kanegroup Building Services
11 Burrenreagh Road
Castlewellan | Co. Down | BT31 9HH
tel 028 4377 8484 | fax 028 4377 8116
INFO@ KANEGROUPBS.COM
WWW.KANEGROUPBS.COM

Project: Herbal House

Document Number: *PTS-SL-01-TS34*

Document Title: *Technical Submission 34- Solar PV*

	NAME	DATE
PREPARED BY:	CDeegan	14.01.16
APPROVED BY:	MMcMullan	14.01.16

PROPOSED STATUS:	For approval

REVISION	DATE OF ISSUE	REASON / HISTORY
A	14.01.16	First Issue

C0665	*PTS*	*SL*	*01*	*A*
JOB CODE	**DOCUMENT TYPE**	**FLOOR / AREA**	**SHEET**	**REVISION**

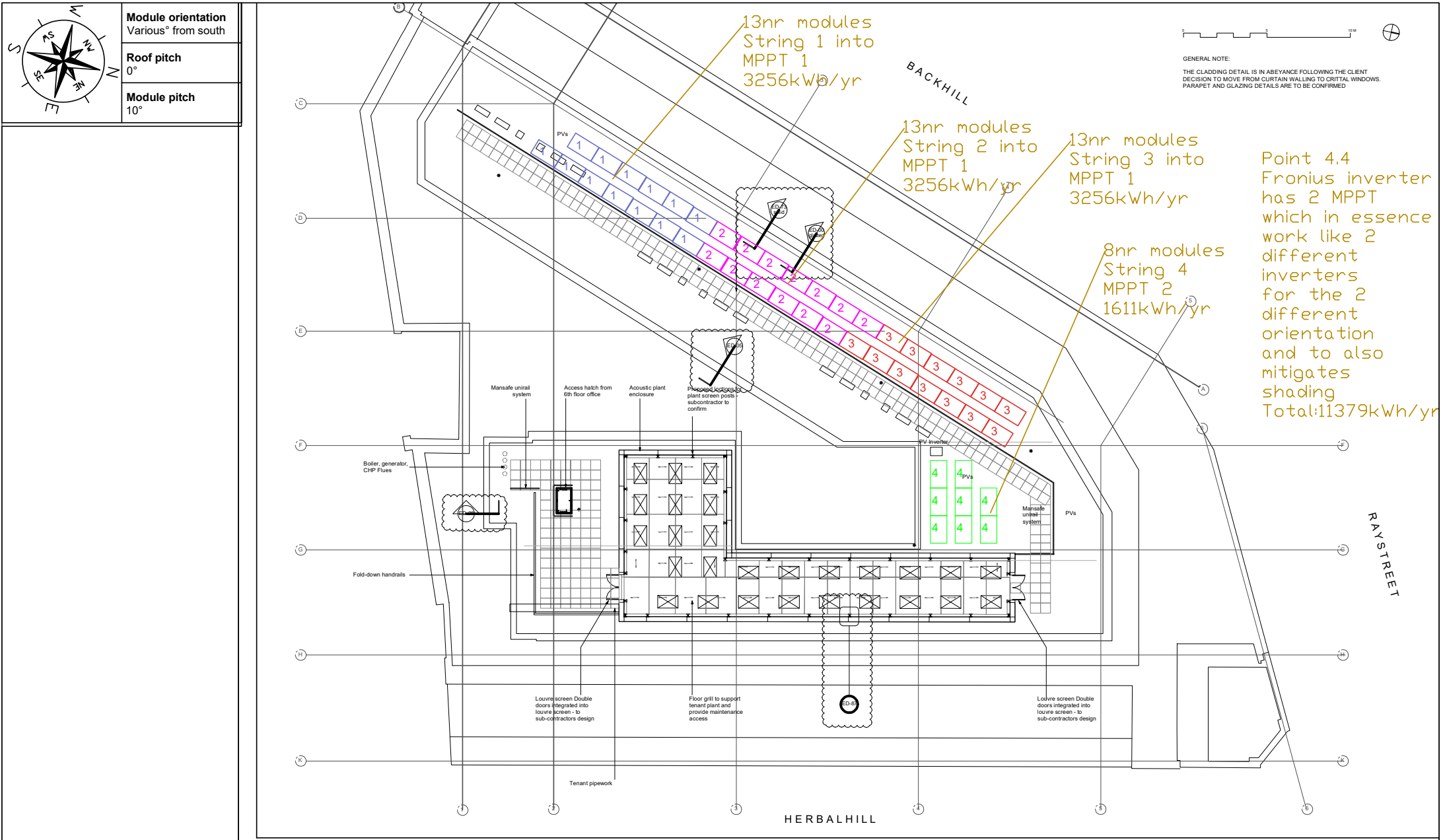
Technical Submittal

Project: Herbal House		**Contractor: McLaren Group**		
Job No: C0665		**Package No:**		
Technical Submission No: 34		**Issue Date: 14/01/16**		
		Approval Required By Date: 28/01/16		
Description of Equipment:	**Solar PV**			
Location of Equipment:	**Roof**			
Manufacturer/Supplier:	**Solstice**			
Equipment Type and Reference:	**JA Solar / Fronius / ValkPro**			
Specification References: **Deviations to Above**				
Drawing Details:				
Specification/Samples Attached:	**Technical Submittal Sheets**			
Approval Status **A** **B** **C**	**Comments:**			
Company:	**Reviewer**	**Comments**	**Date**	**Status**
Consultant:				
Architect:				

Technical Submittal Compliance Sheet-

Technical Submittal TS 34 Solar PV

- System complies with Waterman Electrical Specification Part 2 Standards of Materials & Workmanship Stage 4 WBS-SPC-E101_C01
- System complies with Waterman Electrical Specification Part 1 Scope of Works Stage 4 WBS-SPC-E100_C01
- System will be installed in accordance with the manufacturers technical recommendations
- System complies with all relevant BS Codes



Notes
View at 90 degrees to the roof surface
Roof dimensions taken from 863_Sk_141_E.DWG
Building Height - 6 Floors

Module length 1650mm	**Module type & qty** 47 x JA 295Wp - Mono
Module width 991mm	**PV peak output** 13.63 kWp
Module depth 40mm	**Inverter type & qty** TBC

Site address
Herbal House
20 Back Hill
Farringdon
London
EC1R 5EN

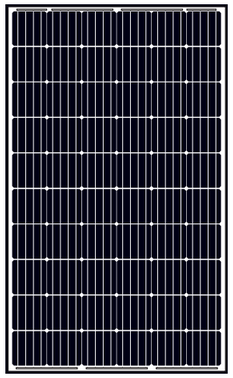
Drawing type As built Layout	**Project reference** HERB3149
Revision number 02	**Drawn by** RB
Scale 1:300 @ A4	**Date** 08/11/2017

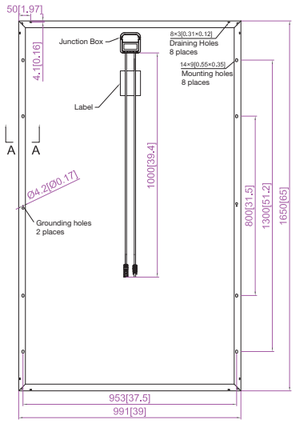
Solstice energy
020 8789 4717
www.solsticeenergy.co.uk
Little Willow, Upper Anstey Lane GU34 4BP

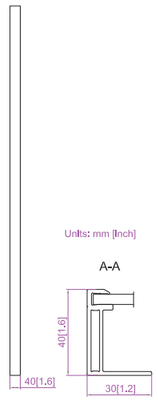
JA SOLAR

JAM6(L) 60 275-295/**PR**

Engineering Drawings







MECHANICAL PARAMETERS

Cell (mm)	Almost Full Square Mono 156x156
Weight (kg)	18.2 (approx)
Dimensions (L×W×H) (mm)	1650×991×40
Cable Cross Section Size (mm^2)	4
No. of Cells and Connections	60 (6×10)
Junction Box	IP67, 3 diodes
Connector	MC4 Compatible
Packaging Configuration	26 Per Pallet

WORKING CONDITIONS

Maximum System Voltage	DC 1000V (IEC)
Operating Temperature	-40℃~+85℃
Maximum Series Fuse	15A
Maximum Static Load, Front Maximum Static Load, Back	5400Pa (112 lb/ft^2) 2400Pa (50 lb/ft^2)
NOCT	45±2℃
Application Class	Class A

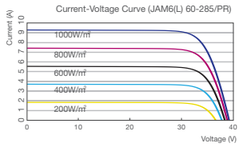
ELECTRICAL PARAMETERS

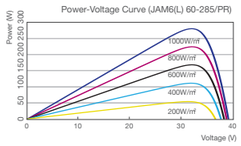
TYPE	JAM6(L) 60-275/PR	JAM6(L) 60-280/PR	JAM6(L) 60-285/PR	JAM6(L) 60-290/PR	JAM6(L) 60-295/PR
Rated Maximum Power at STC (W)	275	280	285	290	295
Open Circuit Voltage (Voc/V)	38.86	39.05	39.25	39.46	39.64
Maximum Power Voltage (Vmp/V)	31.51	31.68	31.85	32.07	32.29
Short Circuit Current (Isc/A)	9.27	9.36	9.45	9.56	9.67
Maximum Power Current (Imp/A)	8.72	8.84	8.97	9.11	9.23
Module Efficiency [%]	16.82	17.12	17.43	17.74	18.04
Power Tolerance (W)	-0~+5W				
Temperature Coefficient of Isc (αIsc)	+0.049%/℃				
Temperature Coefficient of Voc (βVoc)	-0.340%/℃				
Temperature Coefficient of Pmax (γPmp)	-0.410%/℃				
STC	Irradiance 1000W/m^2, Module Temperature 25℃, Air Mass 1.5				

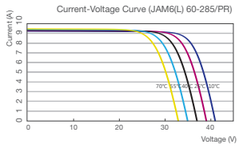
NOCT

TYPE	JAM6(L) 60-275/PR	JAM6(L) 60-280/PR	JAM6(L) 60-285/PR	JAM6(L) 60-290/PR	JAM6(L) 60-295/PR
Max Power (Pmax) [W]	201.05	204.71	208.36	212.02	215.67
Open Circuit Voltage (Voc) [V]	36.02	36.18	36.35	36.47	36.63
Max Power Voltage (Vmp) [V]	28.48	28.63	28.70	28.89	29.07
Short Circuit Current (Isc) [A]	7.54	7.62	7.71	7.79	7.87
Max Power Current (Imp) [A]	7.06	7.15	7.26	7.34	7.47
Condition	Under Normal Operating Cell Temperature, Irradiance of 800 W/m^2, spectrum AM 1.5, ambient temperature 20℃, wind speed 1 m/s				

I-V CURVE







Electrical data in this catalog do not refer to a single module and they are not part of the offer. They only serve for comparison among different module types.

JA Solar 06.2014

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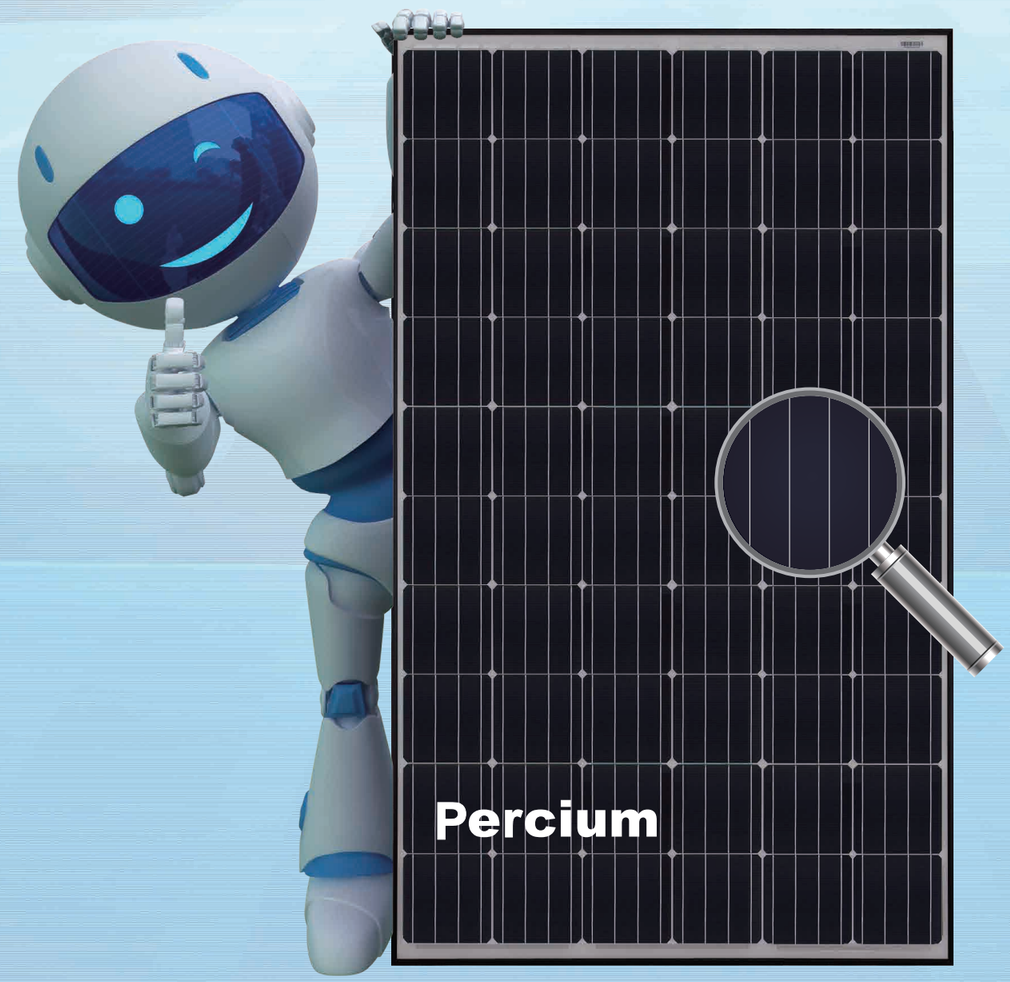
PERCIUM

Mono 60/275-295

290W Mono 60Cells
30W > Average



Harvest the Sunshine

Premium Cells, Premium Modules

www.jasolar.com

JA SOLAR

Harvest The Sunshine
Premium Cells, Premium Modules

Percium Cell

The mono cell technology with passivated backside and local BSF, 20.4% average mass production efficiency

More Power Per m²

Higher conversion efficiency - more power production per unit area

Lower System Cost

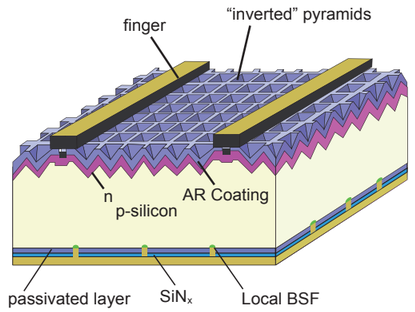
Higher conversion efficiency help you save

- Transportation cost
- Installation cost
- BOS cost

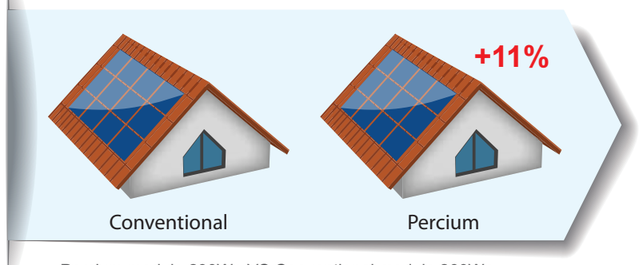
Excellent Low-light Performance

Enhanced spectral response at longer wavelength boosting low-light performance

Average Mass Production Efficiency >20.4%

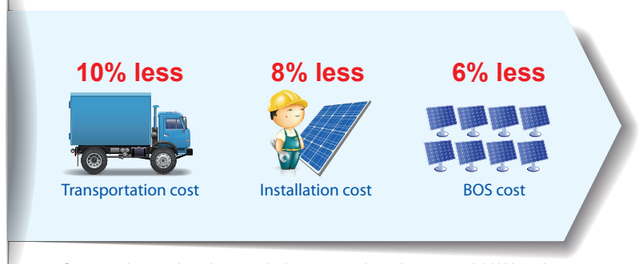


Benefit: 11% More Power



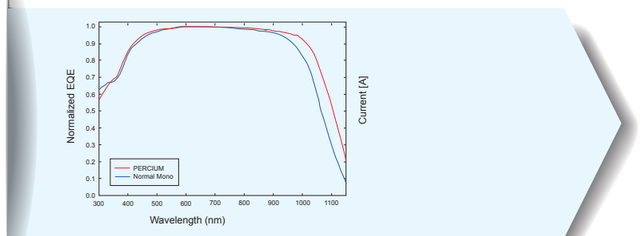
Percium module 290Wp VS Conventional module 260Wp

Benefit: Save System Costs Per Watt



Cost saving estimation made by comparison between 260W and 290W modules

Benefit:1% More Output Per Watt



EQE—External quantum efficiency

High Reliability

- Long-term reliability tests
- Harsh climate environment endurance tests
- PID-resistance tests
- Certified by TÜV SÜD and ETL
- Industry-leading cell tecnology
- High quality components from best suppliers
- Manufacturing inspected and certified by PI-Berlin and Solar-IF
- 100% in-house automatic manufacturing
- 2X 100% EL inspection ensuring defect-free

Fraunhofer

Other Features

0~+5W — Positive power tolerance: 0~+5W

Modules binned by current to improve system performance

5400 Pa / 2400 Pa — Excellent mechanical load resistance: Certified to withstand high wind loads (2400Pa) and snow loads (5400Pa)

Comprehensive Certificates

- IEC 61215, IEC 61730, UL1703, CEC Listed, MCS and CE
- ISO 9001: 2008: Quality management systems
- ISO 14001: 2004: Environmental management systems
- BS OHSAS 18001: 2007: Occupational health and safety management systems
- Environmental policy: The first solar company in China to complete Intertek's carbon footprint evaluation program and receive green leaf mark verification for our products

Specifications subject to technical changes and tests. JA Solar reserves the right of final interpretation.

JA SOLAR

Harvest The Sunshine
Premium Cells, Premium Modules

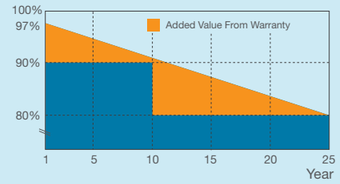
JA Solar Holdings Co., Ltd.

JA Solar Holdings Co.,Ltd is a world leading manufacturer of high-performance solar power products that convert sunlight into electricity for residential, commercial and utility-scale power generation. The company was founded in May 2005 and publicly listed on NASDAQ in February 2007. JA Solar has been the world's leading cell producer since 2010, and has firmly established itself as a tier 1 module supplier since 2012. Capitalizing on our strength in solar cell technology, we are committed to provide modules with unparalleled conversion efficiency, yield efficiency, and reliability to enable you to maximize your returns on PV projects. With its leading industry experience, continuous effort on R&D, customer-oriented service and sound financial status, JA Solar is your best choice of long-term trustworthy partner.

Add : NO.36, Jiang Chang San Road, Zhabei, Shanghai 200436, China
Tel : +86 21 6095 5888 / +86 21 6095 5999
Fax: +86 21 6095 5858 / +86 21 6095 5959
Email : sales@jasolar.com market@jasolar.com

Product Warranty

- 10-year product warranty
- 25-year linear power warranty



Additional Insurance Options

PowerGuard SPECIALTY INSURANCE SERVICES
SOLAR INSURANCE & FINANCE

Partner Section

Limited Warranty

for PV Modules

JA SOLAR

www.jasolar.com

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Tel: +86-21-6095 5888/6095 5999
Email: service@jasolar.com

JA Solar 08.2013

JA SOLAR

JA Solar Holdings Co., Ltd., and on behalf of ALL its DIRECTLY AND indirectly owned and controlled subsidiary, INCLUDING BUT NOT LIMITED TO Shanghai JA Solar Technology Co., Ltd.-(hereinafter jointly referred to as "JA Solar") warrants its Photovoltaic Solar modules' (MODULES) performance starting from the date of sale to the first customer installing (for their own use) the modules ("Customer") or starting at the latest 6 months after modules dispatch from the JA Solar factory, whichever occurs earlier (the "Warranty Commencement Date").

1. Limited Product Warranty – Ten Year Repair or Replacement

JA Solar warrants that the MODULES together with the factory-assembled DC connectors and cables are free from any defects in materials and workmanship under normal application, usage, installation and service conditions for a period of one hundred and twenty (120) months from the Warranty Commencement Date. If MODULES become malfunctioning or non-operative due to defects in material or workmanship during the one hundred and twenty (120)-month period from the Warranty Commencement Date, as verified by an independent testing agency that will be selected and confirmed mutually by JA Solar and Customer in advance, JA Solar will, at its sole option, either repair or replace the malfunctioning or inoperative MODULES. MODULES' repair or replacement remedy shall be the sole and exclusive remedy p ovided under this Limited Product Warranty and shal not extend beyond the period set forth herein. This Limited Product Warranty does not warranty a specific power output at or during any time frame, which shall be exclusively covered under Section 2 of this Warranty hereinafter ("Limited Peak Power Warranty")

2. Limited Peak Power Warranty– Limited Remedy

JA Solar warrants that for a period of twenty-five years starting from the Warranty Commencement Date, loss of power output against the minimum "Peak Power at STC" as specified on the label of the modules (hereinafter "Nominal Power") when measured at Standard Test Conditions (STC) for the Product(s) shall not exceed:

(1) For Mono and Maple Products: 3 % for the first year from the Warranty Commencement Date, and 0.708% per year thereafter from the 2nd to the 25th year of the warranty period: with a power output standing at 80.008% of the Nominal Power at the end of the 25-year warranty period;

(2) For Poly Products: 2.5 % for the first year from the Warranty Commencement Date, and, 0.7% per year thereafter from the 2nd to the 25th year of the warranty period: with a power output standing at 80.7% of the Nominal Power at the end of the 25-year warranty period.

Within the period of twenty-five (25)-year warranty period from the Warranty Commencement Date, should any qualified Module sold by JA Solar exhibit a loss of power output exceed the aforementioned warranted values, provided that any such declared loss in power has been verified by JA Solar, at its sole discretion is due to MODULES' defects in materials or workmanship attributable to JA Solar's own causes and further confirmed by an independent testing agency (if so requested by a customer) (which is to be selected and confirmed mutually by JA Solar and Customer in advance), JA Solar will, at its sole option and discretion, either (1) make up such loss in power by providing to customer(s) additional MODULES; or (2) repair or replace the defective MODULES including free shipping to the location as set out in the original sales contract entered between JA Solar and the customer.

The remedies set forth herein are the sole and exclusive remedies JA Solar is bound to provide under the Limited Peak Power Warranty.

CAVEAT:

The shipping charges for any allegedly defected MODULES shall be borne by the customers making such claims in advance. Should the independent testing agency confirm that such filed defected are to be covered under this Warranty by JA Solar, the shipping charges advanced by the customers may be reimbursed by JA Solar against the original proof of expenditure.

3. Exclusions and Limitations

(a) Warranty claims from any customers, in any event, shall be filed in writing to JA Solar or its authorized distributors within the applicable warranty period and not beyond the last day of the applicable period of time as stated above.

(b) The Limited Product Warranty and Limited Peak Power Warranty shall not apply to MODULES which have been subject to:

- Misuse, abuse, neglect, vandalism or accident;
- Alteration, improper installation or application;
- Repair or modifications that do not strictly follow the manufacturer's instructions;

Non-observance of JA Solar's maintenance instructions;

- Power failure, electrical spikes or surges, lightning, flood, fire, accidental breakage or other events outside JA Solar's control.

(c) The Limited Product Warranty and Limited Peak Power Warranty do not cover any costs associated with installation, removal or re-installation of the MODULES and (except as explicitly set forth in the last paragraph of the Section 5) customs clearance or any other costs for return of the MODULES.

(d) Warranty claims will not be honored if the type or serial number of JA Solar MODULES have been altered, removed or made illegible without written authorization from JA Solar.

4. Limitation of Warranty Scope

This Warranty as set forth herein is expressly in lieu of ad excludes all other express or implied warranties, including but not limited to warranties of merchantability and of fitness for particular purpose, use, or application, and all other obligations or liabilities on the part of JA Solar, unless such other obligations or liabilities are expressly agreed to in writing signed and approved by JA Solar. JA Solar shall have no responsibility or liability whatsoever for damage or injury to persons or property, or for other loss or injury resulting from any cause whatsoever arising out of or related to the MODULES, including, without limitation, any defects in the MODULES or from use or installation.

Under no circumstances shall JA Solar be liable for incidental, consequential or special damages, howsoever caused. Loss of use, loss of profits, loss of production, and loss of revenues. The aforementioned alleged losses by customers are specifically and without limitation excluded from responsibilities of JA Solar. JA Solar's aggregate liability, if any, in damages or otherwise, shall not exceed the invoice value as paid by the Customer, for the single unit of MODULES.

5. Obtaining Warranty Performance

If the Customer has a justified claim covered by this Warranty, an immediate written notification shall be directly made to JA Solar by means of registered letter to the address of JA Solar listed hereunder, or, sending a notification via e-mail to the e-mail account of JA Solar listed hereunder. Together with the notification, the Customer should enclose the evidence of the claim with the corresponding serial number of the MODULES and the date on which the MODULES have been purchased. An invoice with clear indication of the purchase date, purchase price, module type, stamp or signature of JA Solar or its distributors should also be submitted as part of the preliminary evidence.

If the MODULES will be returned to JA Solar for inspection, repair or replacement by JA Solar, JA Solar shall provide the Customer with a Return Merchandise Authorization (RMA). However, JA Solar will not accept a return of any MODULES without such RMA. In connection with both the Limited Product Warranty and Limited Peak Power Warranty, JA Solar may reimburse customer for reasonable, customary and documented transportation charges by sea freight for both the return of the MODULES and reshipment of any repair or replacement MODULES, only if such cost reimbursement is authorized by JA Solar's Customer Service Department in advance.

6. Transferability

This warranty is extended to the original end-user purchaser, and is also transferable to any subsequent owner of the location or holder of the product when MODULES remain at their original installed location upon satisfactory proof of succession or assignment.

7. Severability

If a section, provision or clause of this Warranty, or the application thereof to any person or circumstance, is held invalid, void or unenforceable, such shall not affect and thus shall leave all other sections, provisions, clauses or applications under this Warranty severable, and therefore validly binding.

8. Dispute Resolution

In case of any dispute in terms of warranty-claims, a first-class international testing institute, such as PI Berlin, TÜV SUD or Intertek, UL, shall be entrusted by both parties upon mutual consents in order to provide third party verification and comments. All fees and expenses shall be borne by the party that demanded such verification procedure, unless otherwise agreed.

Further dispute over the claim shall be submitted to dispute resolution as stipulated in the main sales contract to which this Warranty is a part of and subject to the applicable jurisdiction agreed by the parties in the sales contract.

9. Various

The repair or replacement of the MODULES or the supply of additional MODULES does not lead to a new commencement of warranty terms, nor shall the original terms of this Warranty be extended. Any replaced MODULES shall become the property of JA Solar.

JA Solar shall at its own options to deliver another type of MODULES (different in size, color, shape, or power), either a new brand or the original one, in case that JA Solar has discontinued producing the module in question at the time of the claim.

10. Force Majeure

JA Solar shall not be responsible or liable to the Customer whatsoever or any third-party arising out of any non-performance or delay in performance of any terms and conditions of the sales, including this Warranty, due to causes of natural disasters such as fire, flood, blizzard, hurricane, thunder, acts of God, changes of public policies, terrorism, war, riots, strikes, unavailability of suitable and sufficient labor or materials and other events which are out of control of JA Solar.

REMARK:

"Peak Power" is the power in watt peak that MODULES generates in its maximum power point under STC condition. 'STC' are as follows:

(a) Light spectrum of AM 1.5

(b) Irradiance at 1,000W/m2

(c) Cell temperature of 25 degree Centigrade at right angle irradiation

The measurements are carried out in accordance with IEC61215 as tested at the junction box terminals per the calibration and testing standards of JA Solar valid at the date of manufacture of the MODULES. JA Solar's calibration standards shall be in compliance with the standards applied by international institutions accredited for this purpose.

/ Perfect Welding / Solar Energy / Perfect Charging

SHIFTING THE LIMITS

FRONIUS SYMO

/ Maximum flexibility for the applications of tomorrow.

/ PC board replacement process

/ SnapINverter technology

/ Integrated data communication

/ SuperFlex Design

/ Dynamic Peak Manager

/ Smart Grid Ready

/ Boasting power categories ranging from 3.0 to 20.0 kW, the transformerless Fronius Symo is the three-phase inverter for systems of every size. Owing to the SuperFlex Design, the Fronius Symo is the perfect answer to irregularly shaped or multi-oriented roofs. The standard interface to the internet via WLAN or Ethernet and the ease of integration of third-party components make the Fronius Symo one of the most communicative inverters on the market. Furthermore, the meter interface permits dynamic feed-in management and a clear visualisation of the consumption overview.

TECHNICAL DATA FRONIUS SYMO (3.0-3-S, 3.7-3-S, 4.5-3-S, 3.0-3-M, 3.7-3-M, 4.5-3-M)

INPUT DATA	SYMO 3.0-3-S	SYMO 3.7-3-S	SYMO 4.5-3-S	SYMO 3.0-3-M	SYMO 3.7-3-M	SYMO 4.5-3-M
Max. input current ($I_{dc\ max\ 1}$ / $I_{dc\ max\ 2}$ [1])	16.0 A / 16.0 A					
Max. array short circuit current (MPP_1/MPP_2 [1])	24.0 A / 24.0 A					
Min. input voltage ($U_{dc\ min}$)	150 V					
Feed-in start voltage ($U_{dc\ start}$)	200 V					
Nominal input voltage ($U_{dc,r}$)	595 V					
Max. input voltage ($U_{dc\ max}$)	1,000 V					
MPP voltage range ($U_{mpp\ min}$ – $U_{mpp\ max}$)	200 - 800 V	250 - 800 V	300 - 800 V	150 - 800 V		
Number MPP trackers	1			2		
Number of DC connections	3			2+2		

OUTPUT DATA	SYMO 3.0-3-S	SYMO 3.7-3-S	SYMO 4.5-3-S	SYMO 3.0-3-M	SYMO 3.7-3-M	SYMO 4.5-3-M
AC nominal output ($P_{ac,r}$)	3,000 W	3,700 W	4,500 W	3,000 W	3,700 W	4,500 W
Max. output power	3,000 VA	3,700 VA	4,500 VA	3,000 VA	3,700 VA	4,500 VA
Max. output current ($I_{ac\ max}$)	4.8 A	5.9 A	7.2 A	4.8 A	5.9 A	7.2 A
Grid connection (voltage range)	3-NPE 400 V / 230 V or 3-NPE 380 V / 220 V (+20 % / -30 %)					
Frequency (Frequency range)	50 Hz / 60 Hz (45 - 65 Hz)					
Total harmonic distortion	< 3 %					
Power factor (cos $\varphi_{ac,r}$)	0.70 - 1 ind. / cap.			0.85 - 1 ind. / cap.		

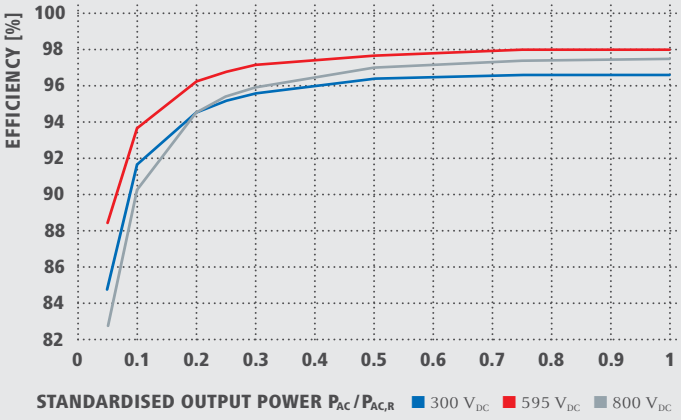
GENERAL DATA	SYMO 3.0-3-S	SYMO 3.7-3-S	SYMO 4.5-3-S	SYMO 3.0-3-M	SYMO 3.7-3-M	SYMO 4.5-3-M
Dimensions (height x width x depth)	645 x 431 x 204 mm					
Weight	16.0 kg			19.9 kg		
Degree of protection	IP 65					
Protection class	1					
Overvoltage category (DC / AC) [2]	2 / 3					
Night time consumption	< 1 W					
Inverter design	Transformerless					
Cooling	Regulated air cooling					
Installation	Indoor and outdoor installation					
Ambient temperature range	-25 - +60 °C					
Permitted humidity	0 - 100 %					
Max. altitude	2,000 m / 3,400 m (unrestricted / restricted voltage range)					
DC connection technology	3x DC+ and 3x DC- screw terminals 2.5 - 16 mm²			4x DC+ and 4x DC- screw terminals 2.5 - 16mm² [3]		
Mains connection technology	5-pole AC screw terminals 2.5 - 16 mm²			5-pole AC screw terminals 2.5 - 16mm² [3]		
Certificates and compliance with standards	ÖVE / ÖNORM E 8001-4-712, DIN V VDE 0126-1-1/A1, VDE AR N 4105, IEC 62109-1/-2, IEC 62116, IEC 61727, AS 3100, AS 4777-2, AS 4777-3, CER 06-190, G83/2, UNE 206007-1, SI 4777 [1], CEI 0-21 [1]					

[1] This applies to Fronius Symo 3.0-3-M, 3.7-3-M and 4.5-3-M.

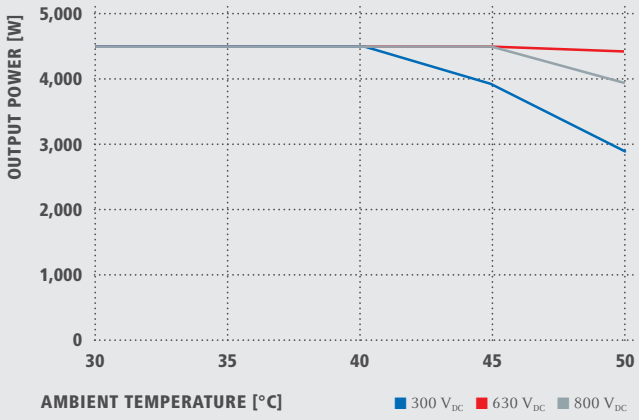
[2] According to IEC 62109-1.

[3] 16 mm² without wire end ferrules. Further information regarding the availability of the inverters in your country can be found at **www.fronius.com.**

FRONIUS SYMO 4.5-3-S EFFICIENCY CURVE



FRONIUS SYMO 4.5-3-S TEMPERATURE DERATING



TECHNICAL DATA FRONIUS SYMO (3.0-3-S, 3.7-3-S, 4.5-3-S, 3.0-3-M, 3.7-3-M, 4.5-3-M)

EFFICIENCY	SYMO 3.0-3-S	SYMO 3.7-3-S	SYMO 4.5-3-S	SYMO 3.0-3-M	SYMO 3.7-3-M	SYMO 4.5-3-M
Max. efficiency	98.0 %					
European efficiency (ηEU)	96.2 %	96.7 %	97.0 %	96.5 %	96.9 %	97.2 %
η at 5 % Pac.r [1]	80.3 / 83.6 / 79.1 %	83.4 / 86.4 / 80.6 %	84.8 / 88.5 / 82.8 %	79.8 / 85.1 / 80.8 %	81.6 / 87.8 / 82.8 %	83.4 / 90.3 / 85.0 %
η at 10 % Pac.r [1]	87.8 / 91.0 / 86.2 %	90.1 / 92.5 / 88.7 %	91.7 / 93.7 / 90.3 %	86.5 / 91.6 / 87.7 %	87.9 / 93.6 / 90.5 %	89.2 / 94.1 / 91.2 %
η at 20 % Pac.r [1]	92.6 / 95.0 / 92.6 %	93.7 / 95.7 / 93.6 %	94.6 / 96.3 / 94.5 %	90.8 / 95.3 / 93.0 %	91.9 / 96.0 / 94.1 %	92.8 / 96.5 / 95.1 %
η at 25 % Pac.r [1]	93.4 / 95.6 / 93.8 %	94.5 / 96.4 / 94.7 %	95.2 / 96.8 / 95.4 %	91.9 / 96.0 / 94.2 %	92.9 / 96.6 / 95.2 %	93.5 / 97.0 / 95.8 %
η at 30 % Pac. [1]	94.0 / 96.3 / 94.5 %	95.0 / 96.7 / 95.4 %	95.6 / 97.2 / 95.9 %	92.8 / 96.5 / 95.1 %	93.5 / 97.0 / 95.8 %	94.2 / 97.3 / 96.3 %
η at 50 % Pac.r [1]	95.2 / 97.3 / 96.3 %	96.9 / 97.6 / 96.7 %	96.4 / 97.7 / 97.0 %	94.3 / 97.5 / 96.5 %	94.6 / 97.7 / 96.8 %	94.9 / 97.8 / 97.2 %
η at 75 % Pac.r [1]	95.6 / 97.7 / 97.0 %	96.2 / 97.8 / 97.3 %	96.6 / 98.0 / 97.4 %	94.9 / 97.8 / 97.2 %	95.0 / 97.9 / 97.4 %	95.1 / 98.0 / 97.5 %
η at 100 % Pac.r [1]	95.6 / 97.9 / 97.3 %	96.2 / 98.0 / 97.5 %	96.6 / 98.0 / 97.5 %	95.0 / 98.0 / 97.4 %	95.1 / 98.0 / 97.5 %	95.0 / 98.0 / 97.6 %
MPP adaptation efficiency	> 99.9 %					

[1] And at $U_{mpp\ min}$ / $U_{dc.r}$ / $U_{mpp\ max}$

PROTECTIVE DEVICES	SYMO 3.0-3-S	SYMO 3.7-3-S	SYMO 4.5-3-S	SYMO 3.0-3-M	SYMO 3.7-3-M	SYMO 4.5-3-M
DC insulation measurement	Yes					
Overload behaviour	Operating point shift, power limitation					
DC disconnector	Yes					

INTERFACES	SYMO 3.0-3-S	SYMO 3.7-3-S	SYMO 4.5-3-S	SYMO 3.0-3-M	SYMO 3.7-3-M	SYMO 4.5-3-M
WLAN / Ethernet LAN	Fronius Solar.web, Modbus TCP SunSpec, Fronius Solar API (JSON)					
6 inputs and 4 digital in/out	Interface to ripple control receiver					
USB (A socket) [2]	Datalogging, inverter update via USB flash drive					
2x RS422 (RJ45 socket) [2]	Fronius Solar Net, interface protocol					
Signalling output [2]	Energy management (potential-free relay output)					
Datalogger and Webserver	Included					
External input	S0-Meter Interface / Input for overvoltage protection					
RS485 [3]	Modbus RTU SunSpec or meter connection					

[2] Also available in the light version. [3] Available from autumn 2014.

TECHNICAL DATA FRONIUS SYMO (5.0-3-M, 6.0-3-M, 7.0-3-M, 8.2-3-M)

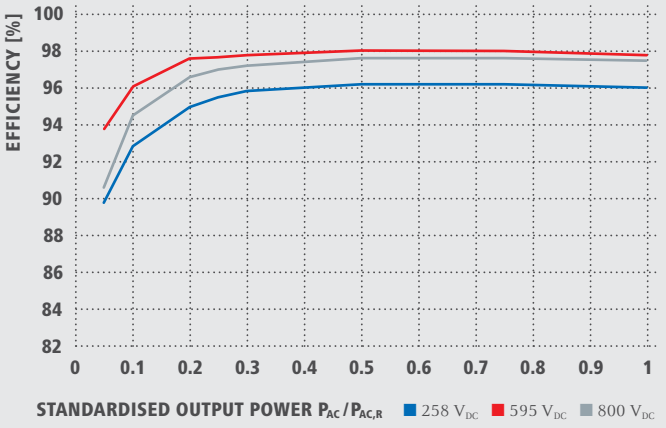
INPUT DATA	SYMO 5.0-3-M	SYMO 6.0-3-M	SYMO 7.0-3-M	SYMO 8.2-3-M
Max. input current ($I_{dc\ max\ 1}$ / $I_{dc\ max\ 2}$)	16.0 A / 16.0 A			
Max. array short circuit current (MPP_1/MPP_2)	24.0 A / 24.0 A			
Min. input voltage ($U_{dc\ min}$)	150 V			
Feed-in start voltage ($U_{dc\ start}$)	200 V			
Nominal input voltage ($U_{dc,r}$)	595 V			
Max. input voltage ($U_{dc\ max}$)	1,000 V			
MPP voltage range ($U_{mpp\ min}$ – $U_{mpp\ max}$)	163 - 800 V	195 - 800 V	228 - 800 V	267 - 800 V
Number MPP trackers	2			
Number of DC connections	2 + 2			

OUTPUT DATA	SYMO 5.0-3-M	SYMO 6.0-3-M	SYMO 7.0-3-M	SYMO 8.2-3-M
AC nominal output ($P_{ac,r}$)	5,000 W	6,000 W	7,000 W	8,200 W
Max. output power	5,000 VA	6,000 VA	7,000 VA	8,200 VA
Max. output current ($I_{ac\ max}$)	8.0 A	9.6 A	11.2 A	13.1 A
Grid connection (voltage range)	3-NPE 400 V / 230 V or 3-NPE 380 V / 220 V (+20 % / -30 %)			
Frequency (Frequency range)	50 Hz / 60 Hz (45 - 65 Hz)			
Total harmonic distortion	< 3 %			
Power factor (cos $\varphi_{ac,r}$)	0.85 - 1 ind. / cap.			

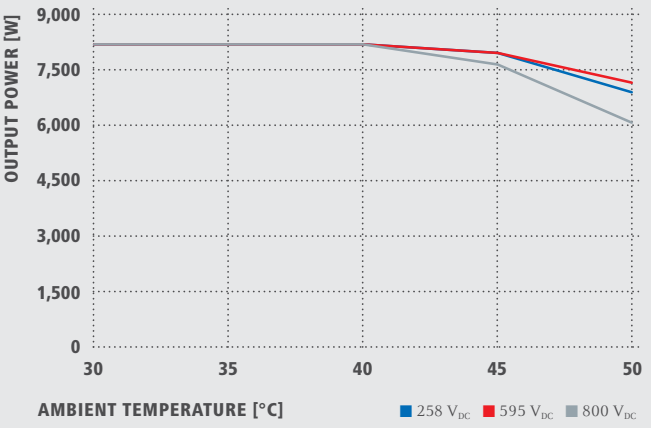
GENERAL DATA	SYMO 5.0-3-M	SYMO 6.0-3-M	SYMO 7.0-3-M	SYMO 8.2-3-M
Dimensions (height x width x depth)	645 x 431 x 204 mm			
Weight	19.9 kg		21.9 kg	
Degree of protection	IP 65			
Protection class	1			
Overvoltage category (DC / AC) [1]	2 / 3			
Night time consumption	< 1 W			
Inverter design	Transformerless			
Cooling	Regulated air cooling			
Installation	Indoor and outdoor installation			
Ambient temperature range	-25 - +60 °C			
Permitted humidity	0 - 100 %			
Max. altitude	2,000 m / 3,400 m (unrestricted / restricted voltage range)			
DC connection technology	4x DC+ and 4x DC- Screw terminals 2.5 - 16mm² [2]			
Mains connection technology	5-pole AC Screw terminals 2.5 - 16mm² [2]			
Certificates and compliance with standards	ÖVE / ÖNORM E 8001-4-712, DIN V VDE 0126-1-1/A1, VDE AR N 4105, IEC 62109-1/-2, IEC 62116, IEC 61727, AS 3100, AS 4777-2, AS 4777-3, CER 06-190, G83/2, UNE 206007-1, SI 4777, CEI 0-21			

[1] According to IEC 62109-1.
[2] 16 mm² without wire end ferrules.
Further information regarding the availability of the inverters in your country can be found at **www.fronius.com**.

FRONIUS SYMO 8.2-3-M EFFICIENCY CURVE



FRONIUS SYMO 8.2-3-M TEMPERATURE DERATING



TECHNICAL DATA FRONIUS SYMO (5.0-3-M, 6.0-3-M, 7.0-3-M, 8.2-3-M)

EFFICIENCY	SYMO 5.0-3-M	SYMO 6.0-3-M	SYMO 7.0-3-M	SYMO 8.2-3-M
Max. efficiency	98.0 %			
European efficiency (ηEU)	97.3 %	97.5 %	97.6 %	97.7 %
η at 5 % Pac,r [1]	84.9 / 91.2 / 85.9 %	87.8 / 92.6 / 87.8 %	88.7 / 93.1 / 89.0 %	89.8 / 93.8 / 90.6 %
η at 10 % Pac,r [1]	89.9 / 94.6 / 91.7 %	91.3 / 95.6 / 93.0 %	92.0 / 95.9 / 94.7 %	92.8 / 96.1 / 94.5 %
η at 20 % Pac,r [1]	93.2 / 96.7 / 95.4 %	94.1 / 97.1 / 95.9 %	94.5 / 97.3 / 96.3 %	95.0 / 97.6 / 96.6 %
η at 25 % Pac,r [1]	93.9 / 97.2 / 96.0 %	94.7 / 97.5 / 96.5 %	95.1 / 97.6 / 96.7 %	95.5 / 97.7 / 97.0 %
η at 30 % Pac, [1]	94.5 / 97.4 / 96.5 %	95.1 / 97.7 / 96.8 %	95.4 / 97.7 / 97.0 %	95.8 / 97.8 / 97.2 %
η at 50 % Pac,r [1]	95.2 / 97.9 / 97.3 %	95.7 / 98.0 / 97.5 %	95.9 / 98.0 / 97.5 %	96.2 / 98.0 / 97.6 %
η at 75 % Pac,r [1]	95.3 / 98.0 / 97.5 %	95.7 / 98.0 / 97.6 %	95.9 / 98.0 / 97.6 %	96.2 / 98.0 / 97.6 %
η at 100 % Pac,r [1]	95.2 / 98.0 / 97.6 %	95.7 / 97.9 / 97.6 %	95.8 / 97.9 / 97.5 %	96.0 / 97.8 / 97.5 %
MPP adaptation efficiency	> 99.9 %			

[1] And at $U_{mpp\ min}$ / $U_{dc,r}$ / $U_{mpp\ max}$

PROTECTIVE DEVICES	SYMO 5.0-3-M	SYMO 6.0-3-M	SYMO 7.0-3-M	SYMO 8.2-3-M
DC insulation measurement	Yes			
Overload behaviour	Operating point shift, power limitation			
DC disconnector	Yes			

INTERFACES	SYMO 5.0-3-M	SYMO 6.0-3-M	SYMO 7.0-3-M	SYMO 8.2-3-M
WLAN / Ethernet LAN	Fronius Solar.web, Modbus TCP SunSpec, Fronius Solar API (JSON)			
6 inputs and 4 digital in/out	Interface to ripple control receiver			
USB (A socket) [2]	Datalogging, inverter update via USB flash drive			
2x RS422 (RJ45 socket) [2]	Fronius Solar Net, interface protocol			
Signalling output [2]	Energy management (potential-free relay output)			
Datalogger and Webserver	Included			
External input	S0-Meter Interface / Input for overvoltage protection			
RS485 [3]	Modbus RTU SunSpec or meter connection			

[2] Also available in the light version. [3] Available from autumn 2014.

TECHNICAL DATA FRONIUS SYMO (10.0-3-M, 12.5-3-M, 15.0-3-M, 17.5-3-M, 20.0-3-M)

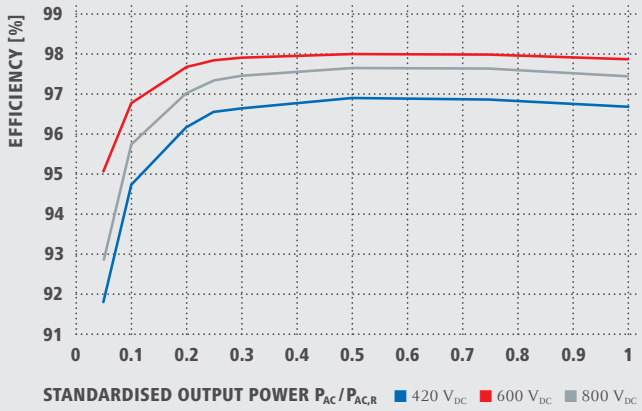
INPUT DATA	SYMO 10.0-3-M	SYMO 12.5-3-M	SYMO 15.0-3-M	SYMO 17.5-3-M	SYMO 20.0-3-M
Max. input current ($I_{dc\ max\ 1}$ / $I_{dc\ max\ 2}$)	27.0 A / 16.5 A		33.0 A / 27.0 A		
Max. array short circuit current (MPP_1/MPP_2)	40.5 A / 24.8 A		49.5 A / 40.5 A		
Min. input voltage ($U_{dc\ min}$)	200 V				
Feed-in start voltage ($U_{dc\ start}$)	200 V				
Nominal input voltage ($U_{dc,r}$)	600 V				
Max. input voltage ($U_{dc\ max}$)	1,000 V				
MPP voltage range ($U_{mpp\ min}$ – $U_{mpp\ max}$)	270 - 800 V	320 - 800 V		370 - 800 V	420 - 800 V
Number MPP trackers	2				
Number of DC connections	3+3				

OUTPUT DATA	SYMO 10.0-3-M	SYMO 12.5-3-M	SYMO 15.0-3-M	SYMO 17.5-3-M	SYMO 20.0-3-M
AC nominal output ($P_{ac,r}$)	10,000 W	12,500 W	15,000 W	17,500 W	20,000 W
Max. output power	10,000 VA	12,500 VA	15,000 VA	17,500 VA	20,000 VA
Max. output current ($I_{ac\ max}$)	16.0 A	19.9 A	23.9 A	27.9 A	31.9 A
Grid connection (voltage range)	3-NPE 400 V / 230 V or 3-NPE 380 V / 220 V (+20 % / -30 %)				
Frequency (Frequency range)	50 Hz / 60 Hz (45 - 65 Hz)				
Total harmonic distortion	< 2 %				
Power factor (cos $\varphi_{ac,r}$)	0 - 1 ind. / cap.				

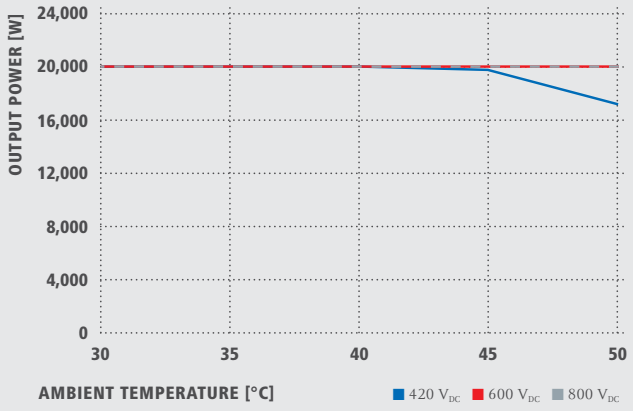
GENERAL DATA	SYMO 10.0-3-M	SYMO 12.5-3-M	SYMO 15.0-3-M	SYMO 17.5-3-M	SYMO 20.0-3-M
Dimensions (height x width x depth)	725 x 510 x 225 mm				
Weight	34.8 kg		43.4 kg		
Degree of protection	IP 66				
Protection class	1				
Overvoltage category (DC / AC) [1]	2 / 3				
Night time consumption	< 1 W				
Inverter design	Transformerless				
Cooling	Regulated air cooling				
Installation	Indoor and outdoor installation				
Ambient temperature range	-25 - +60 °C				
Permitted humidity	0 - 100 %				
Max. altitude	2,000 m / 3,400 m (unrestricted / restricted voltage range)				
DC connection technology	6x DC+ and 6x DC- screw terminals 2.5 - 16 mm^2				
Mains connection technology	5-pole AC screw terminals 2.5 - 16 mm^2				
Certificates and compliance with standards	ÖVE / ÖNORM E 8001-4-712, DIN V VDE 0126-1-1/A1, VDE AR N 4105, IEC 62109-1/-2, IEC 62116, IEC 61727, AS 3100, AS 4777-2, AS 4777-3, CER 06-190, G83/2, G59/3, UNE 206007-1, SI 4777, CEI 0-16, CEI 0-21				

[1] According to IEC 62109-1. DIN rail for optional overvoltage protection (type 2) is included.
Further information regarding the availability of the inverters in your country can be found at **www.fronius.com**.

FRONIUS SYMO 20.0-3-M EFFICIENCY CURVE



FRONIUS SYMO 20.0-3-M TEMPERATURE DERATING



TECHNICAL DATA FRONIUS SYMO (10.0-3-M, 12.5-3-M, 15.0-3-M, 17.5-3-M, 20.0-3-M)

EFFICIENCY	SYMO 10.0-3-M	SYMO 12.5-3-M	SYMO 15.0-3-M	SYMO 17.5-3-M	SYMO 20.0-3-M
Max. efficiency	98.0 %		98.1 %		
European efficiency (ηEU)	97.4%	97.6 %	97.8 %	97.8 %	97.9 %
η at 5 % Pac.r [1]	87.9 / 92.5 / 89.2 %	88.7 / 93.1 / 90.1 %	91.2 / 94.8 / 92.3 %	91.6 / 95.0 / 92.7 %	91.9 / 95.2 / 93.0 %
η at 10 % Pac.r [1]	91.2 / 94.9 / 92.8 %	92.9 / 96.1 / 94.6 %	93.4 / 96.0 / 94.4 %	94.0 / 96.4 / 95.0 %	94.8 / 96.9 / 95.8 %
η at 20 % Pac.r [1]	94.6 / 97.1 / 96.1 %	95.4 / 97.3 / 96.6 %	95.9 / 97.4 / 96.7 %	96.1 / 97.6 / 96.9 %	96.3 / 97.8 / 97.1 %
η at 25 % Pac.r [1]	95.4 / 97.3 / 96.6 %	95.6 / 97.6 / 97.0 %	96.2 / 97.6 / 97.0 %	96.4 / 97.8 / 97.2 %	96.7 / 97.9 / 97.4 %
η at 30 % Pac.r [1]	95.6 / 97.5 / 96.9 %	95.9 / 97.7 / 97.2 %	96.5 / 97.8 / 97.3 %	96.6 / 97.9 / 97.4 %	96.8 / 98.0 / 97.6 %
η at 50 % Pac.r [1]	96.3 / 97.9 / 97.4 %	96.4 / 98.0 / 97.5 %	96.9 / 98.1 / 97.7 %	97.0 / 98.1 / 97.7 %	97.0 / 98.1 / 97.8 %
η at 75 % Pac.r [1]	96.5 / 98.0 / 97.6 %	96.5 / 98.0 / 97.6 %	97.0 / 98.1 / 97.8 %	97.0 / 98.1 / 97.8 %	97.0 / 98.1 / 97.7 %
η at 100 % Pac.r [1]	96.5 / 98.0 / 97.6 %	96.5 / 97.8 / 97.6 %	97.0 / 98.1 / 97.7 %	96.9 / 98.1 / 97.6 %	96.8 / 98.0 / 97.6 %
MPP adaptation efficiency	> 99.9 %				

PROTECTIVE DEVICES	SYMO 10.0-3-M	SYMO 12.5-3-M	SYMO 15.0-3-M	SYMO 17.5-3-M	SYMO 20.0-3-M
DC insulation measurement	Yes				
Overload behaviour	Operating point shift. power limitation				
DC disconnector	Yes				

INTERFACES	SYMO 10.0-3-M	SYMO 12.5-3-M	SYMO 15.0-3-M	SYMO 17.5-3-M	SYMO 20.0-3-M
WLAN / Ethernet LAN	Fronius Solar.web, Modbus TCP SunSpec, Fronius Solar API (JSON)				
6 inputs and 4 digital inputs/outputs	Interface to ripple control receiver				
USB (A socket) [2]	Datalogging, inverter update via USB flash drive				
2x RS422 (RJ45-socket) [2]	Fronius Solar Net, interface protocol				
Signalling output [2]	Energy management (potential-free relay output)				
Datalogger und Webserver	Included				
External input	S0-Meter Interface / Input for overvoltage protection				
RS485 [3]	Modbus RTU SunSpec or meter connection				

[1] And at $U_{mpp\ min}$ / $U_{dc.r}$ / $U_{mpp\ max}$ [2] Also available in the light version. [3] Available from autumn 2014.

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Further information about all Fronius products and our global sales partners and representatives can be found at **www.fronius.com**

v02 Feb 2014 EN

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www.fronius.com

M,06,0092,EN v11 Aug 2014 as17

Warranty terms and conditions

These guaranteed conditions apply to inverters in the following series:

String inverters

- Fronius IG
- Fronius IG Plus
- Fronius IG Plus V
- Fronius IG TL
- Fronius Galvo (light)
- Fronius Symo (light)

Central inverters

- Fronius IG
- Fronius CL

Geographical validity

These warranty terms and conditions are valid worldwide. However, they do not apply to Canada, the United States of America and Mexico. Separate warranty terms and conditions apply to these countries.

Fronius manufacturer's warranty

The inverters listed above come standard with a manufacturer's warranty of 60 months from the date of installation. Fronius guarantees that your photovoltaic inverter will function correctly during this period.

Extended warranty

An extended warranty can be purchased up to 6 months after the date of installation. Applications for an extended warranty after this date can be rejected by Fronius. The extended warranty only applies to the inverters listed above.

You can apply to extend the warranty period to a total of 10, 15 or 20 years for string inverters. For central inverters, the warranty period can be extended to a total of 10 or 20 years.

Services within the warranty period

If a defect should occur within the agreed upon warranty period for which Fronius is responsible, Fronius has the option of

- repairing the defect at Fronius or onsite
- providing an equivalent replacement device or new device
- or having a trained Fronius Service Partner carry out these services

Transport

Fronius pays the transport costs for the inverter (by land or sea)

- into and within countries with a national Fronius subsidiary
- into and within countries of the EU (including the autonomous regions or cities of Spain and Portugal)
- into and within Switzerland
- between the respective national or nearest Fronius subsidiary and the retail site of the official Fronius sales partner from which the device was purchased.

Transport costs are not paid

- from or to EU overseas territories
- from, into, or within countries outside of the EU provided that there are no national Fronius subsidiaries there.

For return transportation, devices or components must be packed in their original or equivalent packaging.

Fronius subsidiaries

As of September 2012, Fronius will have national subsidiaries in the following countries outside the EU, Switzerland and the USA:

- Australia
- Brazil
- Canada
- China
- Mexico
- Norway
- Turkey
- Ukraine

Current information about this can be found on our website at www.fronius.com.

When making a warranty claim, attention should be paid to the following:

The purchase invoice, serial number of the device and start-up report (the date on which the device was provided/commissioned and report from the power supply company), as well as proof of payment of the warranty extension fee, are required for warranty claims.

End customers, please contact your installer. If necessary, the installer will get in contact with Fronius.

The procedure for a warranty claim must be coordinated with Fronius. This is the only way to ensure that the above mentioned warranty services will be provided free of charge for the warrantee.

When devices or components are replaced, the remaining warranty period will be transferred to the replacement device or component. This will be registered automatically by Fronius. You will not receive a new certificate.

If the remaining warranty period is less than one year, you will automatically receive a full year for the remaining warranty period for the replacement device or component.

Scope and validity of the warranty

The manufacturer's warranty is only valid for the inverter that is uniquely identified by the serial number. Other photovoltaic system components as well as Fronius system upgrades (e.g., plug-in cards) are not covered by the warranty.

Fronius DATCOM components (for system monitoring) come standard with a 24-month warranty from the date of installation.

Exclusions from the Fronius warranty

Defects not attributable to Fronius are excluded from the guarantee. Defects not attributable to Fronius are those that are caused in particular by:

- Non-compliance with operating instructions, installation instructions or maintenance instructions
- Improper installation
- Improper commissioning
- Incorrect transport
- Improper or incorrect operation
- Inadequate ventilation of the device
- Tampering with the device by companies or persons not authorized by Fronius
- Non-compliance with safety instructions and installation standards
- Force majeure (storm, lightning, overvoltage, fire, etc.)

Damage to the inverter caused by the remaining components of the photovoltaic system or damage that impairs the function of the inverter, such as "flaws," are also excluded from the manufacturer's warranty.

The warranty does not cover travel and accommodation costs as well as onsite assembly and installation costs if they exceed the service reimbursement received by the installer performing the work from Fronius depending on the service and agreement.

Changes to the existing PV system, the building installation and the like, or any expenditure of time and the costs resulting from this are not covered by the warranty.

Due to technological progress, the possibility exists that a replacement or new device of similar value provided may not be compatible with the system monitoring or other components installed onsite (e.g., Fronius DATCOM). Expenditures and costs resulting from this are not covered by the warranty.

No compensation is provided for lost power that has not been fed into the grid or for energy consumption that does not take place and the like.

Other legal information

Other legal warranty or liability claims against Fronius remain unaffected by this warranty.

In the event of such claims, please contact the vendor of your device.

Our General Delivery and Payment Conditions under "Legal information" on our website (www.fronius.com) also apply.

Previously valid warranty conditions are replaced by these conditions.

Current and detailed information about warranty terms and conditions can be found on our website at

www.fronius.com/solar/warranty

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ValkFlat - Portrait
ValkFlat - Landscape

Installing solar panels on buildings of any kind is a logical development, as the roof offers free space and often a surface large enough for a profitable additional function. Van der Valk's solar mounting system for flat roofs was developed while taking roof and wind loads into account and, consequently, complies with the most stringent safety requirements.

Our range for flat roofs is characterised by great efficiency and ease of assembly. The three south-oriented basic systems described below enable optimal utilization and maximum energy yield for each flat roof.

ValkPro+

Unique to this system:

- ✓ Mounting is faster than ever
- ✓ Metal connectors, no plastic
- ✓ Maximum logistical simplicity
- ✓ Also applicable to high roofs
- ✓ Low ballast due to coupled rows and wind deflectors

ValkFlat - Portrait

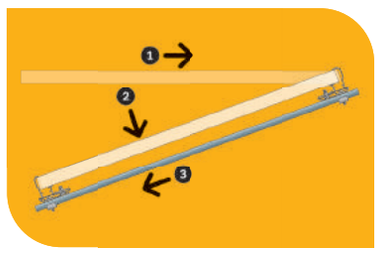
Unique to this system:

- ✓ Clamp system in portrait configuration
- ✓ Any tilt angle possible
- ✓ Universal mid- and end-panel clamps (H 28-50 mm)
- ✓ Quick assembly due to premounted A-frames
- ✓ Low ballast due to coupled design

ValkFlat - Landscape

Unique to this system:

- ✓ Insert system in landscape configuration
- ✓ Extremely fast panel mounting
- ✓ Self aligning panels during installation
- ✓ Support of the panels on the specified long sides
- ✓ Any tilt angle possible
- ✓ Quick assembly due to premounted A-frames
- ✓ Low ballast due to coupled design



Foundations Flat Roof Systems

The **ValkPro+**, the **ValkFlat - Portait** and the **ValkFlat - Landscape** utilize various foundations. For example, the systems can be attached using rubber tile carriers, mass blocks or consoles.

Rubber tile carriers offer ease of transport and installation due to their low weight and raise the system for maximum drainage.

Mass blocks have the advantage that they concurrently provide a significant part of the ballast. In addition, the system is raised higher which offers easy assembly on gravel roofs, for example.

Consoles provide a fixed mounting to the roof in areas with very high wind loads or to roofs that can't tolerate much weight. The special design guarantees watertight sealing.

	ValkPro+	ValkFlat Portrait	ValkFlat Landscape
Rubber tile carriers	✓	✓	✓
Mass blocks	✓	✓	✓
Consoles	✓	✓	✓

This specifies which foundation can be applied.

Glass panels

As well as the standard solar panels with a frame, solar panels without a frame can also be mounted using glass clamps.

Free software

With the 1-2-3 PV Planner, our free software, a complete project calculation, including a list of articles and project-specific installation manual, can be realised in three simple steps.

East west

The systems for flat roofs are also available in east west layout. Please check the separate leaflet for details.

WHY VAN DER VALK SOLAR SYSTEMS?

- Innovative systems developed in compliance with applicable worldwide standards
- Fast and reliable deliveries due to modern machinery and large stocks
- System supplier since 1963
- Free software for project design and calculation
- All systems applicable to any type of roof or surface
- Quick assembly due to premounting of essential components
- All systems available in portrait as well as landscape configuration
- Various systems also available as ready-to-use kits

The mounting systems of Van der Valk Solar Systems are delivered and installed by an extensive network of dealers and installers. We would be happy to help you find your closest point of contact.

Van der Valk Solar Systems develops and produces solar mounting systems for:

Pitched Roofs | Flat Roofs | Open fields | Greenhouses | Water features

VAN DER VALK SOLAR SYSTEMS

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PLEASE CONTACT VAN DER VALK SOLAR SYSTEMS, YOUR DEALER OR INSTALLER FOR FULL INFORMATION.

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