

SOLON *Standard Modules.*

Installation Manual.

These installation instructions apply to the following modules:

SOLON Blue 230/07

SOLON Black 230/07

SOLON Black 230/02

SOLON Blue 270/11

SOLON Black 280/11

SOLON Blue 220/16

SOLON Black 220/16

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Before you Start.

Please carefully read through this installation manual before you begin installation, operation or maintenance work. Failure to follow these installation instructions may result in damage and injury. Please keep this manual safe for future reference.

Symbols used.



Danger! Risk of electrocution



Caution! Risk of damaging the product or harming the environment



Please note

Exclusion of Liability.

No warranty is given or liability assumed for damage arising from incorrect installation.

Safety Information.

This installation manual is intended exclusively for qualified tradespeople. Applicable health and safety regulations and procedures must be followed (in Germany, cf. BGV A1, BGV A2, BGV C22). We will not accept any liability for DIY installation and we strongly recommend that you hire a reputable firm.

General Hazard Warnings.

- › Risk of death or injury from electric shock or arcing.
- › Pay attention to the following specific features of photovoltaic systems:
 - Modules are always live in daylight.
 - The modules can only be isolated at the DC switch, which means the DC side of the system will still be live if a fault occurs (short circuit, earth fault).
 - Electrical arcing that cannot be extinguished may be produced when contacts in use are disconnected.
- › Do not insert any (electrically conductive) parts into module connectors or sockets.
- › Do not install solar modules and wiring if plug connectors are wet. Make sure that tools are dry and that work is carried out in dry conditions.
- › Follow the inverter manufacturer's installation instructions.
- › Do not use damaged modules.
- › Keep children away from modules, inverters and other live system components.
- › Exercise extreme caution when carrying out wiring work.
- › Observe the safety instructions issued by manufacturers of all other system components.

General Warnings.

- › Do not remove any part or type plate attached by the manufacturer. Do not dismantle modules.
- › Do not expose modules to artificially concentrated sunlight.
- › Do not use paint, adhesives or sharp implements on the modules.
- › Do not clean modules with solvent-based cleaning agents.
- › Before installing the system, check the structural strength of the building and the system itself.
- › The module is only intended for use in temperate climates (see also the installation conditions section).

Warnings Relating to Storage, Unpacking and Transportation.

- › Exercise the utmost care at all times when handling modules.
- › Always transport modules in their correct packaging.
- › Always carry the modules with both hands.
- › Wear protective gloves.
- › Do not hold modules by their connection boxes or leads.
- › Avoid bending or flexing the modules.
- › Do not place heavy items on modules. Do not stand on modules. Do not let modules fall over.
- › Do not use sharp implements on the modules.
- › Keep all electrical contacts clean and dry.
- › Store modules in a dry place prior to fitting.



Please note

We recommend you make a note of the module serial numbers for any future enquiries.

Applicable Regulations.

Please make sure both before and during installation that the locally applicable standards, building regulations and health and safety rules are followed.

In addition to any local regulations, the following standards and regulations in particular should be observed.

DIN VDE 0100	High-voltage installations with nominal voltages up to 1,000 volts, all relevant sections, especially T712
VDE 0105 T100	VDE 0105 T100
VDI 6012 Bl. 2	Decentralised energy systems in buildings
VDE 0298 T4	Rubber insulated wiring
DIN 18382	Electrical wiring in buildings
DIN 18334	Carpentry and timber structures
DIN 18338	Roof covering and roof sealing
DIN 18339	Plumbing
DIN 18351	Facades
DIN 18451	Scaffolding
DIN 1055	Load assumptions for supporting structures
VDE 0185	Lightning protection
DIN EN 61724	Photovoltaic system performance monitoring
DIN V VDE V 01261-1	Automatic circuit breaker for PV systems

- German roofing trade regulations
- Technical connection requirements (TAB) for connecting to the energy utilities' low-voltage grid
- VDEW regulations for domestic power generation systems in the low-voltage grid

Accident prevention regulations issued by the Berufsgenossenschaften (employer's liability insurance associations)

BGV A1	General regulations
BGV A2/A3	Electrical systems and equipment
BGV C22	Construction work (personal protective equipment against falls from a height)
BGV D36	Ladders and steps



Please note

The listed standards and regulations are merely a representative selection. The list does not claim to be complete. (Last revised in March 2009.)

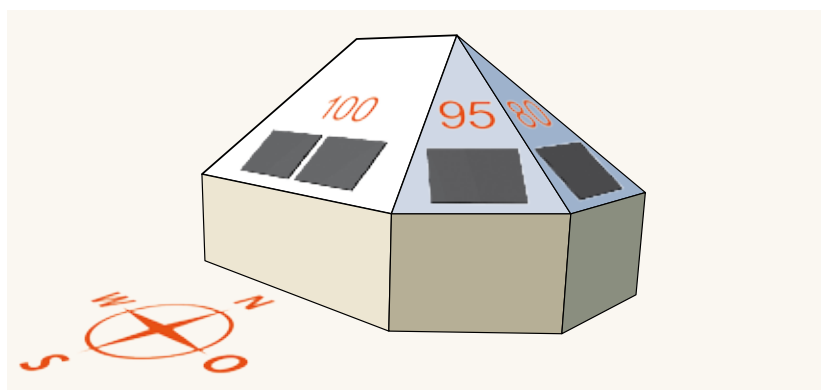
Installation Advice.

The following points must be considered when installing the modules:

- Do not install modules in the vicinity of highly flammable gases and vapours (e.g. gas containers, petrol stations, spray-painting systems).
- Do not install modules near naked flames and flammable materials.
- Do not expose modules to concentrated light.
- Do not expose modules to high concentrations of salt (recommended distance from the sea is at least 500 m) or sulphur (volcanoes) conditions, as this creates a risk of corrosion.
- Do not install modules as overhead glazing or as facade elements.

Orientation and Tilt.

In Europe, the modules should ideally face south. In central Europe the optimal tilt angle for the modules is around 30°. The tilt angle is somewhat steeper in northern Europe and somewhat flatter in southern Europe. Deviating from the optimal orientation and tilt will reduce the system's energy yield. The graphic below serves as a guide.



Percentage energy yield depending on roof orientation

Absence of Shading.

A module is considered to be shadow-free if no shadow is cast across its entire surface all year round – i.e. nothing blocks the sunlight shining on it. Even small areas of partial shading – caused for example by chimneys, roof aerials, buildings, trees (what happens when they grow?) and lamp posts – will result in a reduced yield. Modules should therefore be installed where shading is at a minimum throughout the day, or preferably where there is no shading at all. If necessary, a shading analysis can be performed using a simulation tool or solar altitude analyzer.

! Please note

Temporary shading caused by dirt (dust, bird droppings, leaves, etc.) can also diminish yields. For notes on how to remove this soiling, see the “maintenance and cleaning” section.

Installation Instructions for SOLON Standard Modules.



Please note

SOLON modules should only be fitted by specialist firms that have the necessary skills. Please observe the standards and regulations that are relevant for PV systems, such as VDE regulations, DIN standards, VDEW regulations, the technical connection requirements (TAB) of the relevant grid operators and the health and safety regulations issued by the employer's liability insurance associations (in Germany). Failure to comply may cause serious damage and injury.



Dimensioning

The basis for the dimensioning, size and structural design of solar energy systems using SOLON modules on roof structures and stands is provided by the currently applicable standards and regulations such as DIN 1055 part 4 wind load (issued in March 2005) and DIN 1055 part 5 snow load (issued in July 2005). Since January 2007 the new series of standards has set out new rules for the actions and load assumptions in Germany which contain significantly more precise values for the measurement of wind and snow loads.



Snow loads and wind loads

The value for the ground snow load s_k in kN/m^2 in Germany depends on the respective snow load zone, the building's location and the terrain height above sea level.

The wind load can be found for the project location by consulting the wind zone map, which takes site conditions into account along with four wind zones. A simplified method can be used to calculate the wind load for buildings up to 25 m tall. Depending on the building height, the wind load is expressed as a wind speed pressure q in kN/m^2 .

To keep the specifications practical, the maximum ground snow load s_{kzul} is read from tables and compared with the assumed ground snow load s_k . The conditions for approval to install the modules are met if the maximum snow load from the table is greater than the snow load value at the installation site, i.e. if $s_{kzul} \geq s_k$. Favourable installation conditions enable modules to be used with greater wind and snow load values per DIN 1055. To avoid increased loads on modules in edge zones and corner regions, it is necessary to maintain minimum distances from the edges of the building, or provide separate certification.

Calculation results were also based on DIN 1055-100 Actions on structures (March 2001) and DIN 4113 Aluminium structures (September 2002). Actions resulting from the modules' own weight, wind and snow were not considered in isolation but were combined according to their likelihood of occurrence.

Summary of Installation Instructions for SOLON Standard Modules.

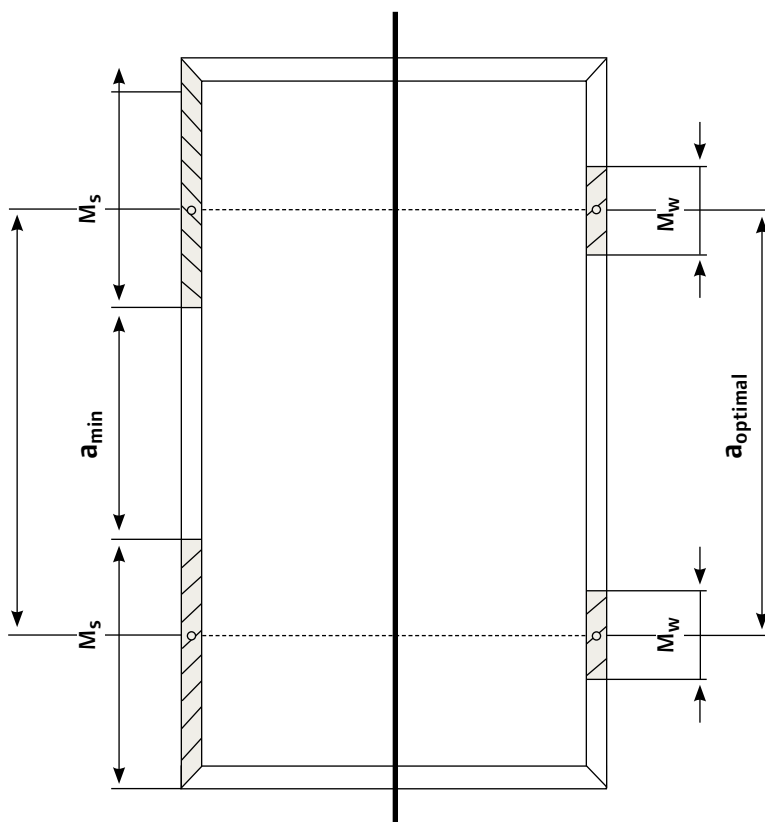
Flat Roof – Elevated.

Module type	Vertical arrangement of modules		Horizontal arrangement
	Maximum support and fastening area	Optimal support and fastening area	Optimal support and fastening area
SOLON Blue 220/16 SOLON Black 220/16		✓	
SOLON Black 230/02	✓	✓	✓
SOLON Blue 230/07 SOLON Black 230/07	✓	✓	✓
SOLON Blue 270/11 SOLON Black 280/11		✓	✓

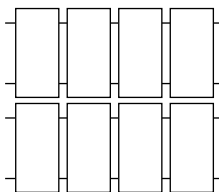
Pitched Roof.

Module type	Vertical arrangement of modules		Horizontal arrangement
	Maximum support and fastening area	Optimal support and fastening area	Optimal support and fastening area
SOLON Blue 220/16 SOLON Black 220/16		✓	✓
SOLON Black 230/02	✓	✓	✓
SOLON Blue 230/07 SOLON Black 230/07	✓	✓	✓
SOLON Blue 270/11 SOLON Black 280/11		✓	✓

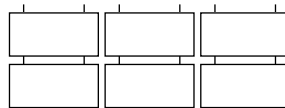
The described installation methods are approved up to the specified resulting load carrying capacity of the surface in kN/m^2 which can be found in the installation instructions for the respective module. This provides the basis for calculating the maximum ground snow load s_{kz} . All results correspond to the currently applicable standards and regulations (e.g. wind load per DIN 1055 part 4 (March 2005) and snow load per DIN 1055 part 5 (July 2005)).



 Required area for attachment and support



Horizontal support profiles



Vertical support profiles

Caution!

The module frame must be fastened torsion-free to the substructure rails (support profiles) at four points in the areas “ M_s ” and “ M_w ”. The module must not be attached via the short side bars under any circumstances.

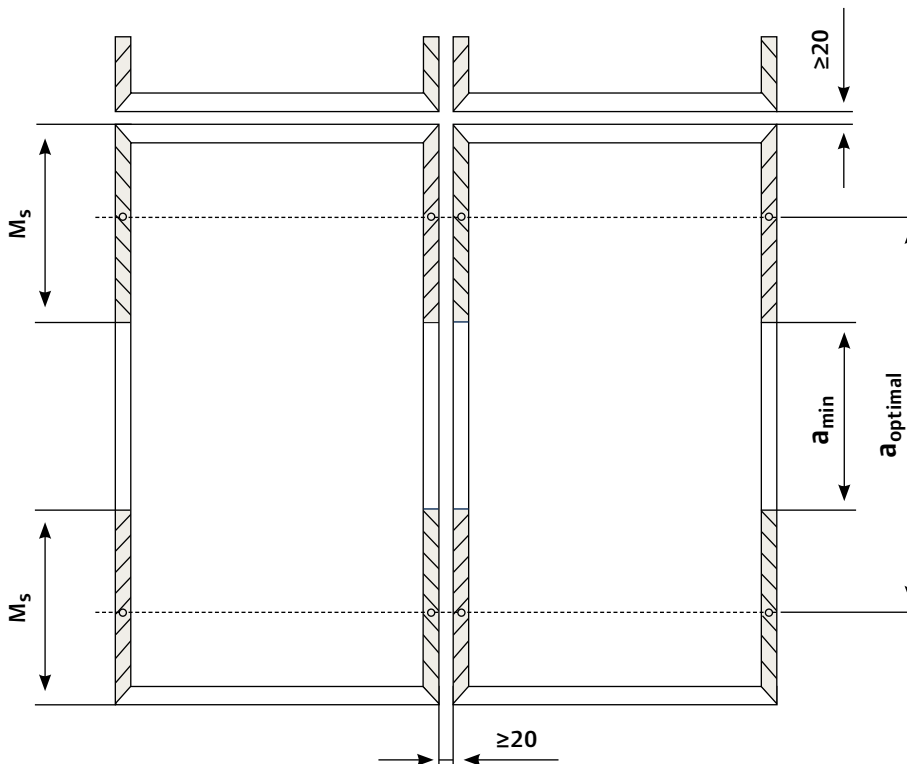
Maximum Resulting Load Carrying Capacity of the Surface.

The installation methods shown here are approved up to the specified maximum resulting load carrying capacity of the surface in kilograms per square meter of module surface area for the module types. This value must not be exceeded. The maximum resulting load carrying capacity of the surface depends on the support and fastening area (maximum or optimal) and on the module arrangement (vertical or horizontal).

Module type	Vertical arrangement of modules		Horizontal arrangement
	Maximum support and fastening area (e.g. insertion system)	Optimal support and fastening area	Optimal support and fastening area
SOLON Blue 230/07	$\leq 125 \text{ kg/m}^2$	$\leq 155 \text{ kg/m}^2$	$\leq 125 \text{ kg/m}^2$
SOLON Black 230/07 (02)	$\leq 125 \text{ kg/m}^2$	$\leq 155 \text{ kg/m}^2$	$\leq 125 \text{ kg/m}^2$
SOLON Blue 270/11	nicht zugelassen	$\leq 135 \text{ kg/m}^2$	$\leq 135 \text{ kg/m}^2$
SOLON Black 280/11	nicht zugelassen	$\leq 135 \text{ kg/m}^2$	$\leq 135 \text{ kg/m}^2$
SOLON Blue 220/16	nicht zugelassen	$\leq 155 \text{ kg/m}^2$	$\leq 125 \text{ kg/m}^2$
SOLON Black 220/16	nicht zugelassen	$\leq 155 \text{ kg/m}^2$	$\leq 125 \text{ kg/m}^2$

Installation on Pitched or Sloping Roofs (roof-parallel).

a) Vertical Arrangement / Installation of Modules via the Maximum Support and Fastening Area "M_s".



Required area for attachment and support

Fig. 1: Horizontal support profiles



Caution!

The module frame must be fastened to the substructure rails (support profiles) in a single plane at four points in the area "M_s".

The module must not be attached via the short side bars under any circumstances.



Slip protection!

To prevent the modules slipping when installed on a sloped surface, cheese head Allen bolts are used in the holes provided for this purpose in the longitudinal bars (spacing a_{optimal}). The bolts are secured using a toothed washer and nut or a self-locking nut.



Please note

Recommendation: bolt DIN 912 M6x10 VA with toothed washer DIN 6797 A6.4 and nut DIN 555 M6 VA.

Mounting Area “M_s” – Vertical Installation.

Standard modules	L [mm]	W [mm]	a _{optimal} [mm]	M _s [mm]
SOLON Blue 230/07	1,640	1,000	980	565
SOLON Black 230/07 (02)	1,640	1,000	980	565
SOLON Blue 270/11	1,980	1,000	1.180	550
SOLON Black 280/11	1,980	1,000	1.180	550
SOLON Blue 220/16	1,640	1,000	980	125
SOLON Black 220/16	1,640	1,000	980	125

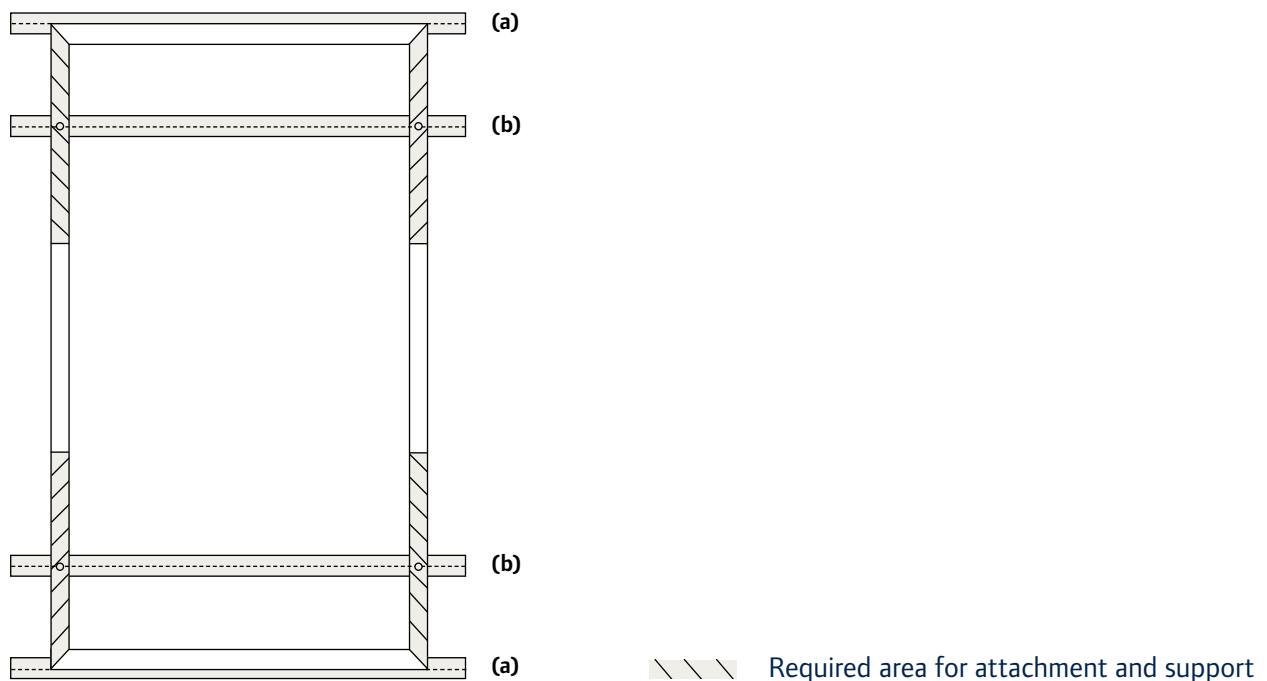


Fig. 2: Horizontal support profiles

⚠ Caution!

The use of an insertion system (see fig. 2), with the module supported at the outer ends of the long bars, places the most extreme load on the module but is approved if the module is secured and supported at four points in the required area for fastening and support.

Horizontal Module Arrangement / Installation in Area “M_w”.

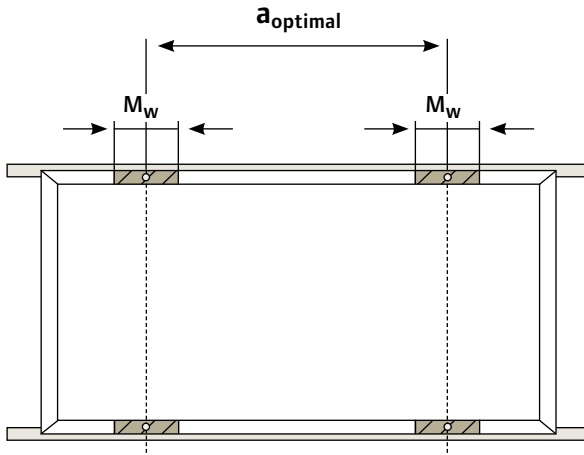


Fig. 3: Horizontal insertion profiles

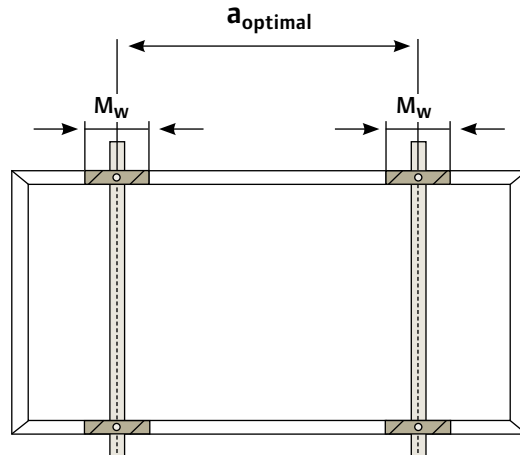


Fig. 4: Vertical support profiles

Caution!

Modules are approved for horizontal installation only for the optimum fastening area “M_w”, regardless of the installation system. The module frame must be fastened to the substructure rails (support profiles) at four points in the area “M_w”.

Table 3: Mounting Area “M_w” – Horizontal Installation.

Standard modules	L [mm]	W [mm]	a _{optimal} [mm]	M _w [mm]
SOLON Blue 230/07	1,640	1,000	980	150
SOLON Black 230/07 (02)	1,640	1,000	980	150
SOLON Blue 270/11	1,980	1,000	1180	150
SOLON Black 280/11	1,980	1,000	1180	150

Alternatively, horizontally arranged modules may also be mounted and secured at the module corners (at the outer end of the long side rails) if the long side rail is also supported in the centre and is held biaxially. All forces must be safely transferred into the mounting system / substructure via the three support and fastening points of the long side rail. Just because the long side rail is supported at three points this does not increase the maximum permitted resulting load carrying capacity of the module's surface. The fundamental suitability of the mounting system used must always be ascertained – no liability is accepted for the SOLON modules if the support system is overloaded or fails.

Installation on Flat Roofs (elevated on supports).

If modules are fitted on flat roofs, we recommend that you choose a substructure that ensures optimum positioning in the region of the anti-slip holes (a_{opt}) without special expenditure.

Depending on the installation type (horizontal or vertical), the module frame must always be fastened to the substructure rails (support profiles) in a single plane at four points (torsion-free) in the respectively approved area " M_w " or " M_s ". In other respects the instructions from "module installation on pitched or sloping roofs" (point 1) apply.

General Notes.

When using commonly available mounting systems, the optimum position of the mounting rails and positioning and securing of the modules in the region close to the holes (spacing a_{optimal}) results in the minimum load on the modules. This always assumes that the commonly available mounting systems that are used, which cannot be covered in these installation instructions, are state of the art. The substructure must be constructed so that a deflection of 1/200 or a maximum of 15 mm is not exceeded. Make sure that the roof structure itself is also suitable!

Direct attachment by the frame (through the anti-slip holes on the long side rail) using high strength stainless steel non-prestressed M6 bolts is allowed provided that washers of at least 14 mm diameter are used and this does not place the modules under stress.



Caution!

When attaching the modules, please remember that the materials will expand due to temperature changes. We therefore recommend a minimum spacing of 20 mm between the modules.

Modules must not sit in pools of water. Rain and melt water must be able to drain away freely. Drainage holes must not be used for fitting.



Caution!

Standing on the modules can cause irreparable damage. Damage of this nature is not covered by the product and performance warranty.



Please note

If circumstances require, e.g. as a personal protection measure when transformerless inverters are used following the inverter manufacturer's specifications, SOLON modules with 4.5 mm holes in all four side rails allow equipotential bonding cables to be attached in order to earth all metallic parts of an electrical installation (every single module frame).

Alternatively the holes for anti-slip protection can also be used for this purpose if they are not required (e.g. in insertion systems).

We reserve the right to make technical modifications. These installation instructions are valid only in conjunction with the data sheets, the General Terms and Conditions and the warranty and performance guarantee of SOLON PV GmbH and SOLON Nord GmbH, in the respectively applicable versions. SOLON accepts no liability for these installation instructions or any consequential damage with the exception of statutory product liability, intent and gross negligence.



Please note

If there are any questions or if anything is unclear, specialist firms carrying out the installation can contact their contract partner directly, or consult an approved structural engineer. SOLON can recommend suitable specialists on request. Please also use the checklist. For details please visit our homepage (www.solon.com).

Maintenance and Cleaning.

In general, SOLON modules are tilted at a sufficient angle to allow rainwater to wash away dust and dirt. An optimum self-cleaning effect is promoted at the recommended tilt angle of 20–60°. Snow will also usually slide off SOLON modules without any intervention. If modules are heavily soiled, they can be cleaned using copious amounts of water and a gentle cleaning implement such as a sponge.

Danger!

When carrying out maintenance and cleaning work, please observe and comply with the safety information and warnings in the “safety information” section. Maintenance and cleaning should only be carried out by a specialist firm.

Caution!

Do not use any cleaning agents or abrasive cleaning implements on SOLON modules.

Please note

Cleaning may slightly improve the yield. This is particularly true for heavy soiling caused by leaves or bird droppings that may result in partial shading. Yield losses caused by snow, however, are negligible as the yield is lowest at this time of year anyway. In addition, the PV system should be serviced by a specialist company at fixed intervals (e.g. every three years).

Caution!

Legal requirements concerning the inspection of PV systems which do not have an MSD (mains monitoring device for the inverter) must be observed.

Snow Loads.

Ground snow load s_k in kN/m^2 per DIN 1055 (part 5) depending on the snow load zone and the terrain height (m) above sea level at the installation site.

Ground Snow Load.

Terrain height (m)
above sea level at
the installation site

Snow load zone s_k (kN/m^2)

	1	1a	2	2a	3
<200	0.65	0.81	0.85	1.06	1.10
300	0.65	0.81	0.89	1.11	1.29
400	0.65	0.81	1.21	1.51	1.78
500	0.84	1.05	1.60	2.00	2.38
600	1.05	1.30	2.06	2.58	3.08
700	1.30	1.59	2.58	3.24	3.86
800	1.59	1.99	3.17	3.97	4.76
900	-	-	3.82	4.79	5.76
1,000	-	-	4.55	5.69	6.86
1,100	-	-	5.34	6.68	8.06
1,200	-	-	6.19	7.74	9.36
1,300	-	-	-	-	10.76
1,400	-	-	-	-	12.26
1,500	-	-	-	-	13.88



Please note

You can find the snow load zone for sites in Germany by visiting:

http://www.dibt.de/de/Data/TB/Schneelastzonen_nach_Verwaltungsgrenzen.xls

Wind Loads.

Wind speed pressure q in kN/m^2 per DIN 1055 (part 4) depending on the wind zone and site conditions, and on building height h (simplified method for buildings up to 25 m; on the North Sea islands this table is only applicable for buildings up to 10 m).

Wind Load as Wind Speed Pressure.

Wind zone and site conditions		Wind speed pressure q in kN/m^2 for building heights h within limits of...		
		up to 10 m	above 10 m up to 18 m	above 18 m up to 25 m
1	Inland	0.50	0.65	0.75
2	Inland	0.65	0.80	0.90
	Baltic coast/islands	0.85	1.00	1.10
3	Inland	0.80	0.95	1.10
	Baltic coast/islands	1.05	1.20	1.30
4	Inland	0.95	1.15	1.30
	North Sea coast Baltic coast/islands	1.25	1.40	1.55
	North Sea islands	1.40	-	-



Please note

You can look up the wind zone at:

www.dibt.de/de/Data/Windzonen_nach_Verwaltungsgrenzen.xls

Stress Tables

Maximum ground snow load s_{kzul} in kN/m^2 per DIN 1055-5 (issued in July 2005) depending on the roof pitch, module tilt, and wind speed pressure q in kN/m^2 .

Vertical installation of modules via the optimal support and fastening area ($a_{opt} \pm M_s$)

[illegible][illegible][illegible][illegible]

Wind speed pressure $q = 0.85 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.90 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.95 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.00 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.05 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.10 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.15 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.20 \text{ kN/m}^2$

[illegible]

[illegible][illegible][illegible][illegible]

*SOLON Blue 230/07,
 SOLON Black 230/07,
 SOLON Black 230/02*

Vertical installation of modules via the maximum support and fastening area (M₂)

Wind speed pressure $q = 0.50 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.65 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.75 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.80 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.85 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.90 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.95 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.00 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.05 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.10 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.15 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.20 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.25 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.30 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.40 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.55 \text{ kN/m}^2$

[illegible]

*SOLON Blue 230/07,
 SOLON Black 230/07,
 SOLON Black 230/02*

Horizontal installation of modules via the optimal support and fastening area ($a_{opt} \pm M_w$)

Wind speed pressure $q = 0.50 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.65 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.75 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.80 \text{ kN/m}^2$

[illegible]

[illegible][illegible][illegible][illegible]

Wind speed pressure $q = 1.05 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.10 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.15 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.20 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.25 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.30 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.40 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.55 \text{ kN/m}^2$

[illegible]

*SOLON Blue 230/07,
 SOLON Black 230/07,
 SOLON Blue 230/02*

Vertical installation of modules via the optimal support and fastening area ($a_{opt} \pm M_s$)

Wind speed pressure $q = 0.50 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.65 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.75 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.80 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.85 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.90 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.95 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.00 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.05 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.10 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.15 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.20 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.25 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.30 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.40 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.55 \text{ kN/m}^2$

[illegible]

*SOLON Blue 230/07,
 SOLON Black 230/07,
 SOLON Blue 230/02*

Vertical installation of modules via the maximum support and fastening area (M₂)

Wind speed pressure $q = 0.50 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.65 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.75 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.80 \text{ kN/m}^2$

[illegible]

[illegible][illegible][illegible][illegible]

Wind speed pressure $q = 1.05 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.10 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.15 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.20 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.25 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.30 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.40 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.55 \text{ kN/m}^2$

[illegible]

Horizontal installation of modules via the optimal support and fastening area ($a_{opt} \pm M_w$).

[illegible][illegible][illegible][illegible]

Wind speed pressure $q = 0.85 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.90 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.95 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.00 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.05 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.10 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.15 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.20 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.25 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.30 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.40 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.55 \text{ kN/m}^2$

[illegible]

Vertical installation of modules via the optimal support and fastening area ($a_{opt} \pm M_s$).

[illegible][illegible][illegible][illegible]

[illegible][illegible][illegible][illegible]

Wind speed pressure $q = 1.05 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.10 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.15 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.20 \text{ kN/m}^2$

[illegible]

[illegible][illegible][illegible][illegible]

Vertical installation of modules via the optimal support and fastening area ($a_{opt} \pm M_x$)

[illegible][illegible][illegible][illegible]

[illegible][illegible][illegible][illegible]

Wind speed pressure $q = 1.05 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.10 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.15 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.20 \text{ kN/m}^2$

[illegible]

[illegible][illegible][illegible][illegible]

Horizontal installation of modules via the optimal support and fastening area ($a_{opt} \pm M_s$)



Wind speed pressure $q = 0.50 \text{ kN/m}^2$

Wind speed pressure $q = 0.65 \text{ kN/m}^2$

Wind speed pressure $q = 0.75 \text{ kN/m}^2$

Wind speed pressure $q = 0.80 \text{ kN/m}^2$

[illegible]

[illegible][illegible][illegible][illegible]

Wind speed pressure $q = 1.05 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.10 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.15 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.20 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.25 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.30 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.40 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.55 \text{ kN/m}^2$

[illegible]

Horizontal installation of modules via the optimum fastening point (mounting hole)



Installation via the optimum mounting area is not possible.

[illegible][illegible][illegible][illegible]

Wind speed pressure $q = 0.85 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.90 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.95 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.00 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.05 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.10 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.15 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.20 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.25 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.30 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.40 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.55 \text{ kN/m}^2$

[illegible]

Vertical installation of modules via the optimal support and fastening area ($a_{opt} \pm M_s$)

[illegible][illegible][illegible][illegible]

[illegible][illegible][illegible][illegible]

Wind speed pressure $q = 1.05 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.10 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.15 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.20 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.25 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.30 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.40 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.55 \text{ kN/m}^2$

[illegible]

*SOLON Blue 220/16,
 SOLON Black 220/16*

Vertical installation of modules via the optimal support and fastening area ($a_{opt} \pm M_s$)

Wind speed pressure $q = 0.50 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.65 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.75 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 0.80 \text{ kN/m}^2$

[illegible]

[illegible][illegible][illegible][illegible]

Wind speed pressure $q = 1.05 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.10 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.15 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.20 \text{ kN/m}^2$

[illegible]

[illegible][illegible][illegible][illegible]

Horizontal installation of modules via the optimal support and fastening area ($a_{opt} \pm Mw$)

[illegible][illegible][illegible][illegible]

[illegible][illegible][illegible][illegible]

Wind speed pressure $q = 1.05 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.10 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.15 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.20 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.25 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.30 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.40 \text{ kN/m}^2$

[illegible]

Wind speed pressure $q = 1.55 \text{ kN/m}^2$

[illegible]

Example application 1.

Installation site	Regensburg / Germany. Height above sea level: 345 m
Building specifications	Pitched roof, roof pitch $\alpha = 20^\circ$, building height 22 m
System data	On-roof mounting system, module tilt $\alpha = 20^\circ = \alpha$ Vertical installation of modules via the maximum support and fastening area
Modules	SOLON Blue 230/07, SOLON Black 230/07

Checking the planned installation method.

1. Calculation of the applicable load data

- › Snow load per DIN 1055 part 5
- › Snow load zone 1a, from annex 1 in installation instructions

Terrain height (m)

above sea level at the
installation site

Snow load zone s_k (kN/m²)

	1	1a	2	2a	3
<200	0.65	0.81	0.85	1.06	1.10
300	0.65	0.81	0.89	1.11	1.29
400	0.65	0.81	1.21	1.51	1.78

Partial result: ground snow load $s_k = 0.81$ kN/m² (terrain height above sea level = 345 m, so use the value for 400 m from the table)

Calculation of the wind load data per DIN 1055 part 4

- › Snow load zone 1 and building is between 18 and 25 m, see annex 2 in the installation instructions

Wind zone and site
conditions

Wind speed pressure q in kN/m² for
building heights h within limits of...

		up to 10 m	above 10 m up to 18 m	above 18 m up to 25 m
1	Inland	0.50	0.65	0.75
2	Inland	0.65	0.80	0.90
	Baltic coast/islands	0.85	1.00	1.10

Partial result: wind speed pressure $q = 0.75$ kN/m²

2. Calculation of the maximum ground snow load s_{kzul} in kN/m² from annex 3, sheet 1.1 in the installation instructions

Wind speed pressure $q = 0.75$ kN/m²

$\alpha = \beta$	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°
10°	1.41	1.42	1.43	1.44	1.45	1.47	1.47	1.48	1.49	1.50
20°	1.51	1.53	1.54	1.55	1.57	1.59	1.61	1.63	1.65	1.67
30°	1.70	1.79	1.88	1.99	2.10	2.23	2.37	2.53	2.70	2.90
40°	3.12	3.36	3.65	3.97	4.34	4.77	5.29	5.90	6.64	7.53

Partial result: $s_{kzul} = 1.51$ kN/m²

3. Checking the conditions $s_{kzul} \geq s_k$

Result: $s_{kzul} = 1.51$ kN/m² > $s_k = 0.81$ kN/m² (The modules can be installed as planned.)

Example application 2.

Installation site	Regensburg / Germany. Height above sea level: 13 m
Building specifications	Pitched roof. roof pitch $\alpha = 20^\circ$. building height 19 m
System data	On-roof mounting system. module tilt $\alpha = 20^\circ = \alpha$ Vertical installation of modules via the maximum support and fastening area (Insertion system)
Modules	SOLON Blue 230/07. SOLON Black 230/07

Checking the planned installation method.

1. Calculation of the applicable load data

- Snow load per DIN 1055 part 5
- Snow load zone 3 from annex 2 in installation instructions

Terrain height (m) above sea level at the installation site	Snow load zone s_k (kN/m ²)				
	1	1a	2	2a	3
<200	0.65	0.81	0.85	1.06	1.10
Partial result: ground snow load $s_k = 1.10$ kN/m ²					

Calculation of the wind load data per DIN 1055 part 4

- Wind zone 3 and building 19 m. see annex 2 in the installation instructions

2. Calculation of the maximum ground snow load s_{kzul} in kN/m² from annex 3. sheet 1.1 in the installation instructions

Wind speed pressure $q = 1.30$ kN/m²

β	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°
10°	1.28	1.29	1.30	1.31	1.33	1.34	1.34	1.34	1.34	1.34
20°	1.35	1.35	1.36	1.36	1.37	1.38	1.38	1.39	1.41	1.42
30°	1.43	1.49	1.56	1.64	1.73	1.82	1.92	2.03	2.16	2.30
40°	2.46	2.63	2.84	3.07	3.32	3.63	4.01	4.46	5.00	5.65
Partial result: $s_{kzul} = 1.35$ kN/m ²										

3. Checking the conditions $s_{kzul} \geq s_k$

Result: $s_{kzul} = 1.35$ kN/m² > $s_k = 1.10$ kN/m (The modules can be installed as planned.)

Example Application 3.

Installation site	Garmisch Partenkirchen / Germany, Height above sea level: 710 m
Building specifications	Pitched roof, roof pitch $\alpha = 44^\circ$, building height 15 m
System data	On-roof mounting system, module tilt $\alpha = 44^\circ = \alpha$ Vertical installation of modules via the maximum support and fastening area (Insertion system)
Modules	SOLON Blue 230/07, SOLON Black 230/07

Checking the planned installation method.

1. Calculation of the applicable load data

- › Snow load per DIN 1055 part 5
- › Snow load zone 1a, from annex 1 in installation instructions

Terrain height (m)

above sea level at the
installation site

Snow load zone s_k (kN/m²)

	1	1a	2	2a	3
...	0.65	0.81	0.85	1.06	1.10
700	1.30	1.59	2.58	3.24	3.86
800	1.59	1.99	3.17	3.97	4.76

Partial result: ground snow load $s_k = 4.76$ kN/m²

Calculation of the wind load data per DIN 1055 part 4

- › Wind zone 1 and building is above 10 m and up to 18 m, see annex 2 in the installation instructions

Wind zone and site
conditions

Wind speed pressure q in kN/m² for
building heights h within limits of...

		up to 10 m	above 10 m up to 18 m	above 18 m up to 25 m
1	Inland	0.50	0.65	0.75

Partial result: wind speed pressure $q = 0.65$ kN/m²

2. Calculation of the maximum ground snow load s_{kzul} in kN/m² from annex 3, sheet 1.1 in the installation instructions

Wind speed pressure $q = 0.65$ kN/m²

$\alpha = \beta$	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°
10°	1.42	1.43	1.44	1.46	1.47	1.48	1.49	1.50	1.51	1.52
20°	1.54	1.55	1.57	1.58	1.60	1.62	1.64	1.66	1.69	1.71
30°	1.74	1.83	1.93	2.04	2.16	2.29	2.44	2.60	2.78	2.99
40°	3.22	3.48	3.77	4.11	4.50	4.95	5.50	6.12	6.90	7.83

Partial result $s_{kzul} = 4.50$ kN/m²

3. Checking the conditions $s_{kzul} \geq s_k$

Result: $s_{kzul} = 4.50$ kN/m² < $s_k = 4.76$ kN/m²

The insertion system is not a suitable installation method for the planned SOLON Black 230/07 modules (checked using the simplified method). As an alternative, a different installation method could be chosen, i.e. the optimal module support (continue at point b) or the detailed calculation method (point c).

2. Installation method: Optimal support and fastening.

4. Calculate the maximum ground snow load s_{kzul} in kN/m^2 from annex 3, sheet 3.1 of the installation instructions with wind speed pressure $q = 0.65 \text{ kN/m}^2$ with a different installation method, i.e. support and fastening in the optimal area.

Wind speed pressure $q = 0.65 \text{ kN/m}^2$

$\alpha = \beta$	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°
10°	1.71	1.72	1.73	1.75	1.76	1.78	1.79	1.80	1.82	1.83
20°	1.85	1.87	1.89	1.91	1.93	1.95	1.98	2.01	2.04	2.07
30°	2.11	2.22	2.34	2.47	2.62	2.78	2.96	3.17	3.39	3.64
40°	3.92	4.24	4.60	5.02	5.49	6.05	6.72	7.49	8.43	9.57

Partial result: $s_{kzul} = 5.49 \text{ kN/m}^2$

5. Checking the conditions $s_{kzul} \geq s_k$

Result: $s_{kzul} = 5.49 \text{ kN/m}^2 > s_k = 4.76 \text{ kN/m}^2$

Hence SOLON Black 230/07 modules can be fitted if a different installation method is used, without requiring certification, i.e. with optimal positioning according to the installation instructions.

3. Installation method: Check using the detailed calculation method

The detailed calculation showed that the SOLON modules can also be mounted in the insertion system.

At a height above sea level of 710 m, the calculated ground snow load s_k is 3.95 kN/m^2 instead of the ground snow load of 4.76 kN/m^2 at 800 m as stated in the table (in the simplified method, the ground snow load at 800 m had to be selected).

The modules can also be installed using the insertion system, as planned.

Example application 4.

Installation site	Hüfingen (near Donaueschingen / Germany) Height above sea level: 550 m
Building specifications	Pitched roof, roof pitch $\alpha = 30^\circ$, building height 15 m
System data	On-roof mounting system, module tilt $\alpha = 30^\circ = \alpha$ Vertical installation of modules via the maximum support and fastening area
Modules	SOLON Blue 230/07, SOLON Black 230/07

Checking the planned installation method.

1. Calculation of the applicable load data

- › Snow load per DIN 1055 part 5
- › Snow load zone 1, from annex 1 in installation instructions

Terrain height (m)

above sea level at the
installation site

Snow load zone s_k (kN/m²)

	1	1a	2	2a	3
<200	0.65	0.81	0.85	1.06	1.10
300	0.65	0.81	0.89	1.11	1.29
400	0.65	0.81	1.21	1.51	1.78
500	0.84	1.05	1.60	2.00	2.38
600	1.05	1.30	2.06	2.58	3.08

Partial result: ground snow load $s_k = 1.05$ kN/m²

Calculation of the wind load data per DIN 1055 part 4

- › Wind zone 2 and building is 15 m, see annex 2 in the installation instructions

Wind zone and site
conditions

Wind speed pressure q in kN/m² for
building heights h within limits of...

		up to 10 m	above 10 m up to 18 m	above 18 m up to 25 m
1	Inland	0.50	0.65	0.75
2	Inland	0.65	0.80	0.90
	Baltic coast/islands	0.85	1.00	1.10

Partial result: wind speed pressure $q = 0.80$ kN/m²

2. Calculation of the maximum ground snow load s_{kzul} in kN/m² from annex 3, sheet 1.1 in the installation instructions

Wind speed pressure $q = 0.80$ kN/m²

$\alpha = \beta$	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°
10°	1.39	1.40	1.41	1.42	1.44	1.45	1.46	1.46	1.47	1.48
20°	1.49	1.50	1.51	1.53	1.54	1.56	1.58	1.59	1.62	1.64
30°	1.66	1.74	1.83	1.93	2.05	2.17	2.30	2.45	2.62	2.80

Partial result: $s_{kzul} = 1.66$ kN/m²

3. Checking the conditions $s_{kzul} \geq s_k$

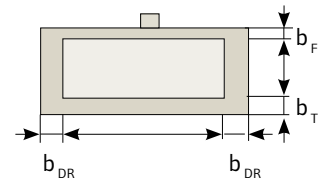
Result: $s_{kzul} = 1.66$ kN/m² $>$ $s_k = 1.05$ kN/m² (The modules can be installed as planned.)

Checklist.

Technical design guide for installation of SOLON modules.

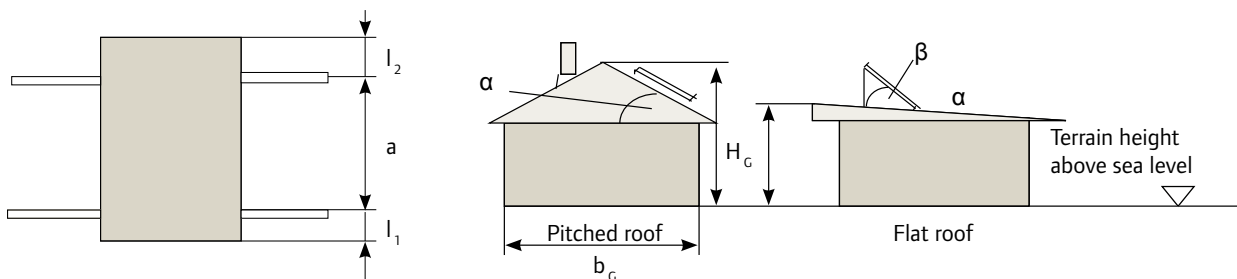
Project	
Postcode, town	
Street	
Contact	
Phone	
Fax	

Module type		
Serial number for a module		
Type of roof	Pitched roof	Flat roof
Roof pitch / module tilt $\alpha = \beta$	$\alpha =$	$\beta =$
Building height (hg) / width (bg)	hg =	bg =
Terrain height	= m ü. NN	
Snow load zone (DIN 1055-5) ¹⁾		
Wind zone (DIN 1055-4) ¹⁾		
Standard situation (DIN 1055-4) ¹⁾		
Module arrangement	vertical	horizontal
Slip protection	yes	no
Support point – module edge (l)	$l_1 =$	$l_2 =$
Rail spacing (a)	a =	
Distance from roof edge (b_{DR})	$b_{DR} =$	
Distance from ridge (b_F)	$b_F =$	
Distance from eaves (b_T)	$b_T =$	



Roof covering type	
Rafter spacing (S_{SP})	$S_{SP} =$

¹⁾ July 2005 edition



If necessary, please fill out all sections of this form and send it to a structural engineer for evaluation (SOLON can make a recommendation if required). The building owner must check and separately certify the static load capacity of the roof.

SOLON SE

Am Studio 16

12489 Berlin · Germany

Phone +49 30 81879-0

Fax +49 30 81879-9999

E-Mail components@solon.com