Instruction Manual
Solarbrain
DegerHellas LTD

Manual Name	:	Solarbrain
Version	:	V3. 2022-02

Edited by	:	Alexandrou Angelos, Electrical Engineer Platanou Diamanto, Mechanical Engineer
Approved by	:	Dr. Markopoulos Ioannis, Mechanical Engineer

Table of contents

1 Notes on this Manual

1.1 Scope of validity

This manual describes capabilities of the product and the procedure for its installation.

 Store this manual where it will be accessible at all times.

1.1.1 Instruction manual

The Manual should be stored with care and must accompany the machine during its lifetime.

- All pages are important and must not be removed, teared-up or modified.
- The manufacturer, at the request of the User, may provide additional copies of the Manual of the machine.
- The manufacturer reserves the right to modify the product and make improvements to the machine without informing the customer, and without updating the Handbook already delivered to the user.

1.2 Recipients

This manual is for the use of Installer, Operator and Service Persons. The tasks described in this manual may be performed by trained technician/electrician able mentally to understand and operate the specific type of equipment.

"OPERATOR" means the staff responsible for operating, adjusting, cleaning, performing maintenance on the machine.

"TECHNICIAN" means a person who, according to their professional training and experience, possesses sufficient technical knowledge related to the operation mode of the described board and is able to plan and coordinate any installation and maintenance. Technician is well versed on procedures of work safety and accident prevention.

1.3 Glossary and Symbols

The following explains the abbreviations used, and the meaning of the symbols to indicate the operator status and the state of the machine .Their use allows to provide information necessary for the proper use of the machine in conditions of safety rapidly and unequivocally.

1.3.1 Glossary

OPERATOR: Person in charge of installing, operating, adjusting, maintaining, cleaning, repairing or transporting the machine (Annex I, 1.1.1 Directive 2006/42/EC)

STATE OF THE MACHINE: The state of the machine includes the operating mode, for example, automatic gear, maintained action control (jog), shutdown, etc..the condition of safety devices on the machine like protectors included, excluded patrons, etc..

RESIDUAL RISK: Risk that could not be eliminated or sufficiently reduced by design, against which the guards are not (or are not totally) effective, the user is given the information of its existence and the instructions and warnings to allow exceeded (see, respectively, 5.4 and 6.5.1 of the European standards EN 12100-1 and EN121000-2);

COMPONENT OF SAFETY: It means a component used to provide a safety function and whose failure or malfunctioning endangers the safety and / or health of persons exposed (eg. lifting tool; fixed, mobile, adjustable protector, etc.., electrical device, electronic, optical pneumatic, hydraulic, that enslaves, ie interlocks, a protector, etc..).

1.3.2 Symbols

Dangerous voltage

Do not remove the safety devices?

In case of fire do not extinguish with water

Gloves for protection against electrical hazards required

Safety goggles required

1.4 General Information

1.4.1 Manufacturer

DegerHellas LTD
Energeiaka Sistimata
169 Great Alexander Str. 13562
Agioi Anargyroi, Athens, Greece
T: 2110127290 F: 2110127293
E: info@degerhellas.gr

2 Scope of delivery

Check the delivery for completeness and for any visible external damage. Contact us as soon as possible if anything is damaged or missing.

Qty	Description
1	Solarbrain
1	P.S.U.
1	Set of CAN-BUS cables

3 Introduction

It is well known that the efficiency of the solar installations is being affected by shadows. These shadows may occur due to the existence of trees or buildings around the PV Plant or because of other trackers. Especially in the morning and late afternoon, these shadows grow bigger, so that the efficiency of the whole PV Plant is being decreased.

At this crucial point, a new technology comes to bring the solution! The backtracking technology drives the tracker in the position where there is no shadow and by using the MLD sensor we can achieve the highest power!

DegerHellas designs and manufactures the **Solarbrain** for HSAT (Horizontal Single Axis Trackers), a device which is connected with the solar park and by using backtracking algorithm determines the optimized tilt of the tracker in order to achieve the maximum efficiency. Moreover, each of the 1axis tracker is not casting any shadow to the neighbor tracker (in west or east) at any time! In addition, you can choose the accurate position of your tracker by doing the settings on your own!

HSAT WITHOUT "BACKTRACKING" FUNCTION

HSAT WITH "BACKTRACKING" FUNCTION
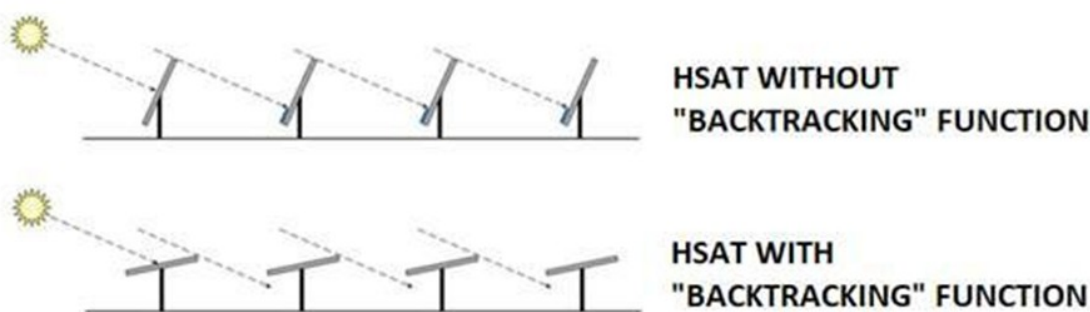
4 Installation
4.1 Safety

If the Solarbrain is going to be mounted on a wall, use the appropriate tools and wear all the P.P.E.

4.2 Physical Installation

The dimensions of the device are 220mmX140mmX60mm and it weights approximately 700 gr.

Photos of the As-built device as shown below:

5 Electrical Connections

The Solarbrain has four ports in total, from which three are placed in the front panel and one in the back. On the left side, there are two identical round connectors that are connected with the CAN-Bus cables. In the center, there is a RJ-45 jack used for Ethernet connection with a router or a network switch. At the back panel on the right side is placed the DC power jack and next to it, is the fuse of the device.

6 Parts
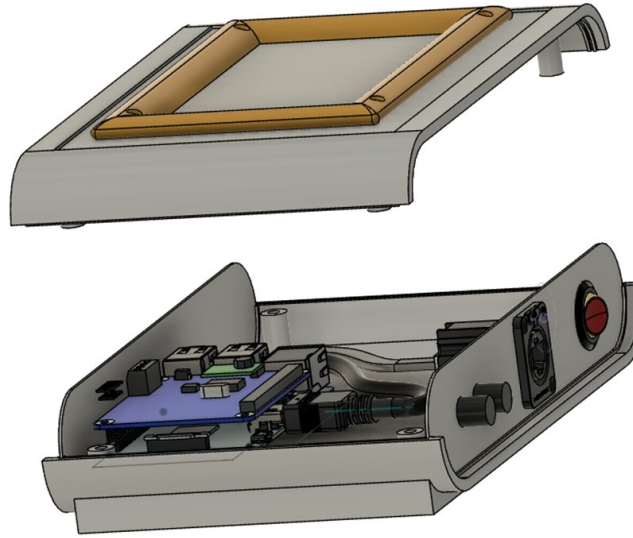
Description

The **main parts** of Solarbrain are:
- the box enclosure, which contains all the electronic parts
- a raspberry pi, a raspberry CAN-Bus Board
- a five-inch touchscreen which allows you to control the position of the trackers.

Solarbrain connects to the Internet via its Ethernet plug, while you can turn it on/off by its switch. Also, some mini fans are used for cooling the electronic parts.

A 3D printed frame is used for the protection of the screen.

7 Software/Firmware

Control and monitoring software that adds backtracking capabilities to solar tracking panels.

7.1 Solarbrain Panel

The Solarbrain Web U.I. consists of 2 main screens that allow you to have an overall look and view with great detail the daily plotted movement of all trackers as well as the wind speed.
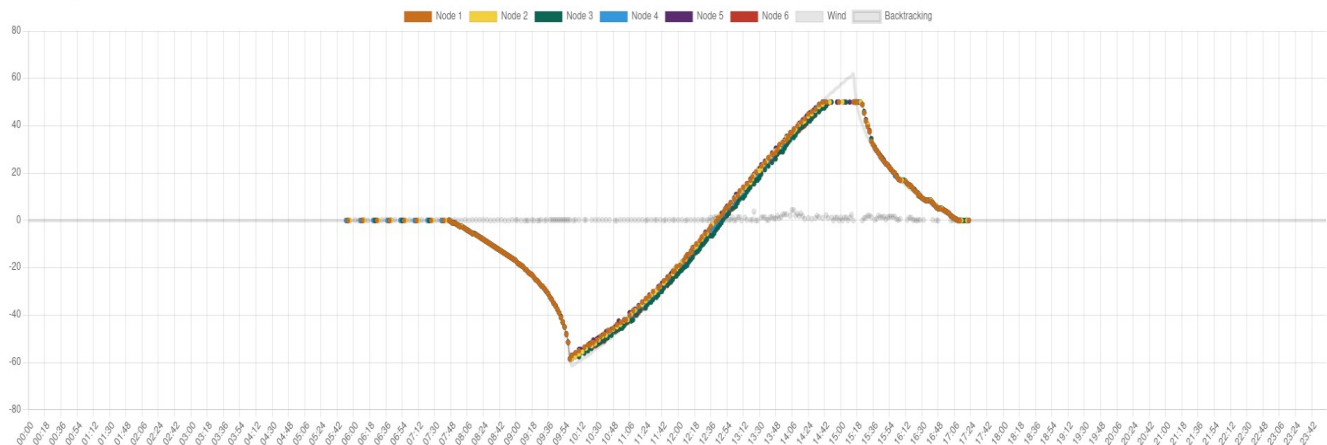
In this section, we view the daily backtracking angle along with the position of all our nodes throughout the day.

7.2 Backtracking

The Backtracking algorithm takes control of the solar trackers from sunrise to early in the morning and from afternoon until sunset. The purpose of the backtracking algorithm is to place each tracker at a specific angle. This happens to eliminate the shadows, which are caused by adjacent trackers when the elevation angle of the sun is low *(sunrise and sunset)*.

7.3 Modes of operation

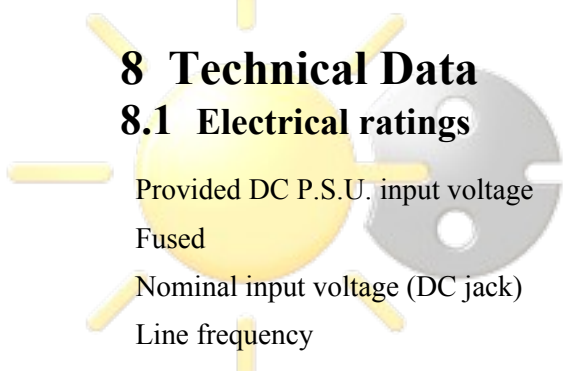|	
Normal use	The backtracking algorithm is enabled and the rest of the day the trackers are controlled via MLD sensor.
Water cleaning	The trackers are forced to be vertical, which means they face east position.
Grass cutting	The trackers are forced to be horizontal *(safe position)*, which means panels are parallel to the ground.
Test mode	The trackers are placed at angles specified by the astronomical algorithm.
Pause mode	The trackers will be controlled only via CTC Software and not from the Solarbrain.
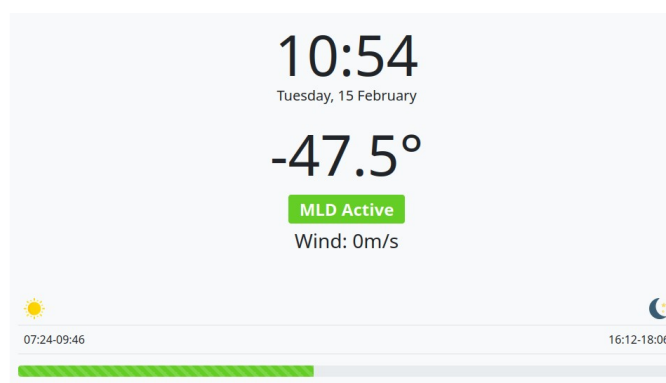
For example, we can set our nodes or zones to maintenance mode or fix their position if severe weather conditions are expected.

*Please bear in mind that Solarbrain as an IoT device, is capable of getting all its menu updates and new functionalities automatically.

8 Technical Data
8.1 Electrical ratings

Provided DC P.S.U. input voltage	220-240 VAC
Fused	4ADC
Nominal input voltage (DC jack)	12V/4A DC
Line frequency	50/60 Hz
Input power	≤ 48W

8.2 Electrical norms

IP protection class	IP 20
Flammability	UL50, UL94, UL746C
Electromagnetic Interference (EMI)	EN 61000-3 EN 61000-4 EN 61000-6
Directives	2014/30/EU 2014/53/EU 2011/65/EU

8.3 Climatic conditions general

Installation above sea level	max. 2000 m
Operating ambient temperature	-20 °C to +65 °C
Relative humidity	5% - 95%, non-condensing

8.4 General

Dimensions	220mm x 140mm x 60mm
Total weight	Approx. 700gr