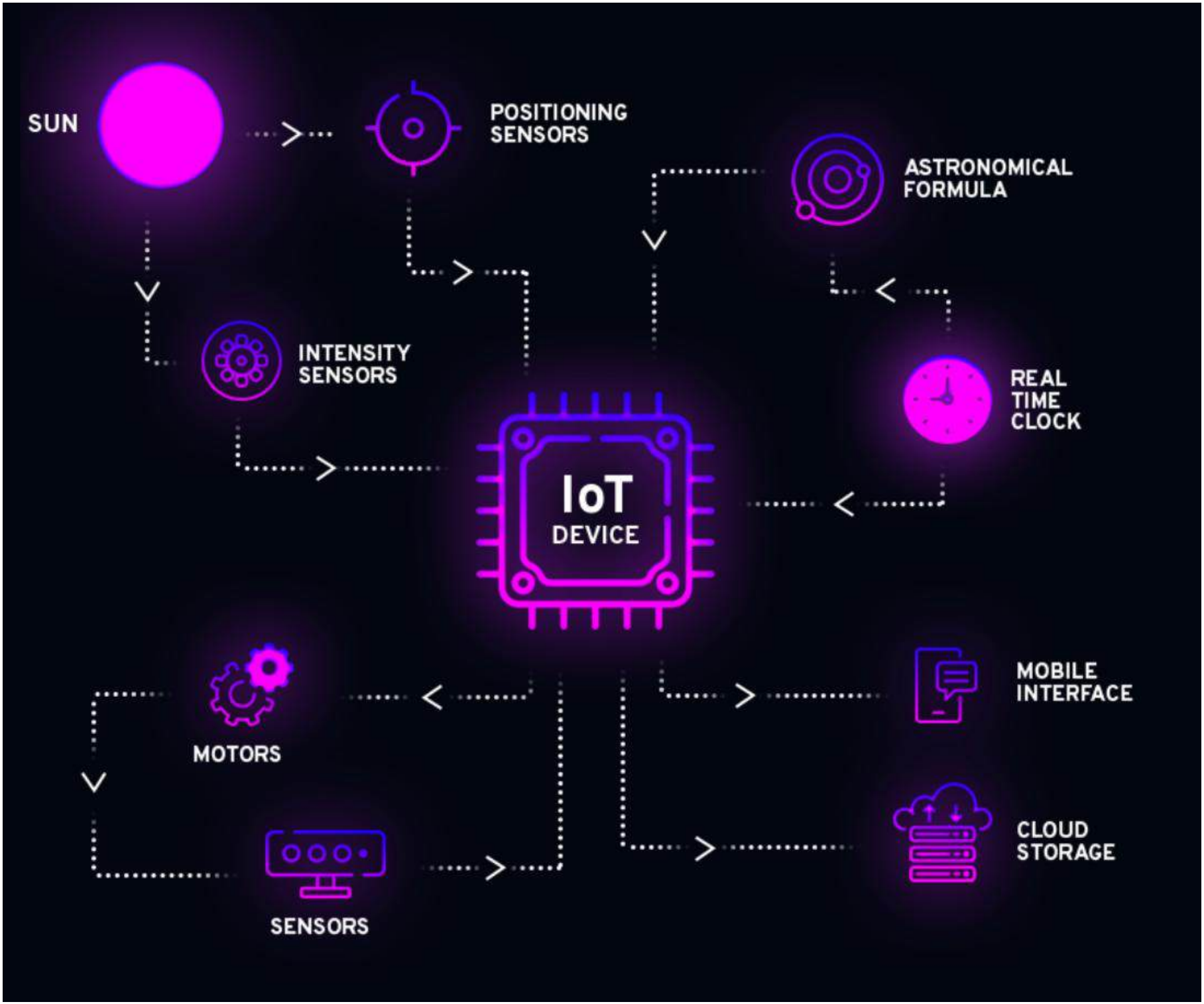

SUN
POSITIONING SENSORS
ASTRONOMICAL FORMULA
INTENSITY SENSORS
REAL TIME CLOCK
IoT DEVICE
MOTORS
MOBILE INTERFACE
SENSORS
CLOUD STORAGE

ENGLISH

REI Solar Tracker controller **works with any kind of trackers,**
[all You have to do is to change parameter];

- Single Axis
- 2x Single Axis
- Dual Axis tilted
- Dual Axis rotary.

Works with Analog and Digital NPN anemometers.

It has a dedicated and innovative algorithm that allows you to work in areas with frequent cloud cover and changes in weather conditions. This is the only device that lets You get even 60% more kWh/Year from Your installation on a dual solar tracker (compared to a fixed installation). All other controllers can increase the yield by about 40%.

I**t has a WiFi module that lets You;**

- remotely lock the tracker in a safe position
- remote control of all motor directions
- remote configuration
- remote viewing of logs of operating parameters
- sending logs to the indicated HTTP server (JSON)

It does not require expensive and cumbersome peripherals such as inclinometers or magnetometers. One irradiation sensor is enough to efficiently work with and accurately control the tracker set. -> EVEN in the Tilted tracker construction types.

REI controllers have noise filters, 2-row power supply, PWM / soft start / stop function, limit sensors, amperage sensor/limits temperature sensors etc.

We are using high-quality DC bridges used in the automotive industry. You can set the threshold to the load/amperage on the motors or set max speed of them.

Works superb with a grid power failure detection sensor, which makes the installation much safer. Very often there is a power outage before the storm.

Also we have an external interface to control 2-3 phase AC inverters, BLDC/ STEPPER motor drivers or even if You need more amperage external DC H-bridges with or without PWM.

Main differences to other products (optical/astronomic/hybrid)

1. Automotive h-bridge instead of relays (relays burn pretty fast and this is dangerous for motors when they are stuck in ON position, the limit switch will not help and the construction/motor will be broken.)

2. The limit switch works in a logical way not just voltage divider so we are insulating the noises (This is the reason when the tracker is stopping here and there. It's dangerous especially when it should go to a flat position in wind hazards. Many times the tracker is not going back after the end of the day. Then the tracker is staying back to the

sun in the morning and the controller is stuck with sensor readings. So You are losing a few hours of production.

2. It has a special algorithm that lets You be accurate even in semi clouds. Most of the available versions are going back and forth east limit to west limit, destroying motors motors and consuming power.

3. You can use that controller for bigger installation with AC motors or BLDC/STEPPER drivers, we have separate I/O connectors programmed as You want.

4. You can connect a second digital wind speed sensor or weather station with logic output.

5. We have PWM Soft start/stop for motors (can be switched on/off as needed + You can set max speed for each motor)

6. There is an amperage sensor on board to control motor overloads. Can be switched on/off

7. We have professional connectors - that reduce costs/time of service on the field.

Device states and reactions on button functions;

1. Automatic mode - the controller performs measurements every **TX** for the **EW** axis and **TY** for the **SN** axis and corrects the tracker's position with the accuracy of **V1**.
    a. **“C”** button held down for a long time will start the wind protection procedure - this function allows you to lay the work surface flat with one button without having to hold it for the entire duration of the movement.
    b. **“M”** button pressed for a short time (1s). switches the device to manual mode
    c. Long (>5s) “**M”** button switches the device into the configuration mode
    d. the **E -** hold the button to view the IP address - if connected to the network
    e. **W S** buttons remain inactive.
    f. **N** - hold the button to view the readings from the light sensors
2. Manual mode - the controller responds to buttons **E W S N** and turns on the motors in selected directions.
    a. Press button **C** for a short time to switch to Automatic mode.
    b. The M button turns the fan on.
    c. buttons **E W S N** turn on the motors in the appropriate directions
3. Configuration mode - the controller displays successive configuration parameters so that they can be modified by the user.
    a. button **C** pressed for a short time saves the settings and switches the device to Automatic mode
    b. the **M** button remains inactive
    c. **E W** buttons are used to move to the previous / next parameter
    d. **S N** buttons are used to decrease / increase the parameter value

Buttons and their functions;

1. C - Confirm parameters / Automatic
    a. (automatic mode) starting the wind protection procedure (hold for 3s)
    b. (manual mode) starting the automatic mode
    c. (configuration mode) exit from configuration with saving parameters
2. M - Manul
    a. (automatic mode) enter into configuration (hold for 4s)

   b. (automatic mode) entering the manual mode (short pressing the button)
   c. (manual mode) turn the fan on
3. E - direction or scroll
   a. (manual mode) start the motor to the east
   b. (configuration mode) scrolls parameters left
4. W - direction or scroll
   a. (manual mode) start the motor to the west
   b. (configuration mode) scrolls parameters right in configuration mode
5. S - direction or decrease in value
   a. (manual mode) start the motor south
   b. (configuration mode) decreasing the parameter value in configuration mode
6. N - direction or value increase
   a. (manual mode) start the motor towards the north
   b. (configuration mode) increasing the value of a parameter in the configuration mode

Configuration parameters (ranges);

We present all parameter settings in three measurement units.

- integer (1,2,3,…) - enable / disable the function
- value expressed in seconds (s) - time settings of individual procedures
- value expressed in Volts (V) - threshold settings for analog sensors that convert e.g. temperature, amps, light into a values expressed in Volts in the range from 0 to 5V

➔ V1 - (0.1-2.50) sun tracking accuracy. If the difference in readings between the E and W or S and N sensors is greater than the indicated value, the tracker corrects its position in relation to the light radiation. (default 0.10)

➔ V2 - (0.0-2.50) wind force at which the controller will pass successively through the T8-T11 times to the safe setting, this parameter also restarts the T2 counter if the stacker is already blocked, thanks to which the tracker remains in a safe position until the wind calms down completely. (default 0.90)

➔ V3 - (0.0-2.50) the smallest light sensor reading value at which the solar radiation strength is on the border between day and night (0.80).

➔ V4 - (0.0-2.50) cloudiness threshold at which the controller slows down the tracking of the sun (1.70), it prevents the tracker from reacting to radiation reflected from the East during normal operation in partially cloudy conditions.

➔ TX - (0-99) time interval after which the strength of the East-West sun is measured (30).

➔ TY - (0-99) time interval after which the North-South sun strength is measured (50).

➔ T1 - (0 - 9800) waiting time for the sun after a temporary decrease in the value read from one of the sensors (default 1000).

➔ T2 - (0 - 9800) time the remains blocked after detecting the wind.
(After going through T8-T11 times) (default 600)

➔ T3 - (0 - 9800) time the motor will be turned on in the E direction after the end of the day

- ➔ T4 - (0 - 9800) time the motor will be turned on in the W direction after the end of the day
- ➔ T5 - (0 - 9800) time the motor will be turned on in the S direction after the end of the day
- ➔ T6 - (0 - 9800) time the motor will be turned on in the N direction after the end of the day
- ➔ T7 - (0 - 9800) waiting time for complete darkness, i.e. all sensors show readings below the V3 value for a long time after the sun disappears (after this time the controller will start returning according to the settings (T3 -T6) (default 4500)
- ➔ T8 - (0 - 9800) Wind Security - parameter dedicated tilted version of the tracker time that the motor will be turned on towards E/ W to reach flat position in azimuth (also to make the single axis tracker flat)
- ➔ T9 - (0 - 9800) time the motor will be turned on towards S after the wind detection
- ➔ T10 - (0 - 9800) time the motor will be turned on towards N after the wind detection
- ➔ T11 - (0 - 250) hydraulic pump advance / delay in case You need to start the pump before opening the direction valves.
- ➔ TRCv - Tracker version (3 by default).
  - ◆ 0 - single axis tilting in the E-W axis
  - ◆ 1 - two single-axis trackers tilting in the E-W axis + S-N motor used as second single axis tracker (two light sensors are needed)
  - ◆ 2 - Two-axis tracker tilting in the E-W and tilting in S-N axis
  - ◆ 3 - Two-axis rotary tracker in the E-W axis and tiltable in the S-N axis
  - ◆ 4 - Two-axis universal tracker.
- ➔ DRV - (0 to 5) motor driver type
  - ◆ 0 - DC motor, soft start, Normally Closed limit switch
  - ◆ 1 - DC motor, soft start, Normally Open limit switch
  - ◆ 2 - DC motor, hard start, Normally Closed limit switch
  - ◆ 3 - DC motor, hard start, Normally Open limit switch
  - ◆ 4 - BLDC external driver, Normally Closed limit switch
  - ◆ 5 - BLDC external driver, Normally Open limit switch
  - ◆ 6 - External DC h-bridge, Normally Open limit switch
  - ◆ 7 - External DC h-bridge, Normally Open limit switch
- ➔ PWM1 - (70-250) East-West steering motor speed - If You are using External h-bridge reduce that parameter to 90
- ➔ PWM2 - (70-250) north-south steering motor speed - If You are using External h-bridge reduce that parameter to 90
- ➔ ALIM - (0 or 1) enable the DC motor load detection system
  - ◆ 0 - OFF
  - ◆ 1 - maximum current limit
  - ◆ 2 - minimum and maximum current limit
  - ◆ 3 - minimum current limit (important in case of using build-in limit switches with zener diodes - linear actuators) MINIMUM = AMP/10.
- ➔ AEW1 - (0-250) setting the maximum east-west motor current consumption
- ➔ ASN1 - (0-250) setting the maximum north-south motor current consumption
- ➔ UART - (0 - 1) enabling communication with the WiFi module - only WiFi version (default-0)
  - ◆ 0 - OFF,
  - ◆ 1 - ON - only remote control,

- 2 - ON for remote control / Watchdog
- 3 - ON automatic log exchange STC<->ESP

➔ !EXT - (0 - 2) enabling / disabling the operation of the AC power line failure detection sensor or snow sensor
- 0- turned off,
- 1- turned on, AC power sensor activated by the low state,
- 2- turned on, AC power sensor activated by the high state (default - 0)
- 3 - turned on, SNOW sensor activated by the low state,
- 4 - turned on, SNOW sensor activated by the low state,

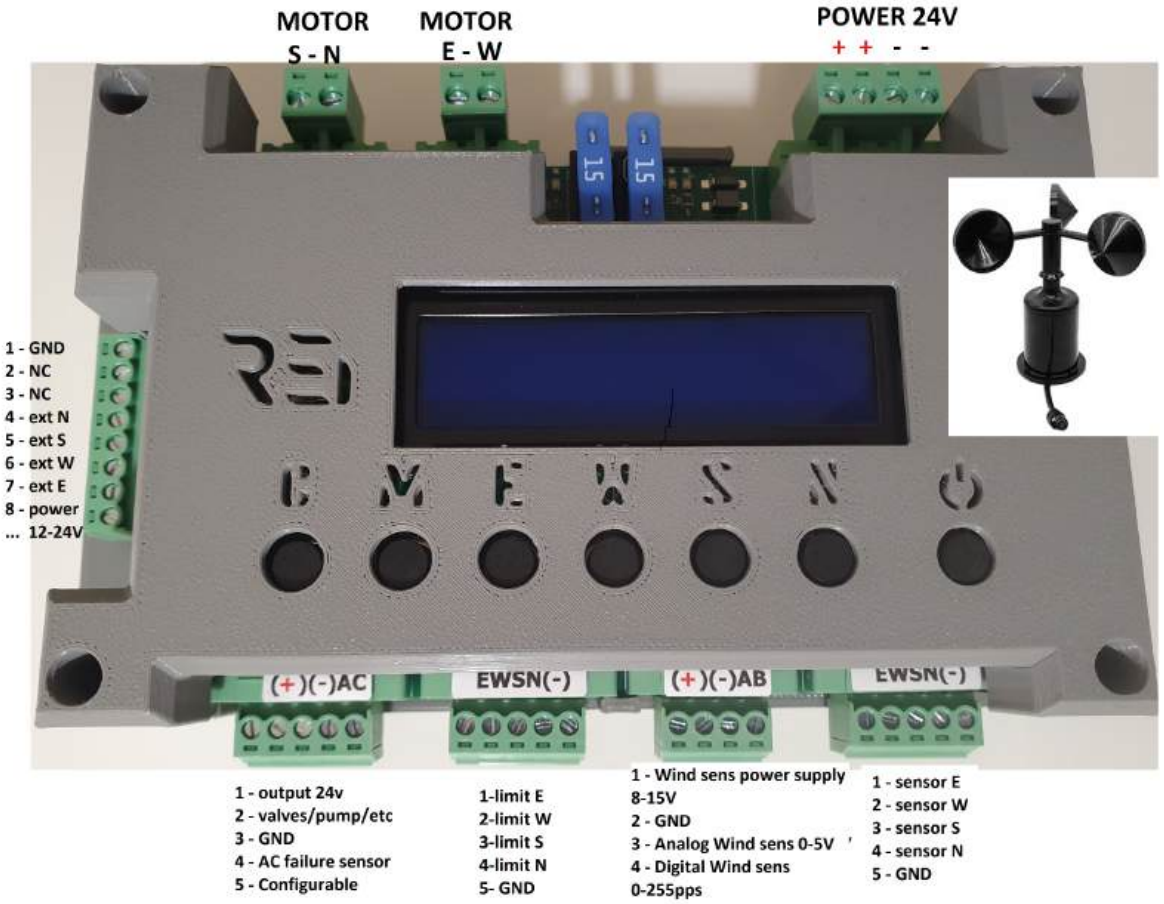
➔ V5 - (0 - 250) Board operation temperature limit security level
- 0-5 - temperature limit off
- >5 - temperature limit on [`1,75 = 60C, 1,45 = 50C, 1,24 = 40C`]

➔ DIG - (0-250) Digital anemometer signal pulse per second
- 0-5 - wind alarm activated by single logical signal
- >5 - pulse per second measurement mode

➔ AEW2 - (0-250) setting the minimum east-west motor current consumption

➔ ASN2 - (0-250) setting the minimum north-south motor current consumption

➔ WIFI IP address - The IP address of the WiFi module received from the router / AP - only in the version with WiFi



INPUT / OUTPUT CONNECTORS

- POWER - 4 terminals (power supply to the system with 24V)
    - 1-2 Positive (+) terminals
    - 3-4 Negative (-) terminals
- EW - 2 DC motor terminals,east - west direction max 10A
- SN - 2 DC motor terminals north-south direction max 10A
- LIMIT - 5 terminals
    - 1 limiter / reed switch in the East "E" direction
    - 2 limiter / reed switch in west "W" direction
    - 3 limiter / reed switch south "S" direction
    - 4 limiter / reed switch in North "N" direction
    - 5 ground (GND) common to all directions
- WIND - 4 terminals
    - 1 supply anemometer / wind sensor - positive pole (+)
    - 2 supply anemometer / wind sensor - negative pole (-)
    - 3 analog signal from the anemometer / wind sensor in the range of 0 - 5V
    - 4 digital signal from the anemometer / wind sensor 0-255 pps
    - 5 not connected
- SENSOR
    - 1 "E" direction light sensor terminal East (red wire)
    - 2 "W" direction light sensor terminal West (green wire)
    - 3 “S” direction light sensor terminal South (yellow wire)
    - 4 "N"direction light sensor terminal North (white wire)
    - 5 terminal ground (GND) for light sensor (black wire)
- EXTERNAL - 8 terminals LHS
    - 1 (GND) negative terminal external (inverter, BLDC, STEPPER driver)
    - 2 NS speed switch or PWM
    - 3 EW speed switch or PWM
    - 4 darlington signal direction N
    - 5 darlington signal direction S
    - 6 darlington signal direction W
    - 7 darlington signal direction E
    - 8 Positive (+) DC power supply external sensors, default 12-24V configurable via J18 jumper
- M3|Sens - 5 terminals
    - 1 peripheral device supply default 12-24V configurable via J18 jumper
    - 2 positive signal for main fan
    - 3 GND
    - 4 AC power line failure sensor signal
    - 5 (5V) (activated by J18 jumper)

FUSES;
The controller has 2 main fuses, counting from right to left. From the supply side to the motor output;

1. E-W max 10A motor power fuse
2. S-N max 10A motor power fuse

   If your motor uses more than 3A, It is recommended to use additionally - 2 fuses between the controller and the motor (on both wires).

How to choose fuses;
If the motor connected to the controller consumes 2A during start-up, the fuse for this motor should be max 3A

ATTENTION;

- it is the fuse to burn, not the controller or the engine in long term lock
- if motor use more than 6A set temperature limit and use fan for ventilation of the box in which the driver is installed (possibly with power supply - also source of heat)

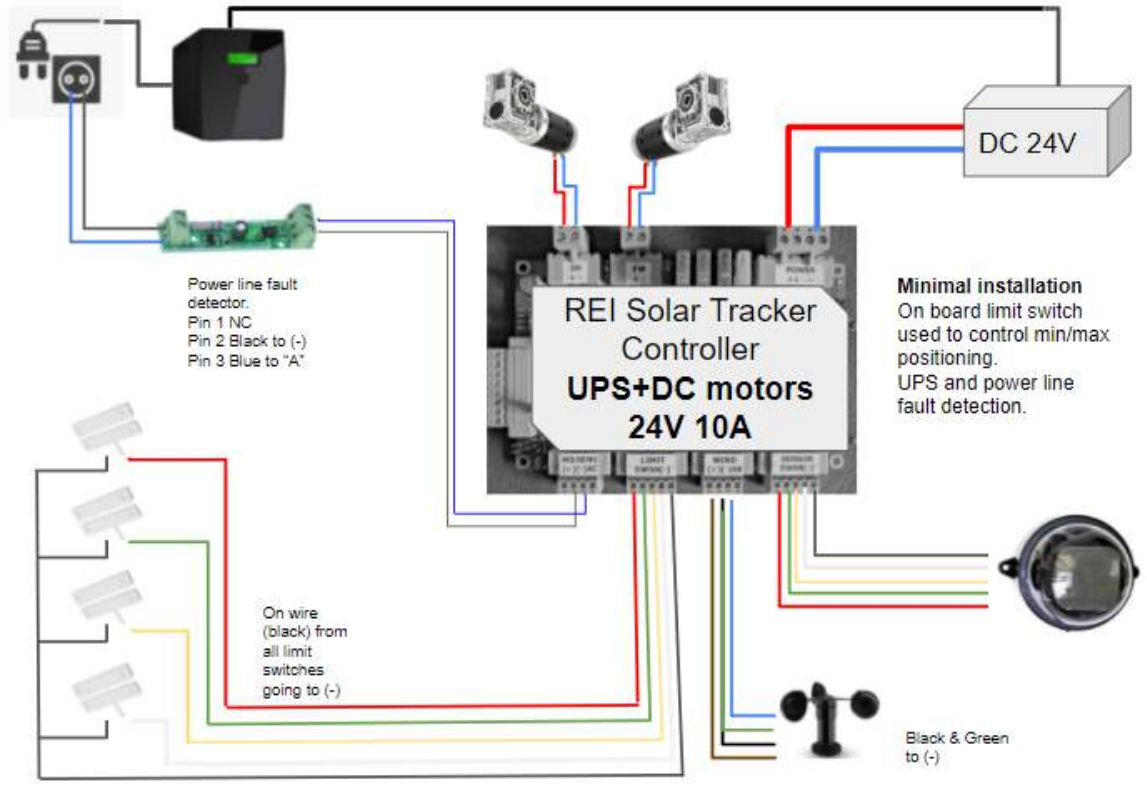
Anemometer; a variety of analog anemometers providing a signal from 0 to 5V can be used. Many units require a power supply, e.g.

- brown (+)
- black (-)
- green (-)
- blue (signal)

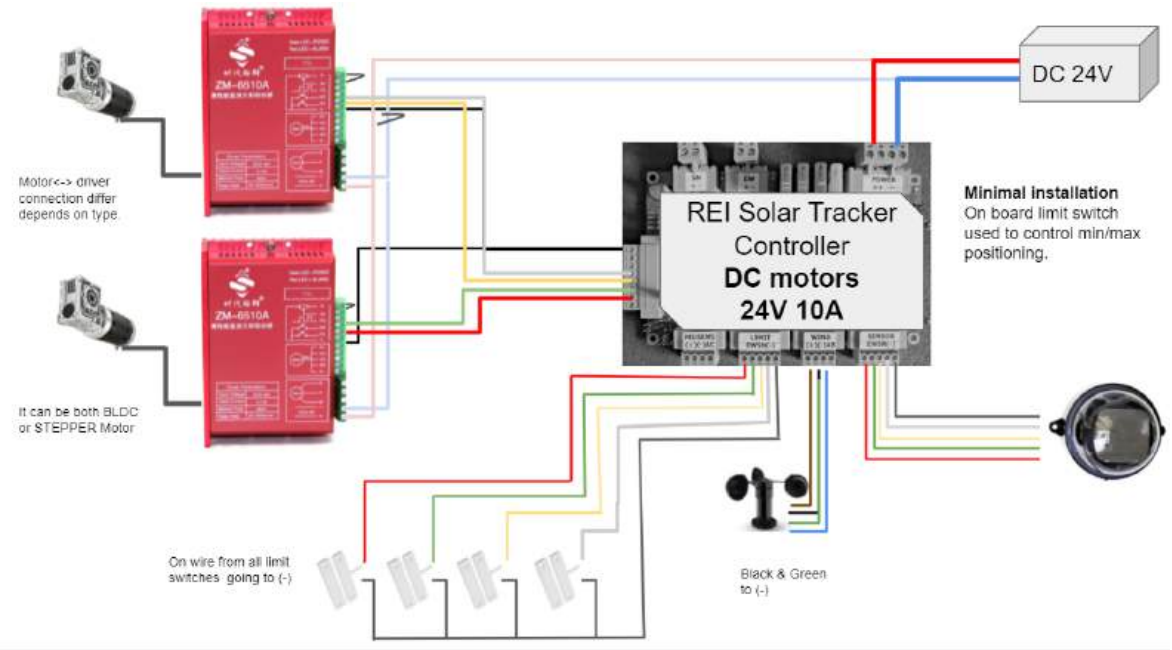
Then you can connect it directly to the controller by connecting the black and green to the same terminal.

ATTENTION; The wind gauge is a very sensitive device, if we use a poor quality DC power supply, it may affect the correct operation of the anemometer - then a separate power supply (small, about 50mA 12V or 24V) should be used for the anemometer, thus we will isolate the disturbances.
The controller also has the option to adjust noise filtering with the rotary potentiometer. The disturbances are manifested by the fact that the controller detects the wind, even if the anemometer is spinning very slowly, the display shows a gradually increasing reading until the threshold set in the configuration is exceeded.

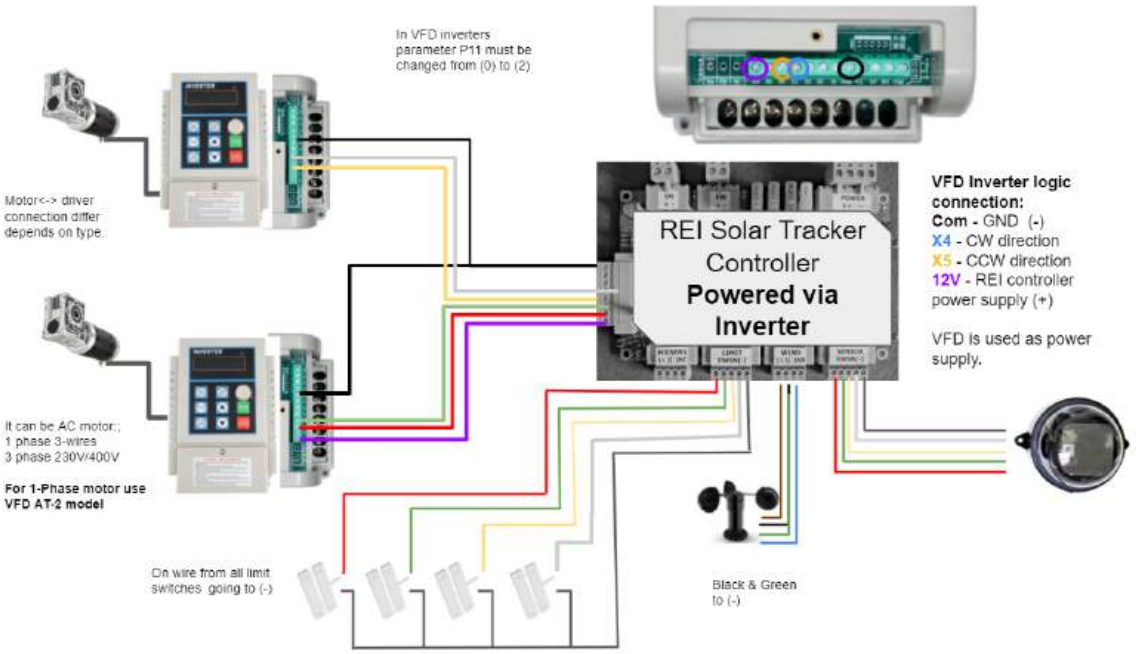
Typical connection schema;



Extended connection schema/ after firmware upgrade
BLDC/STEPPER MOTOR;



External VFD inverters AC Inverter 1/3- PHASE;



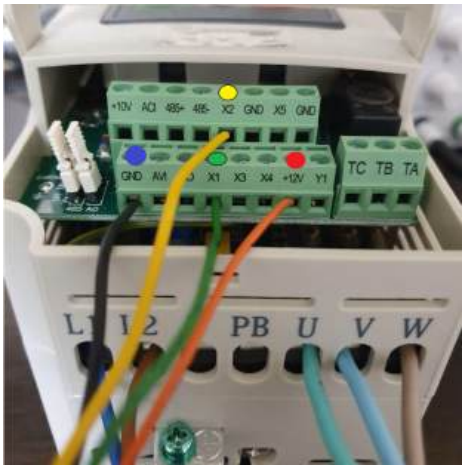
In the VFD inverter, parameter P11 must be set to 2 so that the controller signals are handled by the device.

If you have a 1f 2 coil (3 or 4 wire) motor you must use the AT-2 inverter and change parameter 92 to 2 then the motor will not need a capacitor and its operation will be very smooth.

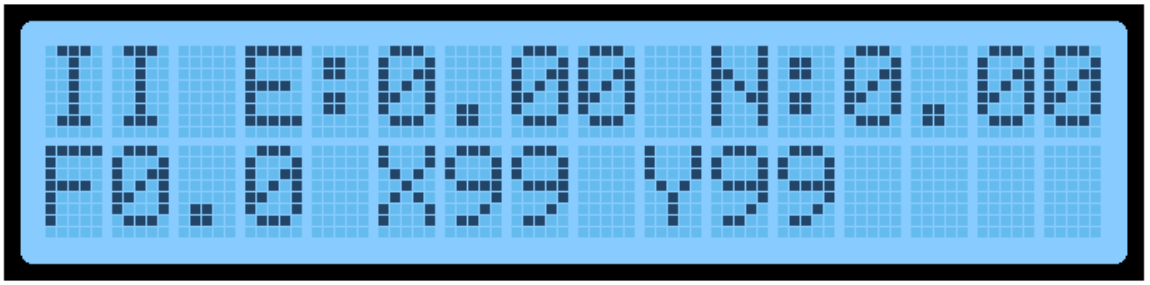
The FMZ inverter is set by changing parameter P 0.02 to 1 so that the controller signal is handled by the device

If you have a 1-phase 2 coil, 3 or 4-wire motor, you must change parameter P 4.12 to 10, then the motor will not need a capacitor and its operation will be very precise. for a three-phase motor P 4.12 = 00.

Connecting FMZ inverter;



Basic device status on the LCD screen [in tracking mode];



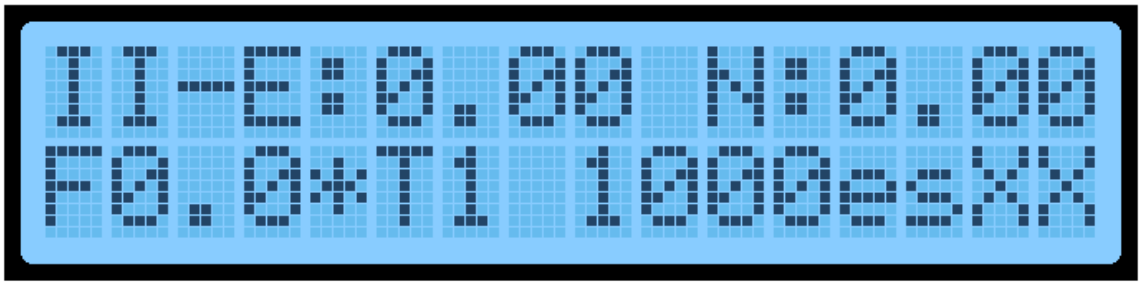
First line (16 characters sequentially);

1. Strength of sunlight in the E - W direction
    a. "I" - [irradiance] - enough sun strength to keep tracking
2. Strength of sunlight in the S - N direction
    a. "I" - irradiance - enough sun strength to keep tracking
3. “ “ - (blank)
4. The difference in the strength of the sun on the E - W sensors
    a. “E” - sun stronger on the E side of the tracker
    b. "W" - sun stronger on the W side of the tracker
5. “:” Reading result start in volts
6. integers position
7. "." fraction divisor
8. decimal position
9. hundredths position
10. “ “ - (blank)
11. The difference in the strength of the sun on the S - N sensors
    a. "S" - sun stronger on the S side of the tracker
    b. “N” - sun stronger on the N side of the tracker
12. “:” Reading result start in volts
13. integers position
14. "." fraction divisor
15. decimal position
16. hundredths position

Second line (16 characters consecutively);

1. the force of the wind
    a. “A” analog anemometer results in volts
    b. “D” digital anemometer result in pps
2. integers position
3. "." fractional divisor
4. decimal position
5. “ “ - (blank)
6. X- the E-W trace routine timer
7. tens of seconds
8. units of seconds
9. “ “ - (blank)
10. Y- the S-N trace routine timer
11. tens of seconds
12. units seconds
13. “ “ - blank field the blockade released
14. “ “ - blank field -> the amperage lock released
15. “” - blank field -> E-W motor stopped
16. “” - blank field -> S-N motor stopped

Device status indicators on the LCD screen
[possible / alternate states in tracking mode];



First line (16 characters sequentially);

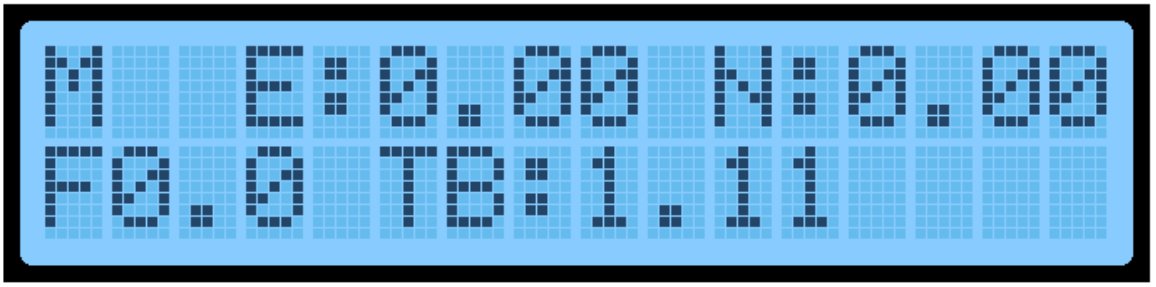
1. The power of sunlight from the direction E - W
    a. "I" - [irradiance] - enough sun power to keep tracking
    b. “C” - [clouds] - partially or fully cloudy stop tracking
    c. *transition state - indication of switching the operating mode
        i. "A" - switch to automatic mode
        ii. "M" - switch to manual mode
        iii. "H" - operating temperature exceeded - if the function is activated.
2. The power of sunlight in the S - N direction
    a. "I" - irradiance - enough sun power to keep tracking
    b. “C” - clouds - partially or fully cloudy stop tracking
    c. *transition state - indication of switching the operating mode
        i. “1” - temperature threshold 1 exceeded E-W drive blocked
        ii. “2: - temperature threshold 2 exceeded W-W and S-N drive blocked
3. Grid power failure sensor status
    a. “” - empty -> sensor off
    b. “-” - low state
    c. "+" - high state
4. The difference in the strength of the sun on the E - W sensors
    a. “E” - sun stronger on the E side of the tracker
    b. "W" - sun stronger on the W side of the tracker
5. “:” Reading result start in volts
6. integers position
7. "."
8. decimal position
9. hundredths position
10. (unused)
11. The difference in the strength of the sun on the S - N sensors
    a. "S" - sun stronger on the S side of the tracker
    b. “N” - sun stronger on the N side of the tracker
12. “:” Reading result start in volts
13. integers position
14. "."
15. decimal position

16. hundredths position

Second line (16 characters consecutively):

1. "F" the force of the wind in volts
2. integers position
3. "."
4. decimal position
5. wind force indicator for digital anemometer
    a. “” - an empty field -> the number of pulses per second has not been exceeded
    b. “ * ” pps threshold set in config has been exceeded
6. "T" - performing procedure with timer
7. "1" (or any) clock name
    a. T1 - Searching for the sun
    b. T2 - wind lock timer
    c. T3 - move to E timer timer after the end of the day
    d. T4 - move to W timer after the end of the day
    e. T5 - move to S timer after the end of the day
    f. T6 - move to N timer after the end of the day
    g. T7 - switchover delay timer to go to the beginning of the day position
    h. T8 - flattering timer (only for tilted tracker versions) after the Wind detection
    i. T9 - move to S timer after the Wind detection
    j. T10 - move to N timer after the Wind detection
    k. T11 - Pump adv./Delay
8. (complement 2-digit clock name)
9. the thousands position
10. the hundreds position
11. the tenth position
12. the unity position
13. amperage lock indicator for E-W drive
    a. “” - blank field the lock released
    b. "e" - lock in the E direction
    c. “w” - lock in the W direction
14. amperage lock indicator for S-N drive
    a. “” - blank field the lock released
    b. "S" - lock in the S direction
    c. “N” - lock in the N direction
15. drive condition in the E-W direction
    a. “” - empty field rest
    b. "E" - move towards E
    c. "W" - move towards W
    d. “X” - E or W limit switch has been reached
16. state of the drive in the S-N direction
    a. “” - empty field rest
    b. "S" - move towards S
    c. "N" - move towards N
    d. “X” - S or N limit switch has been reached

Tracker status indicators on the LCD screen in Manual mode.
[manual control mode];
Despite the similar appearance of the first lines, the numbers represent the readings from **the amperage sensors**, not from the light sensor.



First line (16 characters sequentially);

1. "M" - manual mode
2. “ “ - (blank)
3. “ “ - (blank)
4. Direction of the current consumption (ampere) for the E - W motor
5. “E” - consumption when motor running towards E
6. "W" - consumption when motor runs towards W
7. ":" Start of reading result expressed in volts ~ (0 = 0A, 2.50 = 10A)
8. integer position
9. "." fraction divisor
10. decimal position
11. hundredths position
12. “ “ - (blank)
13. Direction of the current consumption (ampere) for the S - N motor
14. "S" - consumption when motor runs towards S
15. "N" - consumption when motor runs towards N
16. ":" Start of reading result in volts ~ (0 = 0A, 2.50 = 10A)
17. integer position
18. "." fraction divisor
19. decimal position
20. hundredths position

Second line (16 characters (consecutively)

21. "F" the force of the wind in volts
22. integers position
23. "." fractional divisor
24. decimal position
25. “ “ - (blank)
26. "T" - temperature indicator
27. "B" - PCB temperature
28. “:” - start of reading expressed in volts
29. integer position
30. "." fraction divisor
31. decimal position
32. hundredths position
33. “ “ - (blank)
34. “ “ - (blank)
35. “ “ - (blank)
36. “ “ - (blank)

CONFIGURATION OF THE WiFi MODULE;

The WiFi module can be used to take advantage of the remote control;

- start of the wind protection procedure,
- inspection overview,
- status overview
- login service from the device.

In order for WiFi to communicate with the controllers, **UART must be turned on in the controller.**

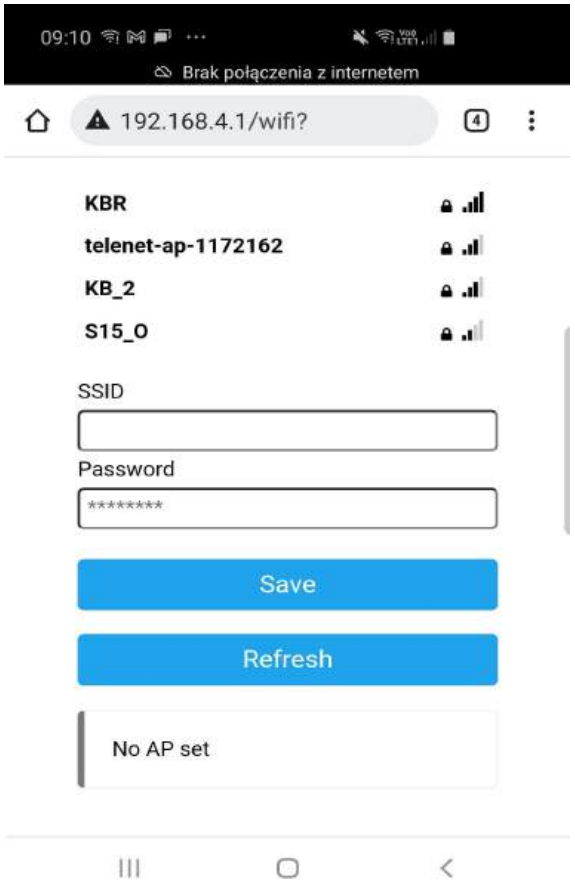
The WiFi module should be in the wireless network coverage. To set the configuration You need a smartphone / tablet device.

An unconfigured module works as an access point for 5 minutes from start-up and is available at;

name: "REI_AP"

password: "rei12345"

Ather connecting to this AP, we can go to WiFi configuration page at 192.168.4.1



On the website, we see the available networks to which we can connect.
We should select the network with the highest signal strength by clicking on the name of it and enter the access password in the appropriate Password field.

By selecting the "Save" button, we will restart the system that is trying to connect to the selected network using the password provided.

If the connection attempt fails, the device will go back to the AP mode, allowing you to connect to it and configure the device again.

Note AP mode is available for 5 minutes after turning on the device, then the device goes into sleep mode.

The module properly connected to the selected network is visible through the browser at the address given by the router managing the network.

This address appears when parameter mode is selected on the controller's display. IP is resend between the controller and the WiFi module - it takes about 10 minutes from restarting the device to propagate the configuration between devices..

So there is no need to get to the device to find out the module address in the WiFi network - just enter the configuration mode on the controller after about 10 minutes.

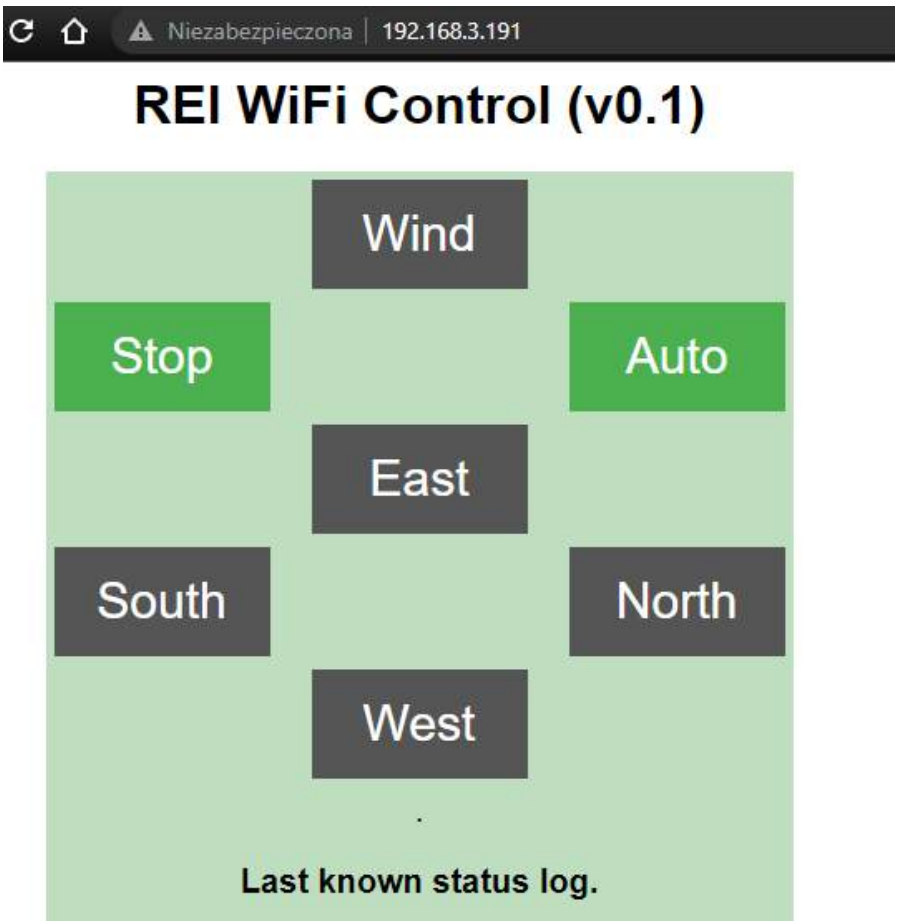
The WiFI module displays the device status page with buttons for remote control.

Remote control allows:

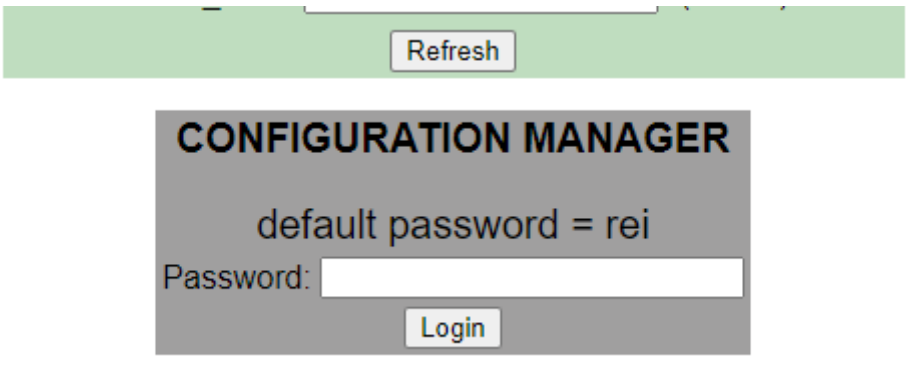
- to turn on wind protection mode
- stop the movement of the device
- move the structure towards
    - E
    - W
    - S
    - N
- return to Automatic Sun Tracking mode

The remote mode will start the movement or stop the tracker for 60 seconds, after which it will return to normal operation -> In order not to leave the device blocked inadvertently.

Permanent blocking of the device is possible by physically switching to the manual mode by pressing the appropriate button directly on the controller.



At the bottom of the page there is a window that allows you to go to the configuration.



To enter the configuration, confirm the action by entering “rei” in the Password field.
This way, we won't accidentally get into the configuration.

REI configuration manager

V1 Accuracy:	5	x10(mV) d.10
V2 Wind Threshold:	10	x10(mV) d.90
V3 Sun Threshold:	80	x10(mV) d.80
V4 Cloud Threshold:	160	x10(mV) d.160
TX_EW_Inter:	15	(s) d.30
TY_SN_Inter:	30	(s) d.50
T1_Sun_Recover:	5000	(s) d.5000
T2_Wind_Lock:	7	(s) d.600
T3_ND_E:	400	(s) d.400
T4_ND_W:	0	(s) d.0
T5_ND_S:	50	(s) d.0
T6_ND_N:	400	(s) d.0
T7_ND_Wait:	400	(s) d.1000
T8_Wind_Sec:	50	(s) d.200
T9_WS_S:	0	(s) d.0
T10_WS_N:	3	(s) d.0
T11_Pump_Ad_Del:	0	(s) d.0
TRC_Version:	3	(s) d.3
Driver type:	3	d.1 DC-PWM
PWM EW:	254	(%) d.120
PWM SN:	254	(%) d.120
Use AMP Limit:	0	0 or 1 d.0 - off
MAX AMP EW:	240	x10(mV) d.250
MAX AMP SN:	250	x10(mV) d.250
MIN AMP EW:	1	x10(mV) d.250
MIN AMP SN:	1	x10(mV) d.250
Use UART:	1	0 or 1 d.0 - off
AC fail senor:	0	d.0 - off
Driver Temp limit:	180	d.0 - off
Digital anemometer pps:	16	d.0 - off
LOG Server:	disable	
NTP Server:	pool.ntp.org	
Blockchain Node:	http://rei-log-gateway.com	
Node PORT:	50	50 -> BC off
Node USER:	X21juqXpdh	
Node PASS:	96b67da085	
Store Logs:	0	0 -> LS off

Refresh Save CONFIG

REI Solar Tracker

Installation scheme

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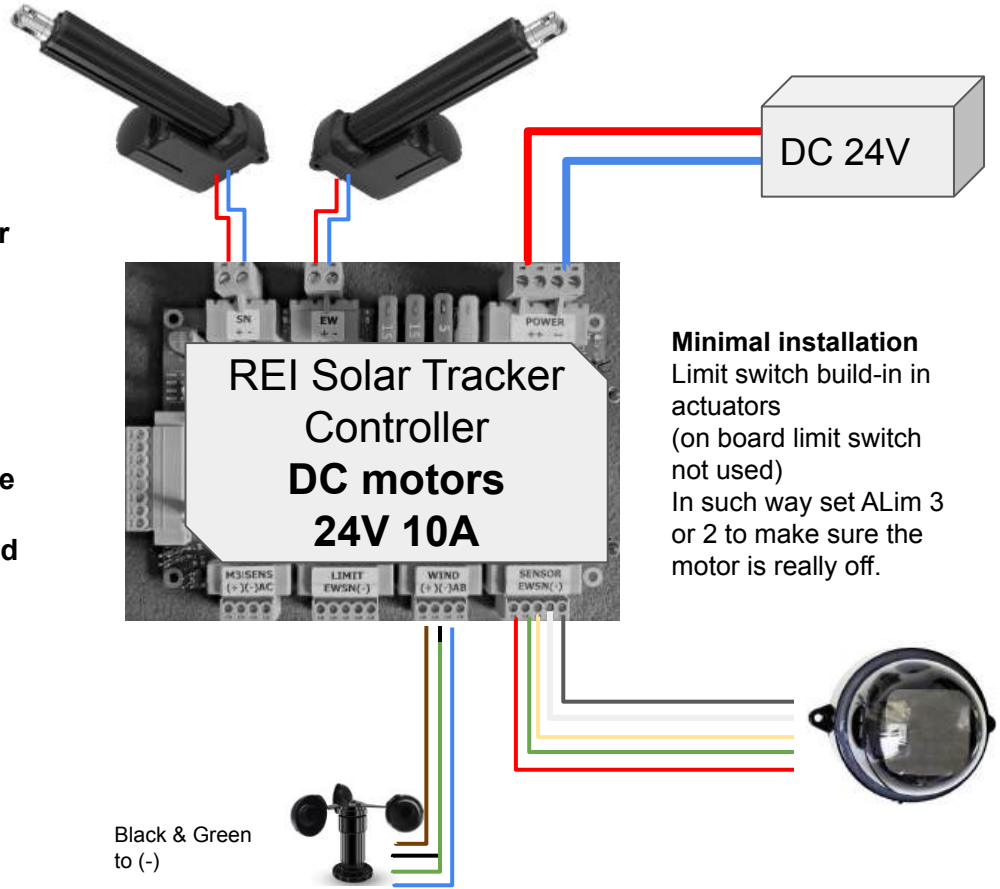
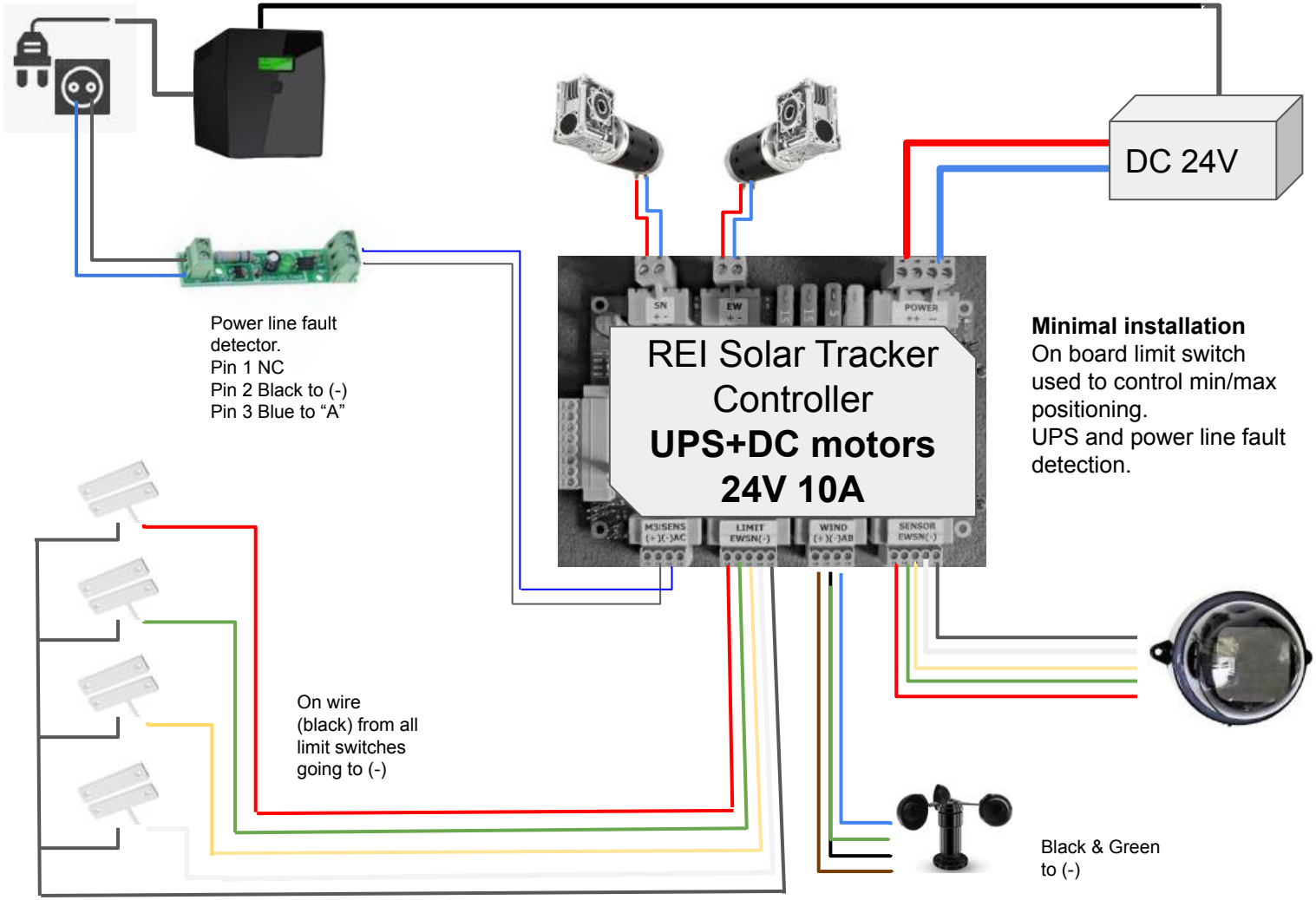
ATTENTION!
If the limit switches do not break the circuit correctly / completely, check the zener diodes used.

We recommend using external limit switches.
or
It is worth setting the ALim parameter to 3 to handle the problem of current leakage through improperly selected diodes.
Check the manual



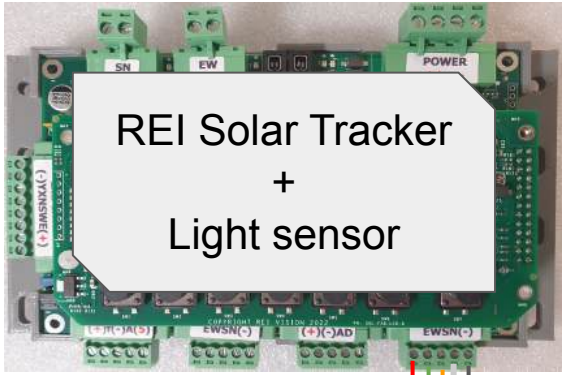
Minimal installation
Limit switch build-in in actuators
(on board limit switch not used)
In such way set ALim 3 or 2 to make sure the motor is really off.


DC 24V
Power line fault
detector.
Pin 1 NC
Pin 2 Black to (-)
Pin 3 Blue to “A”
REI Solar Tracker
Controller
UPS+DC motors
24V 10A
SN
EW
POWER
M3|SENS
(+)(-)AC
LIMIT
EWSN(-)
WIND
(+)(-)AB
SENSOR
EWSN(-)
Minimal installation
On board limit switch
used to control min/max
positioning.
UPS and power line fault
detection.
On wire
(black) from all
limit switches
going to (-)
Black & Green
to (-)

REI controller can handle many types of light sensors

Be aware that the LED light sensors are less accurate than micro PV panels versions.

Use at least twisted pair or control cable to avoid interference



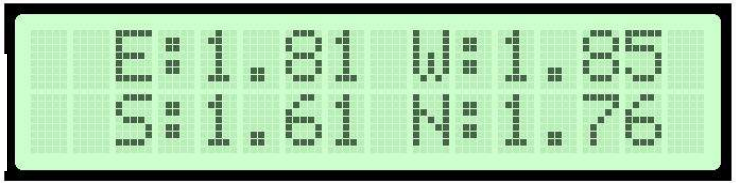
The sensor has an E - direction mark for proper alignment - make sure it is properly mounted.

If you are extending the cable, you can have different colors, but that's not a problem.
It is important to properly connect the direction at the controller.

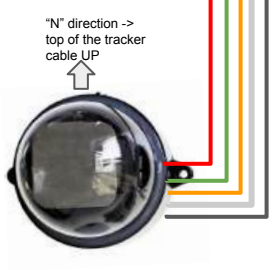
In automatic mode, by holding down the "N" button, you will see the readings of all 4 light sensors.

By connecting the wires one by one, you can see which wire is responsible for each of the four directions.

So even if you mount the sensor upside down - you don't have to disassemble it - you just need to replace the wires on the terminals.
You might as well use a different type of sensor.



TYPE: 1
Red (E)
Green (W)
Yellow (S)
White (N)
Black (-)



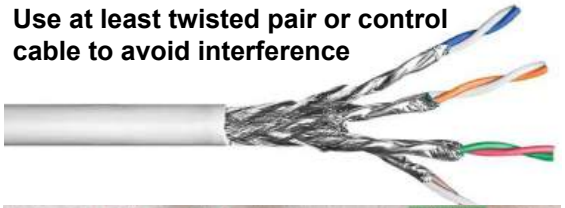
Sensor Type:2
have Yellow cable N and white cable S

TYPE: 2
Red (E)
Green (W)
Yellow (N)
White (S)
Black (-)

REI controller can handle two anemometer simultaneously
[if their signals are of different types; (Analog 0-5V and Digital 0-250 pps)]

The 3 most common anemometers can be connected as below;

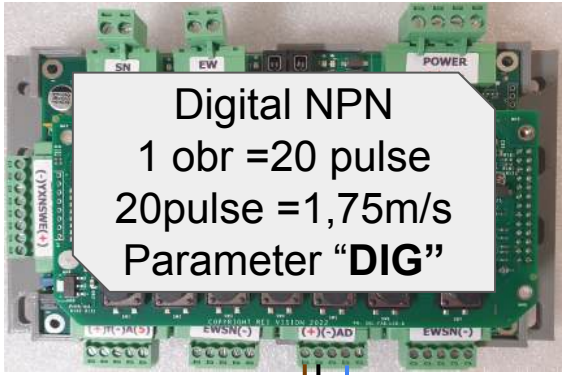
Use at least twisted pair or control cable to avoid interference



Analog 0-5V
5V - 30 m/s
Parameter “**V2**”

power supply;
Brown (+)
Black (-)

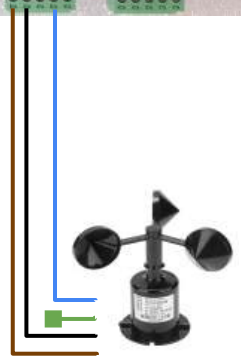
Signal;
Blue (A)
Green (-) or
not connected

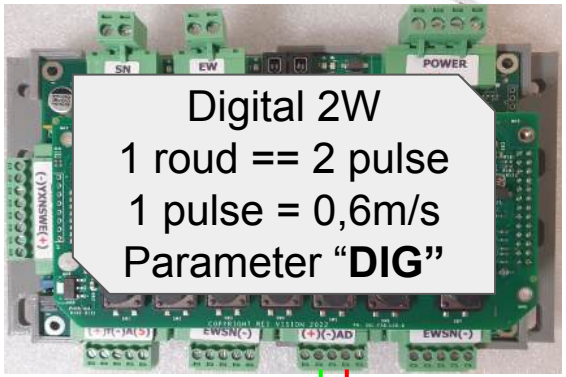


Digital NPN
1 obr =20 pulse
20pulse =1,75m/s
Parameter “**DIG**”

power supply;
Brown (+)
Black (-)

Signal;
Blue (D)
Green (not
connected)

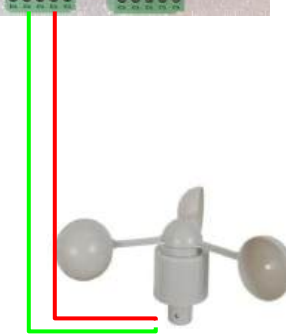




Digital 2W
1 roud == 2 pulse
1 pulse = 0,6m/s
Parameter “**DIG**”

No power
supply;

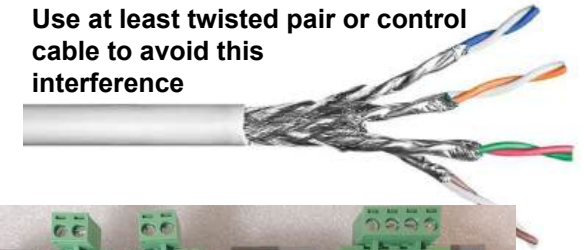
Signal;
Green (-)
Red (D)



The REI controller can operate 2 anemometers simultaneously (2x analog 0-5V and 1x digital 0-250 pps)]

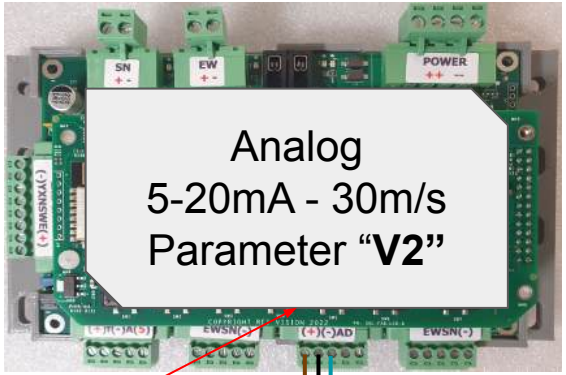
There is another analog signal output type giving 5-20mA signal or even anemometer where power supply is not needed

Use at least twisted pair or control cable to avoid this interference



To properly calibrate the current signal 5-20mA - on the green wire

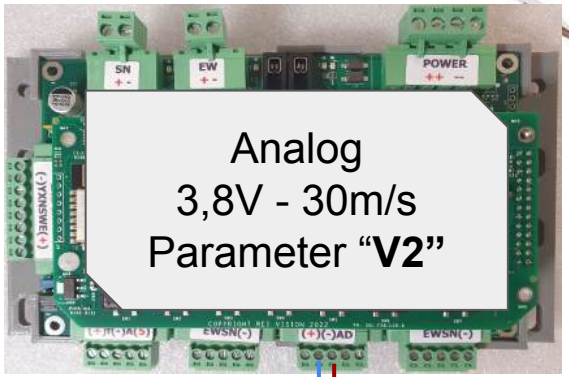
It is necessary to set the potentiometer to such a position that the readings at LCD are in the range of 0.5 to 0.7V at rest (no wind)



The potentiometer is under LCD plate.
It must be completely detached and removed

power supply;
Brown (+)
Black (-)

Signal;
Blue (not connected)
Green (signal to A channel)



No power supply;

Signal;
Brown (A)
Blue (-)

REI controller can operate in parallel;

Analog 0-5V wind direction indicator and Digital wind sensor 0-250 pps

The parameter V2 = 4 activates the weather vane procedure

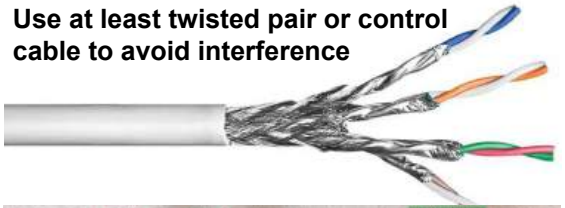
Installation;

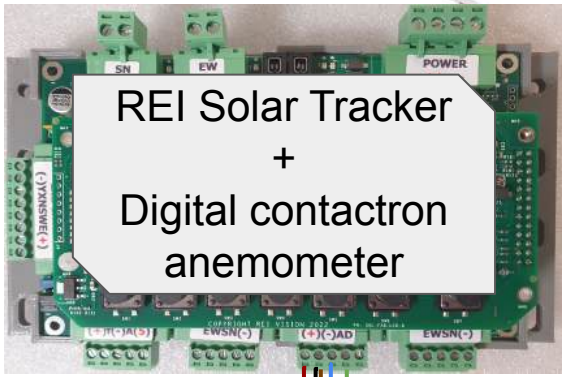
set the weather vane so that the reading A = 0 and the tip indicate the wind from the back of the tracker - in the back of the panels.

Procedure;

1. START - detection of exceeding the threshold of wind speed on the digital sensor or detection of power supply voltage loss
2. GO S - if set (southern hemisphere)
3. GO N - if set (Northern Hemisphere)
4. Determine the wind direction and turn on the E - W motor in the direction according to the shortest way
5. IF contact with the end position is detected [AND] the angle of attack of the wind is> = 45 degrees, start the engine in the opposite direction (set the other / distal side in the direction of the wind)
6. IF the position has been reached [OR] the time for position correction has expired
7. END the procedure and go to the motion lock timer.

Use at least twisted pair or control cable to avoid interference





Power supply;
Brown (+)
Black (-)

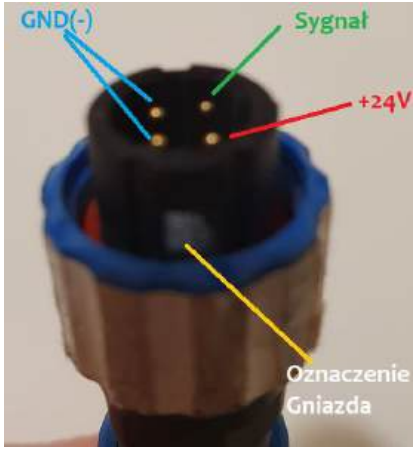
Signal;
Blue (A)
Green (-) or not connected

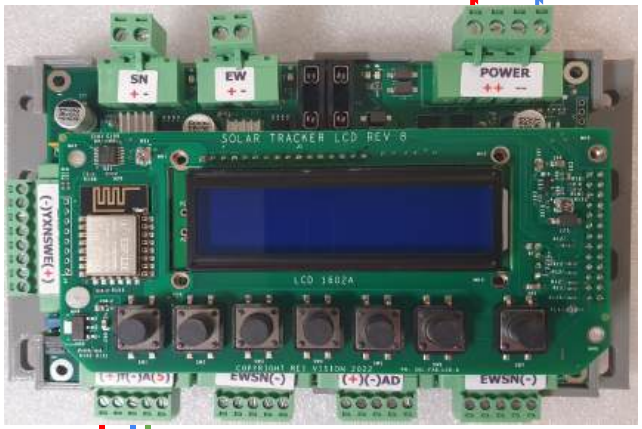
No power;

Signal;
Green (D)
Red (-)

Connecting the snow/rain sensor to the first plug from the right;

Pin 1 (GND) - black to (-)
Pin 2 (f) - free
Pin 3 (Signal)
Pin 4 (VCC) - power supply





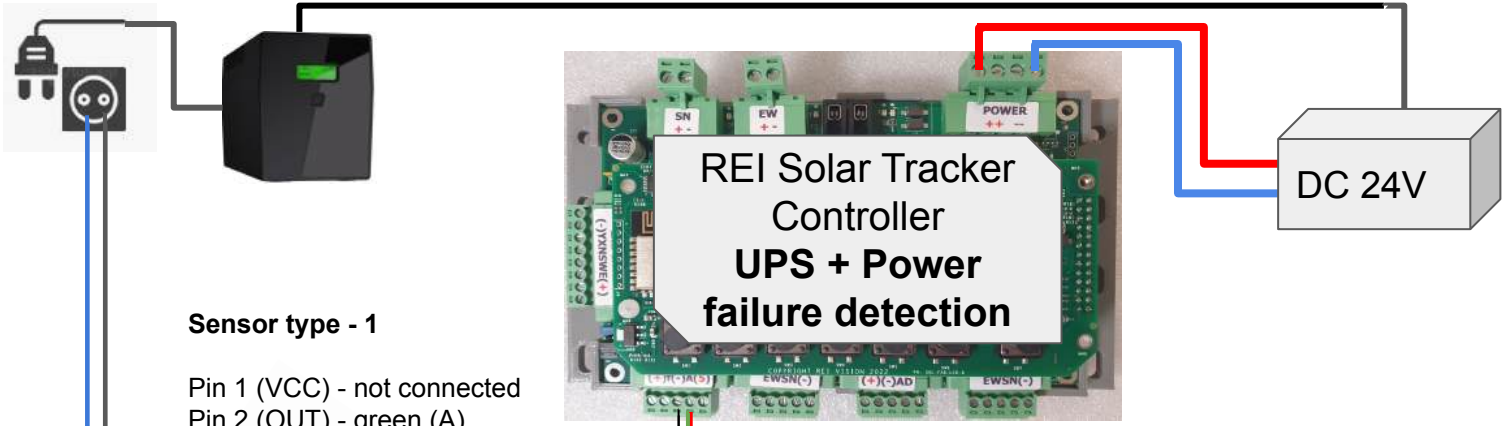
The snow sensor works to short-circuit the tracks.
The output has a relay that is in the Normally Open state.

When snow shorts the paths, the sensor closes the relay.

By connecting the relay wires to GND and to channel A the controller will detect the snow.

In order to perform a procedure appropriate for snowfall/ to dumped the snow

Parameter !EXT : must be set to 3 or 4 depending on the sensor type



Sensor type - 1

Pin 1 (VCC) - not connected
Pin 2 (OUT) - green (A)
Pin 3 (GND) - black (--)

OR

Sensor type - 2

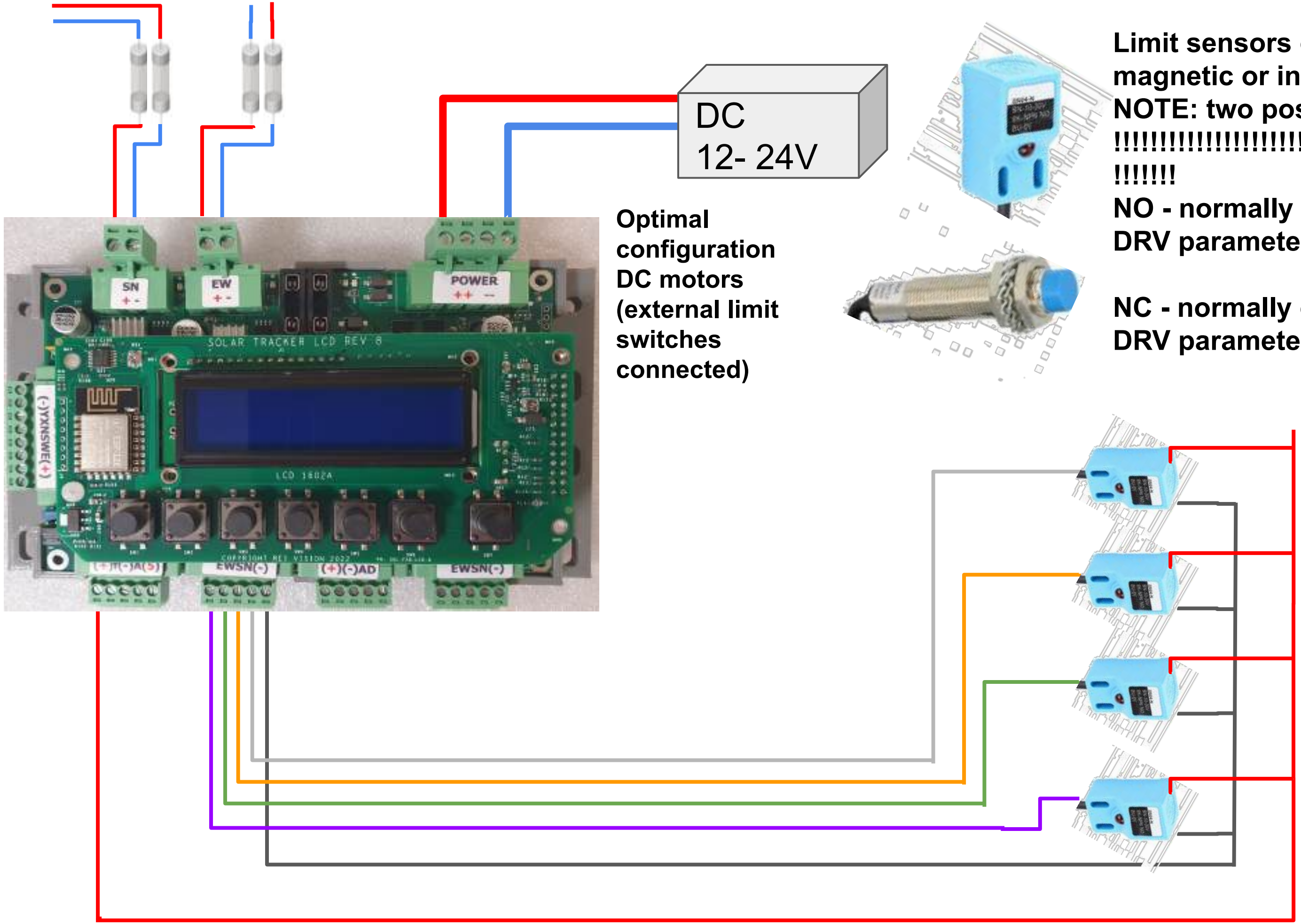
Pin 1 (GND) - black (--)
Pin 2 (PM) - red (A)

To protect the solar tracker in case of a power outage, it is worth using even the cheapest UPS.
Unfortunately, often such ups do not have an output that allows us to inform the driver about the lack of voltage in the network.

This information is used to properly use the UPS's battery.

The basic need is to set the structure in a safe position in case of strong wind - Wind Locker procedure.

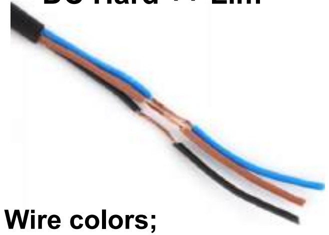
To achieve this, use one of the sensors available on the market.



Optimal configuration DC motors (external limit switches connected)

Limit sensors can be mechanical, magnetic or inductive
NOTE: two possible options;
!!!
NO - normally open → settings DRV parameter == DC Hard -- Lim

NC - normally closed → settings DRV parameter == DC Hard ++ Lim



Wire colors;

- Brown - (plus) 6-30V power supply
- Blue (minus)
- Black (signal) NO or NC

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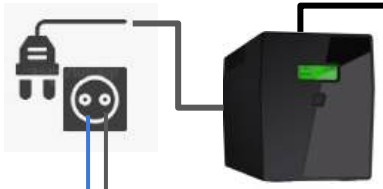
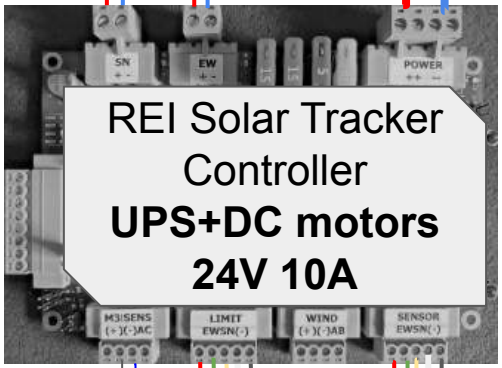


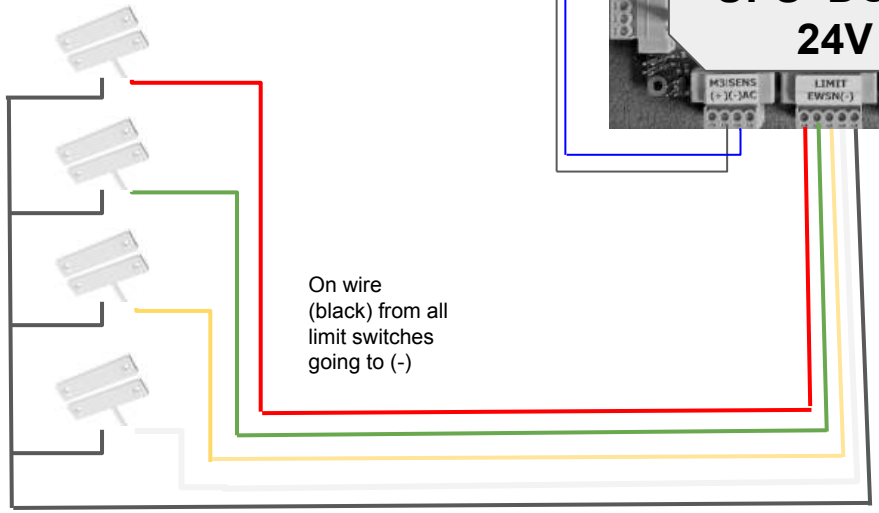
DC 24V

Power line fault
detector.
Pin 1 NC
Pin 2 Black to (-)
Pin 3 Blue to “A”



REI Solar Tracker
Controller
UPS+DC motors
24V 10A

Minimal installation
On board limit switch
used to control min/max
positioning.
UPS and power line fault
detection.



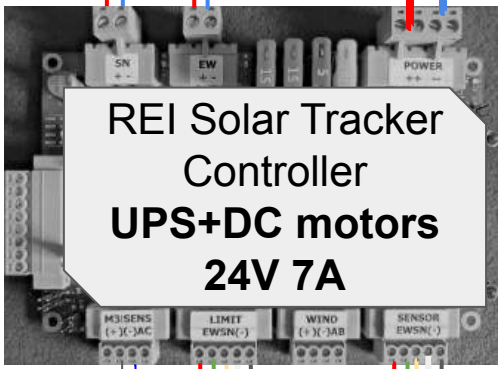
On wire
(black) from all
limit switches
going to (-)

Black & Green
to (-)

2x 12V battery.

Be sure that the external fuses fit to the motor max load.

Fuse on both cables

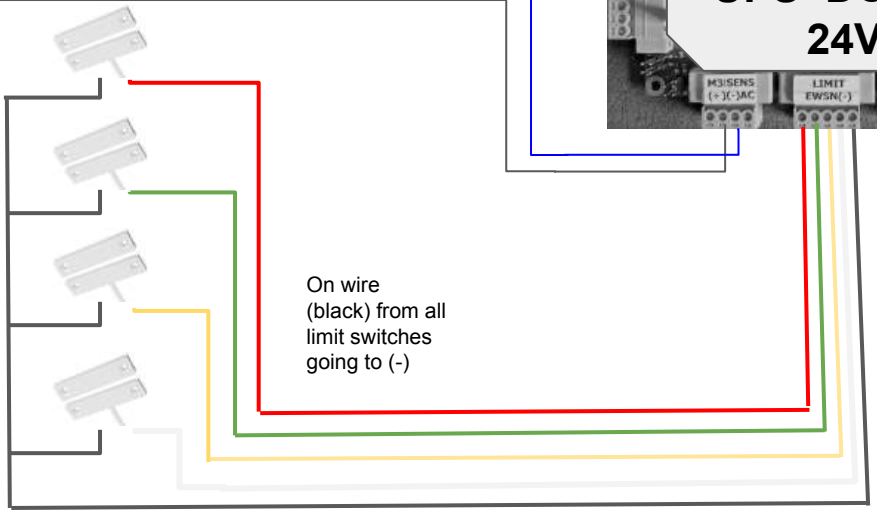


Minimal installation
On board limit switch used to control min/max positioning.
UPS and power line fault detection.

Power line fault detector.
GND to (-)
Signal to “A”

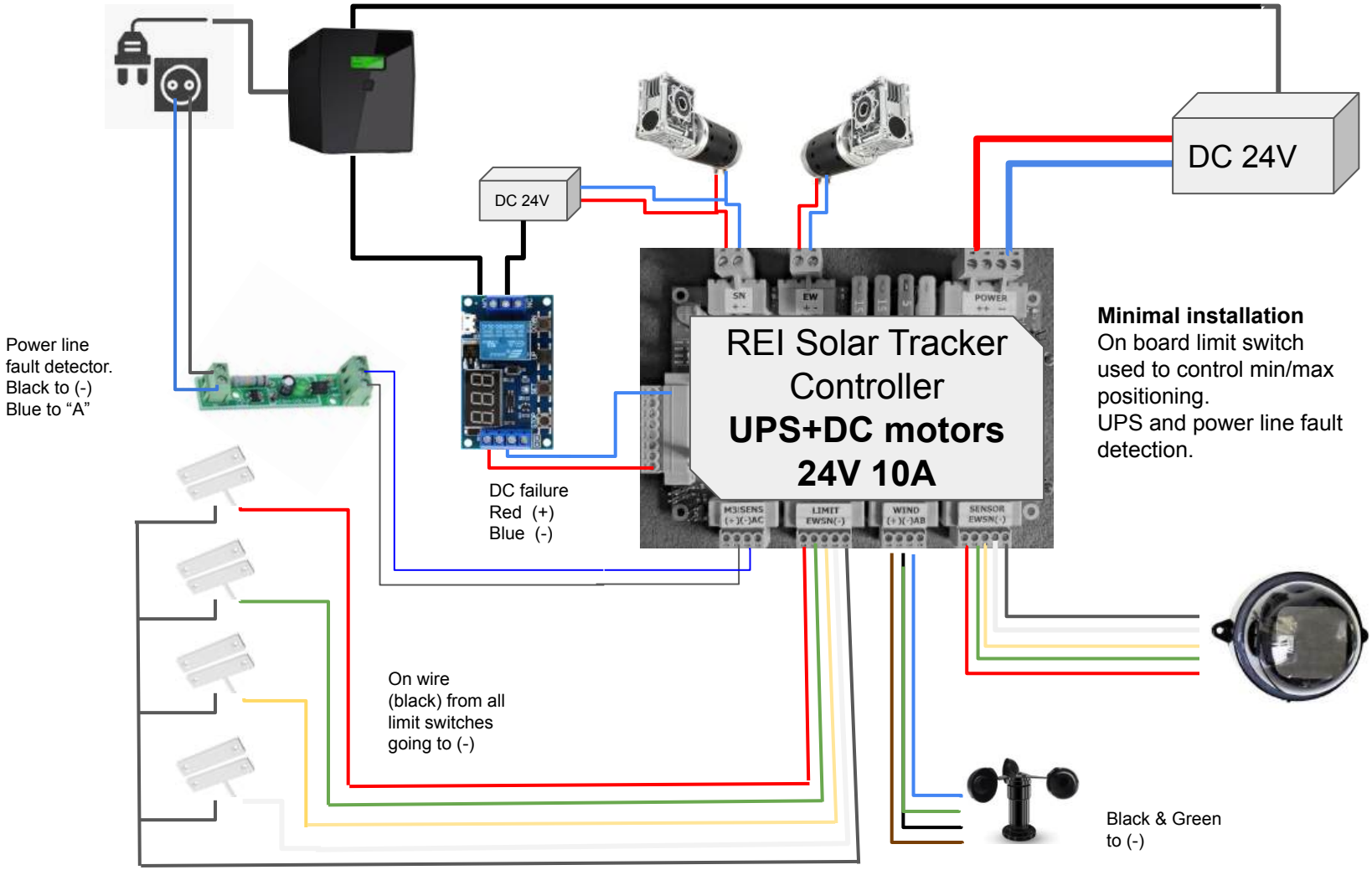
UPS - (0 - 2) enabling / disabling the operation of the AC power line failure detection sensor

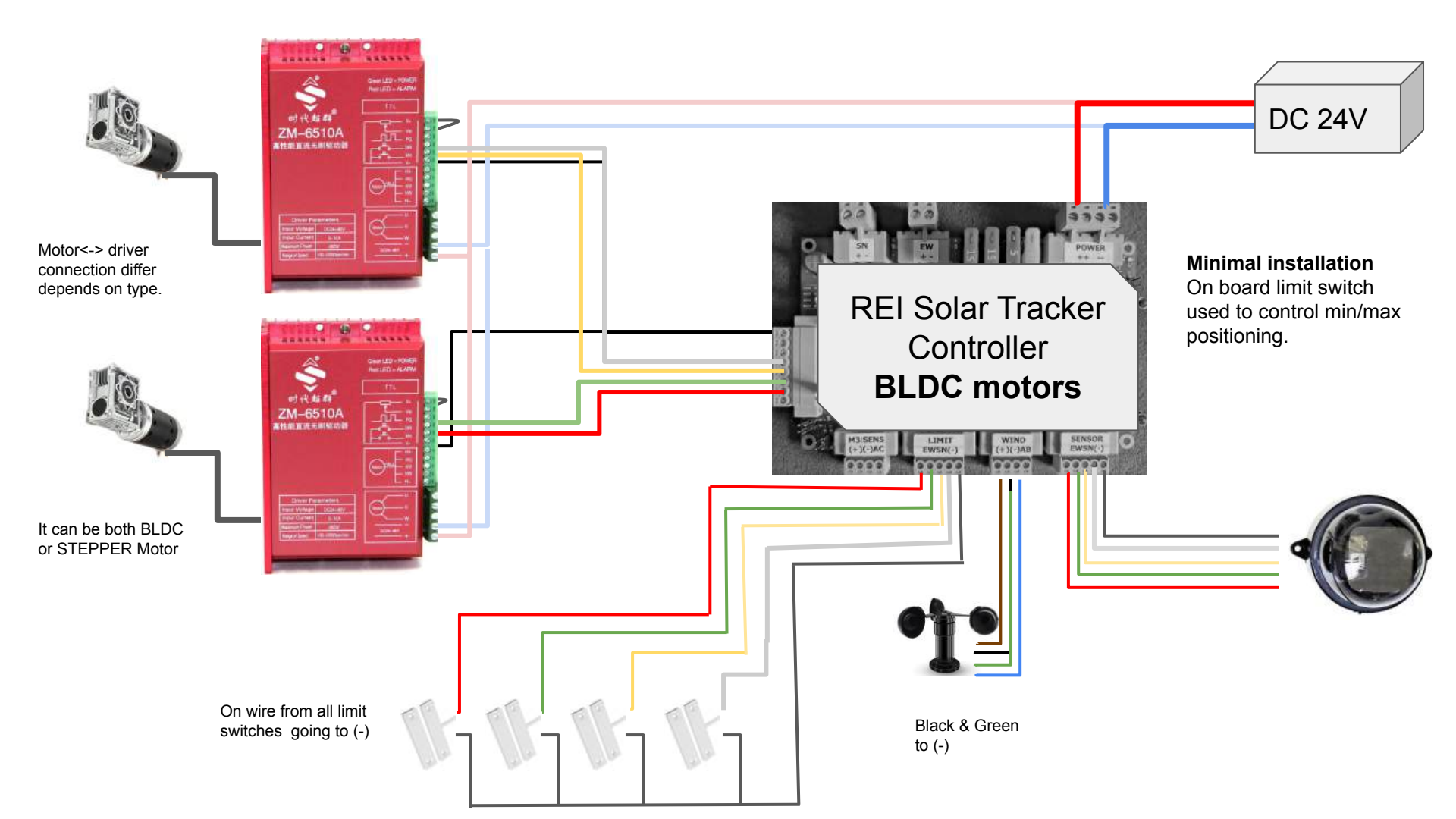
0- turned off,
1- turned on activated by the low state,
2- turned on, activated by the high state



On wire (black) from all limit switches going to (-)

Black & Green to (-)


DC 24V
DC 24V
REI Solar Tracker Controller
UPS+DC motors
24V 10A
SN
EW
POWER
M3|SENS (+)(-)AC
LIMIT EWSN(-)
WIND (+)(-)AB
SENSOR EWSN(-)
Power line fault detector. Black to (-) Blue to “A”
DC failure Red (+) Blue (-)
On wire (black) from all limit switches going to (-)
Minimal installation
On board limit switch used to control min/max positioning.
UPS and power line fault detection.
Black & Green to (-)

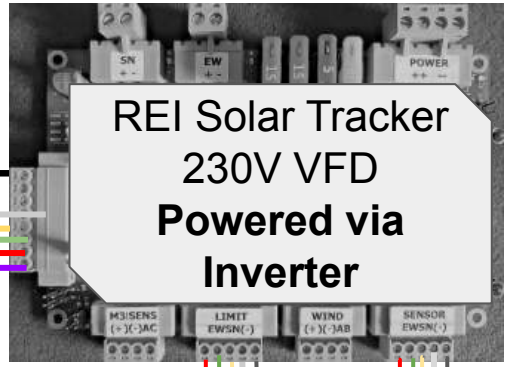

DC 24V
ZM-6510A
ZM-6510A
REI Solar Tracker Controller
BLDC motors
SN
EW
POWER
M3|SENS
LIMIT
WIND
SENSOR
Motor<-> driver connection differ depends on type.
It can be both BLDC or STEPPER Motor
Minimal installation
On board limit switch used to control min/max positioning.
On wire from all limit switches going to (-)
Black & Green to (-)

In VFD inverters parameter P11 must be changed from (0) to (2)

Motor<-> driver connection differ depends on type.

It can be AC motor:;
1 phase 3-wires
3 phase 230V/400V

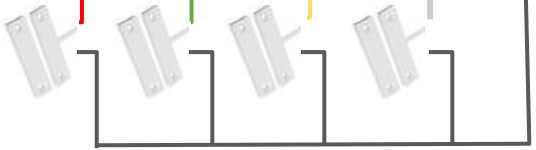
For 1-Phase motor use VFD AT-2 model



VFD Inverter logic connection:
Com - GND (-)
X4 - CW direction
X5 - CCW direction
12V - REI controller power supply (+)

VFD is used as power supply.

Black & Green to (-)



On wire from all limit switches going to (-)

In VFD inverters parameter P11 must be changed from (0) to (2)

It can be AC motor:;
1 phase 3-wires
3 phase 230V/400V

For 1-Phase motor use only VFD AT-2 model Then change parameter 92 from 0 to 2

Motor<-> driver connection differ depends on type.

DC 24V

REI Solar Tracker
DC and AC motor

VFD Inverter logic connection:
Com - GND (-)
X4 - CW direction
X5 - CCW direction

VFD is **NOT** used as power supply.

On wire from all limit switches going to (-)

Black & Green to (-)

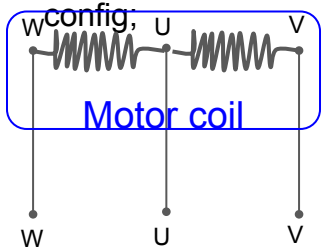
The **FMZ** inverter will only receive the control signal on the terminals if parameter **P0.02 == 1.**
In default settings the controller signal is handled on terminal **X1 and X2**.

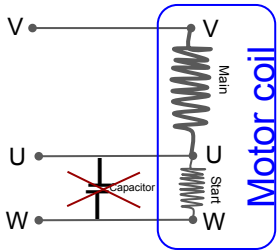
Three-phase motor;
P4.13 == 0, **P5.18 == 2.00**.
The sequence of connecting the U-V-W coils only changes the direction of operation.

Single-phase motor;
P4.13 == 3 and P5.18 = 0.00.
Connect the wire shorting both ends of the coils to U, the other 2 wires/ends of coils to V and W.
Capacitor is not needed.

TIP;
P8.04 == 3 allows you to start the motor with left rotation using MF button

Single-phase motor terminals 2 possible coil config;



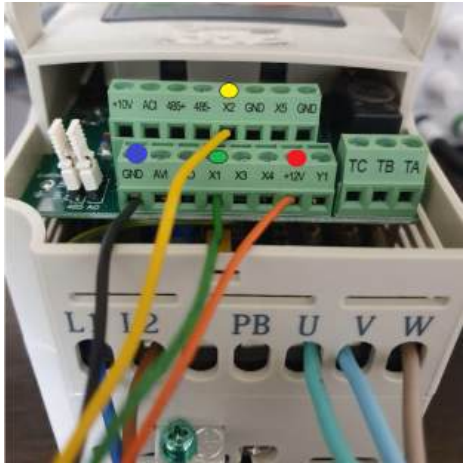


Center wire is to be connected to "U"
Disconnect the capacitor

How to determine the U wire in a single-phase motor when there is no access to the coil terminals?

The resistance between the V - W wires is equal to the sum of the resistance between the U - V wires and U - W wires.

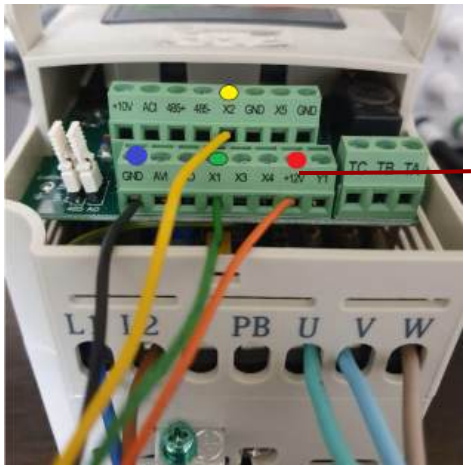
If it is a motor with a starting coil; the resistance between the U - V (main coil) terminals is smaller than between the U - W (starting coil) terminals



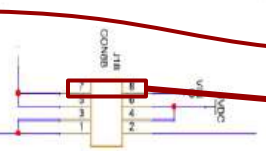
NOTE for the mixed configuration of the AC FMZ inverter + power supply of the controller above 12V, e.g. to supply the DC 24V motor in one of the directions.

Attention; in mixed configuration DC 24V(above DC12V) + VFD inverter;
Jumper J9 on pin 7-8 must be removed.

This way, we will not supply voltage from an external power supply (higher than allowed) to the logic inputs of the inverter.

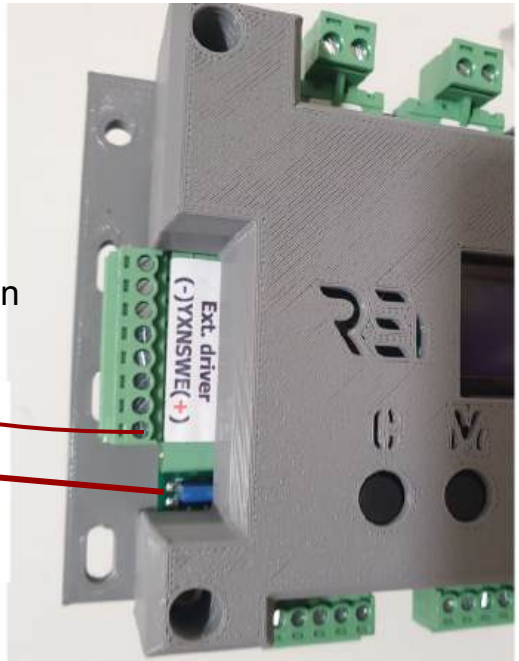


If the cables connecting the inverter and the controller are long, connect the + 12V inverter pin to (+) REI pin. This way you will power up the pull-up resistors.



FMZ inverter on logic pins has;

- 4.6 <V <12 inactive
- ~ 0V active



FMZ allows motors to run at 2 speeds;
Tracking speed - during normal operation
Service speed - when wind is detected or in manual mode

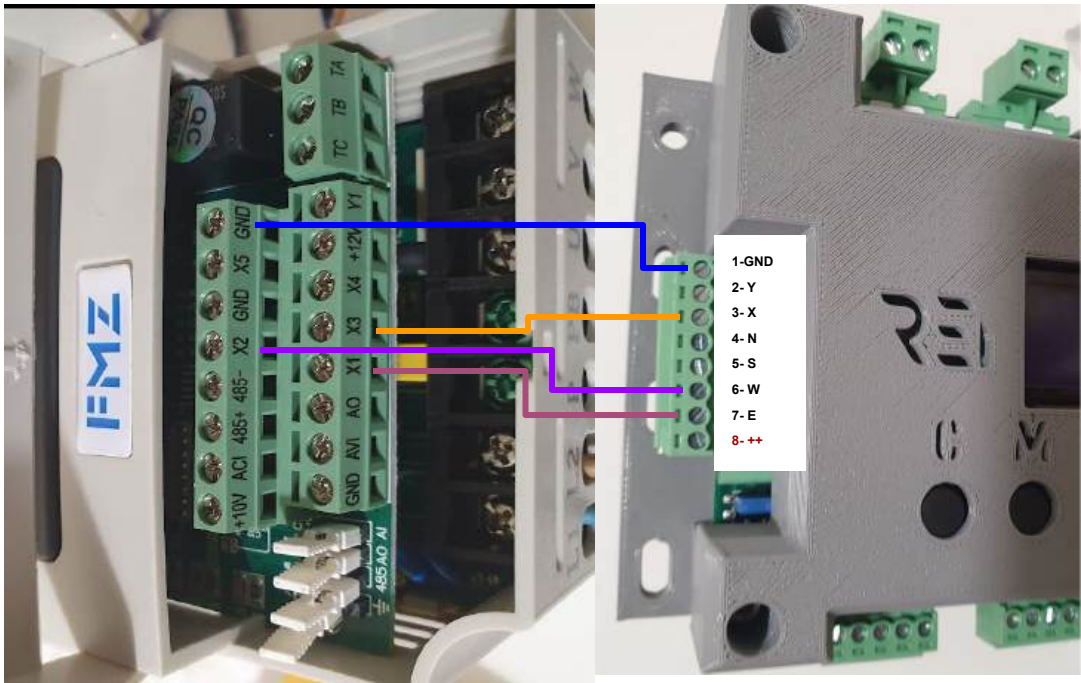
The tracking speed is set by a potentiometer on the inverter - e.g. 40hz for the tracker to be more accurate / slower;

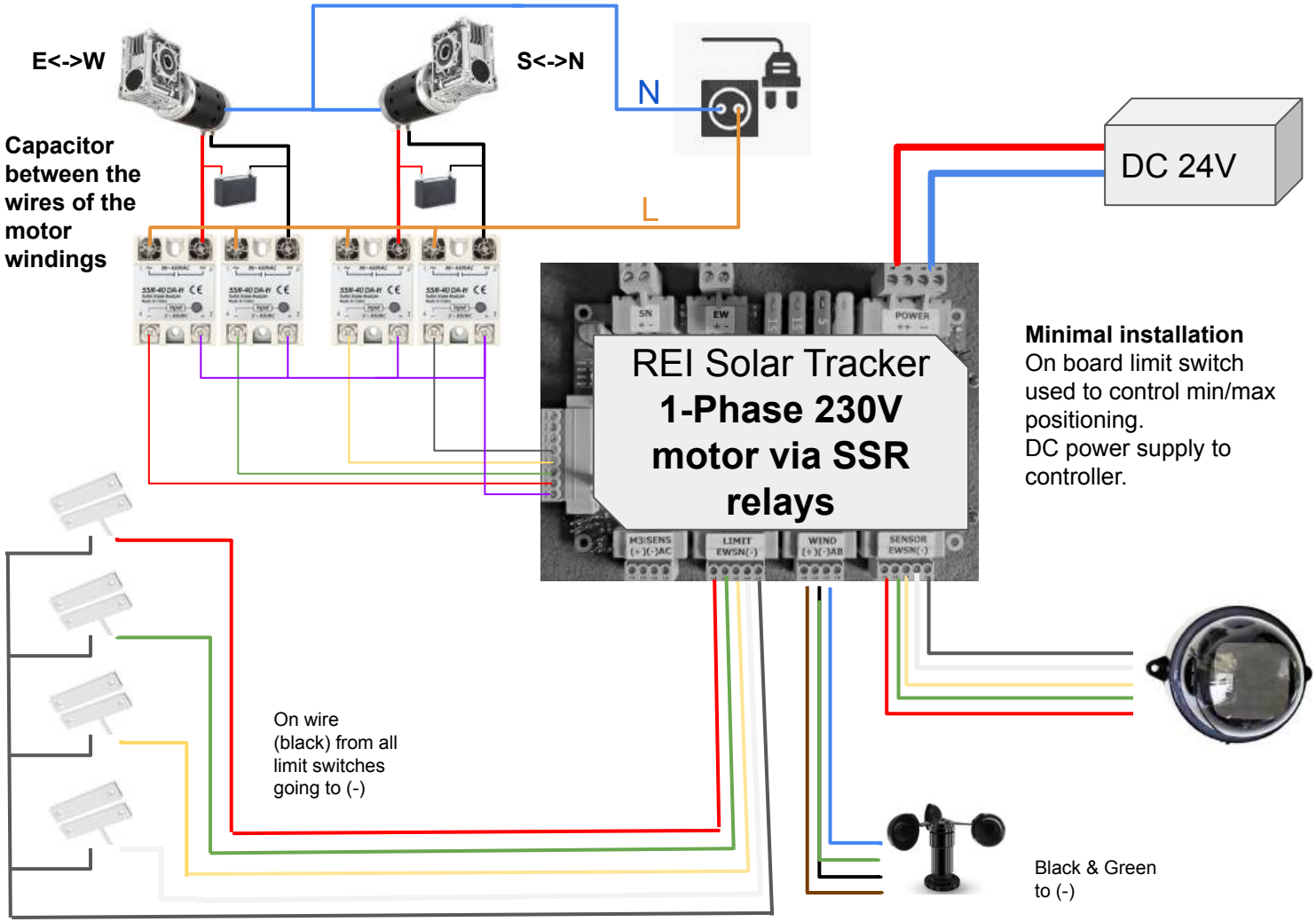
The service speed can be set by parameter **P1.17** by default, 5hz can be set to e.g. 50hz - so that the tracker in for e.g.”the return to the beginning of the day procedure” or when detecting the wind makes a move faster == P1.17.

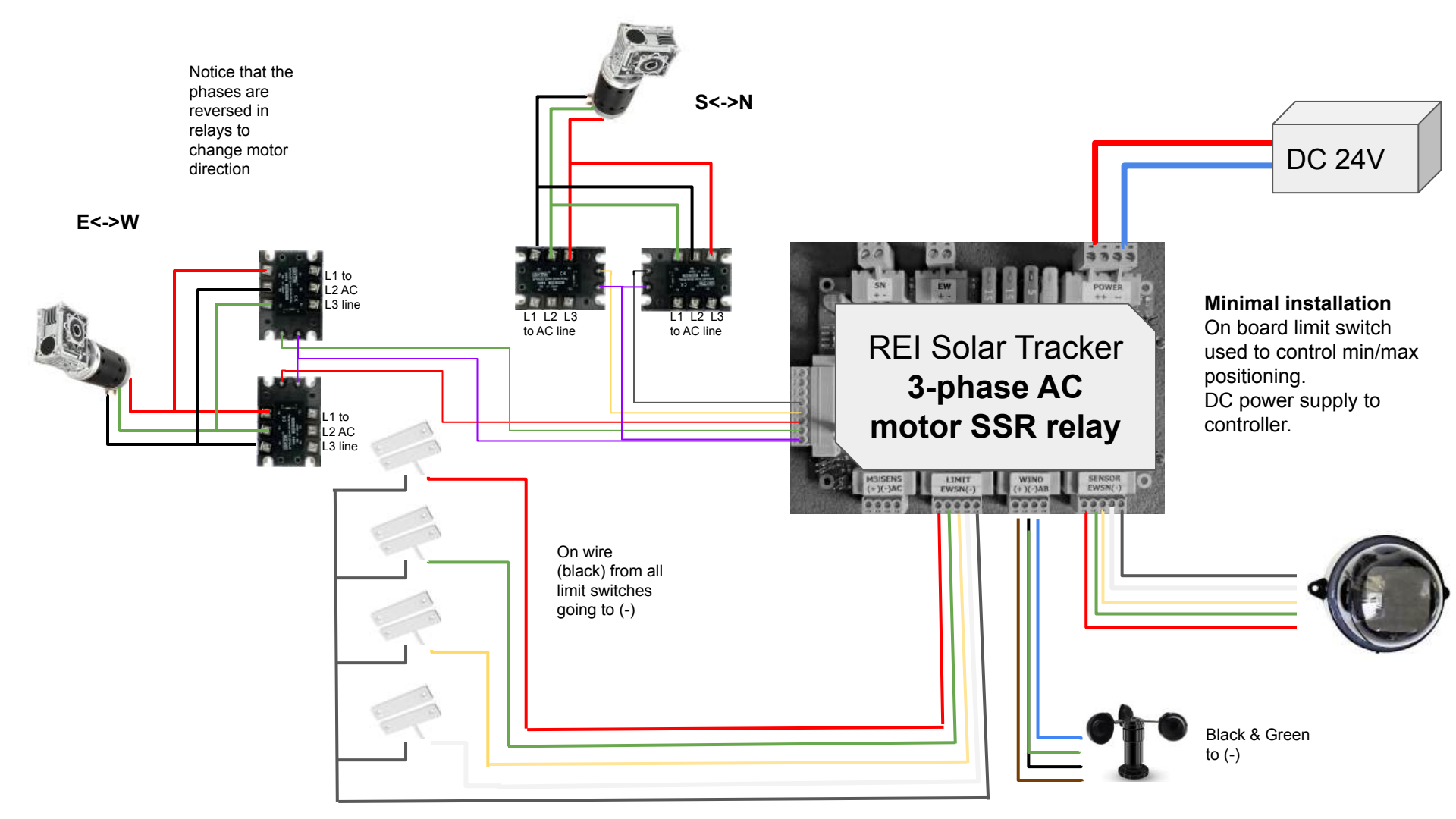
By setting parameter **P2.15** to 13, we activate pin **X3** on the inverter to operate with the speed set by parameter **P1.17**

To send a service speed signal; connect the cable between **pin X3** of the inverter and **pin Y or X** of the controller.
Y is the service speed signal for pitch i.e. S-N direction
X is the service speed signal for rotation, i.e. E-W direction

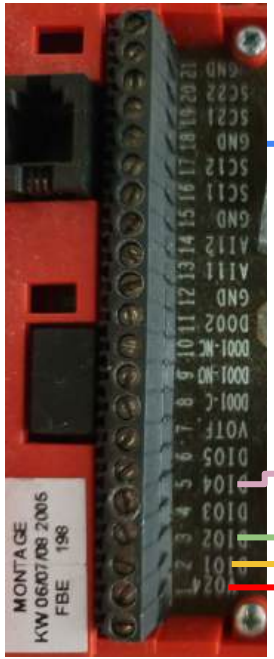
Example of inverter connection for the **E-W** direction




E<->W
S<->N
N
L
Capacitor between the wires of the motor windings
DC 24V
REI Solar Tracker
1-Phase 230V motor via SSR relays
SN
EW
POWER
M3|SENS (+)(-)AC
LIMIT EWSN(-)
WIND (+)(-)AB
SENSOR EWSN(-)
Minimal installation
On board limit switch used to control min/max positioning.
DC power supply to controller.
On wire (black) from all limit switches going to (-)
Black & Green to (-)


Notice that the phases are reversed in relays to change motor direction
S<->N
E<->W
L1 to L2 AC L3 line
L1 to L2 AC L3 line
L1 L2 L3 to AC line
L1 L2 L3 to AC line
DC 24V
REI Solar Tracker
3-phase AC motor SSR relay
SN
EW
POWER
M3|SENS (+)(-)AC
LIMIT EWSN(-)
WIND (+)(-)AB
SENSOR EWSN(-)
Minimal installation
On board limit switch used to control min/max positioning.
DC power supply to controller.
On wire (black) from all limit switches going to (-)
Black & Green to (-)

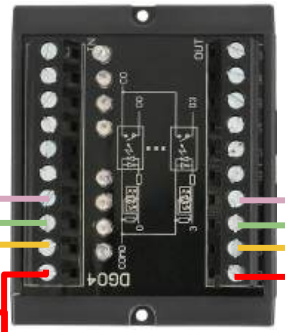
It can be AC motor:;
1 phase 3-wires
3 phase 230V/400V

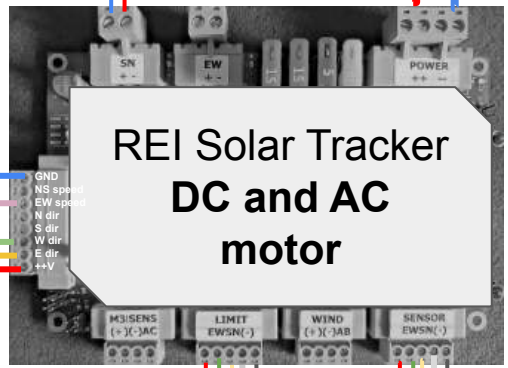


V24 is + 24 Volt
DI01 is CW direction
DI02 is CCW direction
DI04 for speed n21 parameter

also DI05 can be used as different speed form n22 parameter

DC 24V



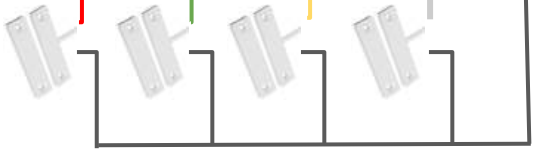


VFD Inverter logic connection:
Com - GND (-)
X4 - CW direction
X5 - CCW direction

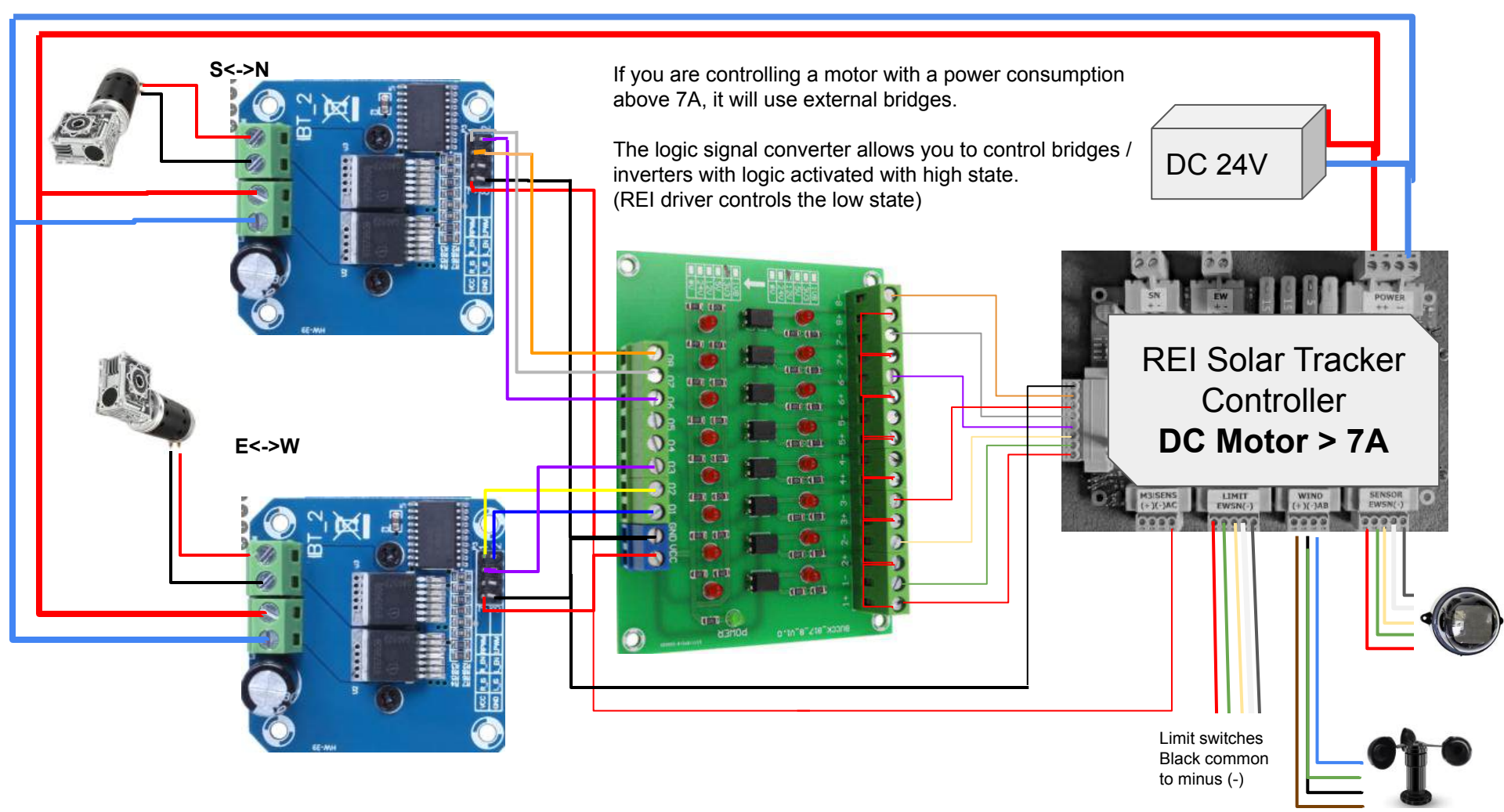
VFD is **NOT** used as power supply.

Motor<-> driver connection differ depends on type.

On wire from all limit switches going to (-)

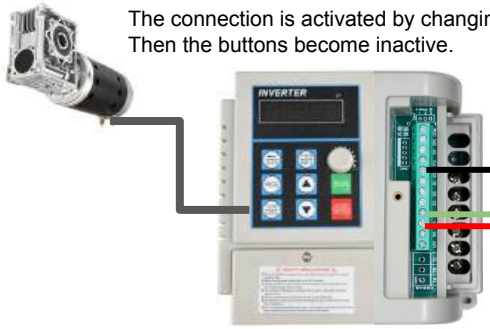


Black & Green to (-)

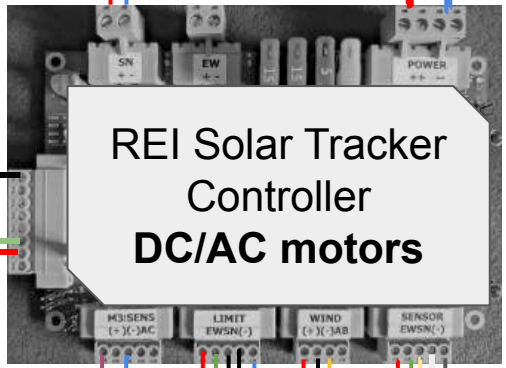

S<->N
E<->W
If you are controlling a motor with a power consumption above 7A, it will use external bridges.
The logic signal converter allows you to control bridges / inverters with logic activated with high state.
(REI driver controls the low state)
DC 24V
REI Solar Tracker Controller
DC Motor > 7A
Limit switches
Black common
to minus (-)

By default, the inverter responds to the RUN STOP FWD / REV buttons
Does not respond to driver commands.

The connection is activated by changing the parameter P11 from (0) to (2)
Then the buttons become inactive.



Zasilacz DC
12-24V



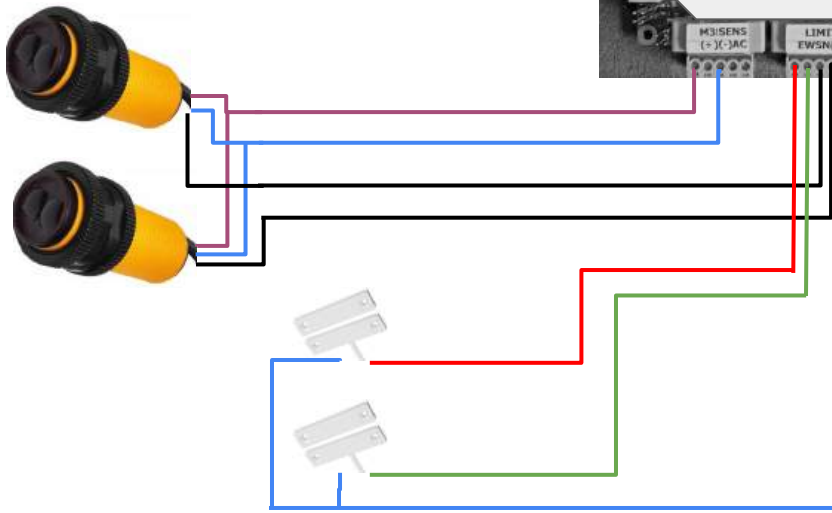
Universal tracker;
Mixed configuration of actuator + 3f AC motor

Optical sensor NO.
The example uses 2x 3-wire sensors.

A pair of sensors allows you to determine the direction of the inclination of the structure when strong wind is detected and turn on the correct engine to set the structure flat.

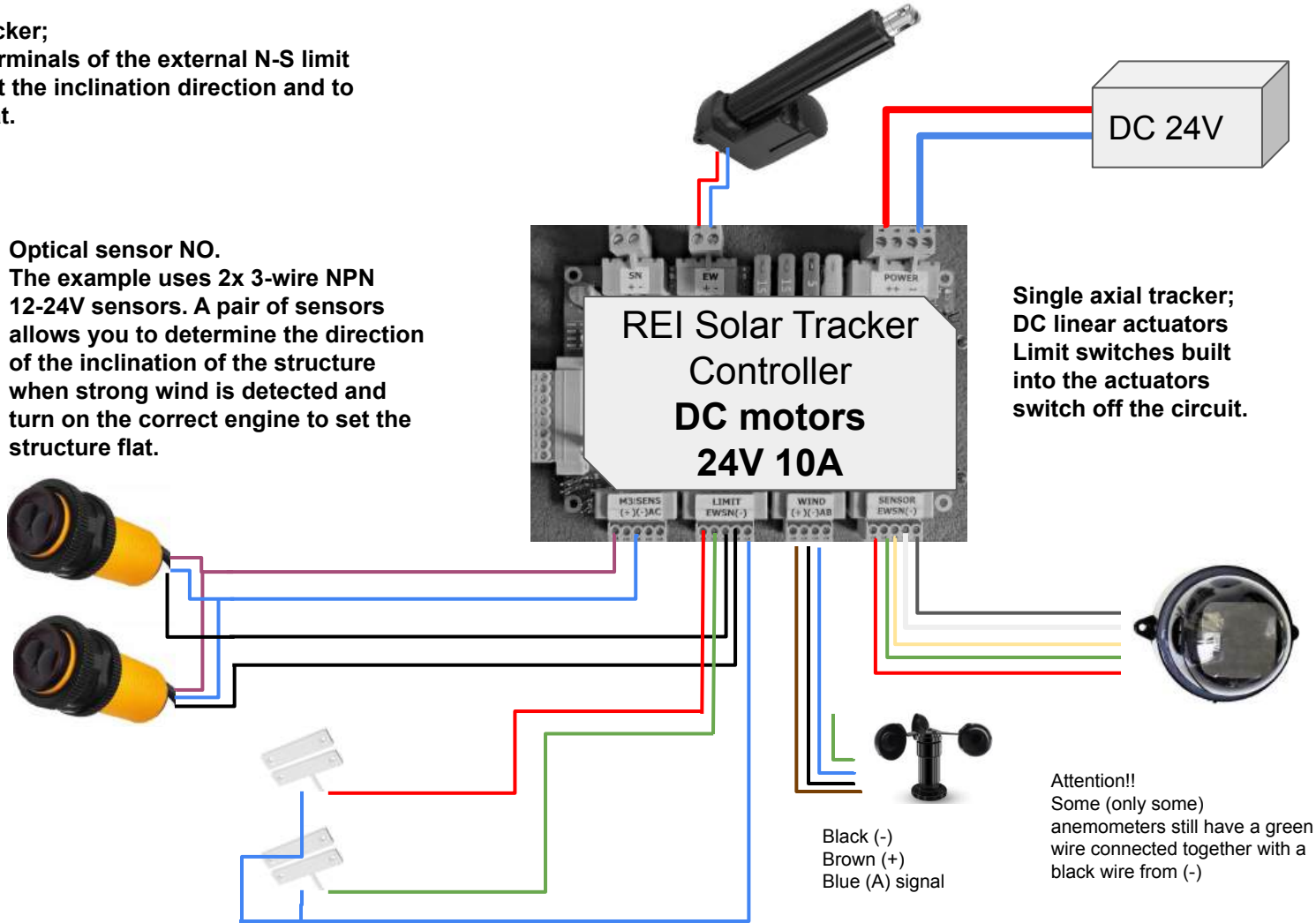
If both sensors are disconnected / open the controller will show P1 error ^

Because it will not be able to put the tracker flat.



RED (+)
BLACK (-)
Yellow (A)

SINGLE AXIS tracker;
We will use the terminals of the external N-S limit switches to detect the inclination direction and to set the surface flat.



Optical sensor NO.
The example uses 2x 3-wire NPN 12-24V sensors. A pair of sensors allows you to determine the direction of the inclination of the structure when strong wind is detected and turn on the correct engine to set the structure flat.

Single axial tracker;
DC linear actuators
Limit switches built into the actuators switch off the circuit.

Black (-)
Brown (+)
Blue (A) signal

Attention!!
Some (only some) anemometers still have a green wire connected together with a black wire from (-)

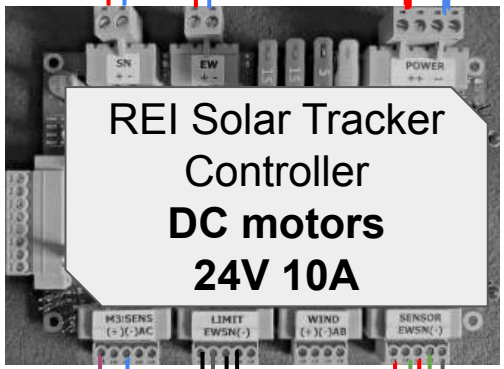
Optical sensor NO.
The example uses 2x 3-wire sensors. A pair of sensors allows you to determine the direction of the inclination of the structure when strong wind is detected and turn on the correct engine to set the structure flat.

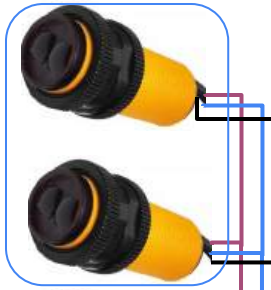
2x single axis tracker;
MV direction motors were used as the tilt drive of the second uniaxial tracker

DC 24V

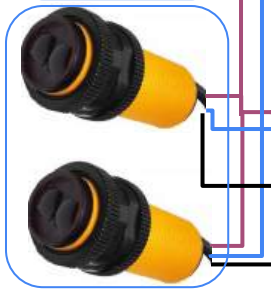
Because
SN direction motors were used as the tilt drive of the second uniaxial tracker, SN indications relate to respectively
EW tracker 2

Uniaxial tracker;
DC linear actuators
Limit switches built into the actuators switch off the circuit.





sensor pair
Tracker X



sensor pair
Tracker Y

2 light sensors only for a limited distance.
The GND ground from both sensors is connected to the same terminal. S N directions not connected

Black and green to (-)

Light sensor Tracker 2

White / Yellow not connected

Light sensor Tracker 1

Technical data:
- 12-24V DC power supply
- current consumption approx. 100mA
- object detection distance in the range of 3 to 80 cm
- NPN digital output
- sensor diameter 18 mm
- sensor length 50 mm
- operating temperature range -25 to 50 degrees Celsius
- the sensor is normally open
Description of the pins:
- brown cable - VDC power supply
- blue cable - ground
- black cable - digital output

An exemplary configuration of the tilt sensor (crescent, trapezoid / triangle)