TP 430 R/S

TRACKERS DRIVER

vers. 1.5

1.0 Introduction

A photovoltaic panel provides power proportional to the amount of sunlight it is hit by, so maximum power is generated when the sun is at a perpendicular to the panel itself.
In photovoltaic fields with fixed panels, the illumination of the panels is not constant over time as the apparent motion of the sun follows the day-night and summer-winter pattern, therefore the yield is penalised.

To improve yield, mobile panels can be used to follow the apparent motion of the sun so that the exposure of the panels is as perpendicular as possible. To achieve this, panels motorised with respect to two axes, east-west and north-south, are used to follow both day-night and summer-winter movement.

However, the implementation of moving panels on two axes is extremely costly both mechanically and electrically, hence economically, so it is often preferred to adopt a solution in which the movement of the panels is on a single axis capable of following the day-night, hence east-west, trajectory. This movement envisages that at dawn the panels are oriented eastwards, then begin to move following the motion of the sun and then maintaining perpendicularity to finish westwards at sunset.

A system thus conceived envisages a mechanical connection between a group of panels, commonly referred to as a ‘sail’, (typically 20/30) moved by a motor driven by an electronic device (tracker) in turn connected to a plant supervisor via a communication network.
In a photovoltaic plant there will typically be several trackers depending on the size of the plant, all connected in a network to the supervisor.
Each tracker is equipped with an inclinometer (tilt sensor) that detects the inclination of the panels with respect to the horizontal and receives at regular intervals from the supervisor the position to be reached and maintained.

The supervisor is equipped with an astronomical clock that, based on geographical coordinates and the current time, calculates in real time the inclination that the panels must reach to maintain perpendicularity to the movement of the sun and sends it cyclically to all trackers.

The components of a control system for a photovoltaic field with single-axis movement are therefore :

- **TK04ACS** : tracker, motor control device to be installed integrated with the mechanical supports of the panels moving in the east-west direction. This device constitutes a node in an RS485 communication network, receives the inclination from the supervisor and controls the motor to maintain it.

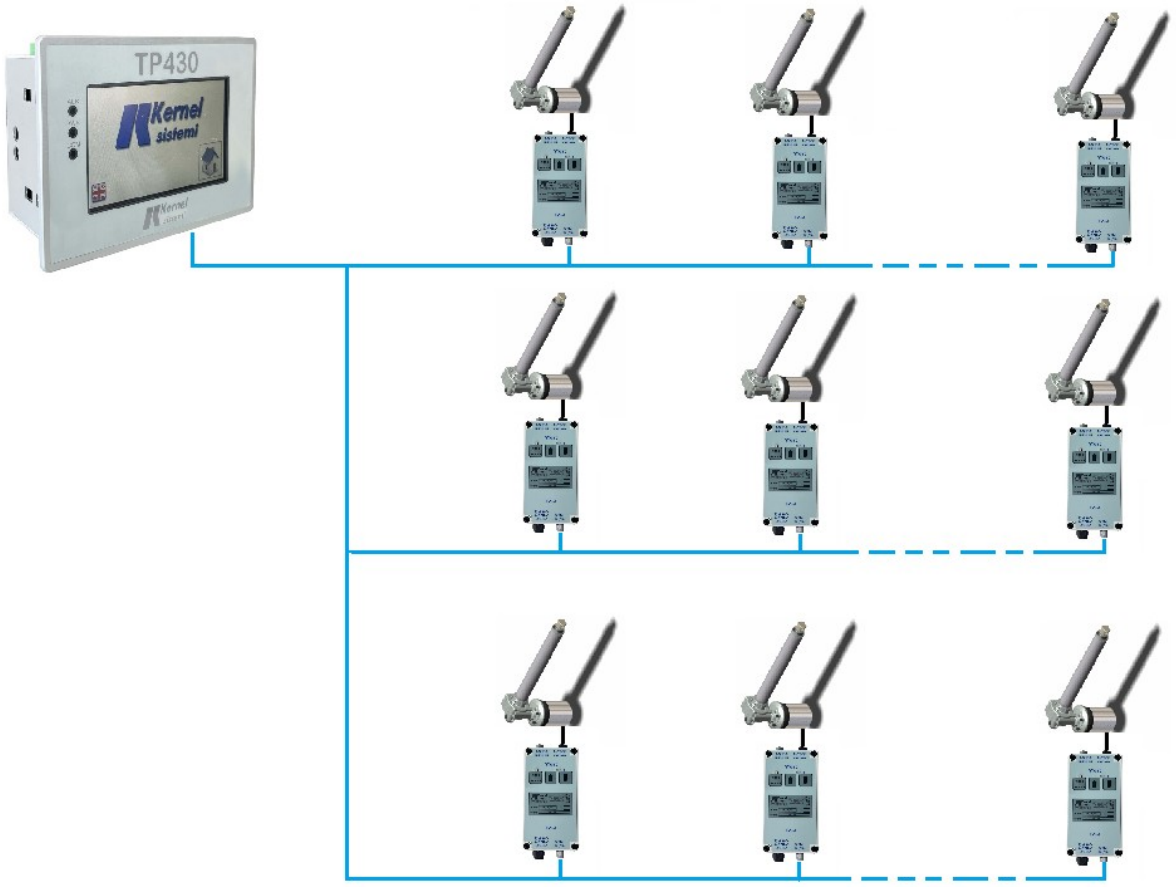
- **TKTP430AC02** : plant supervisor control panel (tracker driver), contains a TP430-type PLC. It calculates the position of the sun based on geographical coordinates and the current time and sends the trackers the inclination to be held. It also manages the possible presence of a weather station or anemometer to guarantee the safety of the panels in the event of adverse weather events.

- **TKAC01** : accessory (optional) to simplify cable wiring: junction box to be installed at the base of the motor unit support pole

- **TKAC02** : accessory (optional) to simplify the cabling of the system. When a photovoltaic field has a comb arrangement of the panel assemblies with a backbone, it is advisable that a distribution box is installed at each junction, which will sort the cables and contain both a set of switches to cut power downstream and a device for repeating/amplifying the network signals.

2.0 Communication Network

All trackers are connected to an RS_485 communication network managed by a supervisor PLC with a maximum of 80 nodes.
The PLC (master of the network) periodically sends the position to be tracked to the drivers (slave nodes of the network) and collects the operating status from them, collecting all relevant data in its internal memory map. Each tracker must have its own node address, unique throughout the network.
Normally, the PLC has at least two communication ports, one intended for managing the network of trackers and the other designed to connect to a weather station for managing adverse weather events.
The PLC can be interrogated by another plant supervisor device (data logger) to which it will supply on demand all data collected by the individual drivers.



The figure above shows the principle diagram of the connections between supervisor PLCs and trackers.

3.0 Functionality

A KERNEL model TP430 PLC can be used as a tracker network coordinator. This PLC designed as a generic PLC for automation can be programmed to meet all the needs and functions of a tracker manager/driver.
The PLC is the master of an RS485 communication network where the trackers are the slave nodes. The PLC collects information about each tracker in its internal memory and makes it available to a possible SCADA or supervisor,
The PLC calculates the current position of the sun based on geographical coordinates and the time

of day and periodically sends it to the trackers that control the sail motor to maintain it. The PLC also manages the positioning of the trackers during the night and during adverse weather events such as strong winds.
There is a night-safe function: if activated at sunset, the PLC brings the trackers into a horizontal position and at sunrise positions them towards the east to be ready to receive the first rays of the sun.
There is a backtracking function that, if activated, avoids the shading that one row of panels can cause on a neighbouring row.

One of the problems encountered when the number of trackers becomes high is the management of current draw if the motors are activated simultaneously.
This issue is dealt with in the following way:
- during normal operation the PLC sends the position to the trackers every 120 sec so the adjustment movements are very short and the scan time between one tracker and the next ensures that the motors are activated one or two at a time.
- When at sunrise and sunset or at safety position activation the trackers should all move together the nodes are divided into groups of eight and, in each group, two trackers are activated at a time. This increases the command execution time but reduces the overall current consumption.

The application programme of the PLC provides several operating modes (manual, automatic, start, etc.), described below, which can be selected by means of the virtual buttons on the display. The top line shows the selected operating mode and the current date and time while the bottom line shows the mode selection keys and, depending on the one selected, other keys with specific functions appear. By pressing on the date or time, the internal clock can be set.

3.1 Automatic Mode

The mode normally in use is automatic: the PLC runs a cycle in which it calculates the position of the sun and sends it cyclically to the trackers that respond with the current status and position; the display shows the number of the tracker currently selected, its target position and its current position. Wind speed and the amount of snowfall are also displayed.
At the end of each cycle, any non-response of the trackers is checked and the number of inactive nodes is indicated. If inactive nodes are present, their number is displayed by pressing the arrow keys.
The MAN key changes the operating mode to manual.
The STAT button takes you to the page displaying the status of individual trackers.

This page displays the status of the trackers organised in groups of eight, press the arrow keys to change groups and the AUTO key to return to the previous display.

The current status is displayed next to each tracker:

`----`	Tracker not installed
`ok`	System is working properly and there are no alarms
`Off line`	the tracker is not communicating with the PLC
`Err enco`	Tracker internal error: encoder not working
`Err star`	Tracker internal error: motor start timeout exceeded
`Err time`	Internal tracker error: positioning timeout exceeded
`Err posi`	Internal tracker error: positioning not performed correctly

Reporting an internal tracker error does not necessarily affect operation; when the next command is received, the tracker retries positioning but does not reset the error. To reset the error, enter the manual operation page, select the tracker, set the tracker to manual, and then set it back to automatic.

Press the AUX button to enter a page where an additional menu is presented :

The ZERO button moves all trackers to the zero (safety) position, which can be set on the Plant Configuration 4 page.
The AUTO button returns to automatic mode.
The AUX1 and AUX2 buttons call up the auxiliary functions described later in section 3.10.

3.2 Manual Mode

In this mode, the individual tracker can be selected for manual movements. The page below is displayed :

where the number of the selected tracker and its current position are shown.
The arrow keys next to it allow you to scroll through the trackers to select the desired one, alternatively, pressing on the tracker number displays a virtual keyboard on which you can select the desired number directly.

The MAN and AUTO buttons on the second line allow you to select the mode of the individual tracker selected, while the arrow buttons move the tracker if it is in manual mode.
In the bottom row, the mode selection keys allow you to return to automatic or select tracker or system configuration modes.

Changing the PLC operating mode (e.g. returning to automatic) does not change the mode of the selected tracker; if the selected tracker remains in MAN state, it is not enabled to track the position it receives from the PLC.

3.3 Tracker Configuration

In this mode it is possible to select an individual tracker to set some of its internal parameters.
The arrow keys next to it allow you to scroll through the trackers in order to select the desired one, alternatively, pressing on the tracker number displays a virtual keyboard on which you can select the desired number directly.

The editable parameters are:

`Min East and Max West :` are respectively the limits of the east and west inclinations that are not exceeded by the tracker (software endpoint), can be set individually for each tracker.

`Course timeout:` timeout time by which if the position is not reached, the tracker signals an error.

`Encoder timeout:` timeout time by which if the encoder does not generate a pulse, the tracker reports an error.

3.4 Plant Configuration

In this mode it is possible to set the parameters that characterise the installation, parameters that are common to all trackers. The different parameters are divided into several pages that you can scroll through with the arrow keys, there are the usual mode selection keys and an R key to restart the PLC.

By pressing the up arrow and down arrow keys, you can scroll through the configuration pages, where all settable parameters appear:

Latitude and longitude: geographical coordinates of the installation, used by the PLC to calculate the correct position of the sun.

- **Scan time:** time for the PLC to scan (poll) the trackers.
- **Tracker Num:** number of trackers in the installation.
- **Sleep Pos:** night position if the Night Safe parameter is set
- **Night Safe:** if enabled in the period from sunset to sunrise the trackers are placed in the Sleep Pos position (usually horizontal position).
- **Backtracking:** If enabled, activates the backtracking function. After sunrise and before sunset, depending on the distance between the trackers' lines and the size of the panels, shading may occur due to excessive tilting. To avoid this phenomenon, the inclination of the panels is corrected according to the distance and size of the panels.
- **Soft Start:** activates the soft start function, described below.
- **Tilt Correct:** correction of the position (azimuth) according to the height of the sun.
- **Poll sequence:** selects between two tracker scanning modes. A value of 0 corresponds to a ‘vertical’ scanning sequence in which the current tracker number is incremented by one until the maximum number is reached, then restarts from one. Value 1 corresponds to a ‘horizontal’ sequence in which two motors are activated for each group of eight.
- **First Start:** activated by default the first time the system is switched on, it allows you to enter a test mode useful for checking the correct connection between the PLC and the

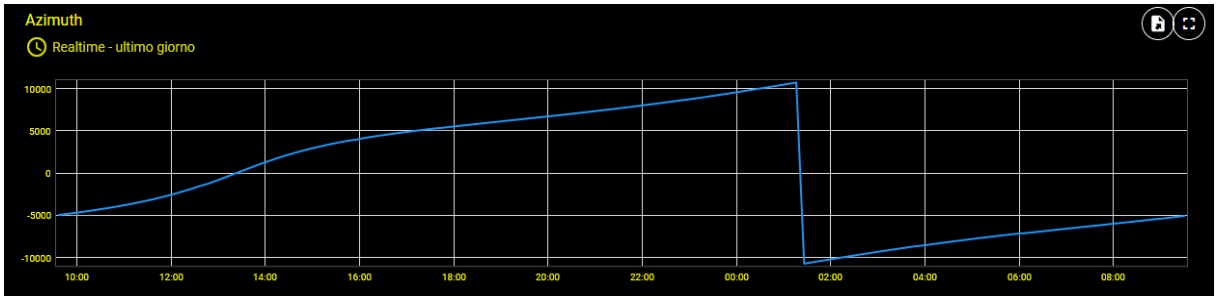
trackers and for setting the system parameters.

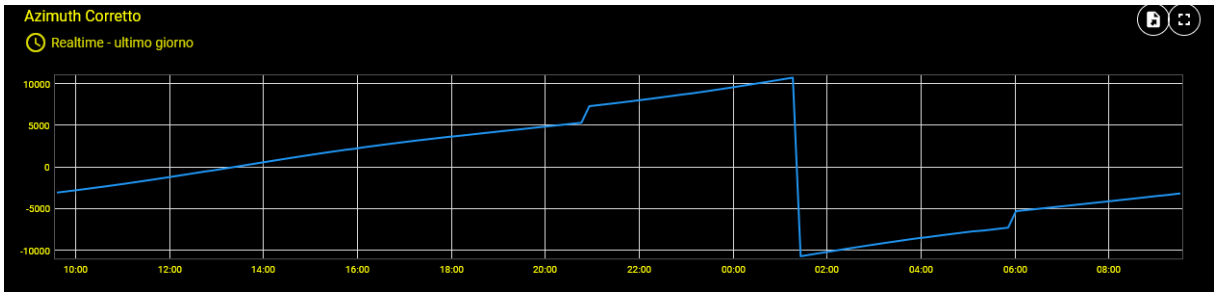
- **East-West:** this parameter allows the east direction to be swapped with the west direction, allowing the position calculation to be adapted to the mechanical assembly of the trackers. The value 0 is for east position with the motor all in, the value 1 for east position with the motor all out.
- **MIN EAST and MAX WEST:** are the tilt limits that must not be exceeded, if the tilt calculation should find values outside the set range, these are limited so as not to exceed it.
- **PV length:** length of the panel, is used in the backtracking function
- **PV distance:** distance between panel rows, is used in the backtracking function
- **Soft Start timeout:** timeout used in the soft start function, described below
- **Safe time:** Scan time used during the Safe function, triggered by extreme weather situations, described below. If the value 0 (zero) is set, a value is automatically calculated from the ratio of the absolute value of the distance between the current position value and the safe position divided by 180:
- time = abs (current - target) / 180. This gives a time proportional to the distance (i.e. the time) the glider has to travel. For example, a movement of 60 degrees corresponds to a time of 2 seconds. A movement of 20 degrees corresponds to a time of 0.11 seconds.
- **Wind Pos:** first safe position
- **Wind Thresh 1:** first trip threshold of the first safe function
- **Wind Thresh 2:** second trip threshold of the first safe function
- **Enabled:** alarm enable/disable
- **Snow Pos:** safe position of the second safe function
- **Snow Thresh 1:** first triggering threshold of the second Safe function
- **Snow Thresh 2:** second trip threshold of the second safe function
- **Enabled:** alarm enable/disable

The following table shows the two tracker scan sequences selectable via the Poll sequence parameter:

Vertical Scan Sequence		Sequence Horizontal Scan		
time	sequence	time	sequence	
1	1	1	1	2
2	2	2	9	10
3	3	3	17	18
4	4	4	25	26
….	...	...	...	...
		...	3	4
		...	11	12
		...	19	20
		...	27	28
		...	...	...

The following figures show the effect of the Tilt Correct parameter on the tracker's position trend during the day.





3.5 Soft Start

When the system is switched on for the first time or switched off and then on again, the trackers can be in any position. To avoid the simultaneous start of all motors, the soft start function can be activated, which activates and positions one tracker at a time.

When switched on, all trackers are started in manual mode, i.e. they do not accept positioning commands from the PLC. If the Soft start function is active the PLC starts a cycle in which, starting from the first tracker, it sends the AUTO command and starts positioning at the current value of the calculated position, at the end of positioning or when the timeout set in the Soft start timeout parameter is reached, the cycle continues to the next tracker until the last one, after which the PLC enters AUTOMATIC mode.
The EXIT key allows you to abort the procedure to activate the AUTO state on all trackers, regardless of position. The SKIP button, on the other hand, allows you to move on to the next tracker, without waiting for the positioning of the current one.

3.6 Forcing automatic status on trackers

Taking into consideration that when the system is switched on, all trackers are in the MANUAL state, it is necessary to bring them into the AUTOMATIC state so that they can follow the position received from the PLC, therefore In this procedure the PLC sends the AUTO command to each tracker in sequence without taking into account the actual position to be reached, so that they can be ready as soon as the automatic cycle starts.

The EXIT key allows you to abort the procedure and enter the automatic cycle. WARNING: If the procedure is not completed the last trackers may be in MANUAL and not follow the position sent by the PLC, It is possible to check the status of each tracker by entering the PLC MANUAL procedure.

3.7 Safe Position

To prevent damage to the panels in the face of extreme weather events such as strong winds or heavy snowfall, a safety procedure is provided. There are two settable safety positions, each of which has two thresholds.

It is possible, for example, to match the first safety position to the wind speed measured by an anemometer; when the threshold is exceeded, the automatic cycle is abandoned and all panels are placed in the relevant safety position. As soon as the wind speed value falls below the second threshold, the automatic cycle is resumed.
Similar operation for the second safety position, which can be combined, for example, with a snow gauge measuring the amount of snowfall.
Positioning in the safety positions takes place with a different scan time from that of the automatic Safe time cycle to allow for a different speed of reaction to the event. In order to obtain the fastest reaction, a short time must be set, even if this can lead to high current consumption due to the simultaneous activation of a large number of motors.

3.8 First Plant Connection

When switching on a system for the first time, it is necessary to check that all trackers are communicating correctly with the PLC, each tracker must have a unique address in the network to avoid interference and overlapping and all addresses must be contiguous, without jumps.

When first switched on, all trackers are in the MAN state so they are not enabled to receive positioning commands from the PLC but must still communicate to exchange other information. The installation page can only be exited by pressing one of the buttons to select the action you want to choose, otherwise it will remain on hold indefinitely.

Once you have verified that the system is working properly, you can disable this function by accessing the system configuration page and set the First Start parameter to zero.

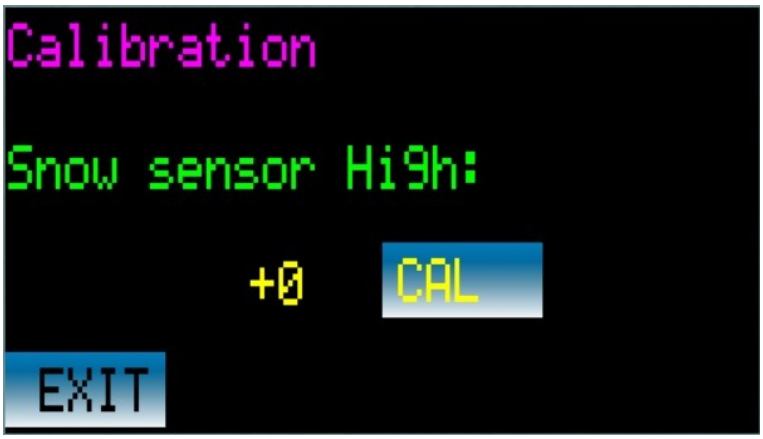
Pressing the AUTO key switches to AUTO mode via the soft start function if this is enabled. Pressing the MAN key switches directly to the MANUAL mode previously described, keeping in mind that all trackers remain in MANUAL.

The TEST key, on the other hand, allows you to enter a test page where you can select the individual tracker to check its connection.

The arrow keys next to the tracker number allow you to scroll through the trackers so as to select the one you want, alternatively, pressing on the tracker number brings up a virtual keyboard on which you can select the desired number directly. The CHECK key sends a command to the selected tracker; if communication fails, an error is signaled and a sound is emitted.

The MAN, START, TRACK CONF and PLANT CONF keys allow you to reach the functions already described above.

The CAL key takes you to a configuration page for the optional snowfall sensor:



The nivometer is an ultrasonic sensor that measures the distance between the sensor itself and the underlying supergicie. The installation height of the sensor is not known in advance so a calibration procedure is required once instsllated. Once the sensor is placed in its final position sens no object in the measurement cone, press the CAL button to acquire the distance to the ground, after this procedure a zero will be displayed, in the case of snowfall the measurement of the snowpack thickness will appear. Enter in the appropriate parameters the alarm intervention thresholds.
The anemometer on the other hand does not need calibration, the value of wind speed in m/s is acquired directly

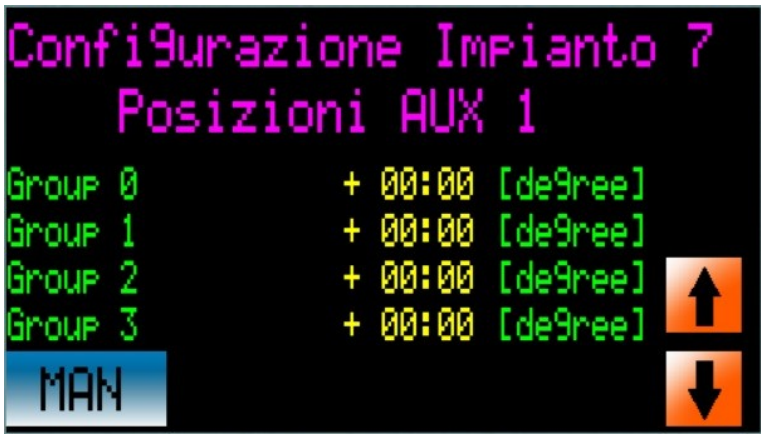
3.9 Emergency

In the control box there is an emergency button connected to an input of the PLC, its activation causes an immediate dispatch of a manual force command to all trackers, thus all those that may be moving stop.

On this page the status of the emergency mushroom is shown, as long as it remains pressed you cannot exit this function.
When the button is released with the EXIT key you go into the soft start function and with the FORCE AUTO key into the Force Auto function, both described above.

3.10 Auxiliary Functions

To ease maintenance work on the plant such as, for example, grass cutting or panel washing, two auxiliary functions AUX1 and AUX2 are provided in which the panels assume defined positions. To do this, it is possible to associate each tracker with one of four groups, each group is characterized by a fixed position that can be set on the PLC in plant configuration page 7 for auxiliary function AUX1 and plant configuration page 8 for auxiliary function AUX2. When the function is activated, each tracker will position itself in the position set in the appartenance group.



On this page you can assign for the AUX1 function to each group the corresponding tilt value.

On this page you can associate each tracker with one of four groups (0, 1, 2, 3), use the arrow keys to scroll through the trackers.

If, for example, you want to place all trackers with odd addresses all to the EAST and those with even addresses all to the WEST to allow a lawn mower tractor to pass smoothly between rows you can follow this setting. In this way, when the function is activated, all trackers with odd node number (group 0) will be positioned at +50:00 degrees (WEST) while all those with even node number (group 1) will be positioned at -50:00 degrees (EAST)

Tracker	Group
1	0
2	1
3	0
4	1
5	0
6	1
7	0
8	1
9	0
19	1
11	0
...	…..

Group	Position
0	+50:00
1	-50:00
2	Non usato
3	Non usato

4.0 Trackers installation and verification

Follow the steps below for proper installation of trackers and connection with the PLC:

4.1. On the tracker connect the motor drive, limit switch and encoder cables and place the tracker in manual operation by pressing the MAN/AUTO button until the LED flashes rapidly. In this condition, verify that pressing the arrow keys executes the corresponding movement.

the crankshaft comes out

the crankshaft comes in

Verify the operation of the limit switches: movement should stop when the limit switch is reached. Veify the correct encoder connection: the COM LED flashes when the motor is in motion.
If these verifications are successful, the connection between tracker and motor is correct but there is no indication that the tracker is installed in the correct position; to do so, it is necessary to go to the next step and connect the tracker to the PLC.

4.2. Once the connection with the PLC has been made, enter the Manual page and select the tracker number to be checked; the current tilt value will appear on the display next to the tracker number.

Press the yellow MAN button, MAN will appear next to it to indicate that the tracker is in manual mode. In this condition the tracker is controlled by acting on the yellow arrows on the display, check that pressing the buttons performs the movement indicated

the value of the inclination must increase

the value of the inclination must decrease

If this does not happen, it means that the tracker is not installed correctly: turn it 180°.
By default, the all-EAST position corresponds to the all-in position of the motor; it is possible to reverse this condition by adjusting the East-West parameter on page 2 of the PLC system configuration.

5.0 Information for the developer (preliminary)

The TP_430 PLC is supplied pre-programmed and ready for use, however, it is always possible to modify the application program if special specific requirements arise. To do this, it is necessary to familiarize yourself with the Logic Paint development environment, which can be downloaded directly from the KERNEL sistemi website: https://www.kernelgroup.it/logicpaint.html . An example of an application program that realizes the functions described above can also be supplied on request.

The operating system of the PLC provides several variables and functions specifically designed to facilitate the drafting of the application program if it is to be used as a driver for trackers; these functions take care of communication between the PLC and the tracker, making it transparent to the application.
The functions provided are organized in such a way as to form a state machine that manages the various operating conditions, described below.
To enable these functions, it is necessary to select the TRACKER protocol in the communication port used and indicate a basic memory address for the variables (default DATA.1024), at which point the variables are defined:

Addr	*default*	*Name*	
Addr + 0	1024	TRACKER_NUM	Number of trackers in the network
Addr + 1	1025	TRACKER_TIME	Scan time between one tracker and the next
Addr + 2	1026	tim_tracker	Support variable used to count the scanning time
Addr + 3	1027	TRACKER_CURR	Node currently selected during scanning
Addr + 4	1028	TRACKER_CYCLE	Current state of the state machine
Addr + 5	1029	TRACKER_CMD	1 Manual
Addr + 6	1030	TRACKER_ACTIVE	2 Automatic
Addr + 14	1038	TRACKER_ACTIVE_SAVE	3 Tracker configuration
Addr + 22	1046	TRACKER_INACTIVE	4 System configuration
Addr + 23	1047	TRACKER_INACTIVE_SAVE	5 Safety Position 1
Addr + 24	1048	TRACKER_MPX	6 Safety Position 2
Addr + 25	1049	TRACKER_CURR_STATUS	7 Emergency, all trackers in manual
Addr + 26	1050	TRACKER_CURR_POSITION	8 Tracker forcing cycle in automatic
Addr + 27	1051	TRACKER_CURR_TARGET	9 First system start-up
Addr + 28	1052	TRACKER_SLEEP	10 Soft Start cycle

1	Manual
2	Automatic
3	Tracker Configuration
4	Plant Configuration
5	Security position 1
6	Security position 2
7	Emergency, all trackers in manual
8	Automatic tracker force cycle
9	First system startup (Startup)
10	Soft Start Cycle
11	Test Cycle

Addr + 29	1053	TRACKER_SOFT_TIMEOUT	Soft start cycle timeout, if the position is not reached within the timeout, the next tracker is reached
Addr + 30	1054	TRACKER_SAFE_TIME	Scan time during safe function
Addr + 31	1055	TRACKER_VALUE_1	Variable current value relative to first safe condition (e.g. wind speed value)
Addr + 32	1056	TRACKER_SAFE_1	Tilt relative to first safe position 1
Addr + 33	1057	TRACKER_THRESH_11	First safe_1 function threshold
Addr + 34	1058	TRACKER_THRESH_12	Second safe_1 function threshold
Addr + 35	1059	TRACKER_VALUE_2	Variable current value relative to the second safe condition (e.g.: snow height value)
Addr + 36	1060	TRACKER_SAFE_2	Inclination relative to the first safe position 2
Addr + 37	1061	TRACKER_THRESH_21	First safe_2 function threshold
Addr + 38	1062	TRACKER_THRESH_22	Second threshold safe_2 function
Addr + 40	1064	TRACKER_EAST_POS	Support variable used during configuration of the individual tracker
Addr + 41	1065	TRACKER_WEST_POS	Support variable used during configuration of the individual tracker
Addr + 42	1066	TRACKER_SPEED	Support variable used during single tracker configuration (DC trackers only)
Addr + 43	1067	TRACKER_DELAY	Support variable used during single tracker configuration (DC trackers only)
Addr + 48	1072	TRACKER_ARRAY	Support table for internal use, used to generate the ‘horizontal’ sequence
Addr + 64	1088	TRACKERS_DATA	Start zone variables read by trackers Base Addr, refer to next table

5.1 Description of State Machine and Functions

When the TRACKER protocol is activated on the COM port in use, the operating system cyclically polls the port in a mode that depends on the state selected by the application program in the TRACKER_CYCLE variable.

The PLC works as a master in the RS485 communication port dedicated to trackers, but it can also work as a slave in the other communication ports (RS232, RS485 or ETHERNET) where the KERNEL, MODBUS RTU and MODBUS TCP-IP protocols are available. Through these ports, a possible PC, DataLogger or SCADA can access the PLC's internal memory to obtain the required data (tracker status, setting variables, etc.).

Automatic: the PLC calculates the position of the sun every 120 sec and sends it to the trackers one at a time with a scan time between one and the next set in the TRACKER_TIME variable. Each tracker responds by sending its current status which is collected in the PLC's internal memory at the corresponding position. Each tracker occupies 4 memory locations starting from the base location Base Addr (default 1088) as described in the memory map below.

Tracker 01	Base Addr + 0	Current Elevation	Signed 16 bit	Degree + minutes
	Base Addr + 1	Target Elevation	Signed 16 bit	Degree + minutes
	Base Addr + 2	Command	Unsigned 16 Bit	Internal use only
	Base Addr + 3	Status	Unsigned 16 Bit	See table
Tracker 02	Base Addr + 4	Current Elevation		
	Base Addr + 5	Target Elevation		
	Base Addr + 6	Command		
	Base Addr + 7	Status		
Tracker n	Base Addr + [(n - 1) * 4] + 0	Current Elevation		
	Base Addr + [(n - 1) * 4] + 1	Target Elevation		
	Base Addr + [(n - 1) * 4] + 2	Command		
	Base Addr + [(n - 1) * 4] + 3	Status		

Each location is a 16-bit word, current and target position are in degrees:minutes of arc, measured relative to horizontal position, negative values to the EAST and positive values to the WEST, below some examples.

Elevation	Decimal Value	Hexadecimal Value
+ 10° e 20 '	60 * 10 + 20 = 620	0x02bc
+ 30° e 40 '	60 * 30 + 40 = 1840	0x0730
- 20° e 30 '	- 60 * 20 – 30 = -1230	0xfb32
- 40° e 10 '	- 60 * 40 – 10 = -2410	0xf69b

The meaning of the different bits of the status variable is shown below. Not all values are significant, some (such as battery status) are relative to different tracker models, refer to specific manuals for details.

Meaning of the status word		
Bit 15		
Bit 14		
Bit 13	POS_REACHED	End of the movement, position reached
Bit 12	VBAT_OK	Status of the battery (only for DC motors)
Bit 11	POS_OUT	Position error, setted if the final position is far from target
Bit 10	TIMEOUT_ERR	Setted if the target is not reached before the timeout elaps
Bit 09	START_ERR	Setted if the motor does not start
Bit 08	ENCO_ERR	Setted if the encoder is not running
Bit 07	ENCO_B	Status of the Encoder channel B
Bit 06	ENCO_A	Status of the Encoder channel A
Bit 05	FC_OUT	Status of the end course sensor at the motor arm all out
Bit 04	FC_IN	Status of the end course sensor at the motor arm all in
Bit 03	GOING_DOWN	Setted if Motor is moving in DOWN direction
Bit 02	GOING_UP	Setted if Motor is moving in UP direction
Bit 01-00 0 0 0 1 1 0 1 1	Status not used manual automatic not used	Status of the tracker

Revision History	
2024.03.21	First version
2024.03.26	Added Wind and Snow. Added scan sequence tables.
2024.04.22	Updated memory map
2024.04.30	Added snow sensor calibration.
2024.07.15	Added east-west parameter
2024.08.19	Added installation instructions
	Added trackers status page.