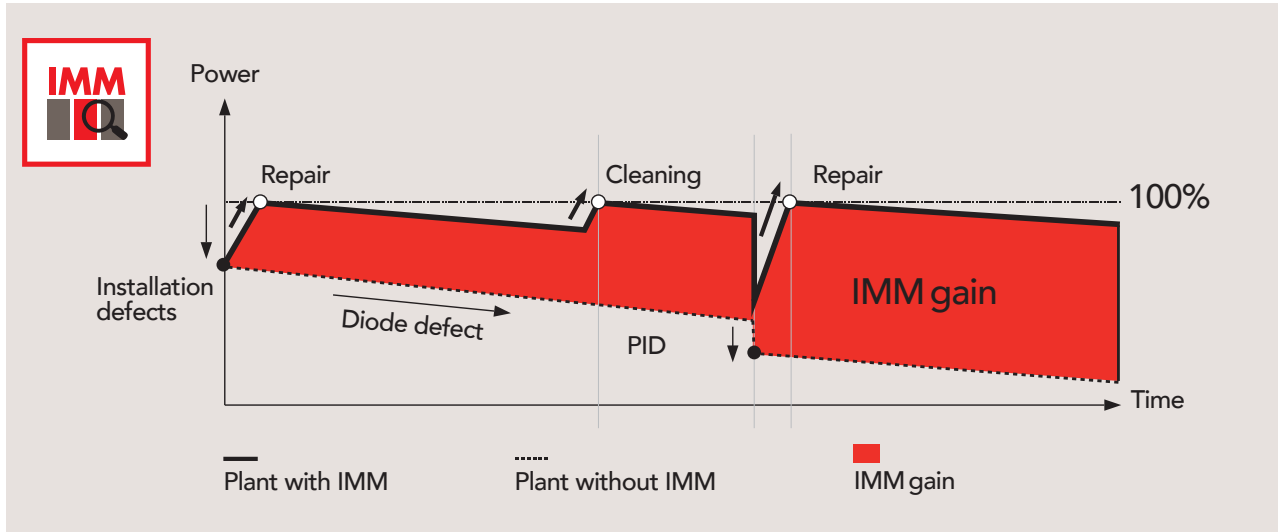
100 % TRANSPARENCY.



IMM shows you exactly how to solve issues in your plant, indicating with clear instructions what, where and when needs to be done to get a

TOP PERFORMANCE

100% TRANSPARENCY=
100% BENEFITS



FOR OWNERS, INVESTORS
AND POWER SUPPLY
COMPANIES



Higher yield due to fast and total recognition of faults and necessary maintenance



Certainty about a good plant condition and a rewarding investment



All performance data is accessible at any time, also via mobile phone



Error messages are easy to understand even for non technicians



Advanced O&M thanks to artificial intelligence; asset management for several plants

FOR SOLAR POWER
SYSTEM
INSTALLERS



Simple recognition of optimization potentials



Fast and easy detection of faults allows perfect service



Time-saving management of plant maintenance



Fast clarification of warranty and guarantee claims



Automatic control of the complete installation; management of several plants using one interface

FOR JUNCTION BOX AND
INVERTER
MANUFACTURERS



Unique selling point, new possibilities for intelligent PV systems



Easy Integration



Achieved performance automatically prepared and visualized



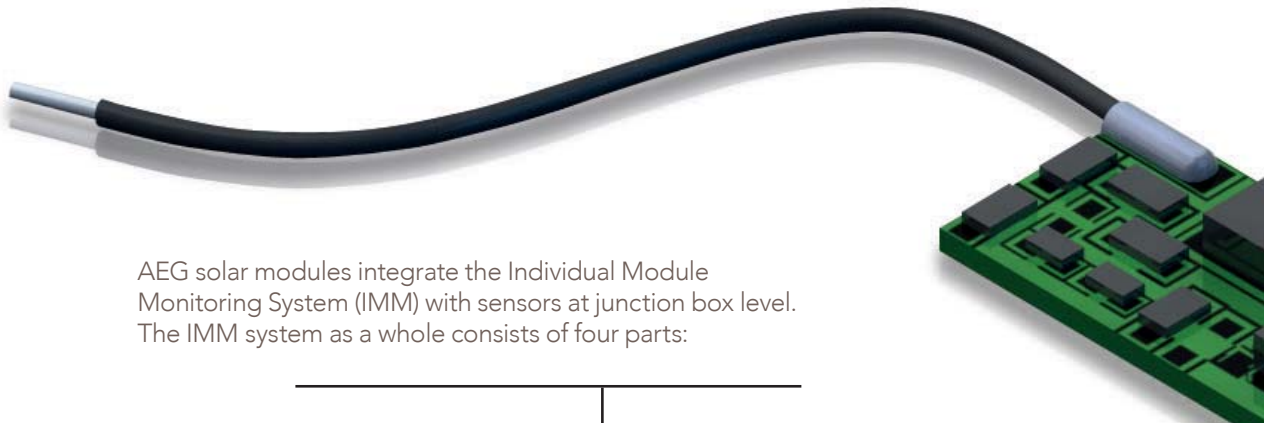
Certification passed according to EN 50178:1997 and UL

SECURE YOUR SOLAR INVESTMENT:

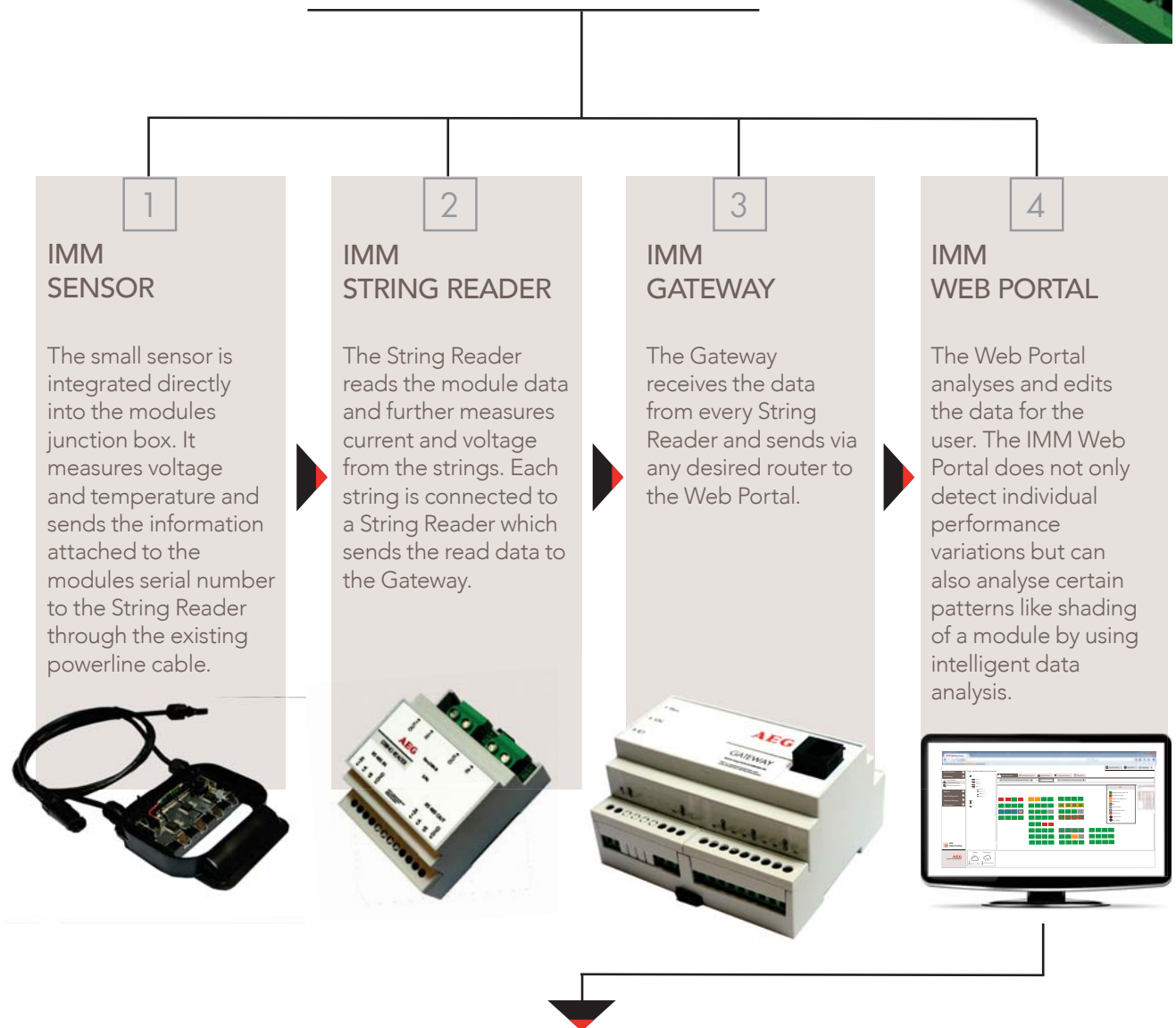


With the IMM you can obtain: possibly up to 7% extra yield & possibly up to 50% in savings from O&M. The Team of Solar Solutions PV will assist customers with ROI calculations for the individual power plants.

THAT'S HOW THE IMM WORKS

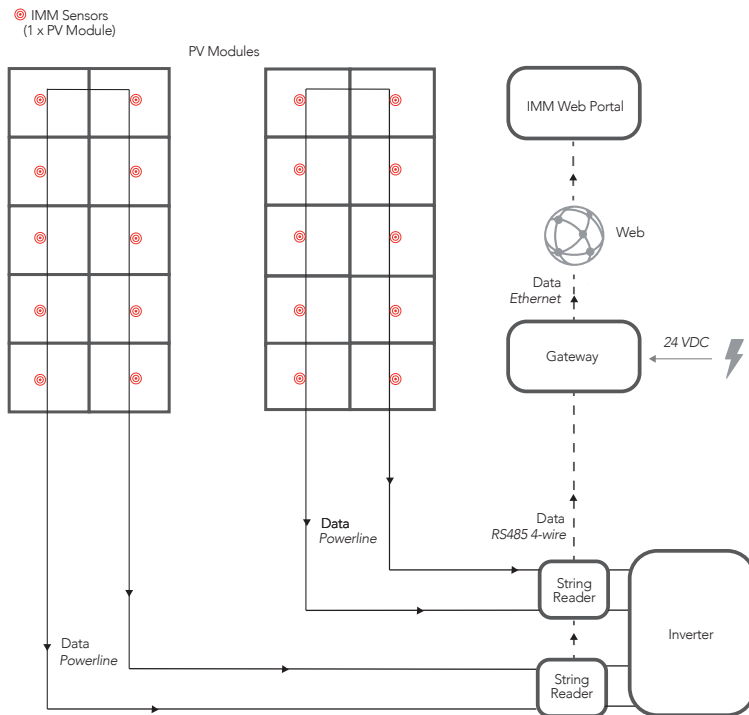


AEG solar modules integrate the Individual Module Monitoring System (IMM) with sensors at junction box level. The IMM system as a whole consists of four parts:



In case issues are found, the IMM will give clear and precise indications about **WHEN, WHERE AND WHAT NEEDS TO BE FIXED**

THE IMM SYSTEM: TECHNICAL SCHEME



1- Irradiated by sunshine, the modules produce clean energy.

2- The IMM Sensors measure the voltage of each module and the temperature of each junction box.

3- The data of the IMM Sensors are sent to the String Readers via smart Powerline communication (existing DC cabling).

4.- The String Readers receive the data from the IMM Sensors and forward them to the Gateway. The String Reader too measures temperature and voltage

5- The transmitted data of the String Readers are collected in the Gateway and send via internet to the Web Portal.

6- The Web Portal analyses and edits the incoming data for the user. The continuous monitoring allows an analysis on module, string and inverter basis. In case of a defect it will give clear indications about what needs to be fixed.

SPECIAL FEATURES



Intelligent warning system - The warning system within the IMM Webportal recognizes performance variations of every component on a percentage basis. This recognition also detects data patterns -like moving shadows or snow on the modules- by automatic data analysis. A warning will be sent via e-mail in case of a problem.



IMM Powerline Patented Technology - Sensor and String Reader communicate over the normal solar cabling. No additional installation of communication cables is needed.



Fast and exact localization - By using the IMM PlantView you can show the plant on the IMM Web Portal the way it was built. This function enables a focused course of action in future maintenance or repair.



Representative illustrations - Visualize your ongoing commitment via different presentation modes and show it via any screen with an internet connection.



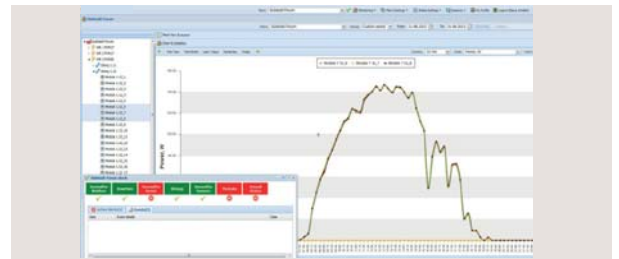
Version for mobile devices - With an easy and clear version of the IMM Web Portal for your mobile devices you can always have one eye on your revenue and can check the operability of the plant at any time.

HOW THE IMM SOLVES PROBLEMS

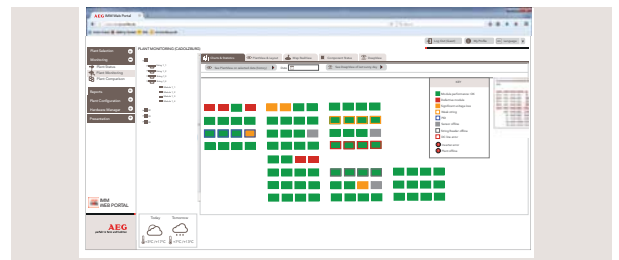
An outlook on the Individual Module Monitoring technology artificial intelligence and on the way it detects problems, analyzing the causes and optimizing your plant:



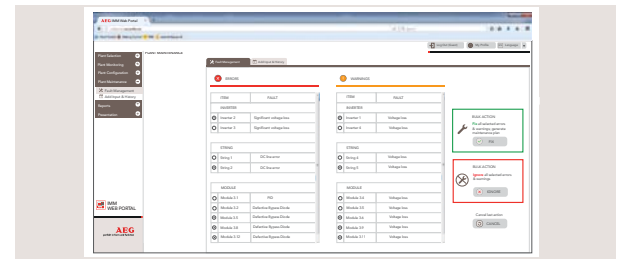
Detection of technical issues in the whole plant down to module level- This is carried out thanks to the three methods of comparison, simulation and 'fingerprint tracking' operated by artificial intelligence. On this basis the IMM system is able to pinpoint any defects incurred down to the module level. This is because each defect/error has its unique electronic signature -its fingerprint, which the artificial brain is able to track down and recognize.



Exact localization of each module and every string - The IMM not only detects and calculates the loss of the defective modules, but it localizes them exactly via the IMM PlantView. You are able to see each module with its power output, its string and inverter number and location on the power plant. A service technician is therefore able to find the modules easily. This saves the costs of a resources- and time-consuming inspection.



Elaboration of optimized O&M action plan, clear instructions for operators - Thanks to the bottom-up simulation on performance ratio from the real data, the artificial brain elaborates an optimized O&M intervention plan, taking into account the sustainability and profitability of the intervention itself. The operators are given clear indications on how to solve the specific issues, so that they can operate with precision and ease.



EXAMPLES

Problem:
A tree is casting a shadow on several modules.

Effect: The power output of the module is decreased by 20 %. Therefore, the inverter has a power loss of 1.5%, with a yearly loss of 51 € for the plant.



Solution:
The IMM detects the moving shadows and the problem can be resolved at the next on-site maintenance.

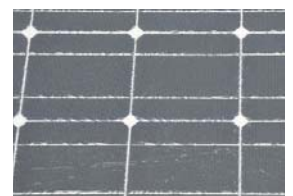


Problem:
The glass of a module is broken by hail.

Effect: The power of this module is decreased by 40 %. Therefore, the inverter has a power loss of 3 % with a yearly loss of 102 € for the plant.



Solution:
The IMM detects the loss and localizes exactly which module is affected.





STRING READING WITH IMM: HIGHEST PRECISION

String monitoring done through the IMM system is made at high precision as it is based on reliable and real-time data coming from the individual modules, with a measurement accuracy of $\pm 1\%$.

AEG MODULES WITH IMM: OUR TECHNICAL EDGE

AEG solar modules are one of a kind, as they are the only photovoltaic panels which can diagnose their own „health status“ and actively inform the plant owner of any disfunction occurring, at the time it is occurring, providing the plant owner with clear instructions on how to maintain them.



Below is a list of issues that the IMM technology can detect...

...At module level

- Hotspot Detection
- PID detection
- Defect Diode Recognition
- Module performance over Lifetime Indicator
- Reduced module voltage recognition
- Presence of small plants in front of the module
- Soiling Indicator

...At string level

- String power down
- Reduced string power
- Wrong cable setup indication
- DC line error

...At inverter level

- Inverter errors
- Inverter warnings
- Differentiation between notifications, warnings and errors

...At plant level

- Accurate Performance Ratio determination



PRODUCT TECHNICAL DATA



Listed below are the main technical features of the IMM system components: Sensor, String-Reader and Gateway.

IMM SENSOR

Monitoring chip for integration into the junction box

Allowed ambient temperature	-40 to +80 (°C)
Absolute measuring tolerance voltage	2%
Absolute measuring tolerance temp.	-/+ 2°C
Energy consumption	0,0012 % @ 8A



IMM STRING READER

Mounting	DIN Rail
Protection class	IP 20
Interface for Gateway	RS485 via RJ45
Max. number of modules per string	30
Max. string voltage	1000 V DC
Max. string current	10 A
Absolute measuring tolerance current	1 % absolute
Energy consumption	0,5 W

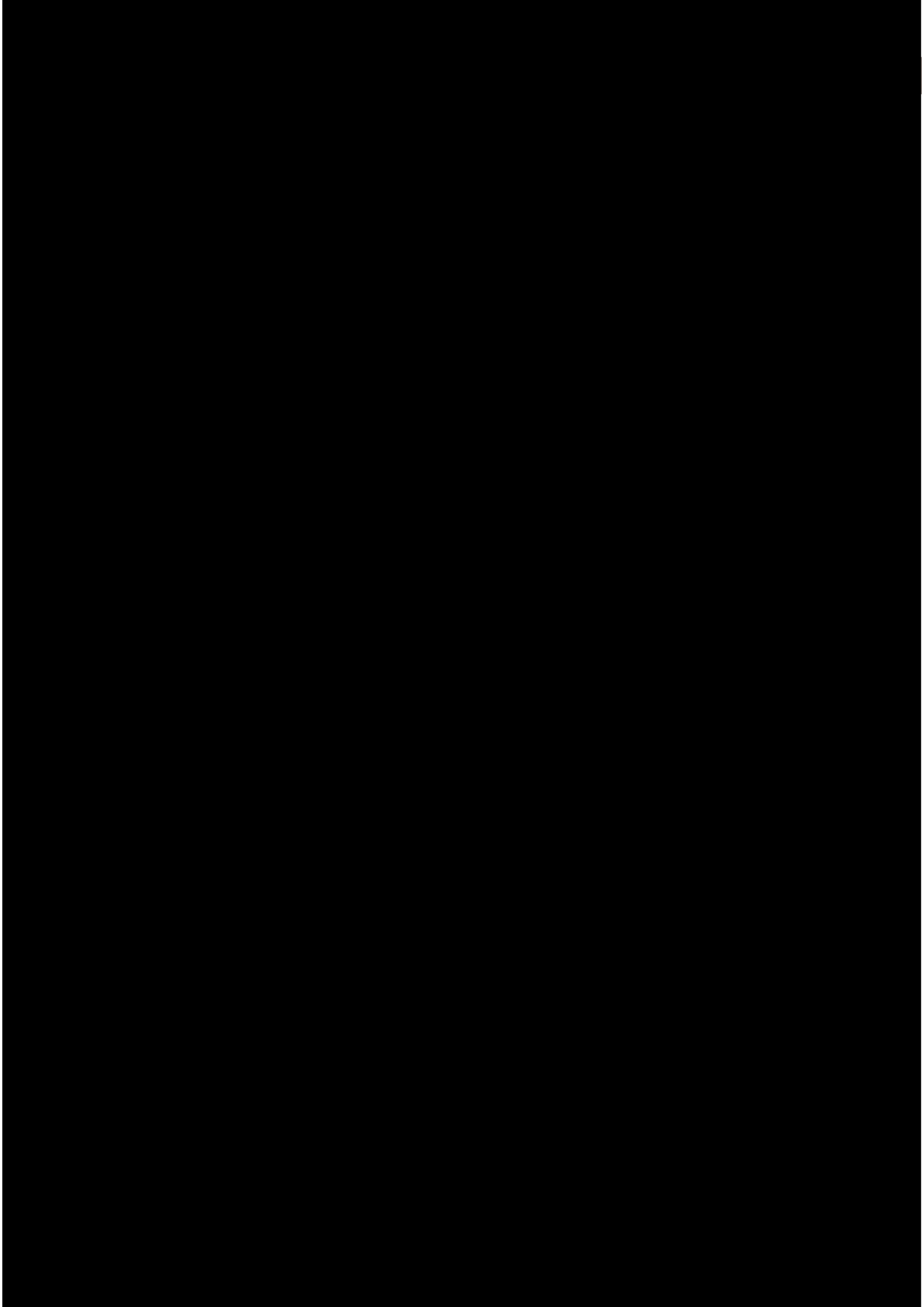


IMM GATEWAY

Mounting	DIN Rail
Protection class	IP 20
Interface for String Reader	RS485
Max. signal cable length	1000 m (800 recomm.)
Interface internet	Ethernet RJ45
Analogue Digital Interfaces (Switchable)	8
Max. number of attached String Readers	120
Max. number of inverters	up to 200
Energy consumption	2 W
Memory Card (for offline buffering)	8 GB (4 GB)



Please refer to www.aeg-industrialsolar.de („Service and Download“ section) for an overview of the AEG solar modules with IMM technology and for the latest component datasheet.



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