



# PRODUCT US 08.09 GUIDE

# YOUR ADVANTAGES, THAT PAY FOR THEMSELVES

## UP TO 45 % ADDITIONAL YIELD



### DEGERconecter ...

#### THE UNIQUE, PATENTED CONTROL SYSTEM

- ▶ High returns
- ▶ Low consumption (0.2% of more yield) – no energy-intensive computer in the background
- ▶ High availability (99.9%) - decentralised control with fail-safe program
- ▶ Most clever control unit - takes full advantage of snow- and eye-of-cloud effect
- ▶ Simple, easily mastered control electronics (no turning angle transmitter, relays, multi-phase motors ...) – thus simple maintenance
- ▶ Lower cabling expenditures at large solar parks – no networking with data lines necessary
- ▶ Poor weather situations are also used efficiently
- ▶ Only movements are made that result immediately in an increased yield
- ▶ The most effective control on large surfaces through individual control – single clouds influence only the respective part of the solar park
- ▶ High precision through large measuring surfaces of the sensors – no loss in performance when dirty
- ▶ With a soft subsurface and use of the foundation, the DEGERconecter automatically readjusts – safety during long-term operation without inspection effort

### DEGERtraker / TOPtraker ...

#### THE COMPLETE TRACKING SYSTEMS

- ▶ Highest additional yields – DEGERtraker up to 45 %, TOPtraker up to 30 %
- ▶ Also suitable for desert and equatorial regions
- ▶ Lowest consumption – calculated mechanics allow the use of cost-efficient mini-DC motors
- ▶ Shortest assembly times
- ▶ TÜV tested and certified, UL/CSA tested and certified
- ▶ Passed hardest load tests of the Stuttgart Institute for Material Testing (MPA)
- ▶ Most flexible assembly system – suitable for all current modules and inverter types
- ▶ Lowest maintenance expenses
- ▶ Long life
- ▶ 99.9% recycable because of aluminium and steel construction
- ▶ Low transport costs – for DEGERtraker up to 150 kWp per truckload
- ▶ Best price-performance ratio – therefore a fast payoff

### DEGERenergie ...

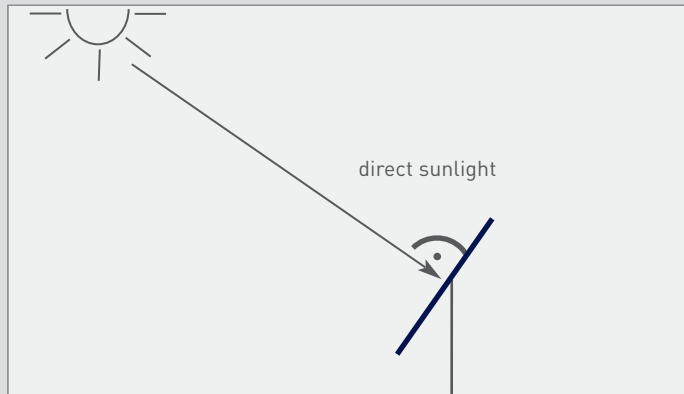
#### MARKET LEADER FOR TRACKING SYSTEMS

- ▶ More than 10 years serial construction of tracking systems
- ▶ 25,000 DEGERtrakers on the grid (status 04/2009)
- ▶ More than 160 MWp installed power
- ▶ 100 MW production capacity
- ▶ Up to 25 years warranty
- ▶ Result: safety. Even in the spare parts supply

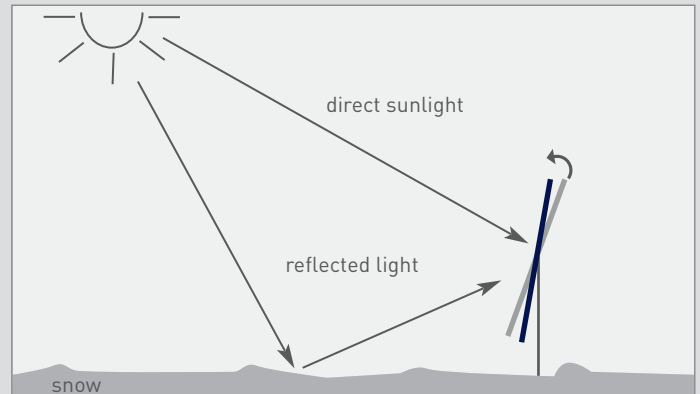
# THE INTELLIGENT CONTROL

## DEGERconecter

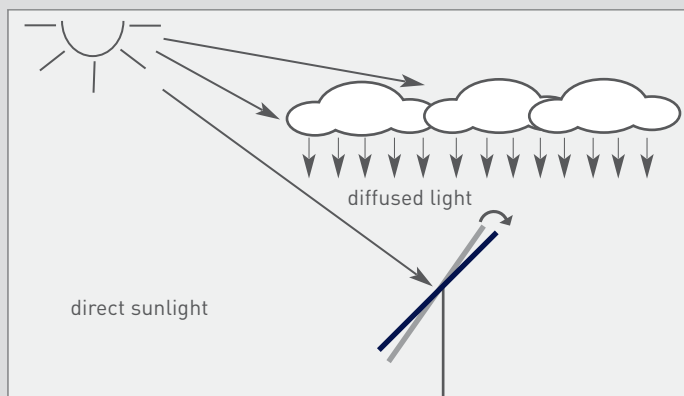
The effectiveness of the solar plant depends essentially on how much energy the solar cells are able to collect. The intelligent control of the DEGERenergie tracking systems guarantees the optimum utilisation of all incidental light energy.



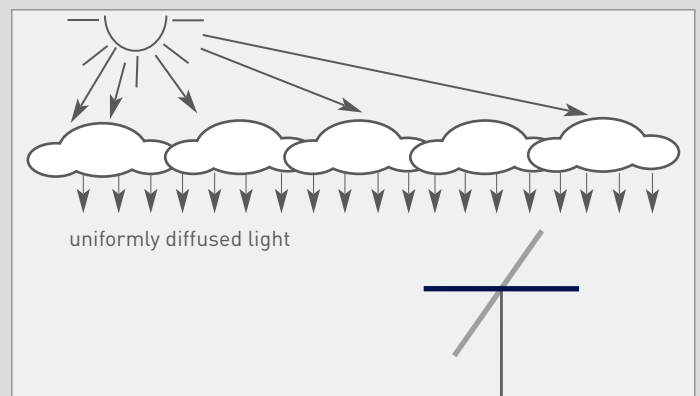
**With bright sunshine:** The DEGERtraker aligns itself with the brightest point in the sky.



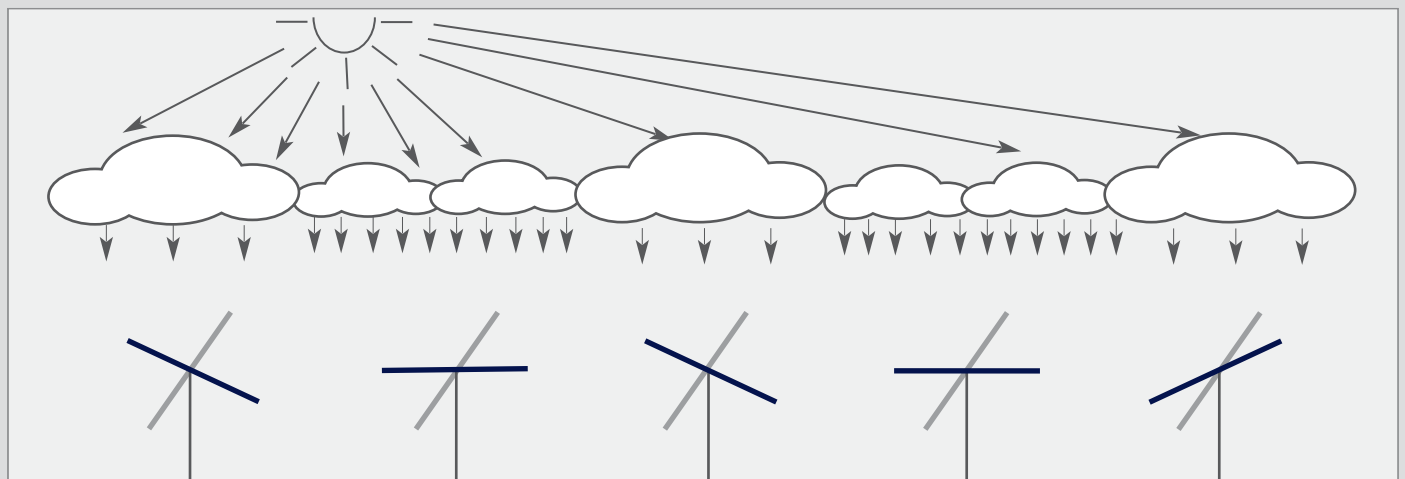
**Snow:** The DEGERenergie tracking system uses direct light irradiation as well as the energy of reflected light.



**Scattered clouds:** beside direct solar radiation also diffuse light is used optimally.



**Overcast sky:** the system detects the brightest spot and directs itself towards the spot.



**Varying lighting conditions:** In solar parks the lighting conditions vary for each single DEGERtraker because of different clouds. The individual control aligns every DEGERtraker optimally to the brightest light source and guarantees therefore the biggest possible energy gain.

# THE DEGERconecter

## DEGERtraker's CONTROL SYSTEM

### ACCURATE ADJUSTMENT

The DEGERconecter always adjusts the solar installation to face the brightest point in the sky. It includes the entire system control.

### MAXIMUM POWER YIELD

During times of sunshine the module surface is accurately adjusted to face the sun. During times of overcast weather, the DEGERconecter automatically adjusts to face the point with the strongest global radiation. A control system to rely on. The patented DEGERconecter control was distinguished with the Innovator Award of Baden-Wuerttemberg Prize in 2001, has been continuously improved and has more than 50,000 units in operation.

### DESCRIPTION OF DEGERconecter FUNCTIONS

Two sensor cells in the DEGERconecter supply reference values which are evaluated by the logic device and which provide the basis for the adjustments of the module surface in the course of the day. A third sensor cell is attached to the back of the DEGERconecter to reset the installation in the morning. Depending on the irradiation intensity, a differential amplifier controls the transition from the logarithmic characteristic curve during strong irradiation to a linear characteristic curve during low currents in diffuse light. That means that the logic device accepts a much higher value for the linear characteristic curve than for the logarithmic characteristic curve. This leads to improved adjustment accuracy in dim light. A load is added to the differential voltage, moving the switch-off threshold further into dusk, to approx. 30 W/m<sup>2</sup>.

### DRIVE CONTROL

The drive is controlled directly – and without requiring additional parts – by the MOSFET bridge circuit, which is integrated in the DEGERconecter. The bridge is characterised by a very low closing resistance. To avoid overload of the motor and the DEGERtraker's structure, a current limiter was integrated into the system. This current limiter functions dynamically, i.e. the motor is switched off as a response to overload (e.g. frozen or blocked drives). As soon as the drive works again, the system resets automatically.

### TASKS OF AN ENERGY CONVERTER

The energy converter exploits wide voltage ranges of solar modules, battery systems and the grid for the DEGERconecter. The power for the control and drive systems may also be supplied without a battery, by direct connection to solar modules with less than one Watt power.

During dawn, the DEGERconecter recognises the brightest spot in the sky and resets the installation. The power supply module for the control system starts by producing 0.01 Watt or less, and

as soon as the DEGERconecter attempts to control the electric motor, the voltage on the solar module breaks down. To avoid the DEGERconecter switching the drive on and off all the time and to achieve quick resetting, DEGERnergie has developed the energy converter. The energy converter collects even small power inputs from the solar module (which are too small to be fed into the grid) in a high performance condenser and makes this energy available to the DEGERconecter. The DEGERconecter is thus able to reset the installation to face the brightest spot even before the modules produce enough energy to be fed into the grid. To avoid both drives from working simultaneously, the energy converter gives the east-west drive priority over elevation. The energy converter also ensures that not more than approx. 1-3 Watts is drawn from the solar module while the drive is running. The control does not use any energy during the night.

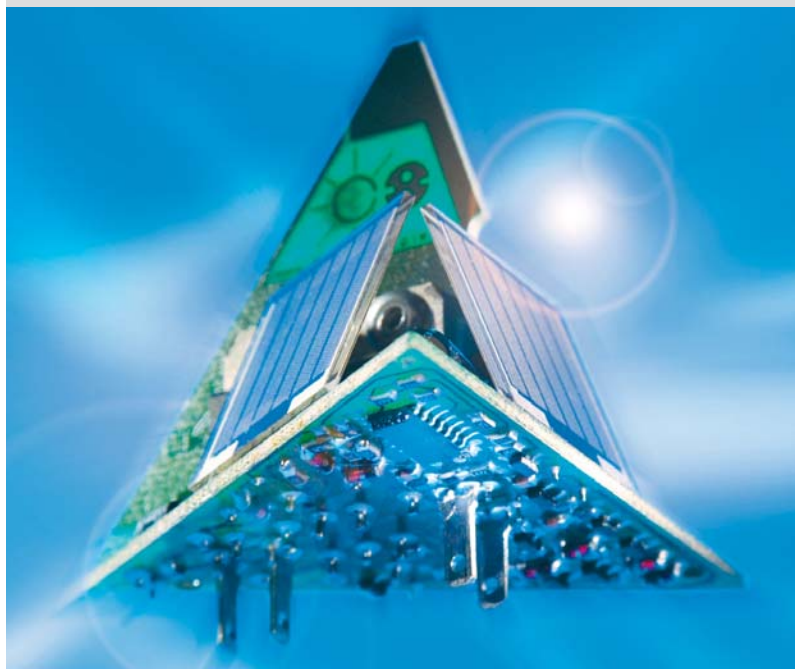


### CIRCUIT DIAGRAM



# THE DEGERconecter

## THE PATENTED CENTREPIECE



### BENEFITS

- ▶ No computer with high energy consumption required
- ▶ No rotation angle potentiometer, relay, step motors ... required
- ▶ No networking with data lines required
- ▶ The automatic drive does not contain any electro-mechanical parts
- ▶ Little cabling required for large solar parks
- ▶ Simple, easy-to-use control technology
- ▶ Also bad weather is used efficiently
- ▶ Contrary to traditional control systems only movements are performed, that lead directly to a yield increase.

### DEGERconecter TECHNICAL DATA

Input voltage	18...50 VDC
External input fuse	5 Amperes
Internal power consumption at night	0 Watt
Internal power consumption control mode	0.1 Watt
Input protection	reverse polarity protection diode max. 5 A
Output voltage	see input voltage
Output on motor side	short-circuit proof, reverse polarity protected
Motor protection	overload recognition, current limitation
Switching capacity loss-free	4 Amperes
Peak switching capacity	9 Amperes
Adjustment accuracy in sunshine	< 1°
Adjustment accuracy in diffuse light	< 6%
Measurement	3.15 Inch
Weight	3 oz.

### ENERGY CONVERTER

	I	II	III	V
Input voltage	9...34 VDC	24 V (20...30 VDC)	80...380 VDC or 80...265 VAC	
Connection	independent of polarity			
Output voltage	22 VDC			
Power consumption with motor	3 Watts	20 Watts	5 Watts	20 Watts
Internal power consumption control mode approx.	0.1 Watt	0 Watt	1 Watt	1 Watt
Output on motor side	short-circuit proof			
Dimensions	5.12 x 5.12 x 3.15 Inch			
Weight	16 oz.	21 oz.	20 oz.	21 oz.
Input external drive system	no	yes	yes	yes

# MAXIMUM SUN YIELD

**MORE YIELD**  
 DEGERtraker:  
**+35-45%**  
 DEGER TOPtraker:  
**+20-30%**

By using DEGERtraker tracking systems you have recognised the signs of the time: In addition to think and act in terms of environmental protection and nature you also benefit from yield increase and from the amortisation linked with that.

### MAINTENANCE FREE. LONG-LIVING. RECYCLABLE.

The systems, which are based on these demanding parameters, are manufactured environmentally friendly in series in an ISO 9001 certified enterprise. Altogether the DEGERtraker-systems are recyclable at 100% as real reusable material. Compared to rigid systems, 40% (DEGERtraker), respectively 25% (DEGER TOPtraker) less electronic scrap accumulates after the end of the service life!

### SHORT ASSEMBLY TIME.

Pre-assembled components and detailed assembly instructions enable an assembly time of less than 2 hours (most erected).

### YOU CAN BUILD ON THIS TECHNOLOGY.

The patented control and the mechanics, that are protected as utility patent, were distinguished already in the year 2001 with the Innovator Award of Baden-Wuerttemberg and are constantly further developed. Thus, DEGERtraker meets the demands equally of experts and investors. All DEGER-systems have tested statics and were certified by the TÜV and the UL-Directives. The construction of the DEGERtrakers is done based on up-to-date valid standards (among others DIN 1055 4 (03/2005)).

### REQUIREMENTS FOR THE HIGHEST SURPLUS:

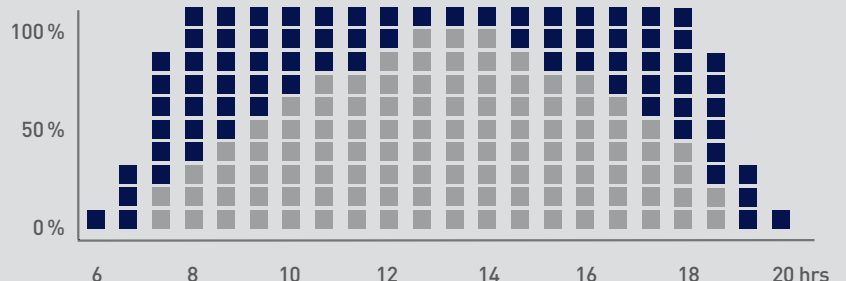
- ▶ free spectrum of 70° east to 290° west
- ▶ Construction inverter:  $W_p = AC_{nom}$   
(Module performance = Inverter output power)

## PERFORMANCE DIAGRAM

### DEGERtraker

using an example of a sunny summer day

steep | DEGERtraker



# BASICS FOR PLANNING

## DEGERenergie ASSISTS YOU



DEGERenergie assists you in planning and realising your solar park with extensive planning aids, like for example:

- ▶ Selection of the tracking system
- ▶ The maximum allowed total module area
- ▶ The maximum dimensions of the total module area
- ▶ The module setup on the DEGERtraker
- ▶ Planning of the mast distances to each other for all regions and all degrees of latitude
- ▶ above- or below-ground foundation for the different systems with different mast lengths on the open space

## EXAMPLE PLANING 36<sup>TH</sup> – 45<sup>TH</sup> DEGREE OF LATITUDE

### DEGERtraker 7000 NT

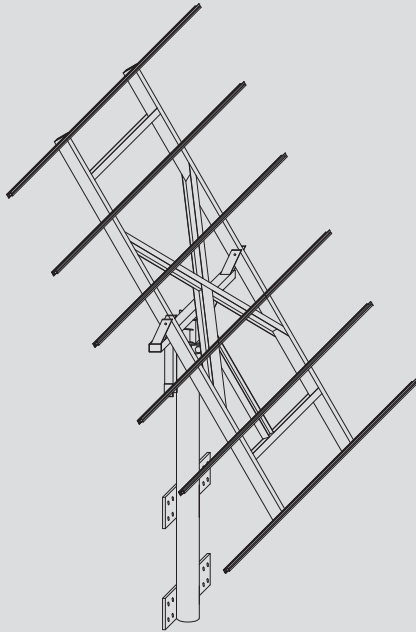
Desired yield increase	distance east-west	distance north-south	Space needed* per DEGERtraker 7000 NT	Space needed* per kWp approx. depending on type of module	
40+ %	27 yd.	22 yd.	0.12 a.	764 sqft.	<p>The yield increase through the DEGERtraker depends on the space.</p> <p>Rule of thumb: The more space the higher the yield.</p> <p>The here stated distances always apply to the distance from the centre of one mast to the centre of an other mast.</p> <p>*Mean values of the DEGERtraker: at the edge of the floor space approx. thehalf of the specified space is needed.</p>
39 %	26 yd.	22 yd.	0.11 a.	732 sqft.	
38 %	26 yd.	21 yd.	0.11 a.	700 sqft.	
37 %	25 yd.	20 yd.	0.10 a.	635 sqft.	
36 %	25 yd.	19 yd.	0.09 a.	603 sqft.	
35 %	24 yd.	19 yd.	0.09 a.	570 sqft.	
33 %	23 yd.	18 yd.	0.08 a.	517 sqft.	
31 %	22 yd.	18 yd.	0.07 a.	495 sqft.	

## IT PAYS

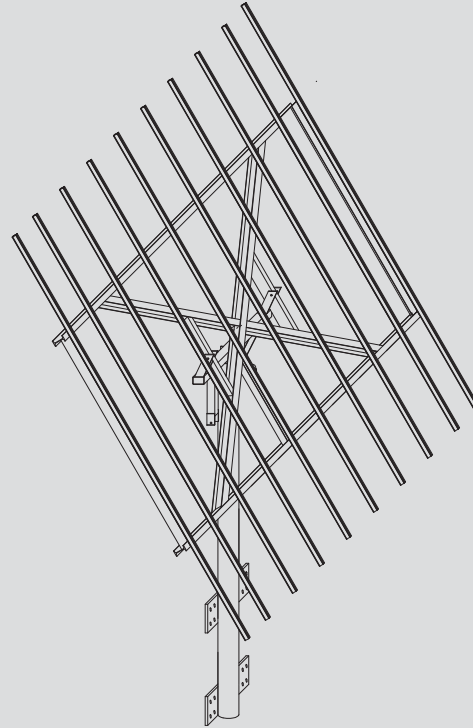
Rigid system yield in 20 yrs:	26,000,000 kWh at 0.49 \$/kWh	= \$	12,740,000.-	<p>Example: 1 MW system with DEGERtrakers rigid systems in one area, providing approx. 1,300 kWh/kWp per year.</p>
DEGERtraker yield in 20 yrs:	36,400,000 kWh at 0.49 \$/kWh	= \$	17,836,000.-	
	<b>Profit</b>	= \$	<b>5,096,000.-</b>	
	Higher purchase price of DEGERtraker vs. rigid approx.	= \$	843,000.-	
	<b>End profit</b>	= \$	<b>4,253,000.-</b>	

# BUILDING INTEGRATION

## DUAL-AXIS, ACTIVE



DEGERtraker® 3000HD

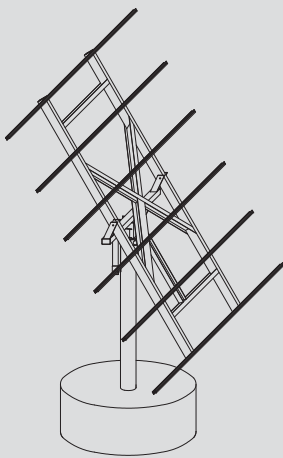


DEGERtraker® 5000HD

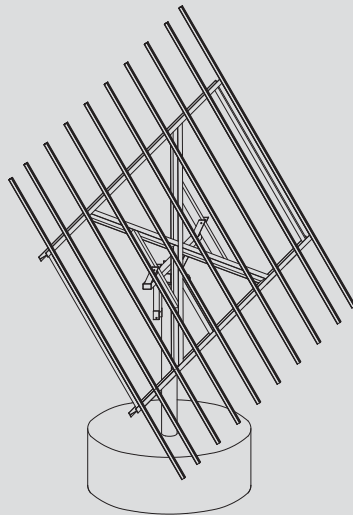
	DEGERtraker® 3000HD	DEGERtraker® 5000HD	
For solar energy capacity	2,000 ... 3,800 Wp	4,000 ... 6,400 Wp	<p><b>Dual-axis, active tracking systems suitable for all current solar modules</b></p> <p><b>Areas of application:</b></p> <ul style="list-style-type: none"> <li>▶ For professional power generation</li> <li>▶ For buildings and for installation with different mast lengths.</li> <li>▶ For all current modules.</li> </ul> <p><b>Scope of delivery:</b></p> <p>Complete dual-axis tracking system, mast, aluminium solar module carrier system to fit the respective module type, DEGER-conecter control electronics with energy converter for extremely economical operation, installation manual.</p> <p><b>HD models:</b></p> <p>Heavy-duty models (HD) are also available with mast to be installed on open land. (Deep-sea islands, zones with strong winds)</p> <p>* designed with planning tool.</p>
Module area up to	269 sqft.	430 sqft.	
Rotation angle east - west	360° with adjustable limit switches		
Elevation inclination angle	20° ... 90°		
Control unit	DEGERconecter		
Energy converter	II or V		
East - west drive	drive integrated in the rotating head		
Elevation drive	39.37 Inch stroke path	43.31 Inch stroke path	
Internal power consumption:			
control mode	1 Watt		
with operating drives approx.	7 Watts		
Power consumption per year approx.	8 kWh	9 kWh	
Mast height	10.8 ... 18 ft.		
Maximum allowed wind speed	106 ... 186* mph		
Weight (excluding mast)	1,102 lb.	1,874 lb.	
Maintenance	maintenance-free		
Geographic region	25° ... 60° / optional equator to 90th degree of latituded		
Art.no.	1310001	1510001	

# PROFESSIONAL POWER GENERATION OPEN LAND

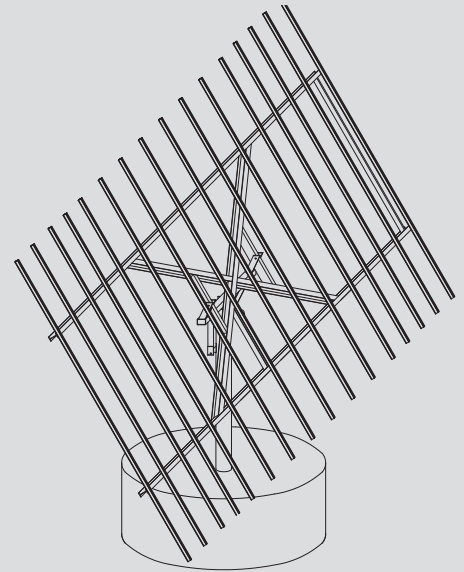
## DUAL-AXIS, ACTIVE



DEGERtraker® 3000NT



DEGERtraker® 5000NT



DEGERtraker® 7000NT

	DEGERtraker® 3000NT	DEGERtraker® 5000NT	DEGERtraker® 7000NT
For solar energy capacity	2,000 ... 3,800 Wp	4,000 ... 6,400 Wp	6,000 ... 9,000 Wp
Module area up to	269 sqft.	430 sqft.	645 sqft.
Rotation angle east - west	360° with adjustable limit switches		
Elevation inclination angle	10° ... 90°		
Control unit	DEGERconecter		
Energy converter	II or V		
East - west drive	drive integrated in the rotating head		
Elevation drive	39.37 Inch stroke path	39.37 Inch stroke path	43.31 Inch stroke path
Internal power consumption:			
control mode	1 Watt		
with operating drives approx.	7 Watts		9 Watts
Power consumption per year approx.	7 kWh	8 kWh	9 kWh
Mast height	10.8 ... 18 ft.		
Maximum allowed wind speed	63 ... 186* mph		
Weight (excluding mast)	1,058 lb.	1,433 lb.	2,403 lb.
Maintenance	maintenance-free		
Geographic region	25° ... 60° / optional equator to 90th degree of latitude		
Art.no.	1300001	1500001	1700001

**Dual-axis, active tracking system  
suitable for all current solar modules**

**Areas of application:**

- ▶ For professional power generation.
- ▶ For open spaces and for installation with different mast lengths.
- ▶ For all current modules.

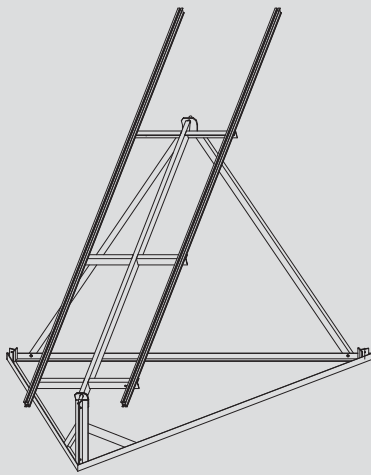
**Scope of delivery:**

Complete dual-axis tracking system, mast, aluminium solar module carrier system to fit the respective module type, DEGERconecter control electronics with energy converter for extremely economical operation, foundation plan, installation manual.

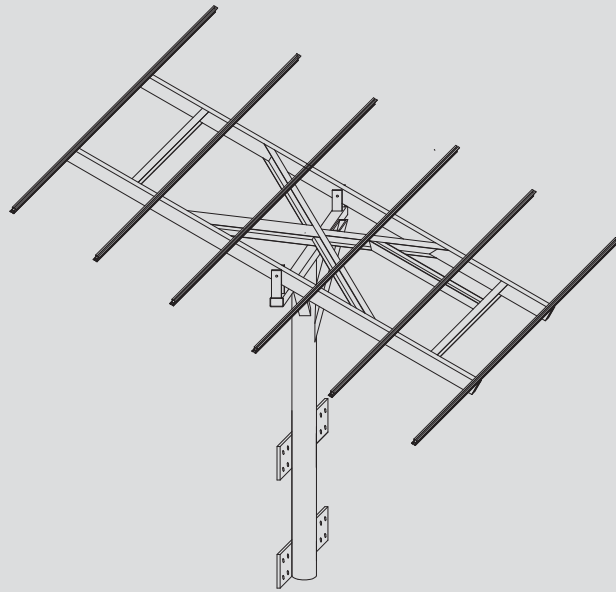
\* designed with planning tool.

# BUILDING INTEGRATION

## SINGLE-AXIS, ACTIVE



**DEGER TOPtraker® 8.5**  
without concrete foundations for flat roof installation



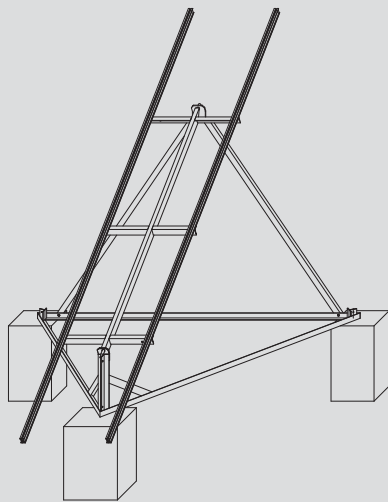
**DEGER TOPtraker® 25HD**

	<b>DEGER TOPtraker® 8.5</b>	<b>DEGER TOPtraker® 25HD</b>	
For solar energy capacity	500 ... 1,290 Wp	2,000 ... 3,800 Wp	<b>Single-axis, active tracking systems suitable for all current solar modules</b>  <b>Areas of application:</b> ▶ For increased performance for all photovoltaic applications. ▶ For flat roofs, landfills and buildings. ▶ For all current modules.  <b>Scope of delivery:</b> Complete tracking system in the optimised azimuth axis, DEGERconecter control electronics, mast for TOPtraker 25HD, module bearing system in aluminium, compatible with the module type used, installation manual.  <b>HD models:</b> Heavy-duty models (HD) are also available with mast to be installed on open land. (Deep-sea islands, zones with strong winds)
Module area up to	92 sqft.	269 sqft.	
Angle of inclination - south	30°	Standard 30°/optional 0° and 15°	
Elevation inclination angle	0° ... 50°	0° ... 45°	
Control unit	DEGERconecter		
Operating voltage	20 ... 40 VDC	Energy converter II	
East - west drive	16.67 Inch stroke path	33.74 Inch stroke path	
Internal power consumption:			
control mode	0.1 Watt		
with operating drives approx.	5 Watts	7 Watts	
Power consumption per year approx.	1 kWh	2 kWh	
Mast height	---	13.12 ... 16.40 ft.	
Maximum allowed wind speed	81 ... 186* mph	81 ... 186* mph	
Weight (excluding mast)	254 lb.	1,235 lb.	
Maintenance	maintenance-free		
Geographic region	Equator...60° latitude		
Art.no.	1110001	1120001	

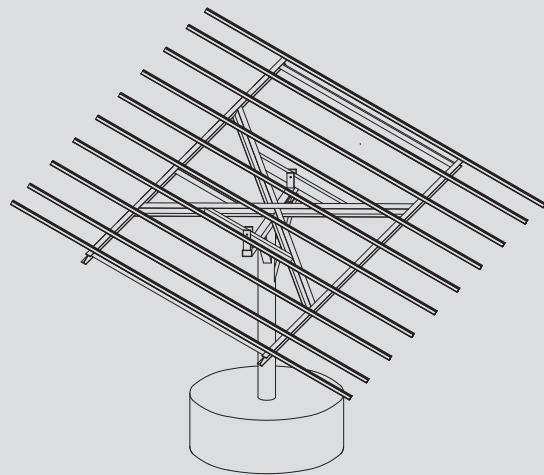
\* designed with planning tool.

# PROFESSIONAL POWER GENERATION OPEN LAND

## SINGLE-AXIS, ACTIVE



**DEGER TOPtraker® 8.5**  
with concrete foundations for  
open land installation



**DEGER TOPtraker® 40NT**

	<b>DEGER TOPtraker® 8.5</b>	<b>DEGER TOPtraker® 40NT</b>
For solar energy capacity	50... 1,290 Wp	4,000 ... 6,400 Wp
Module area up to	92 sqft.	430 sqft.
Angle of inclination - south	30°	Standard 30°/optional 0° and 15°
Elevation inclination angle	0°...50°	0° ...45°
Control unit	DEGERconecter	
Operating voltage	20... 40 VDC	Energy converter II
East - west drive	16.67 Inch stroke path	33.74 Inch stroke path
Internal power consumption:		
control mode	0.1 Watt	
with operating drives approx.	5 Watts	9 Watts
Power consumption per year approx.	1 Watt	2.5 kWh
Mast height	---	13.12 ... 16.40 ft.
Maximum allowed wind speed	81... 186* mph	63... 186* mph
Weight	254 lb.	1,433 lb.
Maintenance	maintenance-free	
Geographic region	Equator ... 60° latitude	
Art.no.	1110001	1130001

**Single-axis, active tracking system  
suitable for all current solar modules**

**Areas of application:**

- ▶ For increased performance for all photovoltaic applications.
- ▶ For open spaces and landfills.
- ▶ For all current modules.

**Scope of delivery:**

Complete tracking system in the optimised azimuth axis, DEGERconecter control electronics, module bearing system in aluminium, compatible with the module type used, installation manual.

\* designed with planning tool.



**„OR CAN YOU AFFORD  
TO DO WITHOUT HALF  
OF THE POSSIBLE YIELD?“**

DEGERenergie GmbH  
INDUSTRIESTR. 70  
72160 HORB AM NECKAR  
GERMANY  
TEL: +49 (0) 7451-53914-0  
FAX: +49 (0) 7451-53914-10

DEGERenergie  
C/JOSÉ AGUSTÍN GOYTISOLO  
29 LOCAL 1-D  
08970 SANT JOAN DESPÍ (BARCELONA)  
SPAIN  
TEL: +34 934 808 466  
FAX: +34 934 808 241

info@DEGERenergie.com  
www.DEGERenergie.com