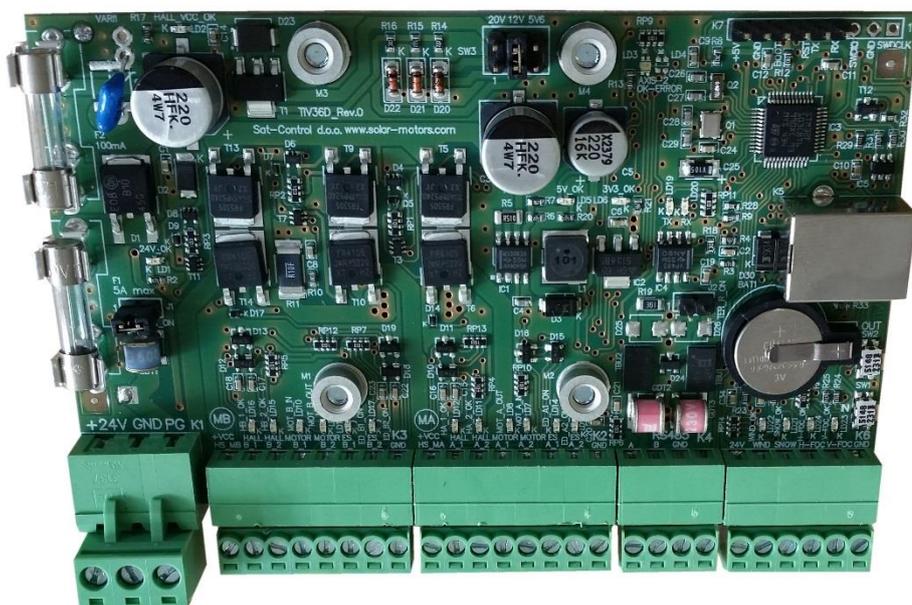
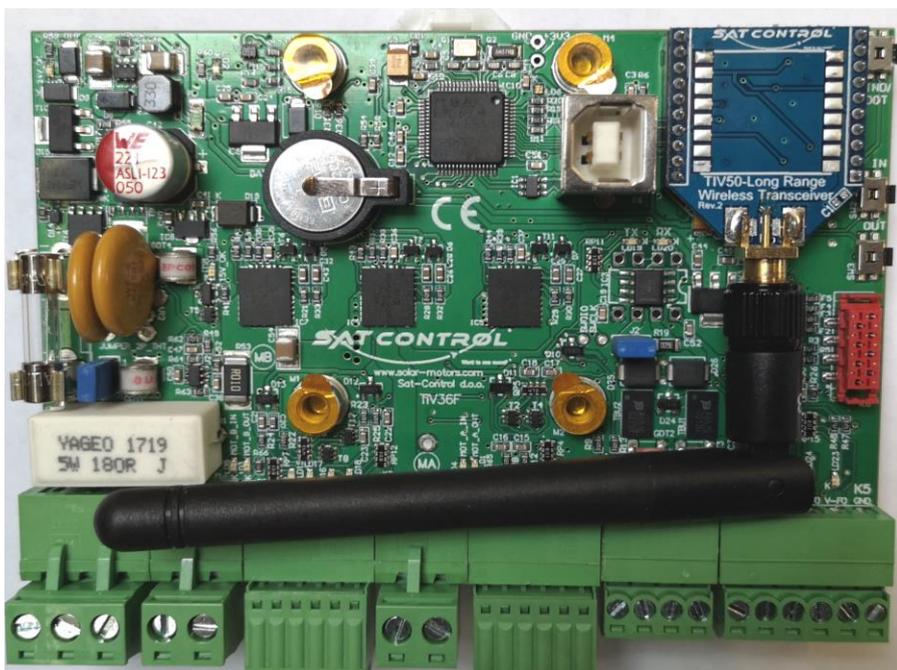


HELIOS ANALYTICS 2.0.26 for positioner MICRO-F User Manual

Document Rev. 2.0.26 dated 16-01-2024

Latest software with firmwares is available at: <https://solar-motors.com/tehnical-support/software-helios-analytics/?v=ce774d9cab3a1>



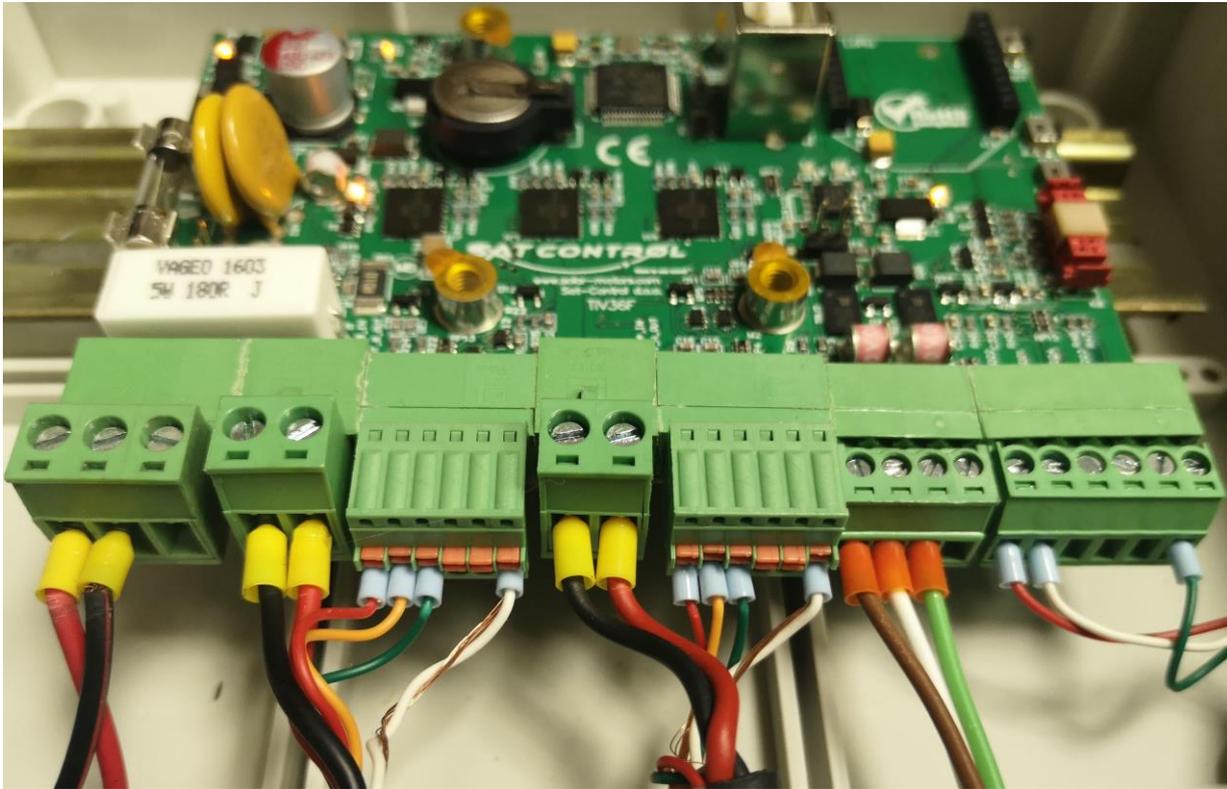
HELIOS ANALYTICS:

The basic tracker operation is not conditioned by the use of a PC, but it is necessary for first setup and it provides additional functions that can be useful for advanced users. In addition, different parameters of solar tracker can be seen in this menu.

CHANGING LANGUAGE:

Language can be changed in drop down menu System, menu Settings. Available languages are English and German. Your language can be add as well, but you have to translate the texts into your language.

CONNECTING/DISCONNECTING of MICRO-F positioner:



Connectors can be pulled out of the positioner and plugged in, without screwing each wire. We suggest though, you make sure that all screws are tied properly on all wires on both ends of cables (on motor side and on positioner side).

Make sure that all connection are made precisely as in the wiring diagram on page 21, otherwise positioner or motors can suffer damage!

BUTTONS:

Positioner Micro-F has two side buttons for manual motor driving, one runs Motor A towards retracted position (in) and the other button runs Motor A towards extended position (out).

If you press both buttons simultaneously at same time, green LED indicator will start flashing and manual operation will go into axis B mode, where one button runs Motor B in and the other button runs Motor B out. After few seconds of inactivity mode automatically goes into axis A mode.

Tip: If tracking is enabled, motors will automatically return to sun-tracking position. If you wish the tracker to stay in position that was set manually, take transparent fuse out of the junction box or disconnect power supply.

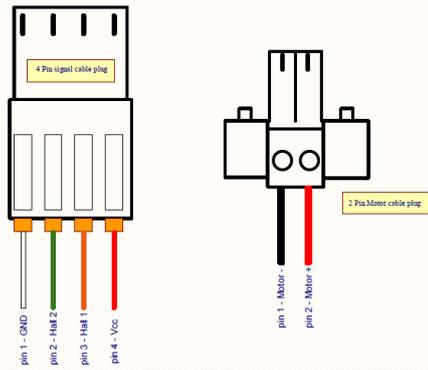
Attention:

- Note that all wiring must be done before running motors!

Motor Cable Color Connection Diagram

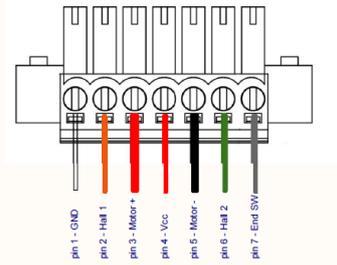
TIV25F

Motor - side connection

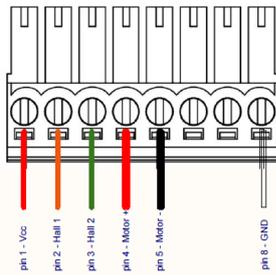


TIV25E

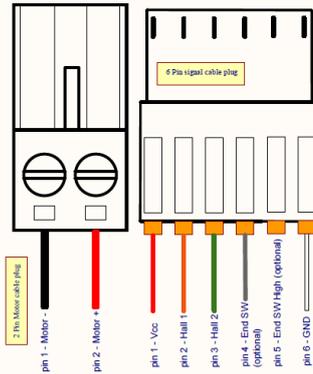
Motor - side connection



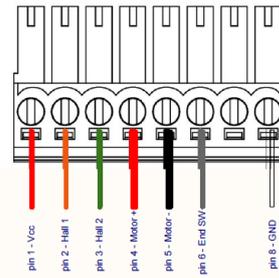
Positioner - side connection



TIV36F positioner



Positioner - side connection



Title		Revisions	
Size	Number		
A3			
Date	2.14.2003	Sheet of	
File	1_Pirkkop-MooreSchDoc	Drawn By:	

ATTENTION!!

- Changing values in the menu may influence the solar tracker operation!
- If you encounter problems with tracker, go to Chapter 50: Troubleshooting.

Each white input field displays the current value, i.e., the solar tracker setting. Clicking in a particular input field enables you to enter new value. When you are satisfied with the new value, press »**Enter**«. Entered value will be sent to positioner and **new** (changed) value will be showed. Some input fields are meant as indicators, so can not be changed (for example: supply voltage display). In such fields, changing value will not take effect.

CONNECTION: Positioner is connected to Helios via **USB bus** (default), RS485 bus (optional) or LoRa (Wireless option). Use shielded USB cable. After you connect positioner through USB cable to your computer, let windows install all drivers. The best option is to have internet connection, so the windows can install all drivers automatically. Windows needs to be updated to latest custom and security updates. In case this fails try with drivers which are described below.

Note: For RS485 you will need a RS485 dongle on the PC side, as PC does not have RS485 standard port. Please refer to additional paper. RS485 dongle is not a part of solar tracker and you need to buy it separately. RS485 dongle has its own driver to create virtual com port – VCP. RS485 driver you can download from this link: http://www.solar-motors.com/files/USB2RS485_DRIVER/USB2RS485_Driver.zip

For Wireless option you need LoRa module installed on your positioner board and a wireless converter with LoRa module on the computer side. Converter must be connected to computer via Micro-USB cable, where the same driver installation procedure as above applies.



Sat Control - Helios Analytics 2.0.19

File System Upgrade Support

Port: COM14 **Connect** Offline

Positioners Link: [] Version: [] Wind speed: [] km/h
 Type: [] RPM [1/min]: [] Overvoltage occur: []

Monitoring Advanced Sensors Options Wireless BLDC Loading Test

Overview
 Mode: [] Sunrise (solar, local): - Sun angle: -
 Voltage: 0 V V.battery: 0 V Sunset (solar, local): - Sun elevation: -

System settings
 Solar h/m/s: [] : [] : []
 Solar d/m/y: [] / [] / []
 GMT h/m/s: [] : [] : []
 GMT d/m/y: [] / [] / []
 Time zone: [] h [] DST
 Lon/Lat: [] ° [] °
 Moving interval: [] s
 Sync time Auto time zone setting
 Last Sync time: []

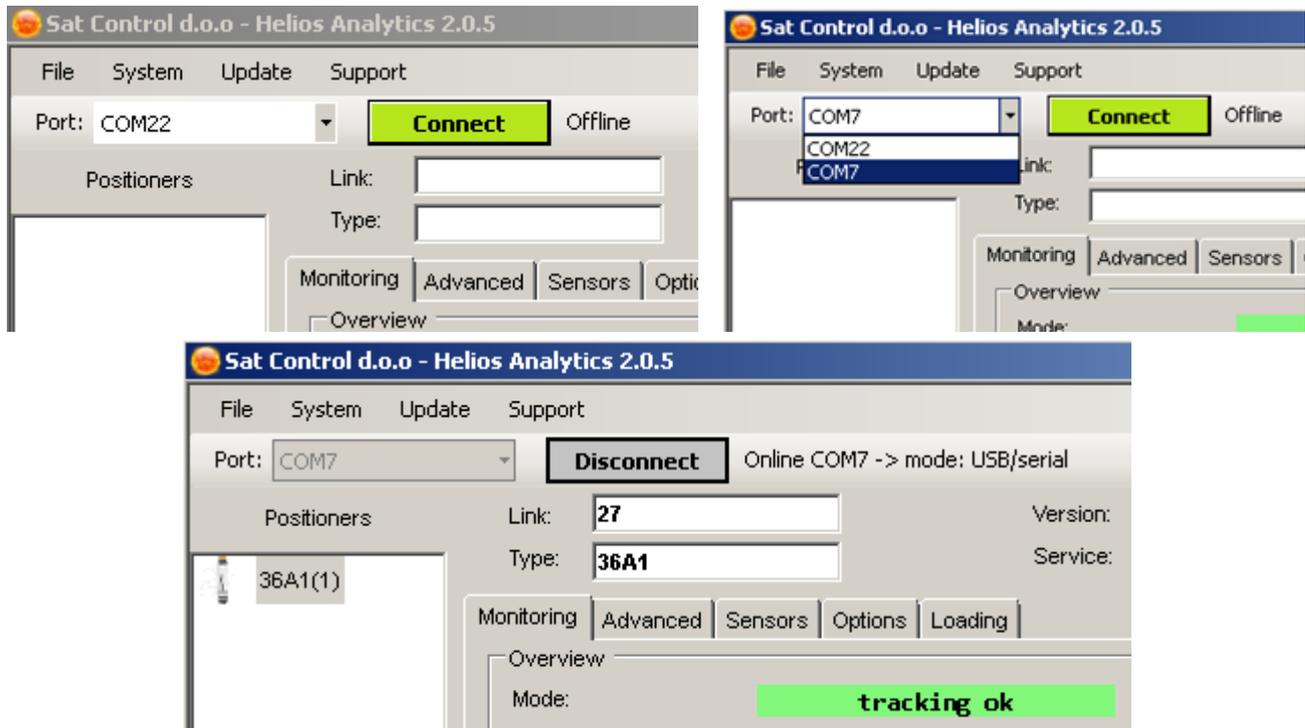
Tracker control
 Automatic tracking:

Motor A
 Angle: [] °
 Position: [] i
 Destination: [] i
 Current of motor: [] A
 Remain: [] i
 Status: []
 Error: []

Motor B
 Angle: [] °
 Position: [] i
 Destination: [] i
 Current of motor: [] A
 Remain: [] i
 Status: []
 Error: []

Common
 Power failed
 Button pressed
 Button stuck
 A end switch pressed - low
 B end switch pressed - low
 A end switch pressed - high
 B end switch pressed - high
 A loosing hall pulses
 B loosing hall pulses
 A&B async

For manual moving with the buttons below, the automatic tracking must be disabled!

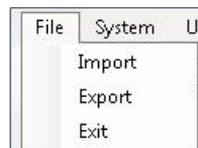


Positioners

Big white space on the left is a space where all positioners on communication bus are shown. When on USB, only one positioner will show. When on RS485 bus or wireless mode, up to 32 positioners can be shown, which can be picked with click.

Files dropdown menu

All values in fields can be **exported** into a file with extension "hss". It is useful to backup current settings. It is also possible to **import** values from saved "hss" file.



If you are unsure whether tracker's settings are correct, you can verify by simple maneuver:

- Check motor label and find parameter "Mech. version" (newer motors) or "MW ver" (older motors). Parameters at newer versions go from MC1 upwards (MC1, MC2, ...). Older versions are at separated by type (SM3, SM4S520M1, SM4S520M2, SM4S900M3) and those types have underclasses by number from 1000 upwards (1000, 1001, ...).
- **Applies to older version "MW ver."**: Basically, motors are the same with different markings. Translation table: http://www.solar-motors.com/files/INSTRUCTIONS_FOR_INSTALLATION_AND_USE/Mechanical%20versions%20-%20Translation%20table.pdf
- Find correct parameters in table Mechanical gears and common parameters: http://www.solar-motors.com/files/INSTRUCTIONS_FOR_INSTALLATION_AND_USE/Mechanical%20gears%20and%20common%20parameters%20-%20Prestavna%20razmerja%20in%20skupne%20nastavitve%20v%20parametrih.pdf
- Both tables are available under tab Support: <http://www.solar-motors.com/gb/support-d24.shtml>
- Another option is to verify motor's "Mech. Version" or "MW ver" and import suitable *.hss file in Helios analytics, which are available under tab Support: <http://www.solar-motors.com/gb/support-d24.shtml>

System dropdown menu

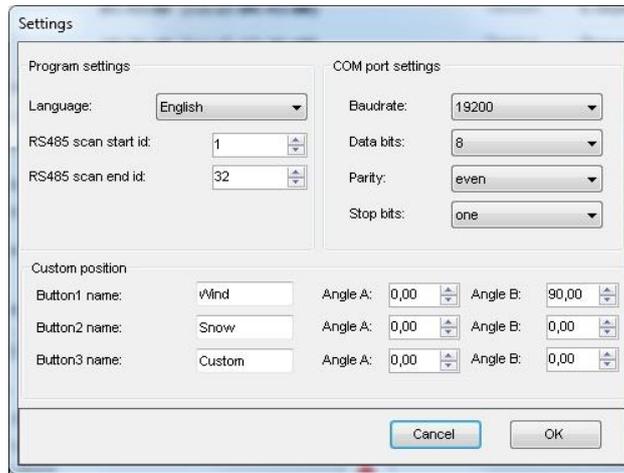
Menu includes two submenus: **Settings** and **Locking**.

Submenu Settings includes parameters "Program settings" box, "COM port settings" box and "Custom position" box.

Under "Program settings" Language and scan of RS485 IDs can be changed.

Under "COM port settings" communication properties for RS485 bus can be changed (already pre-set).

Under "Custom position" angle of three buttons in Helios Analytics main menu can be changed. Clicking on a button disables tracking and forces the position. See details in chapter 19.



Submenu Locking is not relevant for regular users.

Updates

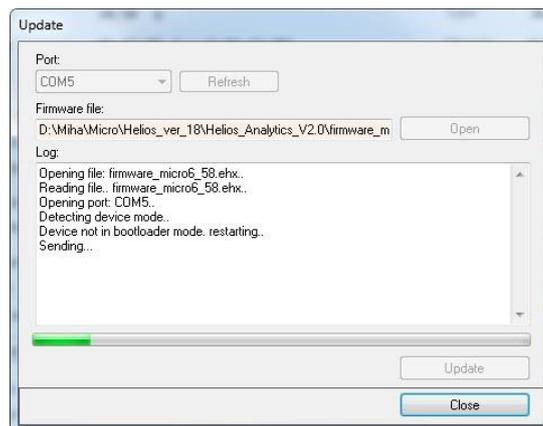
Driving software (firmware) in solar tracker is **upgradable**. It means that we constantly improve the program, which is running in your product. Latest firmware comes in a packet together with latest Helios Analytics software. You can download latest version from <http://www.solar-motors.com/gb/monitoring-programs-d489.shtml>.

Update via Helios Analytics

In Helios analytics program menu click Upgrade, select correct COM port and browse for latest downloaded upgradable file (*.bin or *.ehx for older boards). If you are using Micro-F and the bootloader version is B8.004 (second number as seen on picture bellow) or older, it is important to upgrade

Version: **8.023 (B8.006)**

bootloader first. To upgrade bootloader, select the file "Micro_bw.bin" and press "Update". Wait for the progress bar to reach 100% and LEDs on the board to stop flashing, and then you can upgrade new firmware. To upgrade firmware, select the file "micro_fw.bin" and press "Update". Wait until transfer reaches 100% and click "Close". If update is successful, new number of FW version will be shown. After upgrade procedure on older boards make sure to replace all "-nan" fields with "0" (Zero), if you don't know the appropriate value. "-nan" fields can cause the system to malfunction.



COM port

Before getting any data from solar tracker, select correct **COM port** and click button

Connect

To disconnect, click button

Disconnect

Port: COM7

Connect

Note: you need to have USB (VCP) driver installed. Drivers are included in the archive file.

Monitoring tab

Link

Indicates communication status. If the value is incrementing, Helios has a stable connection to Solar tracker. Otherwise check cables, re-plug USB cable and restart Helios Analytics.

SunTracer type

Is type of electronic module inside the tracker. You will be asked after it when contacting our service team.

SunTracer Version

Is version of program running inside the positioner. This parameter will change after upgrade.

RPM

Field shows current motor speed in number of rotations per minute [1/min].

Wind speed

Field shows value of the measured wind speed. Field is a copy from Sensors tab.

Overvoltage occur

Field shows value of overvoltage detection counter.

Voltage, V.battery

Current supply voltage connected to solar tracker and voltage of internal battery for RTC time and data keeping. If battery voltage is lower than 2.3V, replace it with new CR1225 lithium battery.

Sunrise (solar, local)

Displays solar and local time of sunrise for current day.

Sunset (solar, local)

Displays solar and local time of sunset for current day.

Sun angle

Displays current PM (Polar Mount) hour angle and AE(Azimuth-Elevation) azimuth.

Sun elevation

Shows PM and AE elevation.

Time

Current SOLAR time for your location (see geo. longitude/latitude). Note that solar time could differ from your zone time. It is correct only for your accurate geo longitude. The range for hours is 0-23, and minutes 0-59. Hint: if you set geo. longitude to 0.0, time must completely equal with GMT time.

Day/month/Year

Current date. Range of days is 1-31, months 1-12, of years 1970<.

Time zone

Time zone and **DST**: Parameters "Time zone" and "DST" (daylight saving time) applies to Sunrise and Sunset indication and has no effect on actual tracking.

If the **Auto time zone setting** is selected, Time zone and DST are placed automatically according to the current time zone set on your system.

Longitude, latitude

Indicate your geographical longitude and latitude (important for solar time calculation). Negative longitude values go west from Greenwich, negative latitude values go south from equator (southern hemisphere).

Moving interval

Means at what interval the solar tracker will correct its position to trace the sun. Possible values are from 60 to 900 seconds (1-15 minutes). If you check option "Resolution 0.1 degree" possible values are 1 ~ 900 seconds.

»Sync time« button

Pressing the »Sync time« button automatically sets the current time and date. If your time or date is incorrect (more than ten minutes), press the »Sync« button to open a wizard where you insert your local Longitude. Application automatically downloads GMT time from your computer and writes it in the solar tracker memory. Last time synchronization showing sings **Last Sync Time**. Synchronizing time cause a correction factor **RTC correction** or **Soft. RTC Correction** (visible in the Advanced tab).

Note: The mean solar time used by the solar tracker is set for your geographical longitude, and differs from your zone time. Therefore do not change it after synchronizing.

Enable, disable buttons

Enable button enables tracking, **Disable** button disables tracking.

H/V alignment button

Pressing this button causes solar tracker to move in complete horizontal position. This is necessary during mechanical setup to align tracker correctly to the sun.

A rectangular button with a light gray background and a thin border, containing the text "H/V Alignment" in a dark gray font.

Pre-set angles are: motor A = 0° and motor B = 90.0°. If panels (or mirror,...etc) are not in horizontal position after motor were stopped and some minor shift appear, you need to adjust it mechanically (screws, clamps) to get proper horizontal position. For completely horizontal position, take spirit level as a sufficient measuring device.

Snow button

Pressing this button, automatic tracking will become **disabled** and tracker will turn the panel into snow position.

Wind button

Pressing this button, automatic tracking will become **disabled** and tracker will turn the panel into wind position.

Custom position buttons

These are predefined buttons with predefined angles. You can use them, for example, for emergency park position in strong wind or in high snow to park it in position for cleaning snow from the panels or your custom park position. Pressing any of these buttons, automatic tracking will become **disabled** and tracker will turn the panel into desired position. You can **define** all three buttons on your own: navigate to "System" and press "Settings". Change text, angle A and angle B. See chapter 2.

»Do reference A/B« buttons

Use buttons to synchronize motor counters with its real position. In case of any change between real axes position and internal counters (impulses) or after mechanic/electronic service synchronization needs to be done. A and B designate the A and B axis motors. After pressing each button, motors will retract (run in negative position), until they are stopped by the end-switch. When motors stop, positioner is synchronized with actual motors position.

Attention: If system is not synchronized when in tracking mode, motors could suffer severe damage! Do not use this function if end-switch is not installed properly, is disconnected or it is damaged! (Instead use Overcurrent homing functions under "Options" tab)

By clicking *Do reference A/B*, errors will be cleared automatically.



Stop motors button

Pressing this button stops the engine unconditionally.

Clear errors button

By pressing this button, all errors that have been detected and are no longer present are erased.

Reset button

By pressing this button, the positioner is restarted.

Angle A, B

Parameters show current angle for each tracker axis. Angle A usually means hour angle and angle B elevation. Hour angle has negative values in the morning and positive values in the afternoon. If you want to set tracker to specific angle, disable tracking, insert number into field "Angle" (in degrees) and press enter.

Position, destination (A/B)

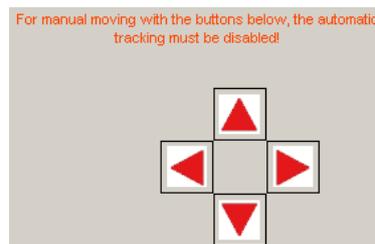
Parameters show current destination and position in millimeters. Those values can be used to diagnose the solar tracker operation.

Current of motor, A,B

Show current of each motor at that moment in Amperes [A].

Manual movements with buttons

With 4 red buttons you can manually move both axes. If you wish to move axes manually by arrows or inserting angle, Automatic tracking must be disabled.



Parameter "**Mode**" indicates current status of tracker:

- » **tracking ok** « - automatic tracking enabled, the Sun is above the horizon, tracking is possible (according to mechanical range)
- » **sun too far** « - automatic tracking enabled, Sun is unreachable
- » **night mode** « - automatic tracking enabled, during the night

- » **tracking disabled** « - automatic tracking disabled

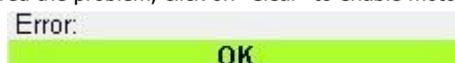
Status (A/B)

Indicate a current operating status of tracker ("← moving in", etc.)

Error (A/B)

Indicates that an error occurred when tracking.

If status shows an error and you have already solved the problem, click on "Clear" to enable motors again.

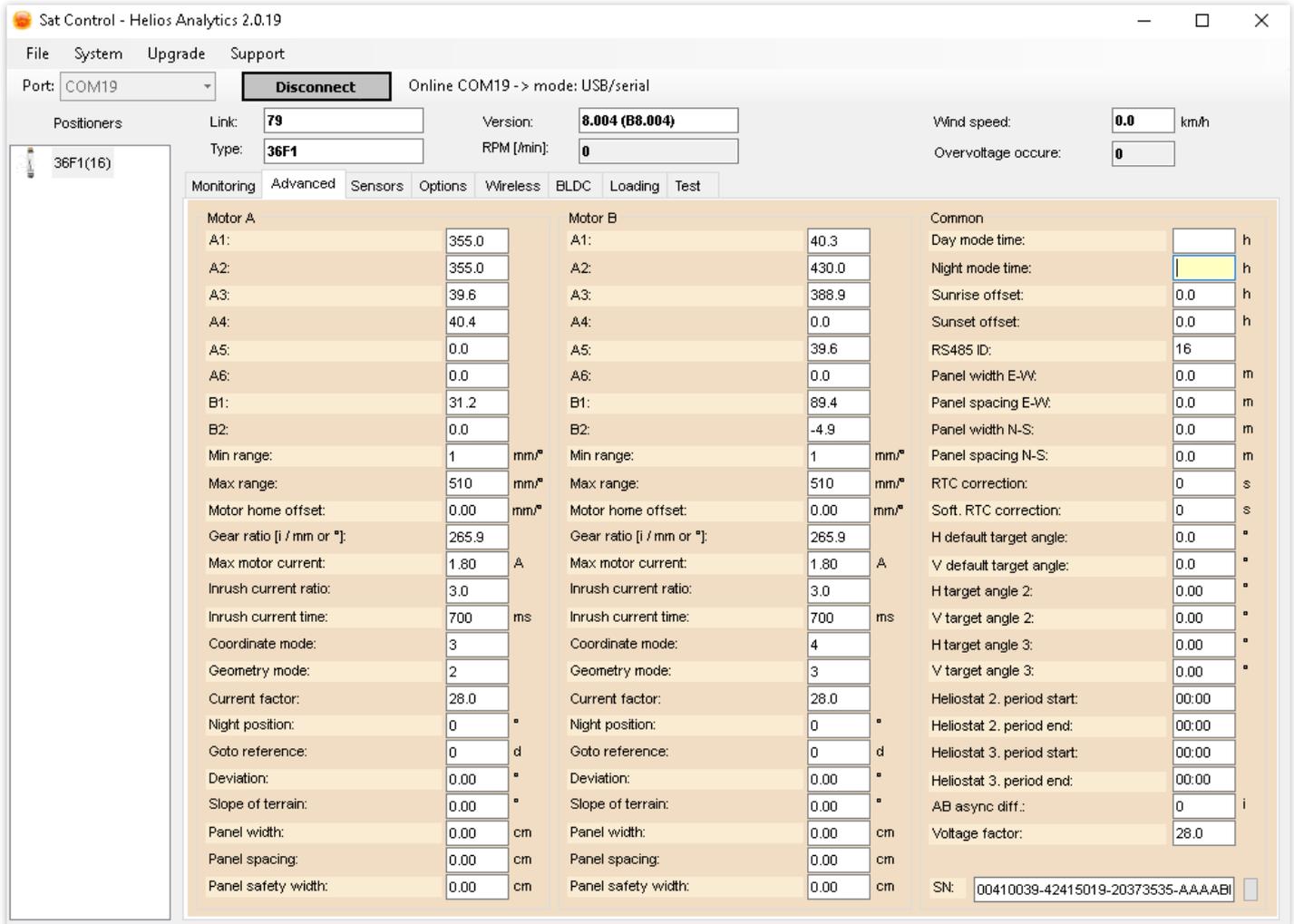


- **overcurrent:** motor's high current exceeds limitation setting
- **hall:** position feedback sensor signal failed
- **too long ref:** going to reference is too long
- **cable:** bad connection between motors and positioner
- **end switch pressed:** the motor is stopped due to the end switch pressed (low or high end switches)
- **stopped by overvoltage:** the motor is stopped due to overvoltage occur

Common

Box indicates warnings and actions that tracker is performing.

- **Power failed:** this flag is set after each power fault (use Clear errors button)
- **Button pressed:** when the button on positioner is pressed the box is checked
- **Button stuck:** button is being pressed for longer time and is probably stuck
- **A/B end switch pressed - low:** motor is at the lowest end – reference position
- **A end switch pressed - high:** motor A is at the highest end. The field is used when the stop & clear input and wind secondary input options are not selected (tab options).
- **B end switch pressed - high:** motor B is at the highest end. The field is used when "Go to reference" input and snow secondary input options are not selected (tab options).
- **Stop & Clear input(7):** When pin 7 on orange plug is connected to GND, flag appears. For more information see title *Options tab*, chapter 42. The field is used when the stop & clear input option is selected (tab options).
- **"Go to reference" input (6):** When pin 6 on orange plug is connected to GND, flag appears. For more information see title *Options tab*, chapter 42. The field is used when the "Go to reference" input option is selected (tab options).
- **Wind secondary input (7):** When pin 7 on orange plug is connected to GND, flag appears. For more information see title *Options tab*, chapter 42. The field is used when the wind secondary input option is selected (tab options).
- **Snow secondary input (6):** When pin 6 on orange plug is connected to GND, flag appears. For more information see title *Options tab*, chapter 42. The field is used when the snow secondary input option is selected (tab options).
- **A/B losing hall impulses:** position feedback sensor signal on specific Motor does not match the actual one.
- **A&B async:** Only in synchronous run mode. If »A-B asynch.diff« value is set and actual difference between A and B exceed this value the flag appears and the motors stop.



Coordinate mode

Means which coordinate system astronomic equations are used. Generally used is Azimuth-Elevation system (AE), other less known is Polar-Mount system (PM).

Note: If you are using our tracker, parameters are already set.

Coordinate m.	1	2	3	4	5	6	7	8	11	
Geometry m.										
1	X	X					X	X	X	Slew drive azimuth, elevation tracking(coordinate 11 azimuth only [Deviation=0°])
2	X		X		X		X	X	X	Azimuth / Hour angle tracking (coordinate 11 Deviation=0°)
3		X		X		X	X	X		Elevation tracking
11									X	Slew drive Elevation tracking (Deviation =90°)
13									X	Elevation tracking (Deviation =90°)

Coordinate modes 5 for Hour angle and 6 for Elevation angle is used in Heliostats. For tracker to operate as heliostat, check "Heliostat" under tab Options and define parameter "Target" under tab Advanced parameters.

Coordinate modes 7 (Azimuth) and 8 (Elevation) are used in mixed motor systems, when one motor is slew drive and another linear one. When geometry modes 11 and 13 are in use, tracker's horizontal position is 0° and vertical position is 90° (opposite of other geometries).

Geometries

Different trackers have different geometries. Geometry includes parameters **A1-A6, B1, B2** and number of selected geometry **geometry mode**.

Note:

- ♦ If you are using **our tracker**, parameters are already set. **Do not change anything.**
- ♦ If you have **your own** tracker, see Geometry document available on our web page or contact our technical support.
- ♦ If Geometry mode is 0, axis is **not in use** (disabled). It will not be controlled.
- ♦ Geometry mode parameters are fixed by purchasing conditions. Contact our sales team to add additional geometries.

Motor A/B – Coordinate mode 11

Coordinate mode 11 is calculating best trajectory for one-axis trackers. Whether trackers are Azimuth / Hour angle / Elevation based, correct Geometry mode should be picked.

Parameters are used for anti-shadowing function:

- **Deviation** (Azimuth / Hour angle only): fixes physical deviation, when tracker is not pointed directly to south at 0° (Rotation parallel with earth, refer to page 20; scheme *Coordinate mode 11* – angle Beta)
- **Slope of terrain** (Elevation only): Useful for powerplants - modifies anti-shadowing regarding terrain angle (Rotation perpendicular to earth, refer to page 20; scheme *Coordinate mode 11* – angle Alpha)
- **Panel width (anti-shadowing function)**: Width of full tracker surface
- **Panel spacing (anti-shadowing function)**: Distance between trackers pillars
- **Panel safety width (anti-shadowing function)**: Panel thickness

Moving properties

Positioner measures motor movement with hall incremental encoder. **Max range** defines maximum permitted impulses, at which motor will stop. Above, motor will be hard stopped. The same goes for **min range** limit. Relation between impulses and degrees (slew drives) or millimeters (linear motors) is defined by gear ratio. **Gear ratio** is counted number of impulses by positioner per one degree or one millimeter.

Note: In case of using our tracker, parameters are already set.

Inrush current ratio, Inrush current time

Inrush current time defines for how many milliseconds current higher than "Max motor current" is allowed. It is limited to "Max motor current" multiplied with "**Inrush current ratio**". This setting is useful in cold weather when motors consume more current in startup.

By default it is set to our motors specifications:

Inrush current ratio = 3

Inrush current time = 500-700 ms

Note that those parameters will take effect in positioners "Micro" with firmware *6.40* or higher and in positioners "TIV27x" with firmware *6.58* or higher or firmware 8.000 or higher

SHORT-CIRCUIT PROTECTION: On Micro F revision 4 boards and forward, there is internal comparator used for short-circuit detection. The parameter "Inrush current ratio" also affects the functioning of this protection. There are 3 different detection speeds based on this parameter:

- Inrush Ratio ≤ 2.99 : HIGHSPEED comparator mode
- Inrush ratio ≥ 3.00 & < 4.5 : MEDIUM SPEED (Default)
- Inrush ratio ≥ 4.5 : Short circuit detection comparator disabled (mosfets will burn if short-circuit occurs)

When overcurrent detection is changed on one axis, it applies to both axis. Most motors should be able to use HIGHSPEED detection, but if motor has large capacitor across its terminals, it will detect it as short circuit.

Sunrise offset , Sunset offset

Sunrise and sunset can be delayed or sped up.

Night position

Is the position in degrees where the tracker will be parked during the night (between Sunset and Sunrise). You can disable night position with typing **off** in this window. This cause that the motor A or B with disabled night position will not move to night position and it will stay at last position driven before sunset or at last manually turned position. You can disable only motor A or motor B, both or none. If you disable B motor, you save one cycle of lifetime of motor each day. For example: By the tracker with 2 linear motors model ST44M3V15Por ST44M2VxP, the night position for motor B can be disabled, because the position of the elevation at sunset is practically same as the position of sunrise. This way the motor at night is not moving anywhere and lifetime of motor is increased.



SN

Is a serial number of solar tracker positioning module.

RS485 Id

Is ID number for RS485 bus. The tracker will respond only to this number.

Note: changing ID during use of RS485 mode can cause communication to be lost. Set proper ID via USB.

Voltage factor and Current factor

Are voltage and current measuring factors that can be used to calibrate the exact measured values. Those values are pre-set at 28. Increasing this number will cause the measured values to be smaller.

RTC correction, Soft. RTC correction

Applies to real time clock divergence. If time is faster or slower than real solar time (expected difference is less than a minute per month), then you can set this value to correct this divergence. Value entered in this field translates to added or subtracted inserted seconds per a day.

Checked parameter "RTC Software" in the options TAB means that when 24V power is present, clock shall run "Soft. RTC correction" but when 24V power is not present, the "RTC correction" is applied. If "software RTC" box is left unchecked, only hardware clock and "RTC correction" is used at all times.

AB async diff

Applies when both motors are supposed to run parallel into a specific direction (useful when one controlling unit is used to control two 1-axis trackers). The value is maximal permitted difference (impulses). The asynchronous function is enabled under Options tab.

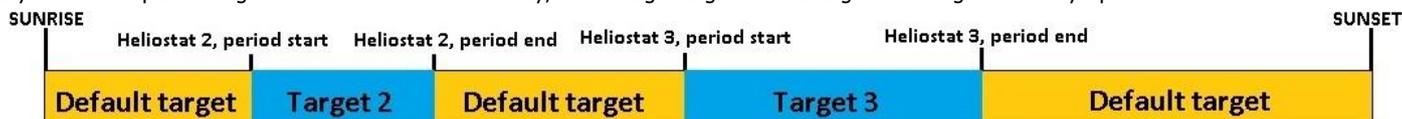
H/V default target angle

Applies to Heliostats only. Parameters define horizontal and vertical angle at which solar tracker sees the target. Target is the point in a front of the tracker, where you want to have a spot. Positive angles are up from the horizon (vertical direction) and west from the south (horizontal direction). Negative are below the horizon (vertical direction) and east from the south (horizontal direction).

Note: For tracker to operate as Heliostat, check "Heliostat" in Options tab and set correct "Coordinate mode" in Advanced parameters tab.

H/V target angle 2/3, Heliostat period 2/3 start/end

If you desire separate targets in different slices of the day, insert target angle and starting and ending time of day's period.

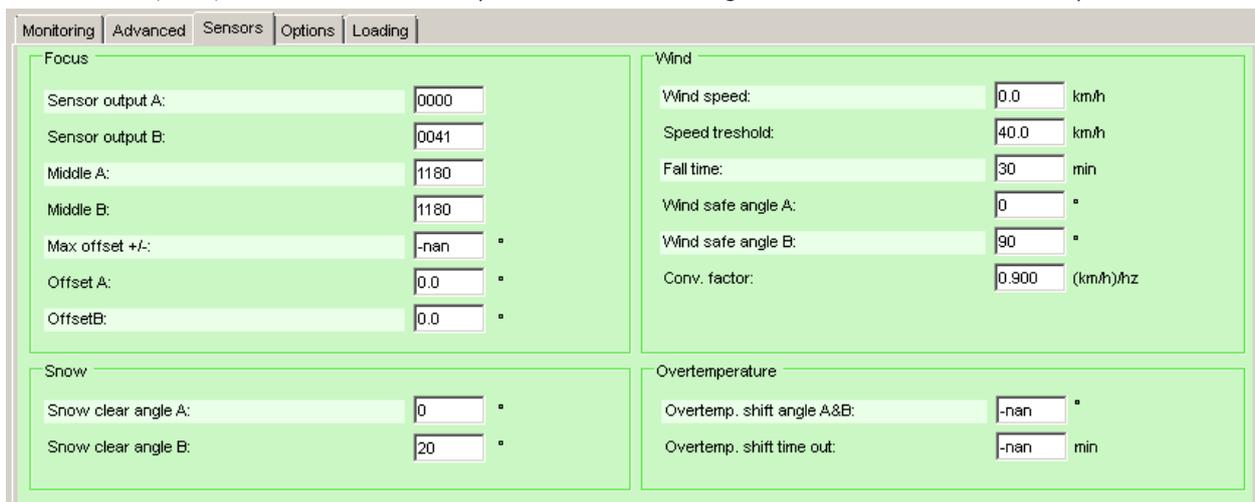


Motor stop time & Freewheeling speed

These two parameters affect how the motor is stopped. Motor stop time determines how much time before destination is reached, the motor starts the stopping procedure. Freewheeling speed is used to calculate the stopping time under load. Avoid changing these manually. Default parameters provide sufficient accuracy. These two parameters can be measured automatically, by setting stop time to 0. On the next move that is at least 10mm long, these two parameters will be measured and set automatically. To further improve accuracy, enable the high resolution mode in tab Options.

Sensors tab

Under tab Sensors focus, wind, snow sensor and over temperature sensors are configured. Sensors are enabled in the "Options" tab.



Focus

Solar Optical sensor function is enabled under tab Options.

Solar Optical sensor or Focus sensor is fine-tuning-only sensor to eliminate mechanical tolerances made by installation and therefore tracker achieves better accuracy. It is essential for concentrator applications. Sensor outputs are direct misalignment readouts for both axis. Expected values are from 0 to app. 2000 (@24VDC powering). According to the "Middle" values, offsets are incremented or decremented slowly to get sensor output values more or less equal to middle values. Offsets will be added to the tracker's angles.

Maximum offset parameter defines at which angle deviation the system will still find sun focus. When using Solar optical sensor for the first time, make sure weather is clear. Set parameter Max offset to "10.0" and observe what is maximum angle deviation in the morning and in the evening (**Offset A/B**). Then insert maximum angle deviation into parameter Max offset, increased by 1.0 (if maximum deviation through day was 2.4°, set it to 3.4°).

When weather is not completely clear the sensor cannot function properly and without "Low sun radiation sensor" tracker goes into previously set Maximum offset negative position. If you have Low sun radiation sensor installed (pin diode with switch, which pulls to GND when radiation is low), system detects it and tracks with last Offset A/B. "F:avg" will appear in Service line.

Low radiation sensor should be plugged into orange connector, pin No. 7 (previously A_end_switch_2). Low radiation sensor should pull down to GND when triggered.

Wind

Wind sensor feature is enabled under tab Options.

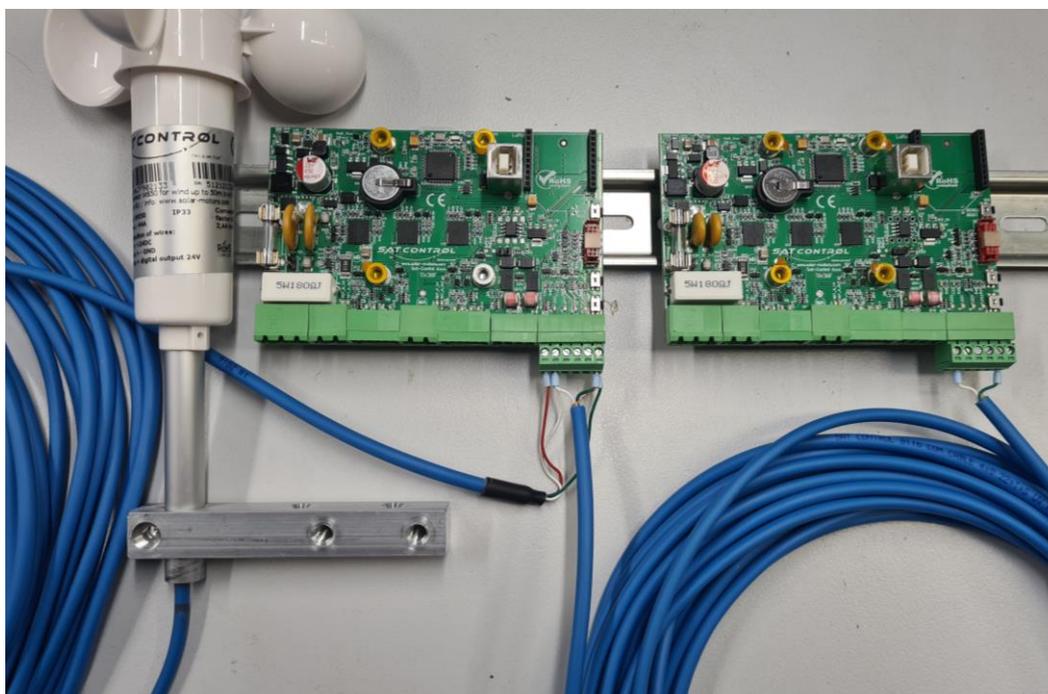
If the wind is strong it can damage the tracker. Therefore it is suitable to move panels into **wind save angle A/ B** (usually in completely horizontal position), when the wind speed exceeds **speed threshold** for the first time. After getting to wind save position, positioner will wait **fall time** long until going back to normal operation. If wind speed exceeds the speed threshold again, a new fall time period must be waited.

Wind speed is output data of the measuring wind speed. **Conversion factor** is factor of wind sensor meaning how much speed causes 1 revolution per second (at impulse types) or how much speed causes 1 volt. Sensor must be of **impulse** type – with no additional resistor by the reed switch (not current loop 4-20mA impulses output type).

Attention: There are two different wind sensor types on market, provided by SAT CONTROL. Older version with "Conv. Factor" = 1.22 and wired on 2 wires (until December 2013) and new version (from January 2014) with "Conv. Factor" = 2.44 and wired on 3 wires. New version also includes a label with parameter "Conv. Factor" and older version does not (blank).

Hint: You can disable wind mode on one axis by setting the "Wind safe angle" of the axis to *off*.

Wind	
Wind speed:	<input type="text" value="0.0"/> km/h
Speed treshold:	<input type="text" value="40.0"/> km/h
Fall time:	<input type="text" value="30"/> min
Wind safe angle A:	<input type="text" value="0"/> °
Wind safe angle B:	<input type="text" value="90"/> °
Conv. factor:	<input type="text" value="0.900"/> (km/h)/h ²



One wind sensor can be connected to multiple positioners as shown on this photo. Note that shielding of the cable (if available), is connected to GND on one end. For one sensor to work on multiple positioners properly, all Micro-F firmwares must be updated to at least version 8017.

Snow

Snow function can be enabled under tab Options. When Snow sensor is enabled, Overtemperature shift is disabled.

When snow sensor is activated, the tracker will move into **snow clean angle A and B** so snow slides down (normally in nearly vertical position). If wind mode is activated, snow mode will be **disabled**.

Over temperature shift

Over temperature shift is enabled under tab Options. When Over temperature shift is enabled, Snow sensor is disabled.

In some applications it is necessary to shift panel out of ideal position to lower the temperature. Tracking is still enabled but shifted for an **Over temperature shift A and B** angle. When temperature drops the sensor is being switched off and the tracker will go into normal tracking after the **Over temp shift time out** runs out.

Tilt sensor

Micro-F positioner supports two modes of axis position encoder. The default mode uses Hall quadrature encoder integrated into the motor to measure extension of the motor. The second option uses tilt sensor (inclinometer), mounted directly under the solar panels.

To select Hall encoder for measuring extension of the motor on any axis, select: "Motor A/B sensor: Disabled"

When using Tilt sensor, select the right model of the sensor from the drop-down menu. MSK217S is a single axis tilt sensor, while BWK227S is a two axis sensor (similar sensors from BWSENSING also work). When tilt sensor is selected, the RS485 communication port is used for communicating with tilt sensor and can not be used for communication with Sigma server.



Note: Update positioner version to 8.025 or higher to support tilt sensor control.

Additional settings:

- **Gear ratio:** When tilt sensor is selected, make sure that gear ratio for that axis is set to 100, regardless of the actual motor gear ratio!
- **Min and Max range:** All parameters are measured in degrees (°) of the panels, when tilt sensor is selected for that axis. Measure the maximum range of the panels in degrees and set them in this field.
- **Geometry mode:** Geometry mode for axis that uses tilt sensor must be set to 1, to operate with angle of the panels only.
- **Coordinate mode:** For two axis tracker, set coordinate mode of the axis that tracks Hour Angle to 3, and axis that tracks Elevation to 4. For single axis tracker oriented in North-South orientation, set coordinate mode to 11.
- **A1:** Usually 180.0 for Hour Angle axis and 90.0 for elevation axis.
- **Motor home offset:** Use this parameter to tune the zero angle of the tilt sensor. For hour angle the neutral setting (zero offset) is 0.0 and for elevation axis it is 90.0 (you must change this to 90).
- **Rotation direction:** If motors are spinning in the wrong direction, change the setting "Swap direction of rotation" in Options tab. This must usually be done for the elevation axis motor. If the motor is spinning in the right direction but encoder is measuring direction wrong, change setting "Swap halls".

The advised method of mounting two axis tilt sensor is using 3 screws to fasten it on the bottom side of the panels on the aluminium frame. Correct orientation and accurate alignment of tilt sensor to the frame as noted below is important.

- **Two axis encoder:** +X should point to the east, -X to the west, +Y to north and -Y to south (when tracker is positioned parallel to the ground and aligned with south axis).
- **Single axis encoder:** +X axis should point to north and -X to the south (when tracker is in horizontal orientation)

The screenshot shows the 'Options' tab in the 'Sat Control - Helios Analytics 2.0.26' application. The interface includes a menu bar (File, System, Upgrade, Support), a port selection dropdown (COM13), and a 'Disconnect' button. The main area is divided into several sections:

- Positioners:** Shows '36F4(16)' selected.
- Link/Type:** Link: 46, Type: 36F4.
- Version/RPM:** Version: 8.029 (B8.006), RPM: 0.
- Wind speed/Overtoltage:** Wind speed: 0.0 km/h, Overtoltage occurrences: 0.
- Configuration options:**
 - A: Use one hall
 - A: Swap halls
 - A: Swap direction of rotation
 - B: Use one hall
 - B: Swap halls
 - B: Swap direction of rotation
 - Focus sensor in use
 - Wind sensor in use
 - checked: Snow sensor in use/ unchecked: Overtemperature shift
 - Synchronous run
 - Software RTC
 - Disable goto reference
- Motor A speed:** Normal
- Motor B speed:** Normal
- Options:**
 - Secondary communication bus
 - Resolution 0.1 degree
 - Heliostat
 - "Go to reference" input (END_SW-HI-B)
 - "Go to Wind mode" input(END_SW-HI-B)
 - Snow secondary input (END_SW-HI-B)
 - Stop & clear input (END_SW-HI-A)
 - Wind secondary input (END_SW-HI-A)
- Normally close endswitch:**
 - A: Low, B: Low
 - A: High, B: High
- Motor operation:**
 - A: DC
 - B: DC
- Hall voltage:**
 - A: 12.60 V, B: V
 - 12V
- Overcurrent homing:**
 - A: Enable, B: Enable
 - A: No switch, B: No switch
- Set the position MA as:** Reference [] mm/°
- Set the position MB as:** Reference [] mm/°
- Current limitation home A/B:** Buttons for 'Current limitation home A' and 'Current limitation home B'.
- Current detection share A/B:** 0 %

Configuration options flags

Sensor flags are available for the user. Here you can turn on external sensors: focus sensor, wind sensor, snow sensor. Other flags refer to mechanical configuration for which the motor was made. Some flags are mechanically depended and are not meant to be changed by user. Different motors can be configured here to set correct direction of rotation, direction of hall encoder counter or selecting a motor with only one hall sensor.

Motor A / B speed can be set to **slow** or **very slow** for motors with a lower number of hall pulses in one motor turn.

Software RTC: Unchecked: hardware RTC clock is used. Checked: Software RTC is used and Software RTC correction from advanced tab is applied when 24V is present.

Disable goto reference: not implemented yet

Options

Show which additional features and functions are available. Those features are free of charge and are included by default.

- **Secondary communication bus:** by selecting this this option also allows CAN communication in addition to USB.
- **Resolution 0.1 degree:** By selecting this flag, accuracy of tracking is improved to beyond 0.1°. The minimum setting of the **moving interval** (tab Monitoring) can be set to 5 seconds, instead of 60 seconds. When this function is enabled, motor stopping is controlled by a PID regulator and injecting braking current. This achieves that motor is stopped on the exact position as commanded. To extend the lifetime of the motors, it is recommended to disable this function on photovoltaic trackers, as such high accuracy does not improve their efficiency. When disabled, motors do not react to destination changes smaller than 0,5 ° or mm. To improve accuracy of any mode, make a **Stop time** calibration as explained in the Advanced panel section.

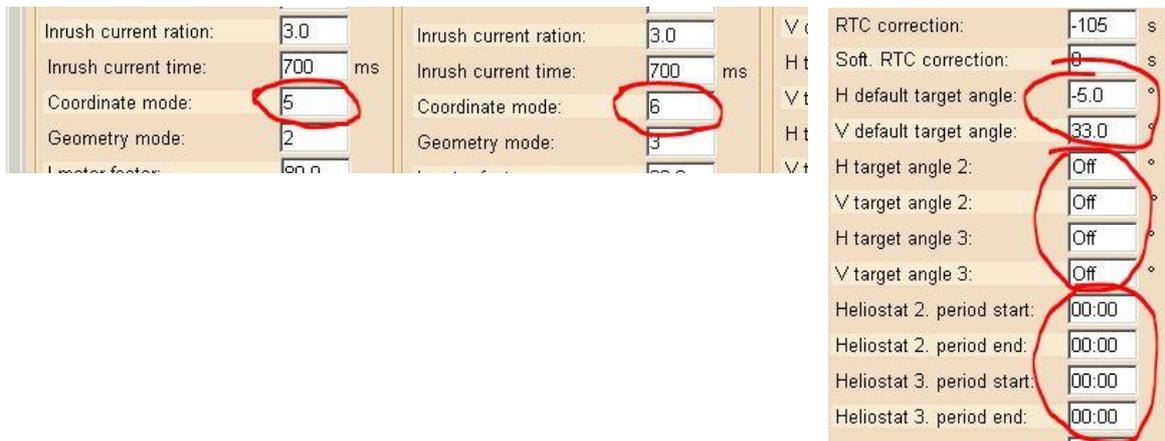
The screenshot shows a dialog box with the following fields:

- Time zone: 1.0 h
- Lon/Lat: 15.0000 ° 37.0000 °
- Moving interval: 20 s (circled in red)
- Sync time button

- **Heliostat**

Checked box mean that heliostat mode is allowed, but this does not mean that will automatically work as a heliostat mode. When you want to switch on the heliostat mode you need to setup the coordinate mode motor A to 5 and coordinate mode motor B to 6. Beside of this you need to setup the resolution 0.1 degree, time interval to 20 seconds and setup the at least default target or more targets and more periods.

Note: For tracker to operate as Heliostat, define its target in "H/V target angle" and set correct "Coordinate mode" in Advanced parameters tab.



- **"Go to reference" input (END_SW-HI-B)** enables external triggering of sending motors into reference. When *End-switch-Hi pin of motor B* is connected to GND (on falling edge), motors will search for reference point. For more information see title *Monitor tab*, chapter 20.
- **"Go to wind mode" input (END_SW-HI_B)** enables external input to send tracker into wind position. As long as input End-switch-Hi pin of motor B is shorted to ground, it will keep sending both axis in wind position as defined in Advanced tab. When input is disconnected from ground, the axis are available to receive the next automatic tracking or manual position command.
- **Snow secondary input (END_SW-HI-B)** enables triggering "Snow sensor function" and "Overtemperature shift function" on *motor B End-Switch-Hi pin* instead off from dedicated weather station connector. Handy if you are missing 6 pin sensor connector. If box is unchecked, functions are triggered from 6 pin sensor connector. Refer to Wiring scheme in chapter 51 *Supplement*. Function is defined in box **Check: Snow sensor in use / Uncheck: Overtemperature shift** under *Configuration Flags*.
- **Stop & Clear input (END_SW-HI-A)** enables the system to stop all motors by external button and clear any possible errors.
- **Wind secondary input (END_SW-HI-B)** enables Wind sensor reading on *End-switch-Hi pin of motor A* instead on *6 pin sensor connector*. Handy if you are missing 6 pin sensor connector. If box is unchecked, wind speed is being read from *6 pin sensor connector*. Refer to Wiring scheme in chapter 51 *Supplement*. Wind mode is enabled with checkbox **Wind sensor in use** under *Configuration flags*.

Normally closed end-switch

Each of the four end-switches can be selected to be of a "normally closed type" (conducting while not pressed, and opened when pressed).

Attention: If this setting is not correct for your motors, they will not work. You must not set this flag if you ordered tracker with our motors.

Motor operation

You can select the type of a motor between brushed (DC) motor, brushless (BLDC) motor or two synchronously operated DC motors.

Attention: If this setting is not correct for your motors, they will not work. You do not need to change this if you ordered tracker with our motors.

SYNCHRONOUS OPERATION: Select option "A and B synchronously" to operate both A and B motors at the same time. This option is used when two motors are fixed to the same axis of the tracker. Both motors must be fixed at exactly the same position before operating them synchronously, otherwise they can get seized. To achieve this alignment, loosen the clamps of the motors first so they can move freely and then press button "Do reference A" in the monitoring tab. Both motors will do reference at the same time. After reference is made, tighten the motor clamp bolts at the correct position. Now both motors can be operated synchronously as controlling a single motor on A axis. (All controls and parameters are used from the A axis motor).

Attention: For synchronous operation on TIV36F revision 1 and revision 2, you must reverse cables Motor-B1 and Motor-B2. For revision 3 and newer, pinout is the same as for normal DC motors. Firmware version must be updated to at least 8.007 to support synchronous functions.

Hall Voltage

Voltage that is supplied to motors for hall counting and end switch detection is measured and displayed here. You can also select between three different voltage levels that is supplied to motors logic board: 5V, 12V and 20V. 12V is usually recommended setting for our motors.

Overcurrent homing

If motor does not have low end switch or it is defective, you can select an option here to detect its reference (home) position by monitoring when the motor current rises above specified value.

Function is enabled by selecting **"Enable"** checkbox for each motor. Then you can enter the value in percent of maximum motor current at which the reference position will be detected. Buttons **"Current limitation home"** can be used to perform reference detection in this mode.

"Set current position Mx as:" Current position can be used as a reference position by pressing the button **"reference"**. Current position can also be defined as a certain distance on a motor by typing in the real position in millimeters. (Use ruler to measure current extension of the motor (distance from the outer tube to the end of the inner tube) and type in this distance. Reference position will be calculated from this distance)

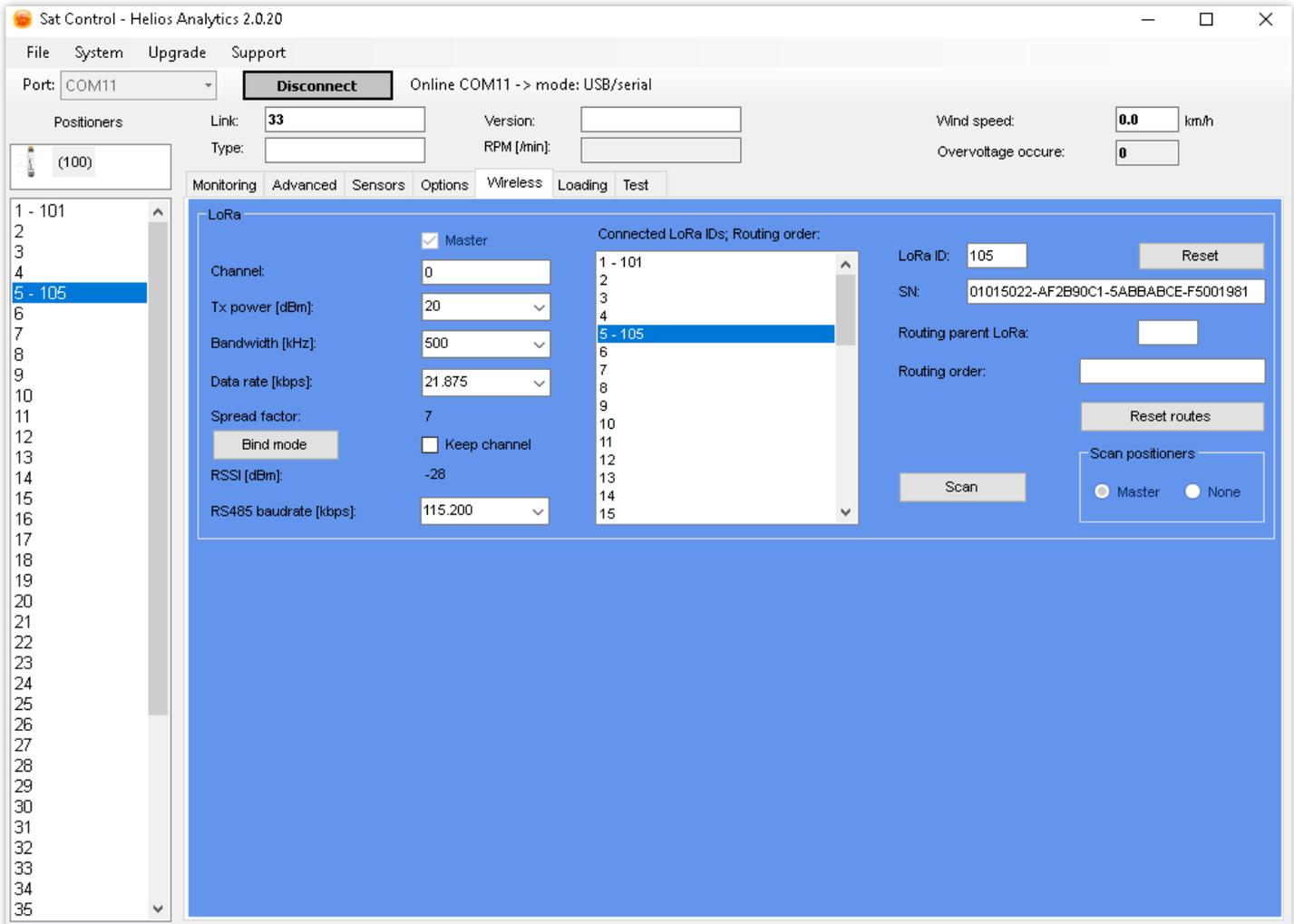
"No Switch" checkbox can be used, if the end switch in the motor is damaged and is constantly being detected as pressed. This setting will ignore the end switch.

Attention: If "no switch" setting is selected while operational end switch is available, the spring in motor end-switch will be damaged when performing reference detection, causing its permanent failure! If this happens, then you will have no choice but to keep this option enabled.

Wireless tab

Instead of cabled connection from PC to positioners, a wireless LoRa connection can be used. To enable wireless communication, a LoRa module on positioner must be installed and a master converter (with LoRa module) must be connected to PC via USB cable.

Wireless settings can be edited directly on the Micro positioner connected to PC via USB cable, or they can be edited wirelessly with a master converter only connected to PC. Both methods use the same wireless tab in Helios.



Link settings

- **TX Power:** You can select between different transmitting output powers. Higher power improves wireless link quality but may cause interference to other devices working on similar bands. Use with caution and check local legal rf power limitations. Possible power options are:
 - 11 dBm = 13mW
 - 14 dBm = 25mW
 - 17 dBm = 50mW
 - 20 dBm = 100mW
- **Bandwidth:** You can select between the following bandwidth options: 62.5, 125, 250, 500 kHz. Selecting higher bandwidth allows you to select higher Data Rate for faster communication. However, higher bandwidth limits the maximum number of Channels you can have.
- **Data Rate:** You can choose between multiple data rates in kilobits/s. Selecting higher data rate makes communication faster, but reduces maximum range of the signal. Different data rates are achieved by internally modifying the LoRa protocol Spread Factor value, which is displayed under data rate field.
- **Channel:** You can have multiple LoRa wireless systems working simultaneously, by assigning each systems its different channel. Each system consists of a master converter and one or more (up to 64) slave units. Maximum number of channels is limited and it depends on selected bandwidth. Channel 0 starts at the frequency of 433 MHz and each next channel is shifted by 1.5 times the Bandwidth value. Your max number of channels is then determined by max frequency you can use (Antenna specification or legal restriction on frequency use). To reduce interference between channels, use channels that are placed as far as possible from each other on radio frequency spectrum, if possible.
- **RSSI:** Received Signal Strength Indicator is a measurement of a strength of signal received in -dBm, meaning that the greater the absolute value in this field is, the more has signal been weakened. Generally, values above -80dBm will allow highest data rate settings, and values bellow -85dbm will require slower data rate settings.

Solar panels conducting current are a powerful obstacle for radio signal and can quickly deteriorate it to the point where it won't reach all slaves in the solar field. To ensure good signal quality over longer ranges, use coaxial radio signal extension cable (LMR-195 with RP-SMA connectors), to place slave antenna higher than solar panels and in line of sight with the master converter. For extreme distances, a directional antenna can also be used on master, slave or both ends. If this is not an option for you, try lowering Data Rate, or use Routing option.

Changing radio settings on master converter, will also automatically send settings to all slaves, and stay synchronized with them.

Attention: If slaves have too poor RSSI or are powered down at the time of configuring settings, they will not receive new link settings and thus will become unresponsive to new settings. Make sure all slaves have strong signal at the time of changing settings. If some slaves fail to receive new settings, you will have to change their settings manually or use Binding procedure.

Binding procedure

To allow synchronizing settings on all slaves when their signal is too weak to change settings remotely, a binding procedure can be used.

- Configure master converter with desired settings and channel.
- To enable binding procedure, first enable binding mode on master converter. This can be achieved by pressing the top button on converter (sw2), or by pressing »Bind Mode« button in Helios Wireless tab. Blue LED will light up, indicating that it is transmitting link settings in bind mode. Bind mode uses channel 0 and lowest possible speed to maximize quality of connection.
- Enter binding mode on slave units: Press the top button on Micro-F labelled "BIND/BOOT" (If you are using slave converter, press top sw2 button). Blue LED will light up, indicating that it is listening to bind channel to receive settings. As soon as it receives valid link settings, green LED will light up and then turn off. Slave is now configured with new settings.
- Exit binding mode on master converter by pressing the top (sw2) button again or "Bind mode" button in Helios. Blue led will turn off and then it should start communicating with slaves.

Bind by channel: If the slave has been lost while configuring Bandwidth and Data Rate settings (if you changed channel this will not work!), there is also an option to get it to bind to new settings without having to press button on slave, with a function bind by channel. In Helios wireless tab check the "Keep Channel" box and then enter bind mode. This sets master in bind mode, but doesn't change channel to 0 as in normal binding procedure.

All slaves that are not receiving any valid signal will be periodically checking every 20 seconds, if they can receive something in bind mode on their channel. Wait for about a minute and then turn Bind mode off. All slaves on this channel should now have the same bandwidth and data rate settings.

LoRa ID

Each slave unit must have its unique wireless LoRa ID defined. Lora ID 100 belongs to the master converter (preprogrammed, can't be changed), while slave LoRa IDs can range from 101 to 165. It is recommended that LoRa ID is set as tracker (RS485) ID + 100, to avoid confusion, e.g.: Tracker ID 15 uses LoRa ID 115. When assigning each positioner its unique tracker ID (RS485ID under advanced tab), make sure to also change LoRa ID in Wireless tab. If you accidentally set the same ID to two slaves, disconnect one from power, and change ID of the one left connected.

Routing

When a slave can't be reached directly with a signal from master converter, routing option can be used to send the signal to it via other slaves. Bellow is a process of assigning routes.

- First select a slave you would like to route, from the list of connected LoRa IDs. If LoRa module is not found, type in LoRa ID to the selected device ID manually.
- In "Routing order" field type a sequence of LoRa IDs separated by space, through which connection will be routed. First LoRa ID on the list will be the first slave in the route after master converter and the last one on the list will be the last slave in line before the final positioner. Each slave can be routed through up to 5 other slaves. Note that each route will add delay to the connection and thus slowing it down. Use as few routes as possible.
- Example: You have selected LoRa ID 101. You assign it a routing order: 102 103. Final connection will look like: 100(master)-102-103-101
Routing order will be displayed for each slave on the Connected LoRa IDs list.
- To remove routing from the selected slave delete them from "Routing order" field and press enter. To remove all routes from all slaves, use button "Reset routes"

Scanning for available devices

When USB connection is established in Helios, master converter will automatically start scanning on all LoRa IDs for available wireless devices. Available device LoRa Ids will be displayed on the list, by the ID of the positioner. When you select a device from the list, it will stop scanning for other devices. To start scanning again, press button "Scan". When a device is selected, you can view and change all of its data and parameters from all tabs.

Troubleshooting

• USB driver is not recognized:

- Turn off UAC (User Account Control):
https://www.google.si/search?q=how+to+turn+off+uac&oq=how+to+turn+off+uac&ags=chrome..69i57j69i61j0l4.3175j0j9&sourceid=chrome&espv=210&es_sm=93&ie=UTF-8

• USB device is not recognized *or* Device is recognized as false communication type:

- Plug it into different USB jack
- If positioner is recognized as RS485 when using USB communication, check if cable/plug/jack etc. is damaged. Pick different USB jack.
- If positioner is recognized as USB when using RS485 communication, one of wires might be loose.

• Positioner's voltage or motor's current consumption is shown incorrectly:

- Verify (with voltmeter) that voltage is 24V on 3 pin supply plug.
- If you can measure voltage/current correctly, check parameters »U supply factor« and »I motor factor«.
- »U supply factor« on Micro = 28
- »I motor factor« on Micro = 28

• Motor does not move:

- **Positioner or motor smells burned or is smoking:** Disconnect it from power supply immediately. CAUTION: Be very careful as equipment can be very hot! Wait one minute after disconnecting before touching it. Take positioner out of housing and visually inspect the damage. Send a photo of burned area to support with request of evaluation whether positioner can be repaired.
- Axis is already in error. Open Helios analytics, verify the error and try to remove it by yourself. When the problem is resolved, click »Clear errors« to clear the error.
- Positioner has no connection to motor and cannot move. »A/B Cable« error will soon be shown. Check that ALL cables are tied into plugs on both sides of cable (on positioner and on motor side) and clear error.
- In case problem is still present, disable tracking and switch cables of motors (Cable A ↔ Cable B).
 - If the problem remains on same axis cable (and different motor), there is still no connection on cable or there is a problem on positioner. Disconnect system from power and disconnect motor cable. Measure conductivity of every single wire with Ohm-meter when bending/twisting the cable!
 - If problem switched to another axis cable (but on the same motor), motor itself is at fault.

• Motor stops after half a second: Motor draws more current than it is defined in parameter »I motor Max«. »Overcurrent« error will be shown. Refer to chapter 26 and online table »Mechanical gears and Common parameters«, additionally to table »Translation Table for Mechanical versions (Older to Newer)«. Both are available on www.solar-motors.com under tab *Support* at the bottom of the page. <http://www.solar-motors.com/gb/support-d24.shtml>

• Motor stops after 3 seconds: There is a problem with position feedback sensor signal. »Motor A/B losing hall impulses« flag is already present, »Hall A/B« error will soon erupt.

- Check that ALL cables are tied into plugs on both sides of cable (at positioner and at motor).
- In case problem is still present, switch cables on motors (Cable A ↔ Cable B).
 - If the problem remains on same axis (and different motor), there is still no connection on cable or there is a problem on positioner. Disconnect system from power and disconnect motor cable. Verify conductivity of every single wire with Ohm-meter when bending/twisting the cable!
 - If problem switched to another axis (but on the same motor), motor itself is at fault.

• Tracker is in wrong position:

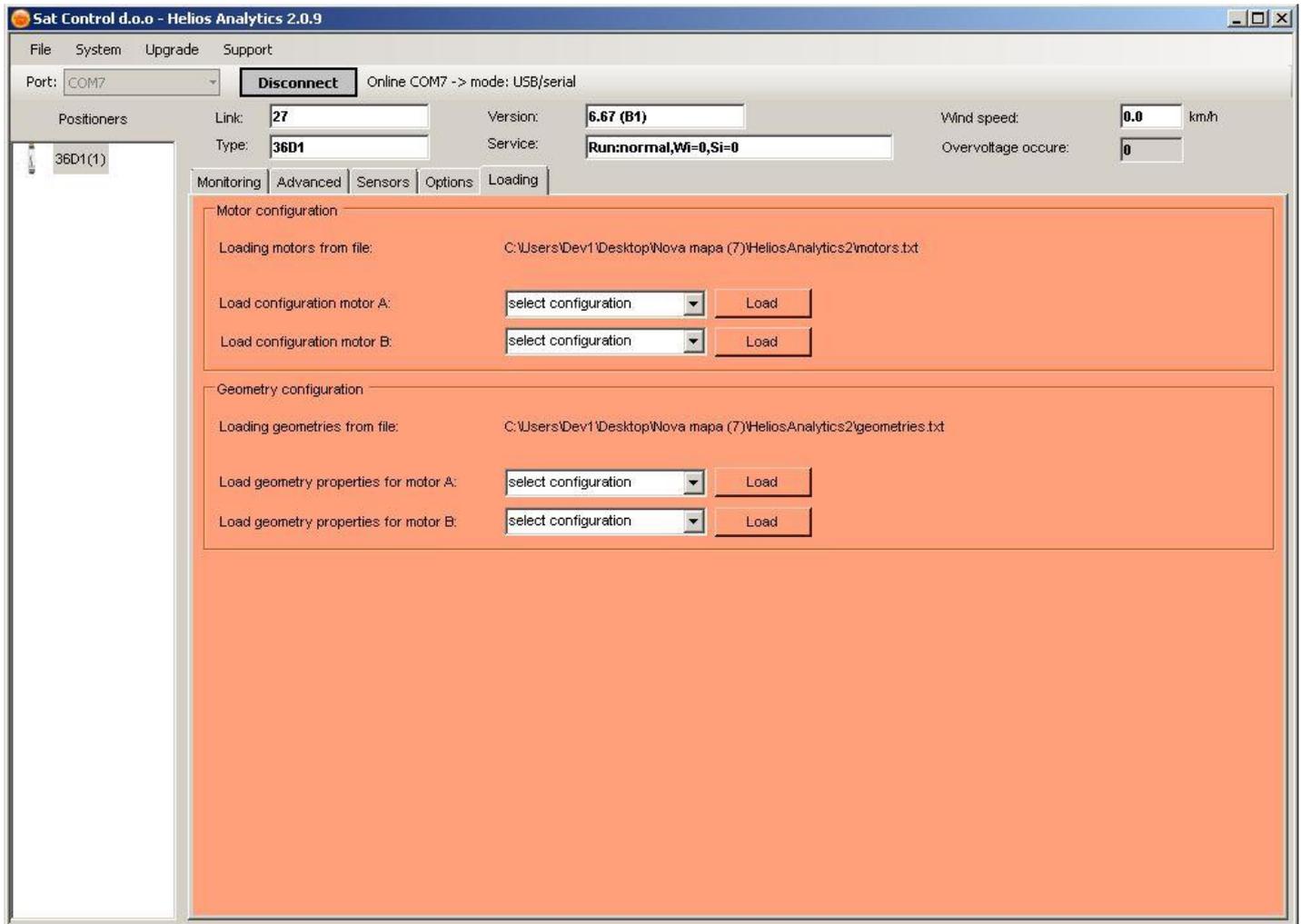
- One of motors already stopped. Refer to troubleshooting options above and to Chapter 26: Errors.
- Motors have lost its reference or it was not set up at all. Disable tracking and click »Do reference A« and »Do reference B«.
- Time, Date or parameters Latitude and Longitude are set up wrong.
 - Set parameters correctly
 - Replace inner battery and set parameters

• Source of problem is not obvious or cannot be discovered:

- Make sure that **NO** field in Helios is filled with »-nan« parameter. If you don't know the value, insert »0« (Zero). "-nan" fields can cause the system to malfunction.
- Download latest Helios Analytics and update positioner firmware. Helios Analytics is available on <http://www.solar-motors.com/gb/monitoring-programs-d489.shtml>. Latest firmware is downloaded along in the Helios map.

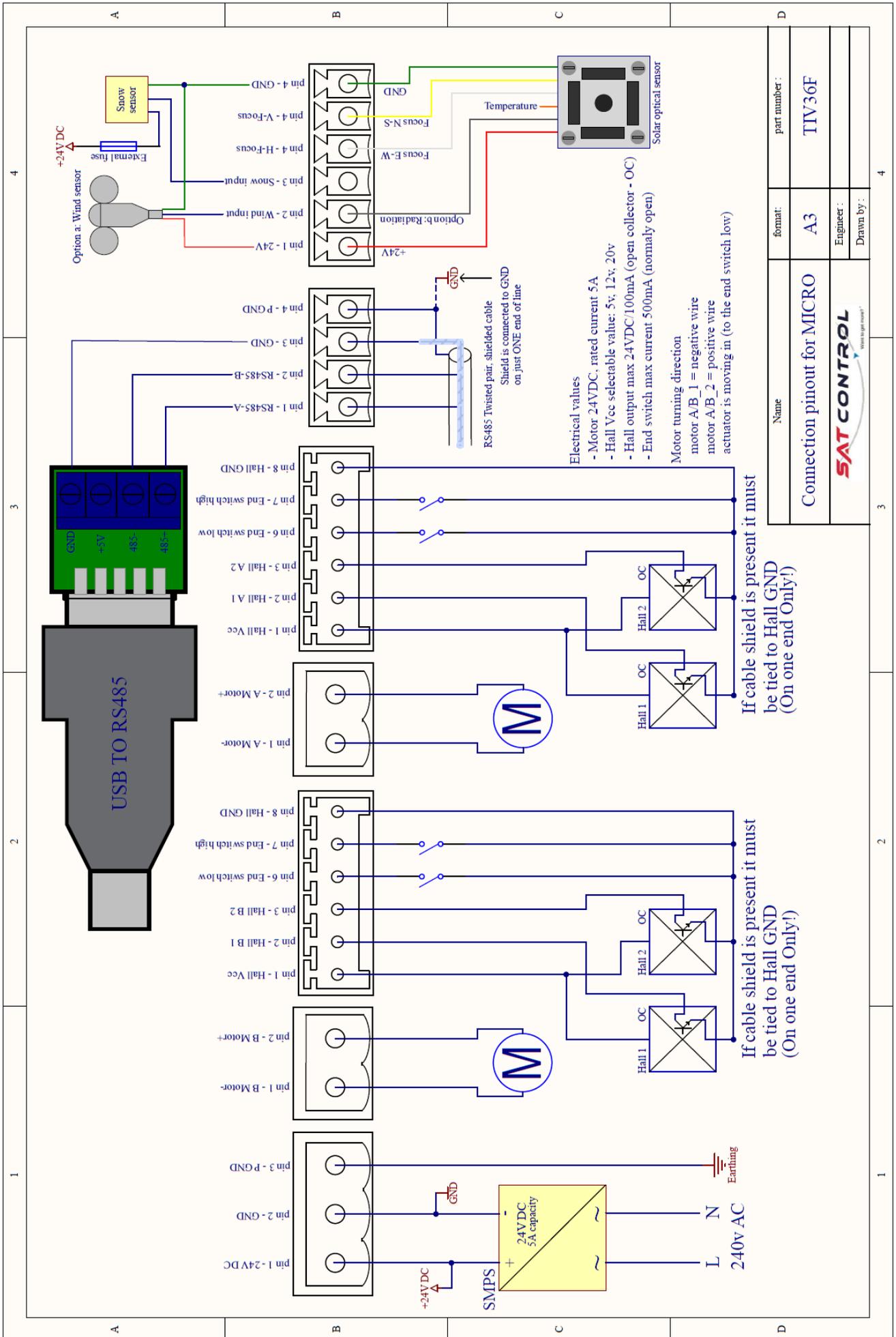
When all options of troubleshooting are exhausted, contact support for help with detailed description of problem, Tracker type and motors type (copy »MW ver.« or »Mech. Version« from motor label). Also attach screen shots of all tabs from Helios Analytics.

Loading Motor Configurations and Geometries

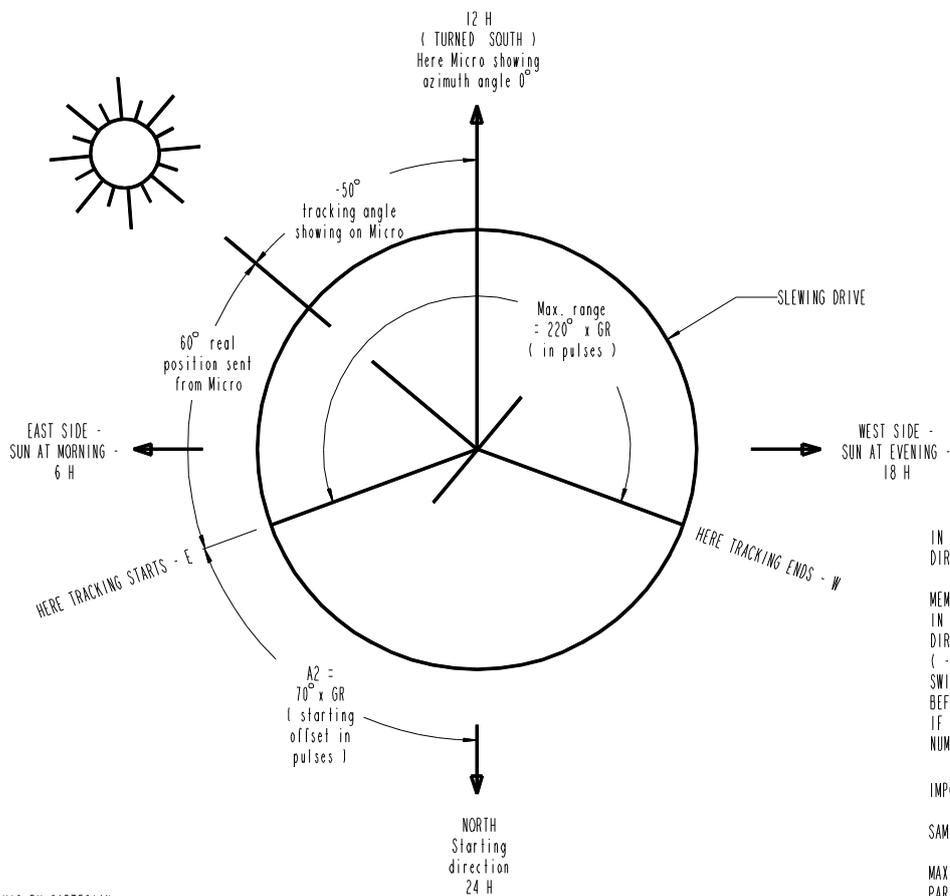


For our trackers you can load completely prepared geometries and motor configurations by choosing one from the drop-down menu in "Loading" tab. To load motor configuration, select desired MC from drop down menu and press button "Load" for each motor separately. To load tracker geometry, select desired geometry from drop down menu and press button "Load" for each motor separately. For two axis trackers, motor A is usually loaded with hour angle or azimuth geometry, while motor B uses elevation geometry.

Wiring scheme:



GEOMETRY 1 FOR CMI for MICRO positioner



AZIMUTH AXIS BY CARTESIAN COORDINATE SYSTEM - TURNING AXIS IS VERTICAL ACCORDING TO GROUND AND TURNING DATUM IS PARALLEL TO GROUND

- COORDINATE MODES OR CM
- 1 - AZIMUTH TURNING IN CARTESIAN COORDINATE SYSTEM - CM1
- 2 - ELEVATION TURNING IN CARTESIAN COORDINATE SYSTEM - CM2
- 3 - HOUR ANGLE TURNING IN POLAR COORDINATE SYSTEM - CM3
- 4 - ELEVATION TURNING IN POLAR COORDINATE SYSTEM - CM4

IN CASE OF USING OPPOSITE DIRECTION USE (-) MINUS SIGN

MEMO:
IN CASE YOU NEED TO USE OPPOSITE DIRECTION OR OPPOSITE SIDE USE (-) MINUS SIGN BEFORE NUMBER OR SWITCH TO OPPOSITE SIGN IF BEFORE POSITIVE LATER NEGATIVE OR IF BEFORE NEGATIVE LATER POSITIVE NUMBER

IMPORTANT NOTES:

SAMPLE CASE !!!!

MAX. AZIMUTH ANGLE RANGE IS 220°
PARAMETERS FOR MATHEMATIC MODEL CALCULATION ARE
GR = GEAR RATIO = pulses per angle degree
GR = 131,6 imp/°
A2 = 70° x GR = 9212
PARAMETERS A1, A3, A4, A5, A6, B1, B2 ARE NOT IN USE AND ARE 0

- COORDINATE MODE A = 1
- GEOMETRY MODE A = 1
- GEAR RATIO A = 131,6 imp/°
- MAX RANGE A = 28952 imp (for 220°)



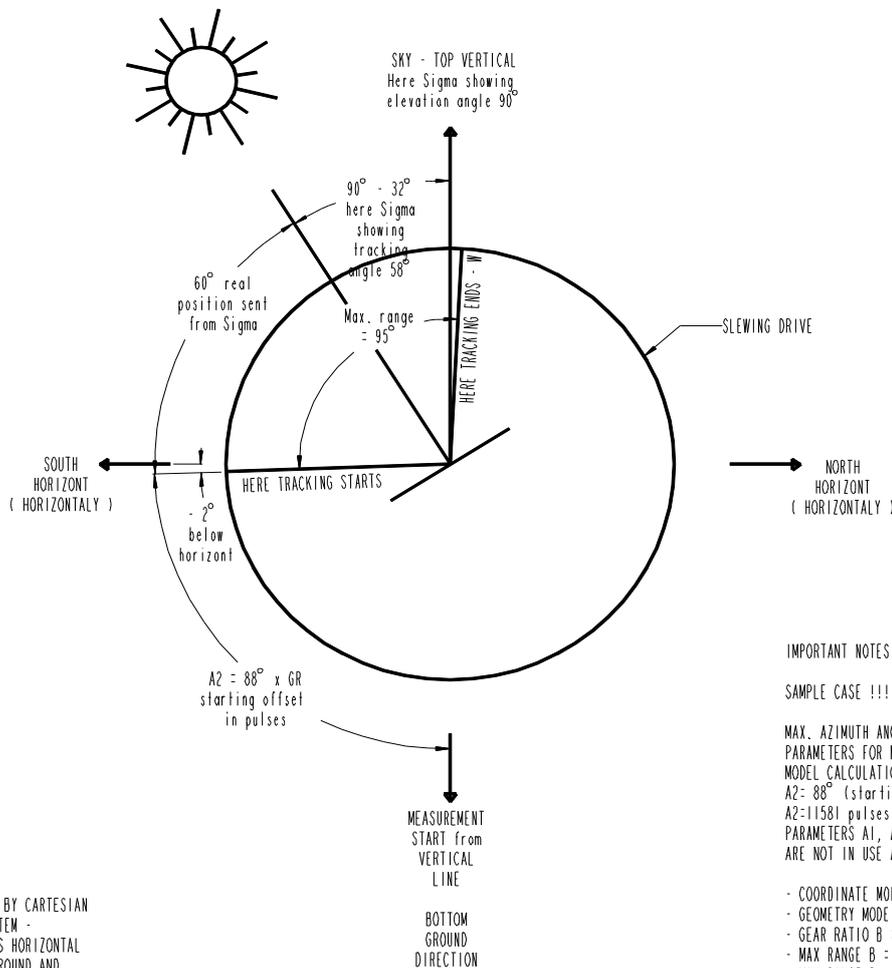
Description: Geometry model sketch 1 for Azimuth axis of solar tracker and coordinate mode 1

File: GEO_MODEL_1_FOR_AZIMUTH.CMI.MIC / GEO_MODEL_1_FOR_AZIMUTH.CMI.MIC

Latest version:
V1

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www.solar-motors.com

GEOMETRY 1 for CM2 & CM4 by MICRO POSITIONER and SLEWING DRIVE installed as ELEVATION AXIS



IMPORTANT NOTES:

SAMPLE CASE !!!!

MAX. AZIMUTH ANGLE RANGE IS 95°
 PARAMETERS FOR MATHEMATIC MODEL CALCULATION ARE
 A2= 88° (starting offset) x GR (gear ratio per 1°)
 A2=11581 pulses
 PARAMETERS A1, A3, A4, A5, A6, B1, B2 ARE NOT IN USE AND ARE 0

- COORDINATE MODE B = 2 OR 4
- GEOMETRY MODE B = 1
- GEAR RATIO B = 131,6 imp/°
- MAX RANGE B = 95° x GR = 12502 pulses
- MAX RANGE B = 12502 pulses

ELEVATION AXIS BY CARTESIAN COORDINATE SYSTEM -
 TURNING AXIS IS HORIZONTAL ACCORDING TO GROUND AND TURNING DATUM IS PARALLEL TO GROUND

- COORDINATE MODES - CM
- 1 - AZIMUTH TURNING IN CARTESIAN COORDINATE SYSTEM - CM1
- 2 - ELEVATION TURNING IN CARTESIAN COORDINATE SYSTEM - CM2
- 3 - HOUR ANGLE TURNING IN POLAR COORDINATE SYSTEM - CM3
- 4 - ELEVATION TURNING IN POLAR COORDINATE SYSTEM - CM4

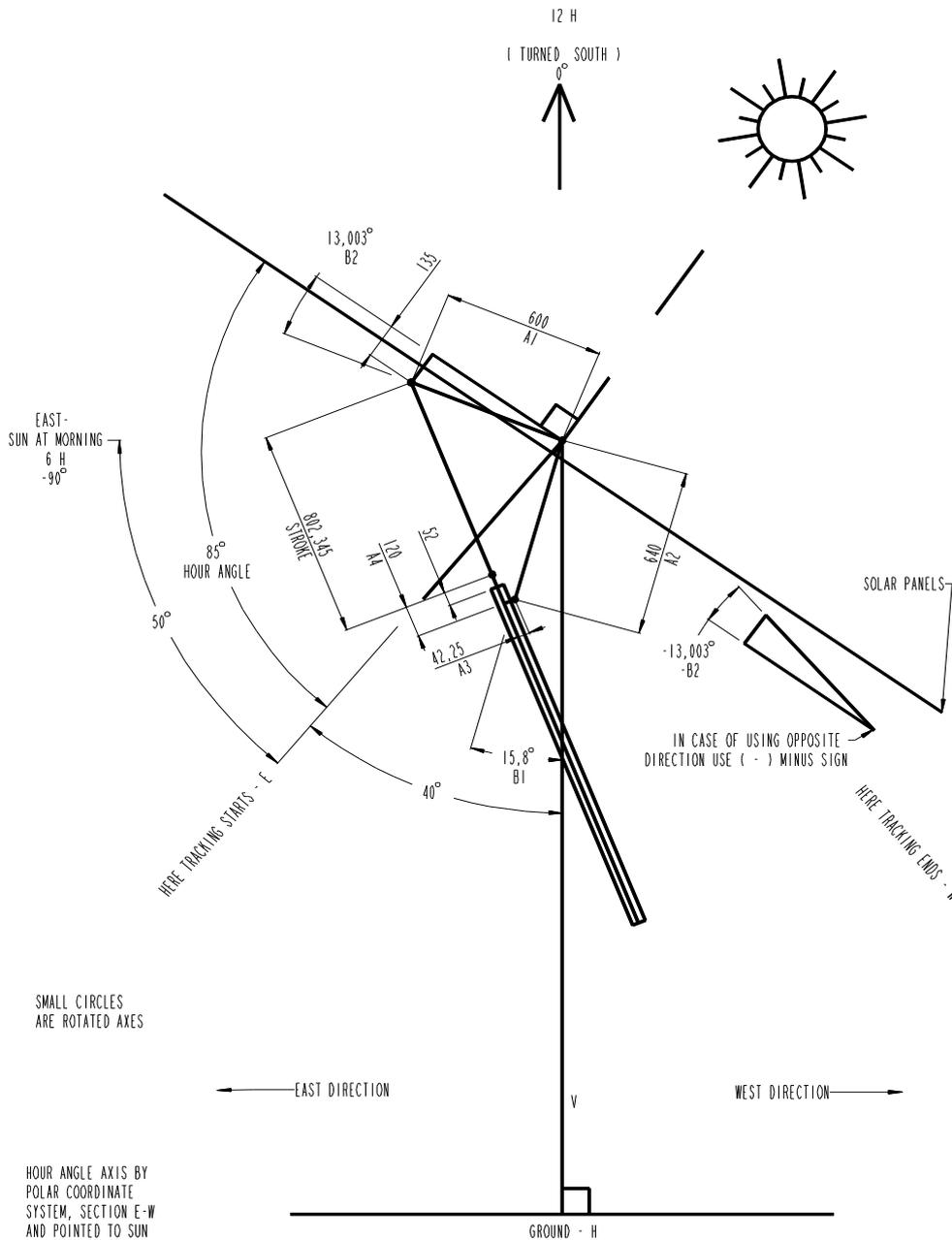


Description: Geo. model sketch 1 for elevation axis of solar tracker for CM2 or CM4 in MICRO

File: GEO_MODEL_1_FOR_ELEV_CM2-4_MIC / GEO_MODEL_1_FOR_ELEV_CM2-4_MIC

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GEOMETRY 2 FOR CM3 OR CM11 (BY DEVIATION 0°)



IMPORTANT NOTES:

SAMPLE CASE !!!!

MAX. HOUR ANGLE RANGE IS 100°
 PARAMETERS FOR MATHEMATIC MODEL CALCULATION ARE
 A1= 600 mm
 A2= 640 mm
 A3= 42.25 mm
 A4= 120 mm
 A5= 0 (NOT IN USE AND IS 0)
 A6= 0
 B1= 15.8°
 B2= 13°

***** PLEASE NOTE *****
 - IF PARAM. A6=0 THEN THE MOTOR IS FIXED IN EAST SIDE
 - IF PARAM. A6=1 THEN THE MOTOR IS FIXED IN WEST SIDE
 IT IS SAME EFFECT AS THAT YOU CHANGE EAST - WEST DIRECTION ON DRAWING

- COORDINATE MODE A = 3 OR 11 BY DEVIATION 0°
 - GEOMETRY MODE A = 2
 - GEAR RATIO A = 188 imp/mm
 - MAX RANGE A by SIGMA = 900 mm
 - MAX RANGE A by MICRO = 169200 imp
 - STROKE SAMPLE CASE
 for HOUR ANGLE +35° = 802,345 mm
 or 180840 pulses by MICRO

***** PLEASE NOTE *****
 HOUR ANGLE = -90° = TURNED TO EAST
 HOUR ANGLE = 0° = TURNED TO SOUTH
 HOUR ANGLE = 90° = TURNED TO WEST

SMALL CIRCLES ARE ROTATED AXES

HOUR ANGLE AXIS BY POLAR COORDINATE SYSTEM, SECTION E-W AND POINTED TO SUN

- COORDINATE MODES -----> CM
- 1 - AZIMUTH TURNING IN CARTESIAN COORDINATE SYSTEM - CM1
- 2 - ELEVATION TURNING IN CARTESIAN COORDINATE SYSTEM - CM2
- 3 - HOUR ANGLE TURNING IN POLAR COORDINATE SYSTEM - CM3
- 4 - ELEVATION TURNING IN POLAR COORDINATE SYSTEM - CM4
- 11 - ELEVATION TURNING IN CARTESIAN COORDINATE SYSTEM - CM11 BY DEVIATION 90°
- 11 - HOUR ANGLE TURNING IN CARTESIAN COORDINATE SYSTEM - CM11 BY DEVIATION 0°

IMPORTANT NOTE !

Sigma solar server is operating only with angle degrees and mm !
 MICRO positioner is operating with angle degrees, mm and is showing always pulses !



Description: Geo. model sketch 2 for Hour angle axis of solar Tracker at CM3 or CM11 by DEV. 0

File: GEOMETRY_MODEL_2.FOR_HAM_CM3 / GEOMETRY_MODEL_2.FOR_HAM_CM3

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Elevation (Geometry 3 for Coordinate modes 2 and 4):

