Version 8

Components Databases

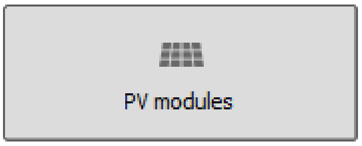
PVsyst SA
www.pvsyst.com

Contents

1 Components Management

1.1 Defining PV modules in PVsyst

We will analyse the definition of PV modules in PVsyst (PAN files) by defining a **new module** from the datasheet. Here, we are going to define a Generic 325Wp module. To do so, first, click on the "Databases" button under Utilities from the main PVsyst screen. Then, click on the "PV modules" button under the components database. Once in the PV module's database click "New" to create a new PV Module in the system.



NB: in practice, it is much easier to start from an **existing** similar component present in the database, modify its parameters according to the datasheets and save it under a new file name, therefore creating a new component in your database.

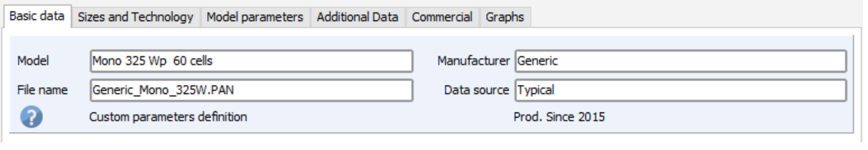
1.2 Defining PV modules from Datasheets

Typically, the first page of a PV module datasheet gives the general features (usually rather "promotional") and the second page gives the technical specifications.

When opening a new PV module, we start by defining the **"*basic data*"**, such as:

- the model,
- the manufacturer (if already existing in the database, exactly the same name),
- the data source (and possibly date of recording)
- the file name, which is the primary key in the database, and should be unique.

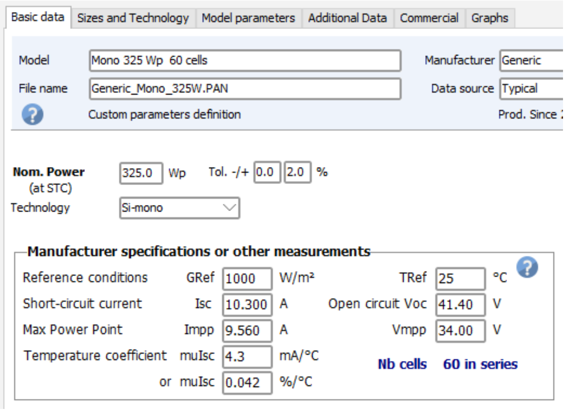
The convention in PVsyst is to define the filename as "*Manufacturer_Model.PAN*".



Next, define the "*Manufacturer Specifications*" of the module:

From the second page of the Datasheet:

- Nom power: the nameplate definition of the module (here 250 Wp).
- Tolerance: usually specified as % of PNom; here through
  - «*Pmpp range from ... to*".
- The technology: here Poly-crystalline (as mentioned elsewhere on the datasheet).



- The STC values: Impp, Vmpp, Isc, Voc.
  - NB: The product Vmpp * Impp should match the PNom (nameplate) within 0.2%., otherwise: *change the Impp value to PNom / Vmpp.*
- Efficiency at STC: not a parameter in PVsyst.
- NOCT: never specified in PVsyst!
- Reverse current feed: property of the by-pass diodes, not used in PVsyst.

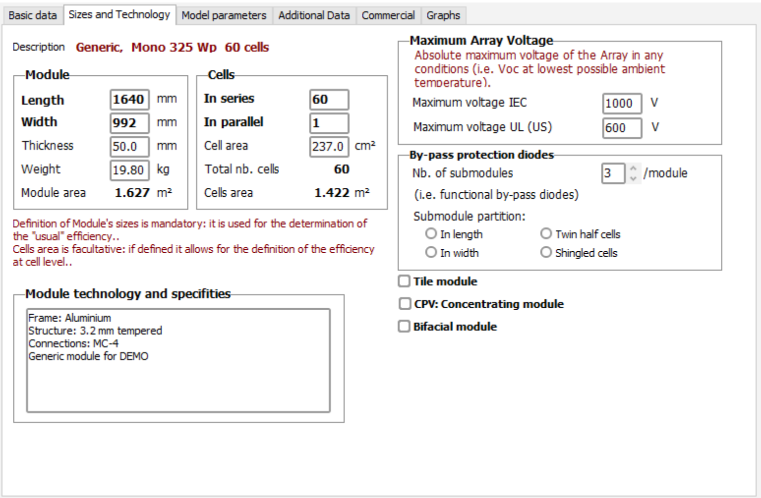
Electrical data (at standard conditions (STC) irradiance 1000 watt/m², spectrum AM 1.5 at a cell temperature of 25° C)

Type	Nominal output Pmpp	Nominal voltage Umpp	Nominal current Impp	Short circuit current Isc	Open circuit voltage Uoc	Module conversion efficiency
AC-240P/156-60S	240 Wp	30.54 V	7.87 A	8.48 A	37.26 V	14.75 %
AC-245P/156-60S	245 Wp	30.91 V	7.93 A	8.57 A	37.46 V	15.06 %
AC-250P/156-60S	250 Wp	31.45 V	7.98 A	8.65 A	37.90 V	15.37 %
AC-255P/156-60S	255 Wp	31.56 V	8.10 A	8.70 A	38.20 V	15.67 %

Many datasheets mention operating parameters (Impp, Vmpp, Isc, Voc) under NOCT conditions.

This information is not well standardized; we do not use it in PVsyst.

The second tab of the dialog to be completed is the "***Sizes and technology***" of the modules.



Usually you will find all these informations on the datasheet:

- **Module size**: mandatory, the area will determine the efficiency of the module.
- **Cells number**: the number in series is mandatory, as the model is defined for one cell.
- Cells size: if defined, the cell's area may be used for defining the efficiency at cell level.
- Usual values: Poly 6" = 15.6 cm x 15.6 cm = 243.3 cm^2, Mono: idem - 6 cm2 = 237.3 cm^2
- Maximum IEC or UL voltage: used for the array sizing (may be 1'500V for new modules).
- Number of by-pass diodes: used for the "Module layout" electrical losses calculation.

You can add some informative features in the "Modul technology and specificities" (5 lines of free text).

Design	
Frontside	0.13 inch (3,2 mm) hardened, low-reflection white glass
Cells	60 polycrystalline high efficiency cells 6 inch (156 x 156 mm)
Backside	Composite film
Frame	1.57 inch (40 mm) silver anodized aluminium frame
Mechanical data	
L x W x H	64.57 x 39.06 x 1.57 inch (1640 x 992 x 40 mm)
Weight	42,99 lbs (19,5 kg) with frame
Power connection	
Socket	Protection Class IP65 (3 bypass diodes)
Wire	43.3 inch, AWG 11
Plug-in system	Plug/socket IP67, MC4 mateable

Limit values	
System voltage	1000 VDC (UL) 1000 VDC (IEC)
NOCT (nominal operating cell temperature)*	45°C +/-2K
Max. load-carrying capacity	113 PSF
Reverse current feed IR	15.0 A

(No external voltages greater than Vo may be applied to the module)

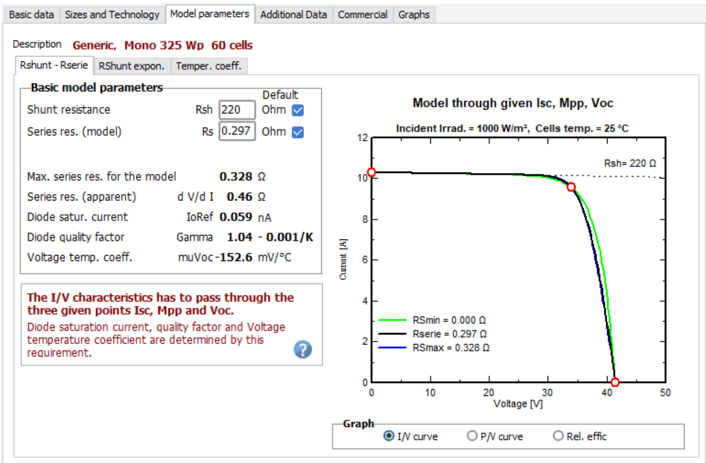
* NOCT, irradiance 800W/m²; AM 1.5; wind speed 1m/s; Temperature 20°C

The third tab is the *"Model parameters"*

*We start by defining the "**Rshunt - Rserie**".*

On this page, you should leave the Rserie and Rshunt at their default value (checkboxes).

Sometimes, you will have to check them several times.

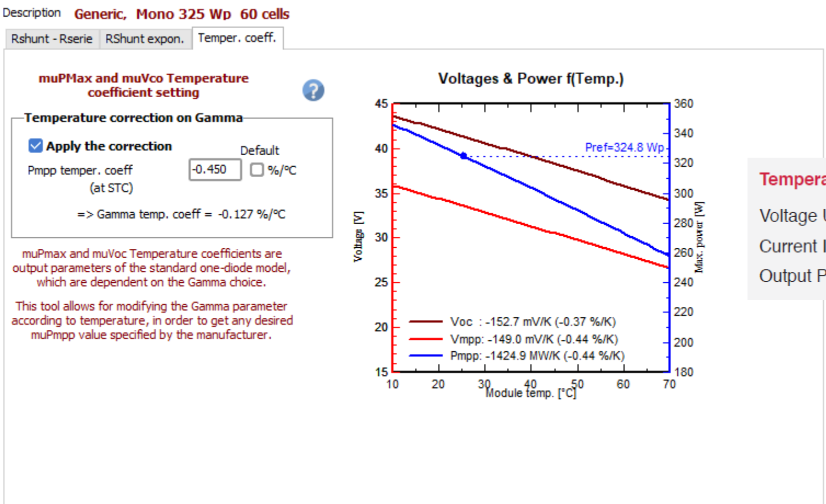


This page summarizes other parameters, as calculated when establishing the one-diode model.

NB: here the "*muVoc*" temperature coefficient is a result of the model. It cannot be matched to the datasheet's specified value. This coefficient in only used during the sizing (safety low-temperature condition), it is not involved in the simulation.

Proceeding to define the "***Rshunt exponential***". In absence of real measured values, leave the parameters at their default value.

Lastly the "***Temperature coefficient***", is defined by Pmpp temperature coefficient, as specified on the datasheet:



Temperature coefficients	
Voltage Uoc	-0.33 %/K
Current Isc	0.06 %/K
Output Pmpp	-0.44 %/K

This is a fundamental parameter for the simulation. PVsyst modifies slightly the usual One-diode model to get the exact specified value.

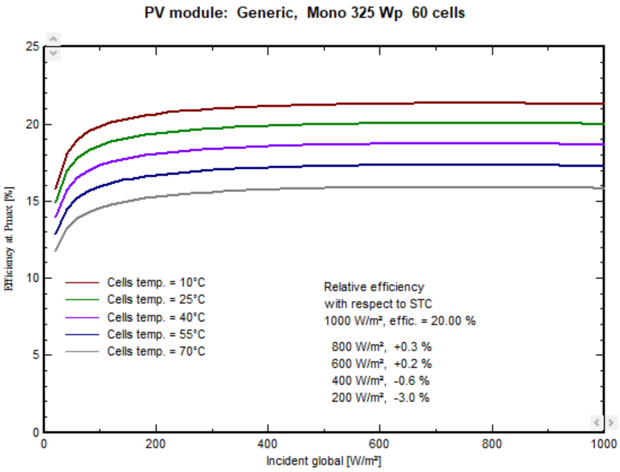
NB: The Current Isc temperature coefficient has been specified on the first page.

The Voltage Uoc temperature coefficient may not match the value calculated by the model (Page "Model parameters > Rshunt-RSerie).

This is not important, only used during the sizing for the voltage limits. If you want to use the value specified by the manufacturer, you can define on the page "Additional data" and choose to use it in the project's parameters.

"*Graphs*" tab:

Now the model is fully determined: you can see the results either as graphs or on the "*Basic data*" page > "*Internal Model result tool*", for any Irradiance and temperature conditions.



"*Additional Data*" tab consists of:

- "*Secondary parameters*": sometimes useful parameter.
- "*IAM*": if you want to define a specific IAM profile for this module (special AR coating, etc.).
- "*Low-light data*": Explicitly specify low-light performances if measured.
- "*Measured I/V curve*": allows to determine the model parameters from a measured I/V curve.

Do not mind unless special requirements.

The **"Commercial"** tab gives the following information:

- Coordinates of the manufacturer (web site).
- Availability (years of introduction and possible retrieval from the market).
- Prices of the component (you may specify them by yourself).

"*Show optimization*" button**:** Allows to modify the parameters and immediately see the effect on the behaviour of the module.

"***Copy to table***" button**:** Exports the PAN file definitions as one line to an EXCEL document.

2 Grid Inverter definition in PVsyst

We will define the Inverter in PVsyst (.OND file) by defining a **new inverter** from the datasheet.

NB: in practice, it is much easier to start from a similar component that exists in the database, modify its parameters according to the datasheets, and save it under a new file name, therefore creating a new component in your database.

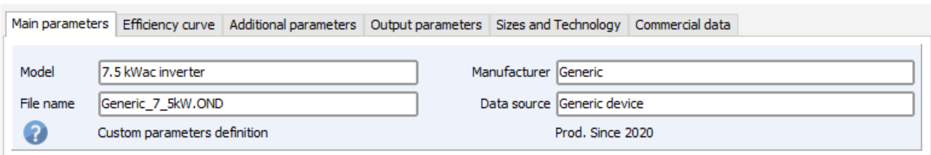
2.1 Defining an inverter from Datasheets

Typically, the first page gives the general features and the second page gives the technical specifications.

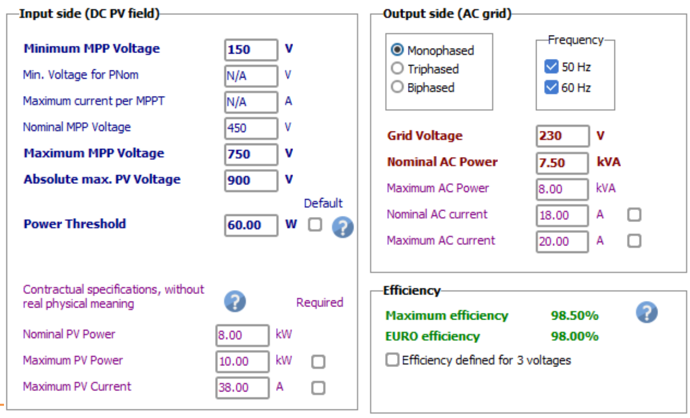
When opening a new inverter, we start by defining the **"*basic data*"** (similarly to the PV module):

- the model,
- the manufacturer (the same name if already existing in the database),
- the data source (and possibly date of recording),
- the file name, which is the primary key in the database, and should be unique.

The convention in PVsyst is to define the filename as" *Manufacturer_Model.OND. "*



Then, we have to complete the main parameters on the datasheet, i.e., the input side, output side and efficiency.



Input side: mainly concerns the voltage conditions.

Technical data	Sunny Tripower 12000TL-US	Sunny Tripower 15000TL-US	Sunny Tripower 20000TL-US	Sunny Tripower 24000TL-US
Input (DC)				
Max. usable DC power (@ cos φ = 1)	12250 W	15300 W	20400 W	24500 W
Max. DC voltage*	1000 V	1000 V	1000 V	1000 V
Rated MPPT voltage range	300 V...800 V	300 V...800 V	380 V...800 V	450 V...800 V
MPPT operating voltage range	150 V...1000 V	150 V...1000 V	150 V...1000 V	150 V...1000 V
Min. DC voltage / start voltage	150 V / 188 V	150 V / 188 V	150 V / 188 V	150 V / 188 V
Number of MPP tracker inputs	2	2	2	2
Max. input current / per MPP tracker input	66 A / 33 A	66 A / 33 A	66 A / 33 A	66 A / 33 A

- "***Minimum /Maximum MPP voltage***"*:* the voltage range for the MPP operation.
- In the PVsyst model, when attaining one of these limits, the inverter will "clip" the operating voltage to the limit voltage. We *suppose* that this corresponds to the «*Rated MPP voltage range*".
- We don't know exactly what the behaviour of the real inverter is outside of this range (what is specified as "MPP operating voltage range", 150 ... 1000V). This is not involved in PVsyst.
- "*Minimum voltage for PNom*": this is specified for some inverters: under this voltage the inverter will not be able to yield its full nominal power. This corresponds indeed to an input current limitation.
- "*Nominal MPP Voltage*": sometimes specified, not used in PVsyst.
- "***Absolute Maximum PV voltage***": this is the voltage which should not be exceeded, under the worst conditions: lower possible temperature and 1000 W/m^2.
- "*Power threshold*": when using an automatic efficiency profile, this value is necessary and cannot be lower than 0.5% of Pnom.
- "*Nominal and Maximum PV power*" are not used in PVsyst, except when they are a contractual condition which affects the guarantee of the device (case "*Required*" checked). In this case they prevent simulation of the system.
- "*Maximum PV current*» is sometimes specified (ISC of the array)), but not used in PVsyst.

Output side: grid-connection conditions.

Output (AC)				
AC nominal power	12000 W	15000 W	20000 W	24000 W
Max. AC apparent power	12000 VA	15000 VA	20000 VA	24000 VA
Output phases / line connections	3 / 3-N-PE			
Nominal AC voltage	480 / 277 V WYE			
AC voltage range	244 V...305 V			
Rated AC grid frequency	60 Hz			
AC grid frequency / range	50 Hz, 60 Hz / -6 Hz...+5 Hz			
Max. output current	14.4 A	18 A	24 A	29 A
Power factor at rated power / adjustable displacement	1 / 0.8 leading...0.8 lagging			
Harmonics	< 3 %			
Efficiency				
Max. efficiency	98.2 %	98.2 %	98.5 %	98.5 %
CEC efficiency	97.5%	97.5%	97.5%	98.0%

- "*Frequency*": Here "Rated AC grid frequency" is 60Hz (for US market); we do not understand well what is meant by "AC grid frequency range".
- "*Grid voltage*" is specific for US. The usual voltage is 400 V (in Europe). This voltage may be used in the simulation if AC losses are defined.
- "***Nominal AC Power***": if phase shift is allowed, this limitation is usually applied to the apparent power, and therefore expressed as [kVA].
- "*Maximum AC Power*": some manufacturers allow to overcome the Pnom value if the temperature is not too high. This behaviour will be specified on the 4th page "*Output parameters*".
- "*Nominal and Maximum AC current*" are not used in PVsyst.

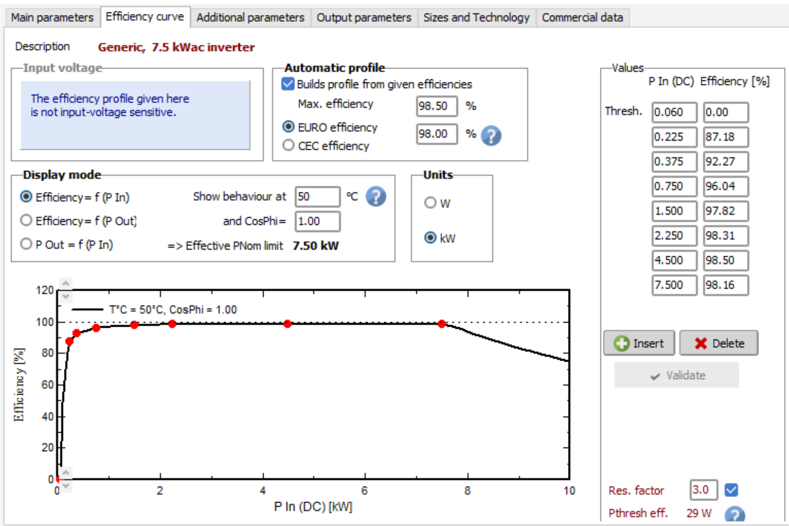
Efficiency variables:

- "*Maximum and Euro or CEC efficiency*» values are a **result** of the second page (not editable here).
- "*Efficiency defined for 3 voltages*" should be checked here when using this feature.

After completing the basic data, we proceed to the **"Efficiency curve"** tab.

Since we do not have the description of a full curve, we define the efficiency profile according to the datasheet:

- Max efficiency = 98.2 %
- CEC efficiency = 97.5 %

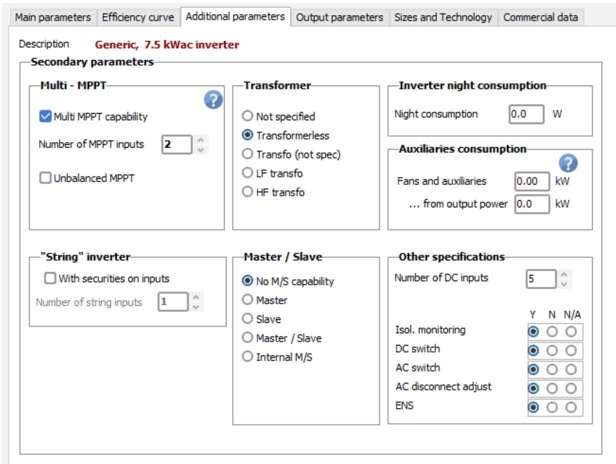


NB: For the PVsyst database, the manufacturers usually specify their efficiency profiles as curves, often for 3 voltages. However, these values are not present on the datasheets.

The ***"Additional parameters"*** tab gives miscellaneous information that you have to gather on the Datasheets. Among these information, only the "*multi-MPPT capability"* and "*number of MPPT inputs"* are really used for the system definition and simulation.

The "*Auxiliary consumptions*" are marginally used as default when defining the detailed losses.

You will get a warning if you use a *transformer-less* inverter with amorphous modules.



"Output parameters" tab includes:

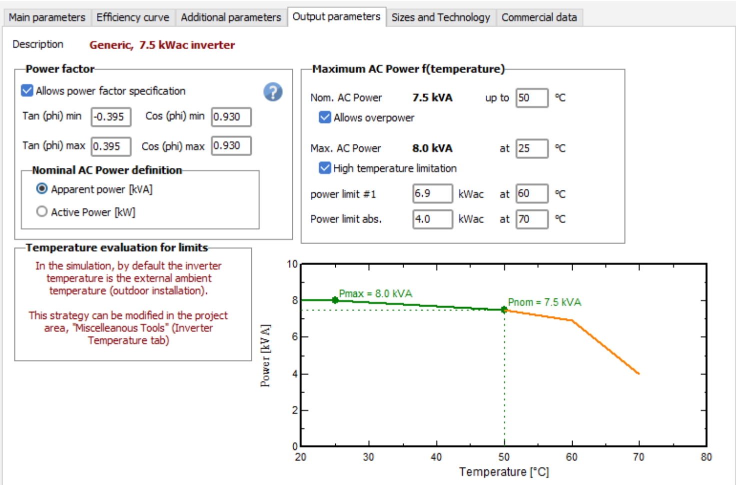
- **Power factor** that specifies the capabilities of this inverter for producing reactive ***energy***. Producing reactive energy (Phase shift) may be a requirement of the grid manager.

It is normally an operating parameter (command) set by the operator of the plant.

- "*Tan(phi) min/max*» or «*Cos(phi) Leading/Lagging*": the limits which may be set for this inverter. But the real value to be used for the simulation will be specified in the "*Miscellaneous parameters*" of the calculation version.

"*Nominal AC power (PNom) defined as ...*": specifies whether the nominal output power Pnom applies to the Active power [kW] or the Apparent power [kVA].

In practice, this is most often applied to the Apparent power, as this corresponds to an output current limitation.



- **Max. AC power f(Temperature)**

- Many inverters specify a "*PNom*" value, and a "*PMax value*", representing a power attainable when the temperature is not too high.
- "*Allows overpower*" specifies if this is implemented for this inverter.
- The involved PMax is specified on the "*Main parameters*" page.
- If not defined or equal to the PNom value, this option is disabled.
- "*High temperature limitations*": defines other limitations as f(Temperature) on PNom.

NB: The temperature involved in these specifications during the simulation is specified in the "Miscellaneous Tools". It may be the ambient temperature (outdoor installation), the ambient plus a constant, or a fixed (room) temperature.

"*Sizes and Technology*" tab:

- "*Technology specificities*" allows to specify some features in 5 lines of free text maximum.
- "*Operating conditions – Behavior at limits*": Never modified, don't mind.

"*Commercial*" tab: Identical to the corresponding page for PV modules.