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SF70-1EH TRACKERS FEINA

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1 - GENERAL PRODUCT AND COMPANY INFORMATION

1.1-The company

Trackers Feina has made trackers since 1998, being one of the five most veteran companies in the world in this activity.

It is also one of the most veteran companies in concentration. Since 2003 it has developed trackers suitable for concentration.

In 2008 it provided trackers for the main plant in the world at that moment, CPV, with a nominal power of 800 kW, which is working with the expected precision and reliability.

Trackers Feina has supplied trackers to a large part of the CPV panel brands all over the world. With this experience it can be said that it is the company with the most experience in this technology in the world.

This company has several patents related to trackers and high precision tracking systems.

It should be noted that this company has supported the international crisis added to the Spanish photovoltaic crisis. This provides a very important security to business continuity and it ensures that replacements and consulting can be given in the coming decades.

1.2- Products

1.2.1- Trackers



SF4



SF9



SF20



SF28



SF45



SF40



SF70

SF4: Tracker with an axis for 4 m².

SF9: Trackers with two axes for 9 m². Flat panel and concentration panel.

SF20: Trackers with two axes for 20 m². Flat panel and concentration panel.

SF28: Trackers with two axes for 28 m². Flat panel and concentration panel.

SF45: Trackers with two axes for 45 m². Flat panel and concentration panel.

SF40: Tracker with a horizontal axle for 40 m². Special for roofs.

SF70: Tracker with a horizontal axle for 70 m². Special for large plants.

1.2.2- Others



Alarm. Active security against theft.

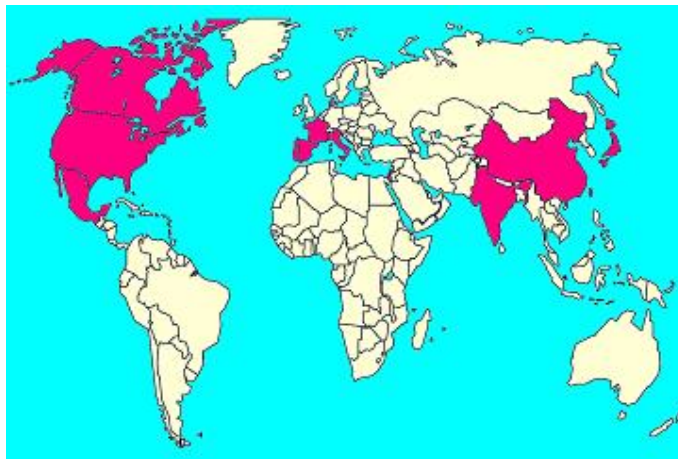
Panel attachment braces. Passive security against theft.

1.3- Presence of Trackers Feina throughout the world

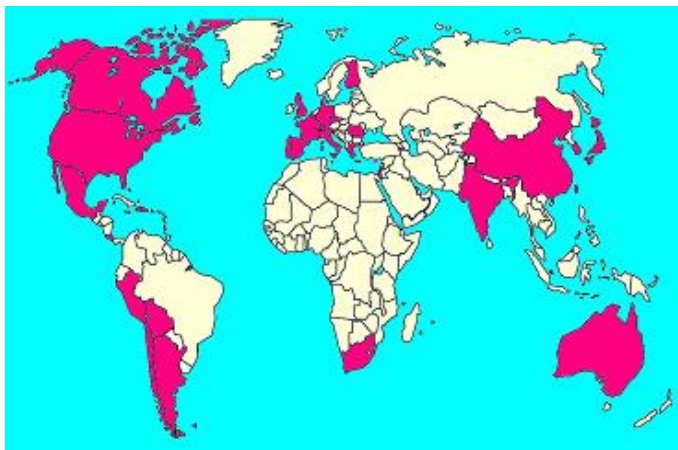
The characteristics of our products make them suitable for the whole world



Countries where Trackers Feina has distribution





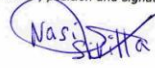
Countries where Trackers Feina has CPV systems



Countries where Trackers Feina has trackers

1.4- Certificates

Trackers Feina has EC conformity certificates for all their trackers.

		DECLARACIÓ  DE CONFORMITAT <i>EC Declaration of Conformity</i>	
L'empresa / The company:		FEINA SCP	
amb adreça a / with the address:		C/ Era d'en Coma, 12 08240 Manresa (Barcelona) Tfno.: 00 34 3 8751001 feina@tracker.cat	
Declara sota la seva única responsabilitat que la màquina: <i>Declares under sole responsibility that the product:</i>			
Denominació / Name:	TRACKER 1 AXIS HORIZONTAL		
Model / Type:	SF70-1EH		
Pes propi / Tare:	700 Kg.		
Any de fabricació / Year of manufacturing:	2010		
ha estat fabricada de conformitat amb els requisits de seguretat i salut de les següents normes: <i>to which this declaration relates is in conformity with the essential health and safety requirements in accordance with the following norms:</i>			
Directives / Directives:		89/392/CEE, 91/368/CEE, 93/44/CEE, 93/68/CEE, 98/37/CEE, 98/79/CEE	
▪ Màquines / Machinery:			
Lloc i data / Place and date:		Nom, càrrec i signatura / Name, position and signature:	
Manresa, 06/15/2010		 Ignasi Sivillà Llobet Gerent	

EC Declaration of Conformity for the SF70-1EH.

2 - INFORMATION ON THE TRACKER

2.1- Features

The SF70-1EH is a horizontal single axis that can be customized to fit any size photovoltaic panel or solar thermal module.

The SF70-1EH has a maximum sail area of up to 70 square meters, but the tracker modular design can be installed in different lengths to deal with obstacles and obstructions in the installation sites terrain.

The SF70-1EH has networking capabilities which allow for the sharing of common resources in a solar field, such a GPS unit, which provides accurate time and pin point location updates, and an Anemometer to protect the trackers in the event of extreme wind conditions.

The networking capabilities also allow for remote monitoring and programming, reducing the onsite maintenance costs.

The SF70-1EH incorporates a fully programmable control system which includes a new "Backtracking" feature. The Backtracking feature commands the tracker to reverse its functional motion during the beginning and ends periods of the year in order to reduce the amount of shadowing that an individual tracker in a field, resulting in a higher density of kW per unit of area while maintaining quality power generation during those times of the day (kWh/kWp).



In a typical application, the high performance horizontal single axis tracker can increase the yield of silicon flat plate panels between 10 % and 28 % compared to fixed installations.

PHYSICAL DATA

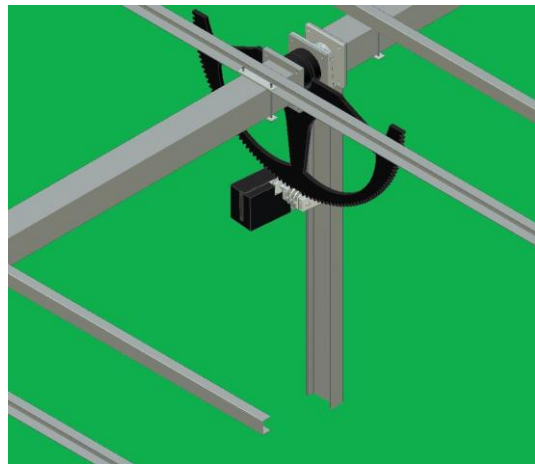
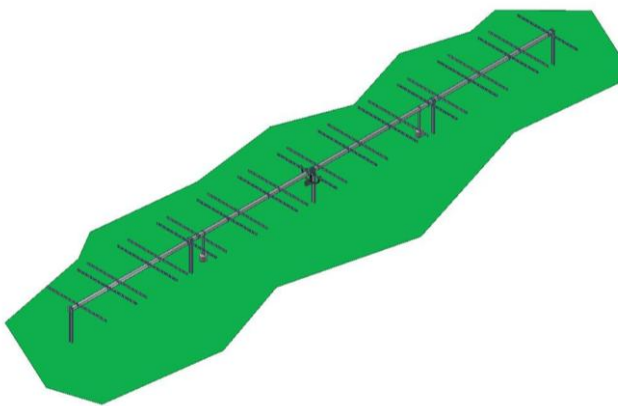
Type	1 axis
Length	24 meters
Height	1,6 meters
Width	3 meters
Wind resistance	140 Km / h
Total weight	640 kgs

ELECTRICAL CHARACTERISTICS

Operating voltage	12 V
Operating current	4.0 A
Consumption	10 Wh/ day
Tracking Accuracy from East to West	1°

CAPACITIES

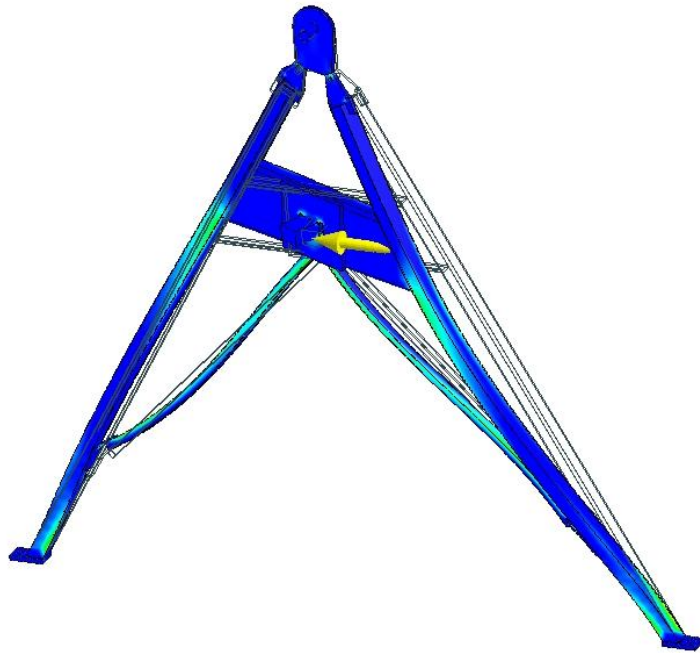
Maximum sail area	23,5 m x 3 m
Electrical yield (aprox.)	10 kW
Weight capacity	1000 kg



2.2- Load resistance

One of the main features of our trackers is that they have been strictly calculated to support all forces.

Although the calculation for finite elements are used for many parts, with as many parts as is possible (the majority), we use the traditional calculation for formulas, which is more accurate and does not lead to errors.



2.3- Wind resistance

Due to the different windstorms that our trackers have endured, we have a complete report which proves that they perfectly support the wind speeds by which we have designed them.

Feina trackers are guaranteed for gusts of 140 km/h. As can be seen, the first damages to the trackers turn up at 150 km/h, with some quite small repair costs.

A total accident does not result even near 180 km/h.

The evaluation of these results are good or bad, which is provided for potential clients and insurance companies that could make use of this data.

If you need references on all this data, please get in touch with us and we will give them to you.

2.4- Performance

The annual increase in performance of one-axle trackers with respect to fixed panels at optimum tilt ranges from 10% to 28% depending on the area of land and weather conditions of the site.

2.5- Profitability

Feina's trackers, due to their reliability, durability and low price, are highly profitable with respect to the fixed panels. As much as the price of panels lowers, they remain profitable.

2.6- Availability

The SF70-1EH one-axle tracker has a coefficient of availability, if there is proper maintenance, of more than 99.6%.

2.7- Plants and facilities

Our trackers have helped to increase efficiency in many small and medium sized plants around the world.



Solar plant In the north of Greece

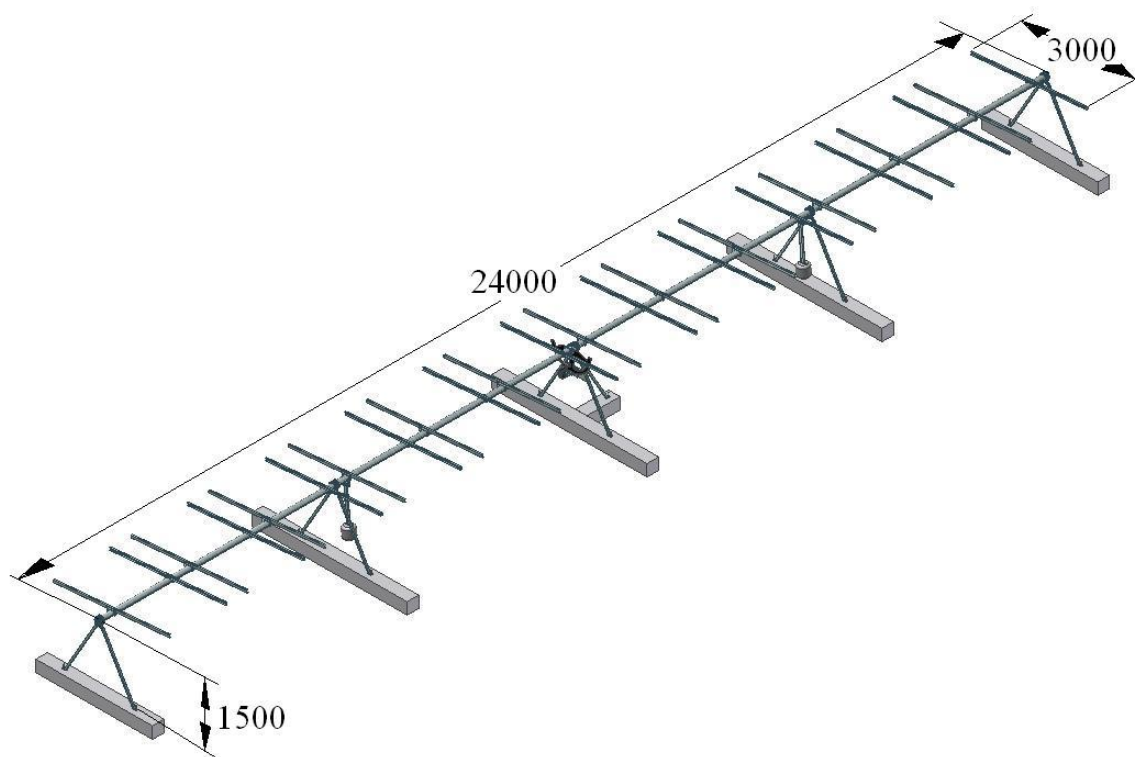


200 kw solar power plant near of Thessaliniki, Greece



3 - PRACTICAL ASSEMBLY AND ECONOMIC INFORMATION

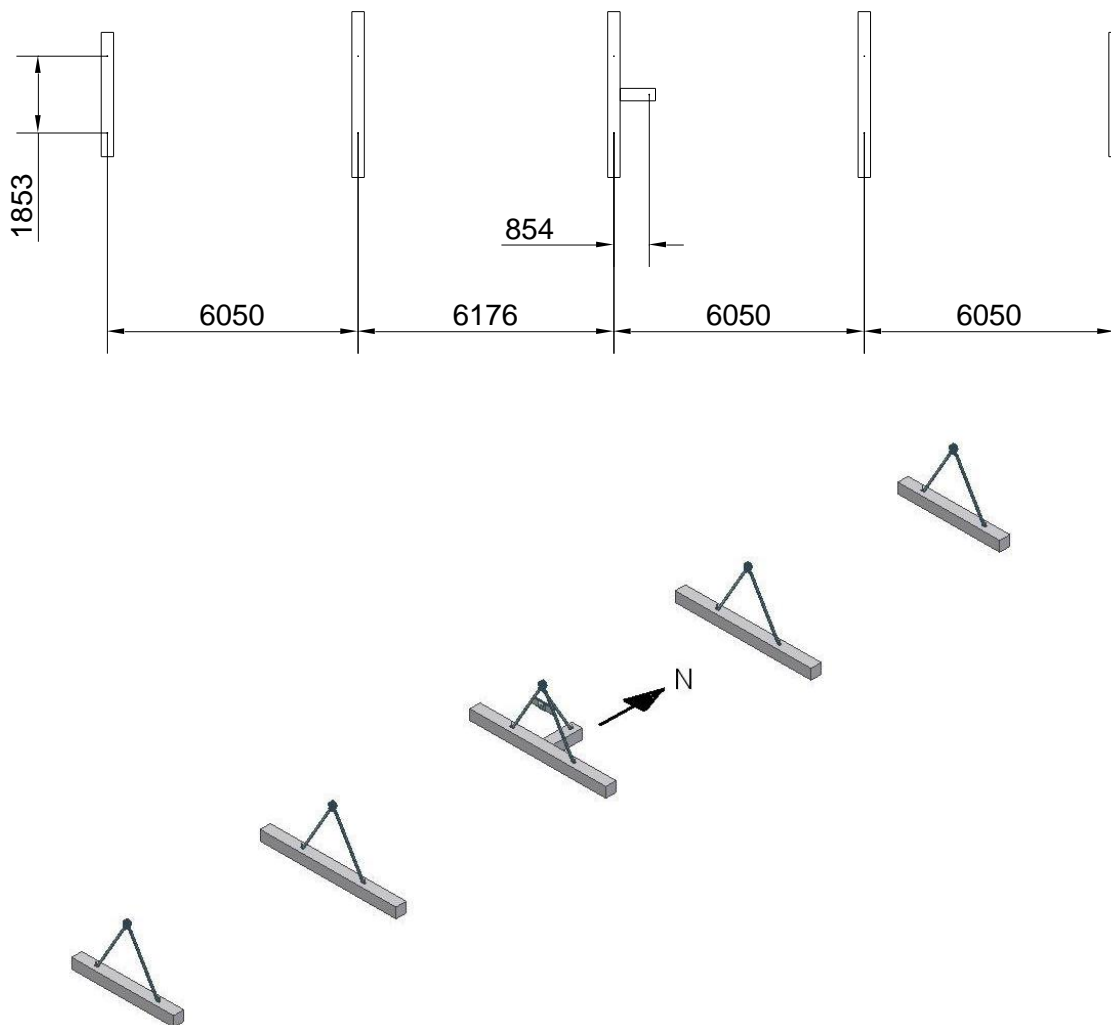
3.1- Main dimensions



3.2- Foundations

The values are valid for the heights shown in the drawings, for a panel surface of 70 m^2 , for a wind speed of 140 km/h and a safety coefficient of 1.6 .
Three types of foundations.

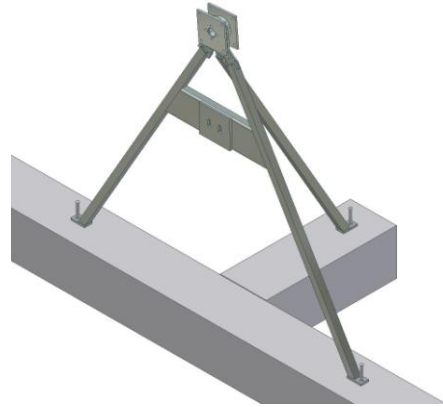
3.2.1- Concrete foundations



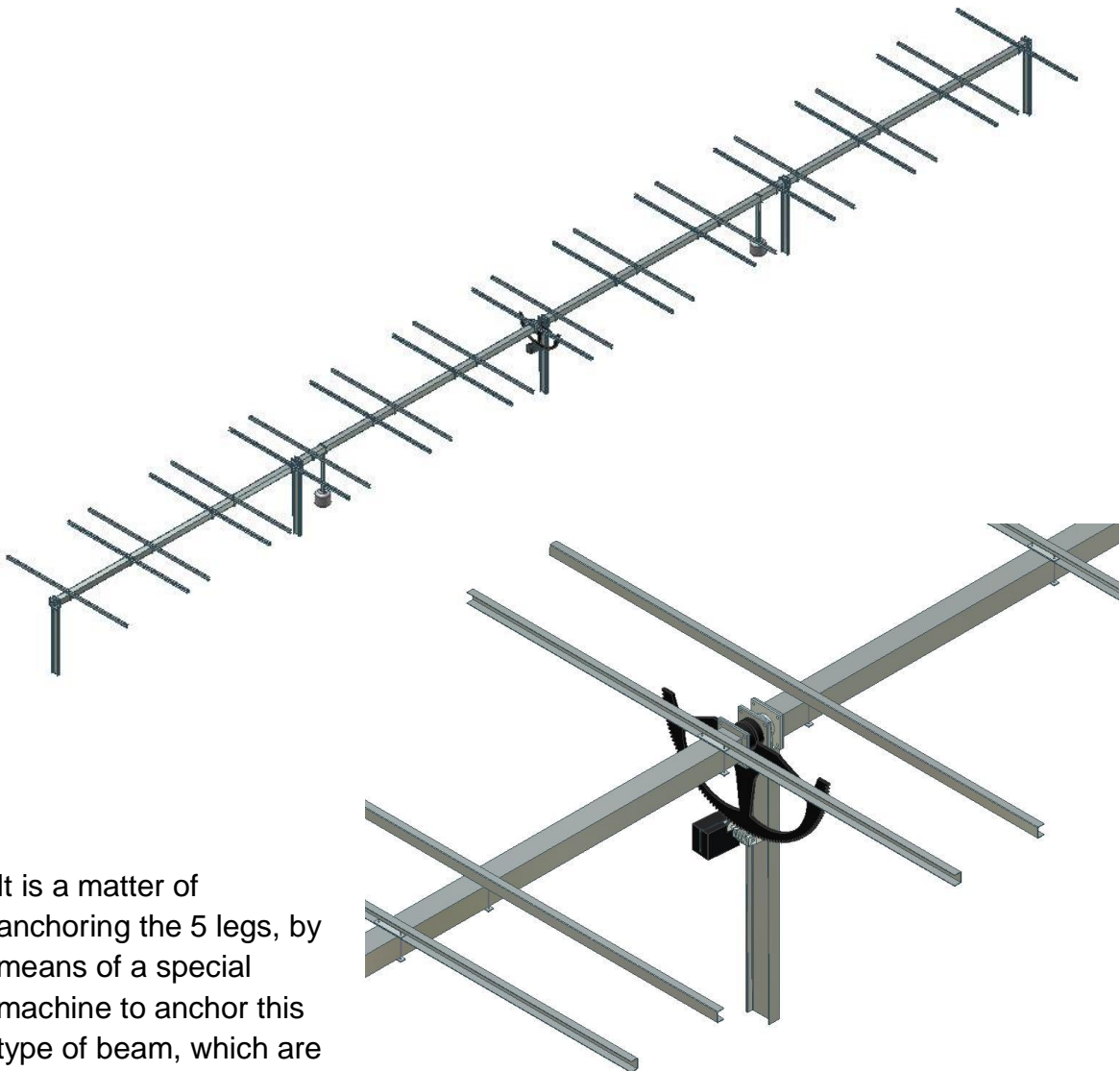
Place the concrete blocks; if they are not poured, the three central blocks can be $35 \times 35 \times 400 \text{ cm}$ and the two with the tips can be $35 \times 35 \times 300 \text{ cm}$.

M18 10 cm long threaded rods will come out of the concrete blocks. The measurements for spacing the threaded rods are indicated in the drawing.

They have to be placed so that the axis of the tracker is aligned north to south.



3.2.2- Anchoring foundation



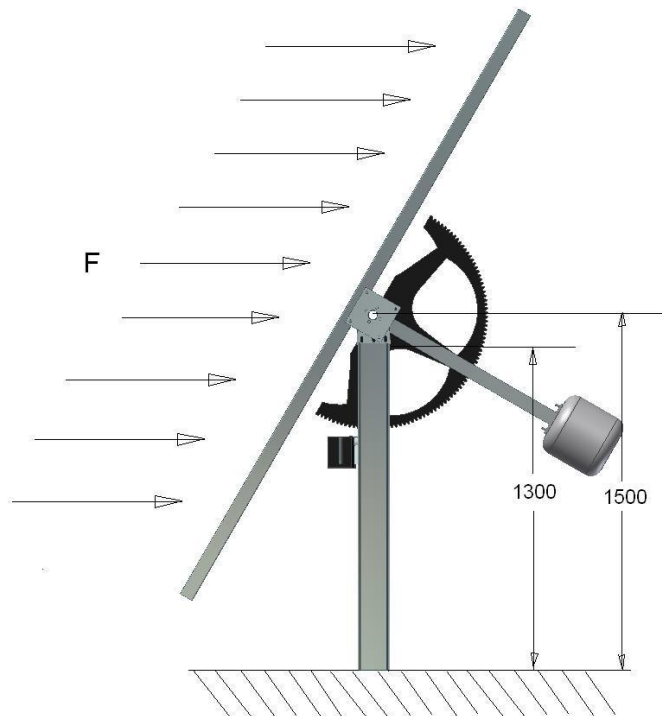
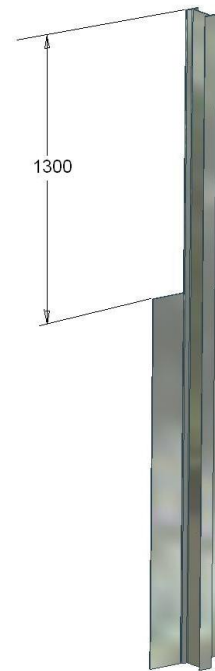
It is a matter of anchoring the 5 legs, by means of a special machine to anchor this type of beam, which are

nothing more than IPN-140 beams.

The beam stands out of the ground 1,300 mm and is anchored a minimum of 1,500 mm into the ground. It depends on the iron that it is welded to and the strength of the ground.

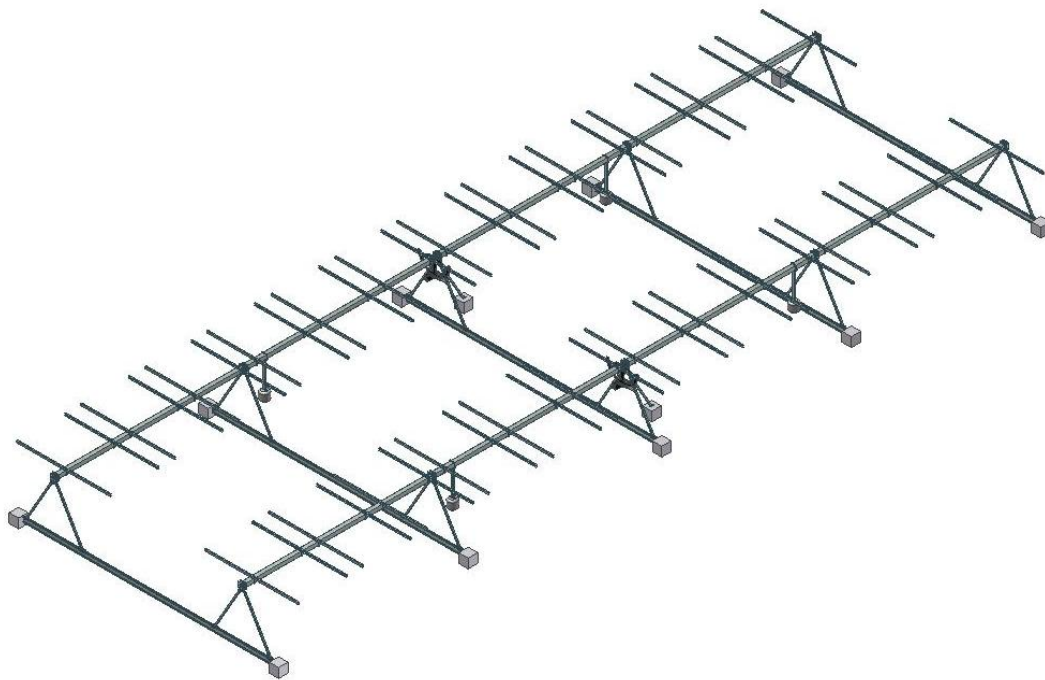
Normally, the beam is welded to the iron sheet, some 5 mm thick and some 400 mm wide, in the buried part, so that the ground can bear the forces.

The width and the depth depend on the strength of the ground, and this will have to be calculated by the company that anchors the beam, who will take the lead with this subject.

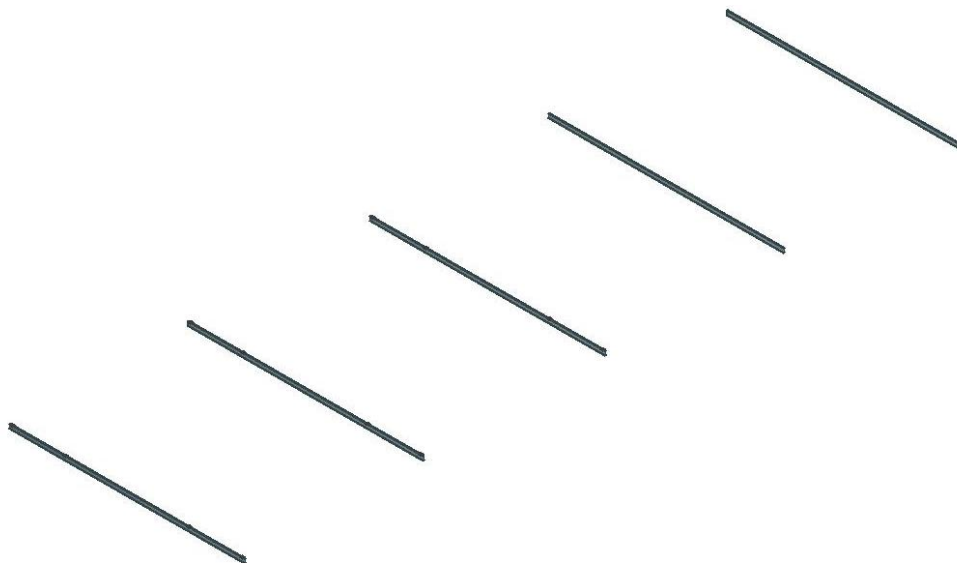


This company has to know, however, that the beam must be able to bear a wind force of 1,400 kg per 1.5 meters of height, that is to say, a torque of 21,000 Nm.

3.2.3- two trackers foundation



Join the trackers together, with the axis pointed north-south, in pairs, using an IPN-140 beam.



First place the five beams on the floor, so that the distances are as indicated in the SF70-1EH tracker manual, and that they are totally flat.

The length of each beam must be the distance between tracker axes plus 2.2 meters. In this way, for example, if the trackers are 6 metres between axes, the beams must be 8.2 meters long.

If there is a logistic problem with using beams that are so long, you can use beams that are half the length and weld them in the middle, which is the point where you have less strength.

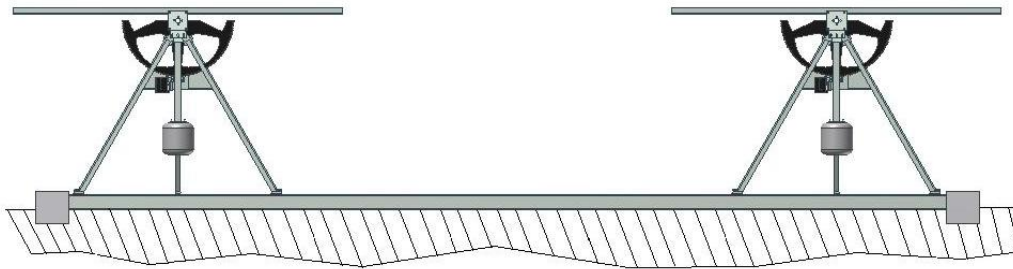
Then place the trackers as shown in the image:



Then make a few holes in the ground, at the end of each beam, about 30 x 30cm and 20cm deep. After that, place the concrete so that it covers the end of the beam.

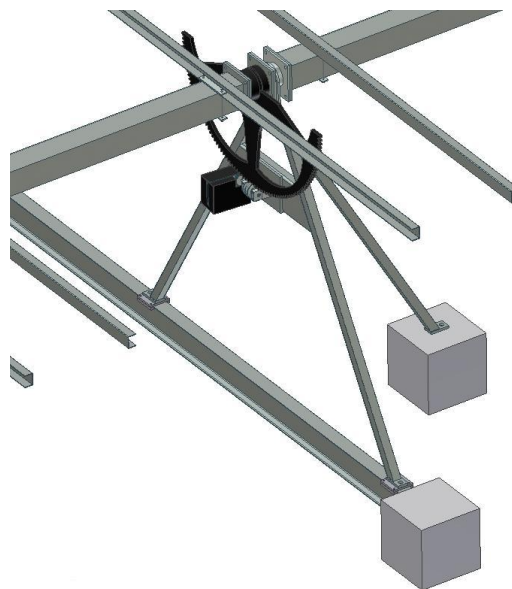
If the beams have to be wedged to be set fully horizontal, the concrete will set them in the correct position and very rigid.

The concrete blocks remain slightly buried so that the wind cannot drag the trackers.



Of course, it is not necessary that the blocks are parallelepiped; they can be left as discharged from the concrete mixer.

Then, at least 100 kg of concrete must be poured on the central leg so that the tracker does not move laterally. The leg may be buried in concrete.



The accuracy when the beams and trackers are placed is not much, but we must bear in mind that the maximum angle that the bars can turn as the tracker's axle should be 0.7° . This means that the 6 metres of each bar, from one end can go up or down (or turn to the right or left) 73 mm with respect to perfect alignment.

3.3- Distance between trackers, and backtracking

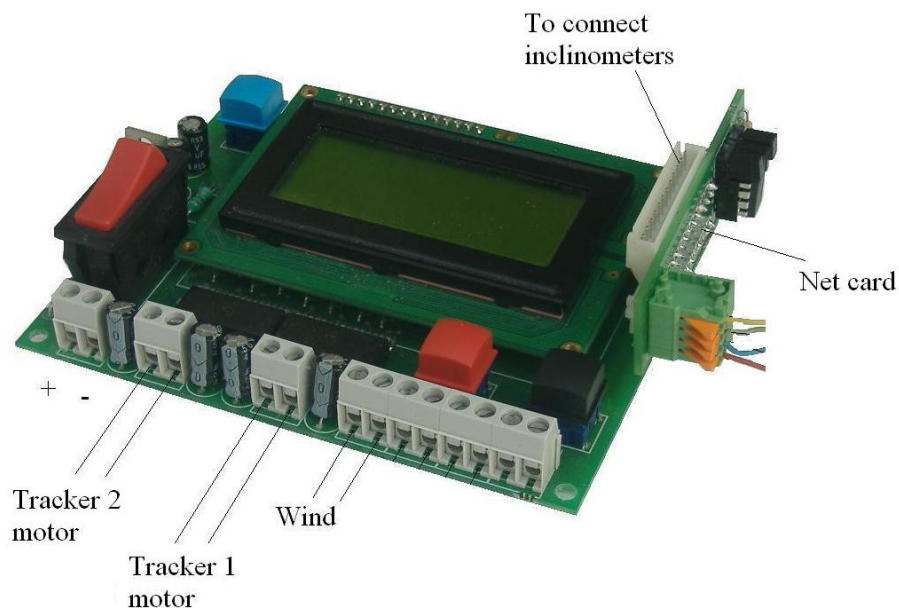
The distance between rows of trackers can be at least 1.5 times the width; but it's better that it be over 2 times. This is possible because it is equipped with backtracking so that the trackers move in a way that avoids the shadows of other trackers.

The power capacity per hectare is slightly higher than fixed panels. The increase in energy as compared to fixed panels as well as kW per hectare is quite independent of the distance between trackers.

The power per hectare can be a maximum of 1200 kW, but there can be a standard value of 500 kW/ha.

3.4- Electronics

This is the electronic control of the tracker, with its inputs and outputs.



An electronic assembly can control two trackers.

3.5- Accuracy data

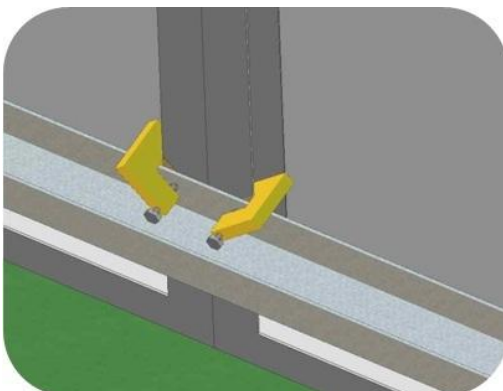
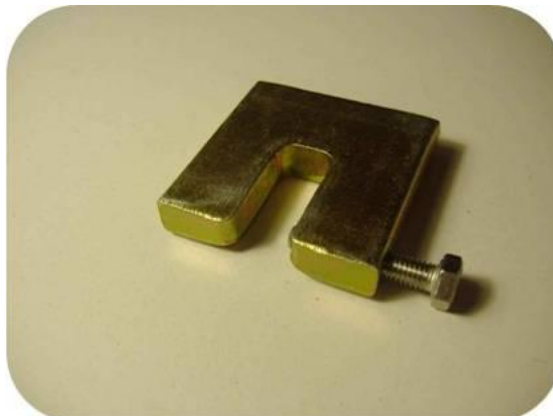
A single-axis tracker can only be accurate in its symmetry plane. The deviation of this plane with respect to the sun is only 1° . If the solar probe is installed the deviation is about 0.1° .

Therefore, apart from photovoltaic, this tracker is useful for solar thermal cylindrical-parabolic collectors.

3.6- Quick fixing system for panels and anti-theft devices

The clamps patented by FEiNA make it possible to place photovoltaic panels on fixed structures or on FEiNA trackers much more quickly and easily than with bolts or any other kind of fixing.

4 or 6 pieces are enough for each panel.





They are held firmly. We do not know of any of the 100,000 clamps on many installations all round the world coming loose. When the whole installation is complete, the head is cut off the screw holding it with a pair of pliers, which means it cannot be taken out except by cutting the whole piece. This makes it practically impossible to steal the panels. Noisy tools and a great deal of time are needed for each panel. It

is also a reversible system, if you want to remove the panels, this can be done with a little patience.

If this system is also combined with our anti-theft alarm, security is almost total.

If a solar plant with many panels is to be assembled, a piece of equipment for drill assembly can be supplied to help fix the pieces quickly.

3.7- Communications

The trackers are commanded from a central command.

Alongside this central command are an anemometer and a GPS. The anemometer is used for knowing the wind speed and arranges all the trackers that are put in place if the wind exceeds a certain speed (programmable by the user). The GPS is used at the beginning of the installation to send ground coordinates to all the trackers and the exact time each day.

From this control several things can be ordered to one particular tracker (they are numbered) or all trackers simultaneously move to a certain position, calibrate, stop, reboot, etc. You can also request the most important information from the trackers, such as knowing their position, time, if it has a position error, if the tracker was too slow, etc.

Simultaneously, all the information and commands that can be made from the master and also through a modem can be done from a website on the Internet.

3.8- Capacity according to the wind

Usable surface area according to the wind speeds that it must withstand:

	140km/h	175 km/h	205 km/h
SF70-1EH	70 m ²	55 m ²	46 m ²

If you are outside of these characteristics you must calculate for each support.

In areas that might experience hurricanes, (130 mph) since there might be a sufficient warning, you can make better use of the trackers by putting four anchors into the ground, putting the tracker horizontal, and tying it down for

safety. In this way you could put up to 90% of the nominal surface of the tracker.

3.9- For shipping

Weight: 750 kg

Volume for packaging : 0.7 m³

Container 40 feet: 35 units

3.10- Guarantee

Feina trackers have, by default, a 3-year warranty, extendable to 10 years, with a small surcharge of 6% of the price.

The warranty covers all parts of defective material or if there has been damage in normal use.

3.11- Production capacity

Trackers Feina has an estimated production capacity for the SF70 of:
40 units after the first 3 months of an order.

120 units at 4 months

300 units at 5 months

600 units at 6 months

1500 units at 8 months

4000 units in a year

3.12- Payment and terms

The complete network system includes the cards that must go on every tracker, central control, anemometer and GPS.

Price does not include assembly or transportation fees.

The method of payment is as follows:

40% of sum at the time of making the order
40% of sum at the time of receiving the material
The 20% remaining 60 days after the trackers have been delivered

Delivery time is a week if we have it in stock. If not, see the chapter on production capacity.

3.13- Maintenance

3.13.1- Scheduled maintenance:

Just grease the gears and friction parts once every 6 months. This may take 12 minutes for one person per tracker.

3.13-2- Non-scheduled maintenance:

After a few years it may be appropriate to review the possible occurrences of rust so as to apply an anti-rust treatment.

Control, repair and replacement of damaged and parts failures.

Trackers Feina can take care of the maintenance for a small annual cost.

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