



# INSTALLATION RULES TO MAXIMIZE BIFACIAL SOLAR MODULES PERFORMANCES

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<b>1. MODULES</b>	<b>5</b>
1.1 MBF-GG60 BiSoN series – with frame	5
1.2 MBA-GG60 BiSoN series – frameless	5
<b>2. INTRODUCTION</b>	<b>6</b>
2.1 Disclaimer of liability	6
2.2 Module specification	6
2.3 Product identification	6
<b>3. HOW IT WORKS A BIFACIAL MODULE</b>	<b>7</b>
3.1 Front side module	7
3.2 Back side module	7
<b>4. MAIN ITEMS AFFECTING TO BIFACIAL PERFORMANCE</b>	<b>8</b>
<b>5. GROUND INSTALLATION HIGHLY RECOMMENDED RULES</b>	<b>8</b>
5.1 SITE OF INSTALLATION and surface reflection	8
5.2 Tilt, Azimuth, rows pitch	9
5.3 Fixing structure	9
5.4 Inverter, cables sizing, string connection	11
<b>6. ROOFTOP HIGHLY RECOMMENDED RULES</b>	<b>13</b>
6.1 SITE OF INSTALLATION and surface reflection	13
6.2 Tilt, Azimuth, rows pitch	13
6.3 Fixing structure	13
6.4 Inverter, cables sizing, string connection	15
<b>7. INSTRUCTIONS LIABILITY</b>	<b>16</b>



## 1. MODULES

### 1.1 MBF-GG60 BiSoN series – with frame



\* 270-280Wp only front at STC  
\*\* 338-350Wpe (Watt peak equivalent) with Bifacial gain

### 1.2 MBA-GG60 BiSoN series – frameless



\* 270-280Wp only front at STC  
\*\* 338-350Wpe (Watt peak equivalent) with Bifacial gain

## 2. INTRODUCTION

This manual contains recommendation to maximize performance of bifacial modules produced by MegaCell s.r.l. (Megacell) and it's an addendum to the MegaCell Installation Manual.

**IMPORTANT:** Before installing modules, read carefully the Installation Manual *MCELL PV Modules Installation Manual EN v1.2 xxx* containing all mandatory safety rules and electrical/mechanical specifications.

**These modules produce power from both the front and back side with significant more power than their STC rating.**

We strive to be the leader in innovation and research, while continuing to improve our products. For this reason we reserve the right to make changes to this installation guide without prior notice.

### 2.1 Disclaimer of liability

Since the methods of system design, installation techniques, handling and use of this product are beyond company control, MegaEngineering does not assume responsibility and expressly disclaims liability, for loss, damage or expense resulting from improper installation, handling or use.

The information in this manual is based on MegaEngineering's knowledge and experience and it is believed to be reliable. Nevertheless, such information including product specification (without limitations) and suggestions do not constitute a warranty, expressed or implied. MegaEngineering reserves the right to change the manual, the PV module, the specifications, or product information sheets without prior notice.

### 2.2 Module specification

Please refer to the appropriate MegaCell MBF or MBA datasheet for electrical performance data and mechanical installation information.

### 2.3 Product identification

Each module can be identified by means of the following embedded information:

#### **Nameplate:**

it is located on the reverse side of the module or on the frame. It gives information about the main parameters of the module referred to STC condition : Product Type, Maximum Power, Current at Maximum

Power, Voltage at Maximum power, Open Circuit Voltage, Short Circuit Current, all as measured under Standard Test Conditions, weight, dimensions, Maximum System Voltage, etc.

**Warning :** bifacial modules increase energy and power production respect to STC nominal data through Albedo on rear surface. Refer to the specific area on data sheet for real parameters expected after installation to calculate correctly inverter, cables and connection size.

**Serial number:**

Each individual module is identified by a unique serial number accompanied with a barcode. They are permanently inserted inside the laminate, under the front glass of the module, visible when viewed from the front of the module.

### 3. HOW IT WORKS A BIFACIAL MODULE

#### 3.1 Front side module

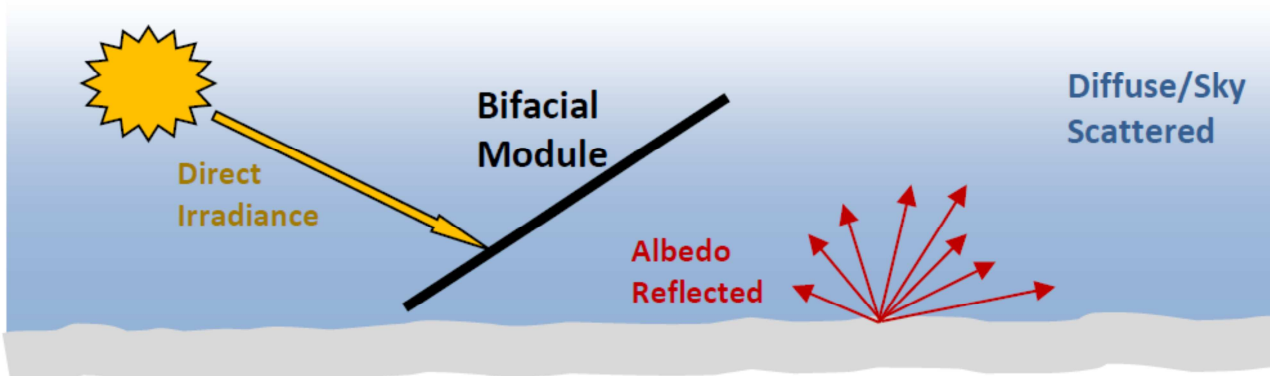
Front side work as a standard monofacial module, converting sunlight energy to voltage and current. All parameters are reported at STC

#### 3.2 Back side module

The active back side module receives light reflected form ground surface and diffused from surrounding, increasing current at the cell level.

This is “similar” to consider a monofacial standard module receiving and increased amount of light as the sum of front + back contribute.

⇒ Bifacial added effect depends on light [W/sm] received from module backside and all rules for the optimum installation are focused to maximize this contribution.



## 4. MAIN ITEMS AFFECTING TO BIFACIAL PERFORMANCE

Following all topics developed referred to **GROUND INSTALLATION** and **ROOFTOP INSTALLATION** :

- a. Site of installation and how to maximize ground surface reflection
- b. Azimuth, Tilt and rows pitch
- c. Fixing structure
- d. Inverter, cables sizing, string connection


## 5. GROUND INSTALLATION HIGHLY RECOMMENDED RULES

### 5.1 SITE OF INSTALLATION AND SURFACE REFLECTION

	<p><b>AVOID SURROUNDING SHADOW</b></p>
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Even a low degree of shading will have a negative effect on the system yield. Therefore, the system must be installed in a location without shading. The module should never be shaded completely during the whole year.

**Note : this is mandatory for ALL crystalline modules, either standard or bifacial.**

	<p><b>MAXIMIZE GROUND SURFACE ALBEDO</b></p> <p>Use <b>WHITE GRAVEL OR SHELLS</b> to increase yearly performance by <b>20-25%</b> ( depending on latitude and weather)</p> <p><b>Sand ground surface</b> is enough reflective to increase performance by <b>18-22%</b> in average</p>
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Following some examples of ground reflectivity and expected power gain on a single MegaCell's bifacial module installation.

Surface reflectivity	Reflectance %	Equivalent power up to
Snow	75%	+40%
White gravel	60%	+30%
Sand	55%	+25%
Green grass	26%	+ 12%
Surfaces of asphalt and gravel	13%	+7%
Dark roads	4%	+2%



## 5.2 TILT, AZIMUTH, ROWS PITCH



**Tilt, Azimuth, rows pitch** => optimized with reference to a **STANDARD monofacial crystalline module**.

Use market available sun simulators to define parameters to maximize energy yield

## 5.3 FIXING STRUCTURE

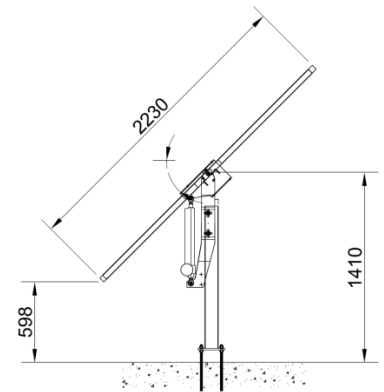


**Avoid shading the back side** of the module by the support rack



**Landscape installation** is the best solution for all crystalline modules reducing effect of mutual rows shading in the morning and evening and also maximizing back side light uniformity on bifacial modules.

### ○ SINGLE AXIS HORIZONTAL TRACKER :

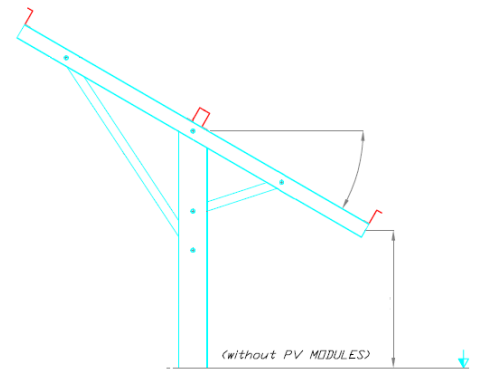
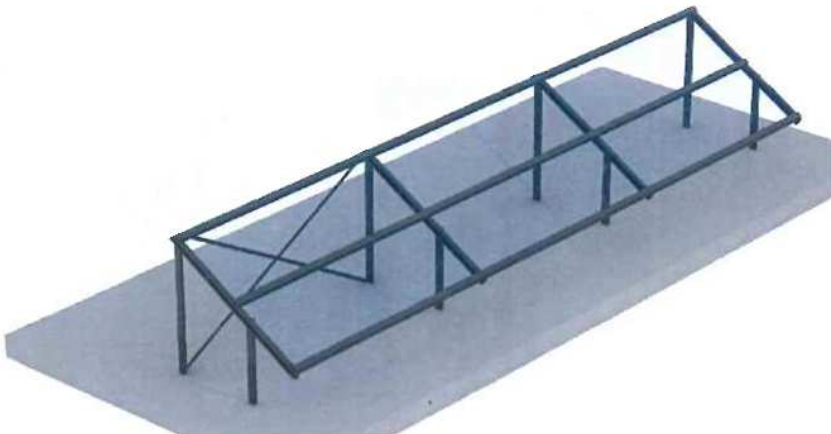


- This is the best solution to **maximize energy production by 35-45%** ( with daily maximum over 60%) respect to a standard tilted solution increasing both contributes on front side and also on back side.
- This is also the best solution for grid PV energy availability increasing hours of maximum power.

○ **FIX GROUND MOUNTED INSTALLATION :**



Highly recommended **2 rows landscape structure**



Elevate the modules above the mounting surface. It's recommended a **minimum height of 70 cm, better 100cm**



If possible, leaves **20 cm free space between rows** to have direct light passing through. The benefit is **~ +3%**




## 5.4 INVERTER, CABLES SIZING, STRING CONNECTION

**CAUTION:**

System design should consider the potential increased power output (Pmax) and current (Isc) due to the modules bifacial abilities. Additional power and currents beyond the STC rating are possible. See the Electrical Specifications on the data sheet for electrical parameters in presence of albedo. All protections, wiring, equipment ratings, and inverters should be sized accordingly o the product ratings, maximum expected output and required protection factors.

○ **INVERTER SIZING, CABLES CROSS SECTIONS, ELECTRICAL PROTECTION**

- must be calculated using Electrical Specification of the data sheet evaluated at the expected performance gain of the installation and not referring to the nominal STC values.
- It's suggested at least +20% bifaciality gain

	<b>Module data to be used for sizing</b> : marked with red box
	<b>Sun simulator</b> : could be used the module model with the same data of red box


Following an example referred to the 280Wp module.

Electrical Specifications MBF-GG60-280				Irradiance % on back side (depending on ground reflection)			
				Only front (STC <sup>1</sup> )	15%	20%	25%
<b>Equivalent peak power (Bifacial gain)</b>	Pmpp	Wpe	<b>280</b>	<b>315,7</b> (+12,75%)	<b>327,6</b> (+17,00%)	<b>339,5</b> (+21,25%)	<b>351,4</b> (+25,50%)
Short Circuit Current	Isc	A	9,21	10,38	10,78	11,17	11,56
Open Circuit Voltage	Voc	V	39,12	39,16	39,2	39,24	39,30
Current at Pmpp	Impp	A	8,72	9,8	10,18	10,52	10,88
Voltage at Pmpp	Vmpp	V	32,13	32,2	32,21	32,26	32,27
Efficiency (Nominal P)	η	%	16,9	19,0	19,7	20,4	21,2

<sup>1</sup> Measurement conditions: STC 1000 W/m<sup>2</sup> - AM 1.5 - Temperature 25 °C • Measurement uncertainty ≤ 3%  
 • Sun simulator calibration with modules calibrated by Fraunhofer Institute. Electrical characteristics may change by ±5% and power by -0/+5W.

○ **STRING CONNECTION**

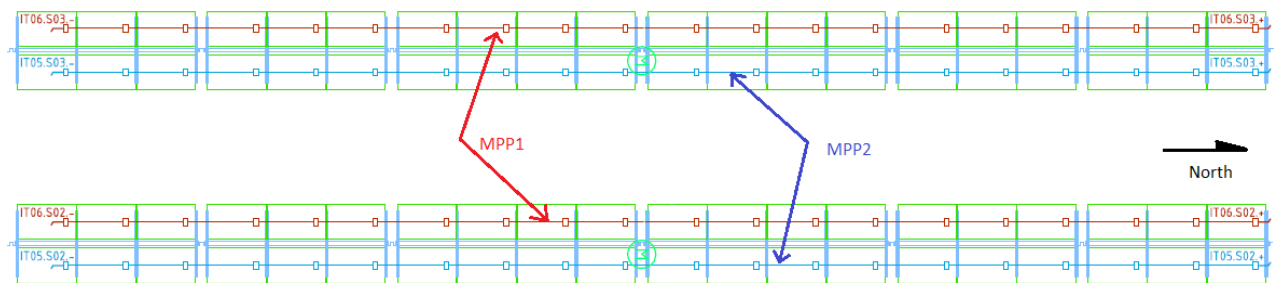
Maximum performance is obtained using different MPPT according to light uniformity on modules.

	<p><b>Electrical series connection</b> : to be done connecting modules per horizontal rows as demonstrated on following examples</p>
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▪ **SINGLE AXIS HORIZONTAL TRACKER :**

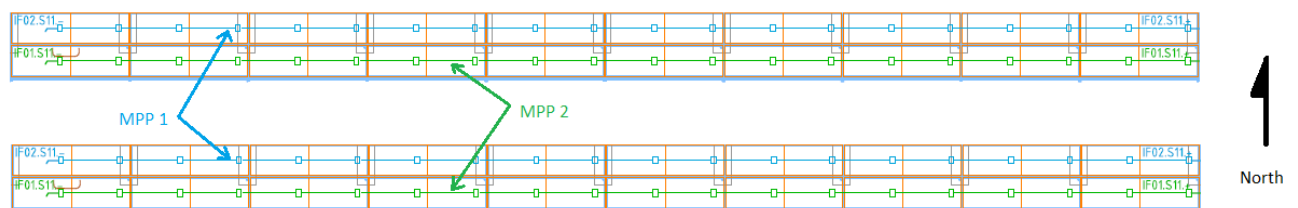
MPP1 : all strings composed by west modules connected in series

MPP2 : all strings composed by east modules connected in series



▪ **FIX GROUND INSTALLATION :**

MPPi : all strings composed by row i modules connected in series



## 6. ROOFTOP HIGHLY RECOMMENDED RULES

### 6.1 SITE OF INSTALLATION AND SURFACE REFLECTION



#### AVOID SURROUNDING SHADOW

Even a low degree of shading will have a negative effect on the system yield. Therefore, the system must be installed in a location without shading. The module should never be shaded completely during the whole year.

**Note : this is mandatory for ALL crystalline modules, either standard or bifacial.**



#### MAXIMIZE GROUND SURFACE ALBEDO

**Rooftop surface white painting** increases reflectivity by over 60% and bifacial performance **up to +30%**

It could be used also a “**coolroof**” solution developed to reduce thermal transmittance on building and with added benefit of a reflectance > 90%

### 6.2 TILT, AZIMUTH, ROWS PITCH



**Tilt, Azimuth, rows pitch** => optimized with reference to a **STANDARD monofacial crystalline module.**

Use market available sun simulators to define parameters to maximize energy yield

### 6.3 FIXING STRUCTURE



**Avoid shading the back side** of the module by the support rack



**Landscape installation** is the best solution for all crystalline modules reducing effect of mutual rows shading in the morning and evening and also maximizing back side light uniformity on bifacial modules.

○ **TILTED AND COPLANAR ROOFTOP INSTALLATION :**

- The coplanar tilted installation is not maximizing bifacial performance because not providing enough light to the back surface.
- Bifacial module performance will be similar to a standard high efficiency module



**Coplanar installation :** highly suggested to use **glass-backsheet** module solution that increases overall energy production by 4-5% thanks to the internal reflection on the white backsheet.

○ **FLAT ROOFTOP INSTALLATION :**



Highly recommended **SINGLE** row landscape structure



Elevate the modules above the mounting surface. It's recommended a **minimum height of 40 cm**



**If possible, increase pitch** between rows to avoid mutual shadow and increasing surface reflection on modules backside


## 6.4 INVERTER, CABLES SIZING, STRING CONNECTION

### CAUTION:

System design should consider the potential increased power output (Pmax) and current (Isc) due to the modules bifacial abilities. Additional power and currents beyond the STC rating are possible. See the Electrical Specifications on the data sheet for electrical parameters in presence of albedo. All protections, wiring, equipment ratings, and inverters should be sized accordingly o the product ratings, maximum expected output and required protection factors.

### ○ INVERTER SIZING, CABLES CROSS SECTIONS, ELECTRICAL PROTECTION

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- It's suggested at least +20% bifaciality gain

	<b>Module data to be used for sizing</b> : marked with red box
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• Sun simulator calibration with modules calibrated by Fraunhofer Institute. Electrical characteristics may change by ±5% and power by -0/+5W.

### ○ STRING CONNECTION

Maximum performance is obtained using different MPPT according to light uniformity on modules.

	<b>Electrical series connection</b> : With single line installation, no rules because in any case electrical connection follows physic rows
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## 7. INSTRUCTIONS LIABILITY

If any of the instructions given in the user information are not adhered to, MegaEngineering will not guarantee the availability and functionality of the modules. Since the compliance with the said safety instructions as well as the conditions and methods for installation, operation, usage and maintenance of the modules cannot be checked or monitored by MegaCell - Megaengineering, MegaCell - MegaEngineering do not accept any liability for damage due to improper use, incorrect installation, operation, usage or maintenance. The text and the figures of this installation guide comply with the state of technology at the time of printing.

Subject to alterations.



Please retain a copy of this manual.

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