

Characteristics of photovoltaic panels and their installation.

Manufacturer: PV Enterprise Sweden AB,

Bengt Arnby and Rathinavelu Pannuswamy,

Susan AB, Ltd. Sweden

František Kurilla and Marcela Kurillová,

Architecture and design studio, Ltd.

Electrical Installation

Modules should be mounted to maximize direct exposure to sunlight and to eliminate or minimize shadowing. Even partial shadowing can substantially reduce module and system output. Furthermore, partial shadowing can elevate the shaded portion's internal temperature, which may lower output and shorten module life. Bypass diodes are factory installed. Blocking diodes should be installed in series with each module or series string to prevent possible back flow of energy through the module(s) when modules or strings are connected in parallel or used in conjunction with a battery.

Whenever necessary to comply with local codes, use a listed fuse or circuit breaker, rated for the maximum series fuse rating of the module and the system voltage.

All electrical components should have ratings equal or greater to the system rating. Do not exceed the maximum allowable system voltage as listed on the module label.

The number of modules that can be wired in series is recommended at fifteen (15) or fewer. If connecting sixteen (16) modules in series, check local temperature conditions and follow the local codes to ensure compliance with maximum voltage limitations.

Under normal conditions, a photovoltaic module may experience conditions that produce more current and/or voltage than reported at Standard Test Conditions. Accordingly, the values of short circuit current, I_{sc} , and open circuit voltage, V_{oc} , marked on modules should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor capacities, fuse sizes, and size of controls connected to the module output.

Rated electrical characteristics are within $\pm 3\%$ of measured values at Standard Test Conditions of: 1000 W/m², 25°C cell temperature and solar spectral irradiance per ASTM E 892.

PVE modules are equipped with factory-installed wires and quick connectors. These

modules have been designed to be easily interconnected in series. Each module has two single-conductor wires, one positive and one negative, that are pre-wired inside the junction box. The connectors at the opposite end of these wires allow easy series connection of adjacent modules by firmly inserting the male connector of a module into the female connector of an adjacent module until the connector is fully seated.

A separate return wire or wires may be required to run the positive and negative terminations of the series string of modules to the load. Male and/or female connectors pre-attached to wires may be used at the string terminations for return wire connections and/or for source circuit box terminations.

Grounding methods

The module frame should be connected to an earth ground for safety, protection from lightning and related static discharge.

Ground modules with a heel using a 4mm drill and live on the outer flange to the desired location to suit your installation (Figure 3)

Examples of placement of the drilled Ø4 grounding hole

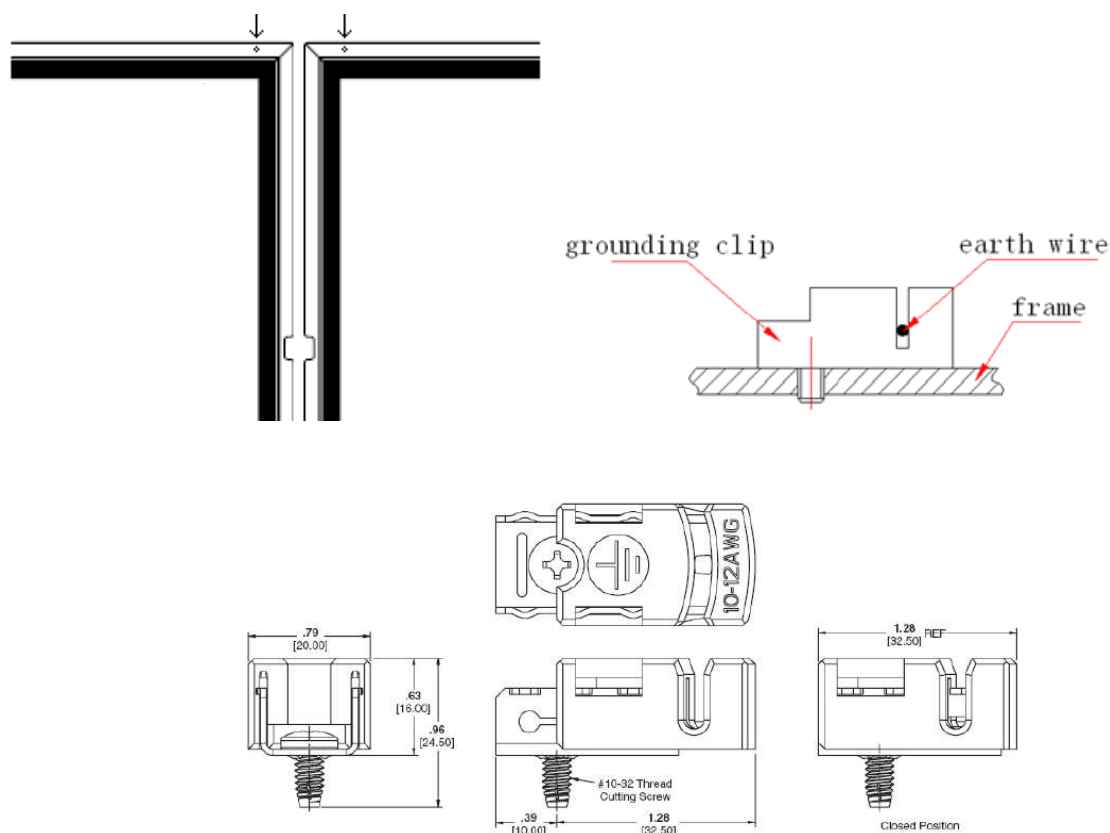


Figure 3

Notice: Use TYCO. 1954381-1

Using Existing Unused Module Mounting Hole (Figure 4)

An existing otherwise unused module mounting hole can be used to install the same grounding hardware noted above. Do not use a mounting hole or hardware that is used for structurally mounting the module.

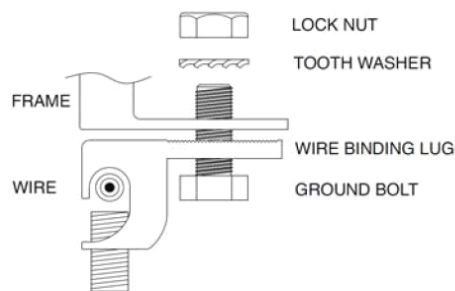


Figure 4

Using Existing Module Mounting Hole

It is also possible to ground the panels with a cable lug in module mounting hole (Figure 5)

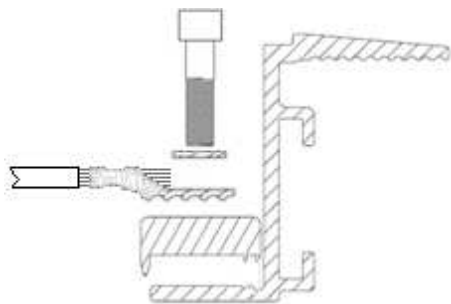


Figure 5

Operation and Maintenance

No routine maintenance is required. However it is advisable to perform periodic inspection of the modules for damage to glass, back sheet, or frame. Check electrical connections for loose connections and corrosion.

PV modules can operate effectively without ever being washed, although removal of dirt from the front glass can increase output. The glass can be washed with a wet sponge or cloth. Wear rubber gloves for electrical insulation.

Electrical Characteristics

Module Type	PVE-MTF1-170-5	PVE-MTF1-175-5	PVE-MTF1-180-5
Maximum power (Pmax) voltage (Vmax) current (Imax)	170 Wp +-3% 35,80 V 4,75 A	175 Wp +-3% 35,90 V 4,88 A	180 Wp +-3% 36,00 V 5,00 A
Open circuit voltage (Voc)	43,60 V	43,70 V	43,80 V
Short circuit current (Isc)	5,20 A	5,30 A	5,47 A
Maximum system voltage	850 V	850 V	850 V
NOCT (800 W/m ² , 20 °C, AM 1.5, 1m/s)	46°C	46°C	46°C
Temperature coefficients	NOCT 46°C, TC Im 0,04%/°C, TC Vm – 0,38%/°C, TC Pm – 0,47%/°C	NOCT 46°C, TC Im 0,04%/°C, TC Vm – 0,38%/°C, TC Pm – 0,47%/°C	NOCT 46°C, TC Im 0,04%/°C, TC Vm – 0,38%/°C, TC Pm – 0,47%/°C

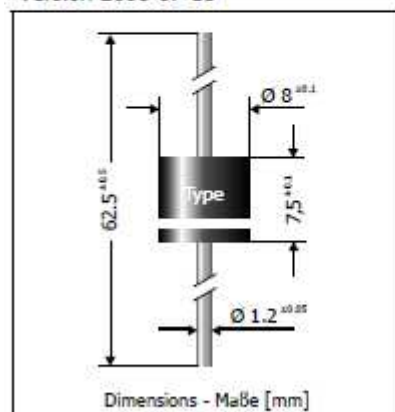
Module Type	PVE-MTF1-210-6	PVE-MTF1-215-6	PVE-MTF1-220-6
Maximum power (Pmax) voltage (Vmax) current (Imax)	210 Wp +-3% 28,70 V 7,32 A	215 Wp +-3% 28,90 V 7,44 A	220 Wp +-3% 29,20 V 7,56 A
Open circuit voltage (Voc)	36,40 V	36,50 V	36,60 V
Short circuit current (Isc)	7,90 A	8,00 A	8,10 A
Maximum system voltage	850 V	850 V	850 V
NOCT (800 W/m ² , 20 °C, AM 1.5, 1m/s)	46°C	46°C	46°C
Temperature coefficients	NOCT 46°C, TC Im 0,04%/°C, TC Vm – 0,38%/°C, TC Pm – 0,47%/°C	NOCT 46°C, TC Im 0,04%/°C, TC Vm – 0,38%/°C, TC Pm – 0,47%/°C	NOCT 46°C, TC Im 0,04%/°C, TC Vm – 0,38%/°C, TC Pm – 0,47%/°C

Module Type	PVE-MTF1-225-6	PVE-MTF1-230-6	PVE-MTF1-235-6
Maximum power (Pmax) voltage (Vmax) current (Imax)	225 Wp +-3% 29,50 V 7,63 A	230 Wp +-3% 29,70 V 7,75 A	235 Wp+-3% 29,90 V 7,86 A
Open circuit voltage (Voc)	36,80 V	36,90 V	37,00 V
Short circuit current (Isc)	8,20 A	8,35 A	8,45 A
Maximum system voltage	850 V	850 V	850 V
NOCT (800 W/m ² , 20 °C, AM 1.5, 1m/s)	46°C	46°C	46°C
Temperature coefficients	NOCT 46°C, TC Im 0,04%/°C, TC Vm – 0,38%/°C, TC Pm – 0,47%/°C	NOCT 46°C, TC Im 0,04%/°C, TC Vm – 0,38%/°C, TC Pm – 0,47%/°C	NOCT 46°C, Im 0,04%/°C , Vm – 0,38%/°C, Pm – 0,47%/°C

The Parameter of Diode

F1200A ... F1200G
Superfast Silicon-Rectifiers
Superschnelle Silizium-Gleichrichter

Version 2008-07-15



Nominal Current Nennstrom	12 A
Repetitive peak reverse voltage Periodische Spitzensperrespannung	50...400 V
Plastic case Kunststoffgehäuse	Ø 8 x 7.5 [mm] P600 Style
Weight approx. Gewicht ca.	1.3 g
Plastic material has UL classification 94V-0 Gehäusematerial UL94V-0 klassifiziert	
Standard packaging taped in ammo pack Standard Lieferform gegurtet in Ammo-Pack	

**Maximum ratings****Grenzwerte**

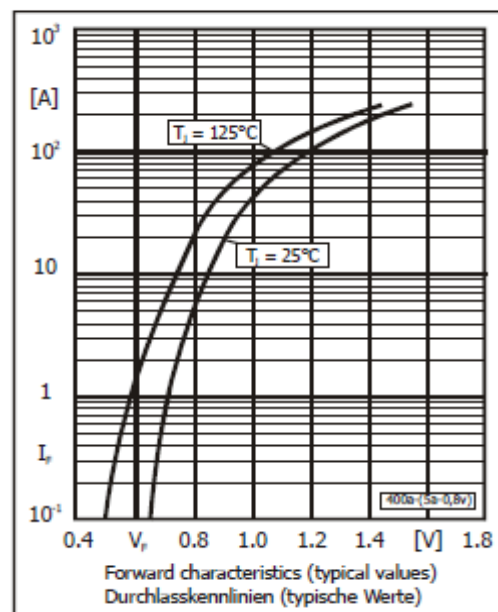
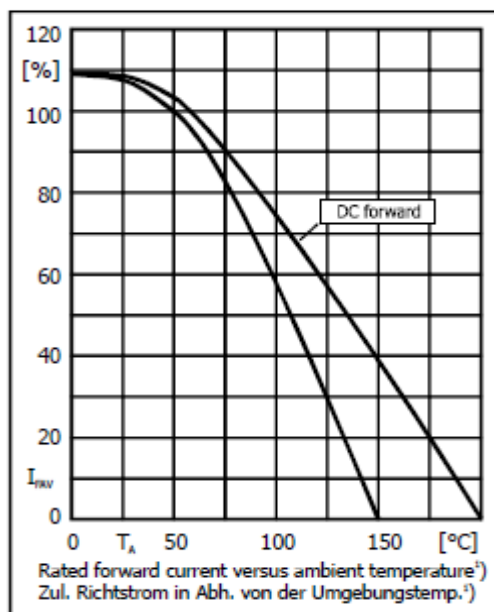
Type Typ	Repetitive peak reverse voltage Periodische Spitzensperrespannung V_{RRM} [V]	Surge peak reverse voltage Stoßspitzensperrespannung V_{RSM} [V]
F1200A	50	50
F1200B	100	100
F1200D	200	200
F1200G	400	400

Max. average forward rectified current, R-load Dauergrenzstrom in Einwegschaltung mit R-Last	$T_A = 50^\circ\text{C}$	I_{FAV}	12 A ¹⁾
Repetitive peak forward current Periodischer Spitzenstrom	$f > 15\text{ Hz}$	I_{FRM}	80 A ¹⁾
Peak forward surge current, 50/60 Hz half sine-wave Stoßstrom für eine 50/60 Hz Sinus-Halbwellen	$T_A = 25^\circ\text{C}$	I_{FSM}	375/390 A
Rating for fusing, $t < 10\text{ ms}$ Grenzlastintegral, $t < 10\text{ ms}$	$T_A = 25^\circ\text{C}$	i^2t	680 A ² s
Junction temperature – Sperrschichttemperatur in DC forward mode – bei Gleichstrom-Durchlassbetrieb		T_J T_J	-50...+150°C +200°C
Storage temperature – Lagerungstemperatur		T_S	-50...+175°C

Characteristics

Kennwerte

Forward Voltage – Durchlass-Spannung	$T_J = 25^\circ\text{C}$ $I_F = 5\text{ A}$	V_F	$< 0.82\text{ V}$
Leakage current – Sperrstrom	$T_J = 25^\circ\text{C}$ $V_R = V_{RRM}$	I_R	$< 25\text{ }\mu\text{A}$
Reverse recovery time Sperrverzögerung	$I_F = 0.5\text{ A}$ through/über $I_R = 1\text{ A}$ to/auf $I_R = 0.25\text{ A}$	t_{rr}	$< 200\text{ ns}$
Thermal resistance junction to ambient air Wärmewiderstand Sperrschicht – umgebende Luft		R_{thA}	$< 10\text{ K/W}^{1)}$
Thermal resistance junction to leads Wärmewiderstand Sperrschicht – Anschlussdraht		R_{thL}	$< 2\text{ K/W}$



Dimensions & Parameters

Technical specifications Module Type PVE Mono

PHYSICAL CHARACTERISTICS

Distance between module installation points:

Length	1000 mm
Width	841 mm

Physical dimensions:

Length	1637 mm
Width	855 mm
Thickness	35 mm
Weight	16,1 kg
Number of cells in series	72
Number of cells in parallel	1
Distance between cells	2 mm

Distance between cells and glass edge:

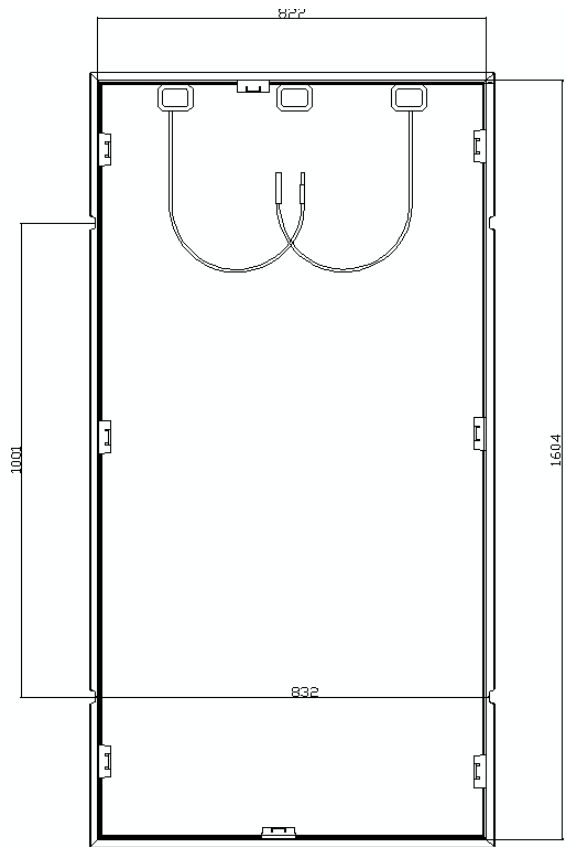
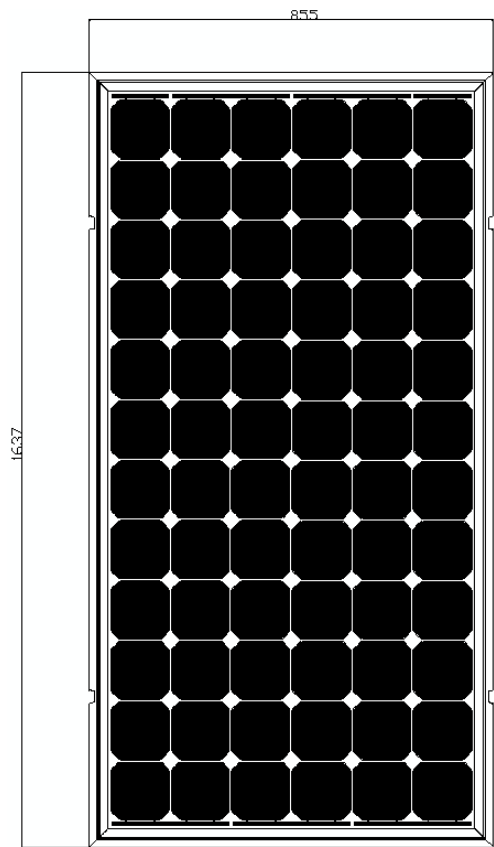
Sides	18 mm
Top	31 mm
Bottom	31 mm

CONSTRUCTIVE CHARACTERISTICS

Cells	Mono crystalline 125X125 mm
Contacts	Full length soldered
Laminate	EVA
Front face	Anti-reflective tempered glass
Back face	TPT
Frame	Anodized aluminium 3,5 cm high
Junction boxes	Filled up permanently
Cables and Connectors	2 x 85cm 4mm ² Huber & Suhner cables and connectors



Module Type PVE-MTF1-xxx 5



Technical specifications Module Type PVE Poly

PHYSICAL CHARACTERISTICS

Distance between module installation points:

Length	1000 mm
Width	1030 mm

Physical dimensions:

Length	1682 mm
Width	1042 mm
Thickness	35 mm
Weight	20,4 kg
Number of cells in series	60
Number of cells in parallel	1
Distance between cells	2 mm

Distance between cells and glass edge:

Sides	20 mm
Top	29 mm
Bottom	29 mm

CONSTRUCTIVE CHARACTERISTICS

Cells	Poly crystalline 156x156 mm
Contacts	Full length soldered
Laminate	EVA
Front face	Anti-reflective structured tempered glass
Back face	TPT
Frame	Anodized aluminium 3,5 cm high
Junction boxes	Filled up permanently
Cables and Connectors	2 x 85cm 4mm ² Huber & Suhner cables and connectors



Module Type PVE-MTF1-xxx 6

