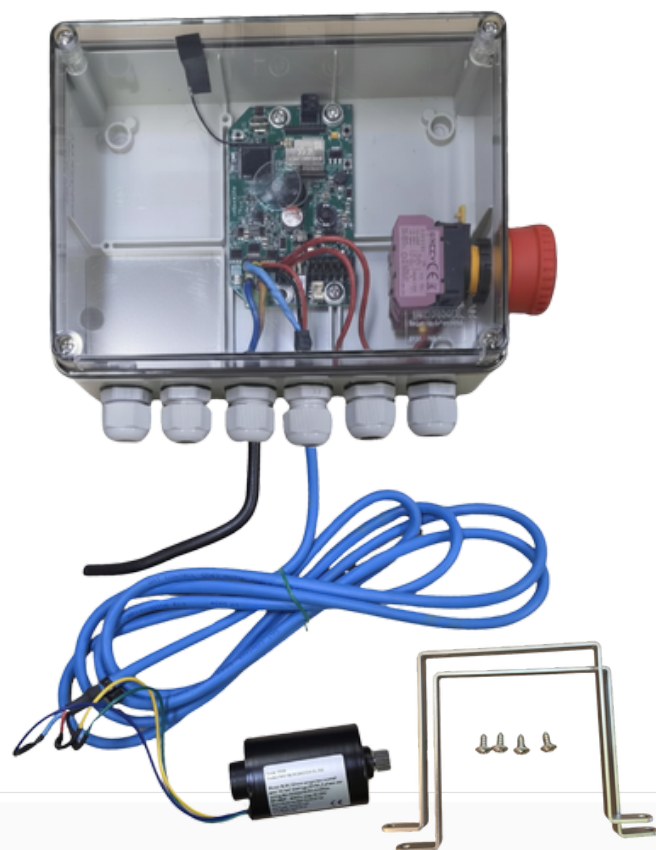


Upgrade the drive. Keep the tracker. Extend the lifetime. The SAT CONTROL BLDC-SL Upgrade Kit is a cost-effective retrofit solution for existing solar tracking systems with older brushed DC motors and encoder-based position feedback. Instead of replacing the complete actuator or tracker, only the critical drive and control components are upgraded. The new brushless sensorless BLDC-SL motor eliminates brushes, Hall sensors and encoder feedback wiring - reducing wear, EMC sensitivity and moisture-related failures. The new PICO-G positioner measures the real tracker angle directly with an inclinometer integrated on the positioner board. This eliminates motor encoder pulse counting errors and provides direct absolute tilt feedback. Together with integrated LoRa wireless communication, Sigma compatibility and USB-C service access, the system provides a modern and reliable retrofit path for existing SAT CONTROL solar tracker installations. Lower cost. Less downtime. Longer lifetime.



Give your old solar tracker a new heart. Old solar tracking systems do not always need a complete mechanical replacement. In many cases, the tracker structure, linear actuator body, Sigma server, power supply and existing field cabling can remain in operation. SAT CONTROL now offers a dedicated retrofit upgrade kit for existing solar trackers equipped with older brushed DC motors and motor encoder position feedback. The upgrade replaces the most sensitive and wear-prone parts of the old system - the brushed DC motor, encoder-based motor feedback and outdated drive electronics - with a new BLDC-SL brushless sensorless motor and the new PICO-G solar positioner. The result is a modern, robust and long-life drive solution for existing solar tracking plants - without replacing the complete actuator and without rebuilding the tracker.

Retrofit instead of replacement

A full actuator replacement is often unnecessary, expensive and time-consuming. With the SAT CONTROL BLDC-SL Upgrade Kit, only the old DC motor and control unit are replaced. The existing actuator mechanical body can remain installed, provided it is mechanically suitable.

This gives the customer the best return on investment:

- Keep the existing tracker structure.
- Keep the existing actuator body.
- Keep the existing Sigma server.
- Keep the existing power supply, if technically suitable.
- Keep the existing field cabling, if cable condition and cross-section are suitable.
- Replace only the critical drive and control components.
- Reduce downtime and installation cost.
- Extend the lifetime of the solar tracking system.

What is included in the upgrade kit?

- New BLDC-SL brushless sensorless DC motor.
- New PICO-G solar positioner with integrated BLDC-SL motor driver.
- Integrated inclinometer on the PICO-G positioner board.
- Integrated LoRa wireless communication module as standard.
- Pre-assembled plastic junction box with transparent cover.
- Cable glands and internal wiring.
- Emergency stop switch.
- Clamp set for mounting the box to the torque tube / square tube.
- Flexible motor cable connection.
- Interface for existing 24 VDC power supply.
- Connection to existing Sigma server system.
- New BLDC-SL motor only - without replacing the complete linear actuator.

What remains unchanged?

The main advantage of this retrofit solution is that the existing installation can largely remain as it is.

1. Existing tracker structure remains unchanged.
2. Existing linear actuator body remains installed.
3. Existing Sigma server can remain in use.
4. Existing 24 VDC power supply can remain in use, if technically suitable.
5. Existing field cabling can remain in use, if technically suitable.
6. Existing mechanical fixing points remain unchanged, depending on actuator type.
7. No need to replace the full actuator.
8. No need to replace the complete tracker.
9. No major mechanical reconstruction is required.

This makes the upgrade fast, cost-efficient and technically clean.

PICO-G BLDC-SL retrofit kit for SAT solar trackers, incl. Jbox1, LoRa, clamp, cable, BLDC-SL motor

Why BLDC-SL?

BLDC-SL means Brushless DC - Sensorless. The motor has no brushes and no Hall encoder. It is controlled by three-phase electronic commutation directly through the motor phases.

The motor uses only three motor phase wires in star connection:

U - V - W

- star wiring / Y-connection
- No Hall sensor wiring is required.
- No encoder wiring is required.
- No fragile low-voltage sensor electronics are placed inside the motor.
- No additional Hall or encoder connectors are required.
- No weak signal contacts are exposed to vibration, humidity or corrosion.

The motor cable connection is designed as a robust power connection. The wires are soldered together and protected with adhesive heat-shrink tubing, preventing water, condensation or moisture from reaching the electrical joint.

The motor winding has 2 kV insulation strength between the winding and the motor housing. This is an important protection feature in solar tracker installations. If a PV cable is damaged and voltage is transferred to the tracker structure, the metal structure can rise to a much higher electrical potential compared to other trackers or control electronics. Low insulation strength between the motor housing and winding could allow this voltage to break through into the motor winding and then into the electronic motor driver, damaging the power transistor stage and potentially spreading the fault through the electrical network.

The same risk can occur during atmospheric overvoltage events, such as nearby lightning or surge discharge.

Higher winding-to-housing insulation strength reduces the risk of electrical breakdown from the tracker structure into the motor and driver electronics.

The motor is also equipped with stainless steel ball bearings. This improves long-term reliability in outdoor applications where condensation, humidity or water ingress may occur, because the bearings are much less sensitive to corrosion than standard steel bearings. This creates a much more reliable motor concept for long-term field operation:

1. Less wiring.
2. No brush wear.
3. No Hall encoder failure.
4. No encoder connector problems.
5. No weak low-voltage signal contacts.
6. Better moisture protection at the cable joint.
7. 2 kV winding-to-housing insulation strength.
8. Better resistance against electrical potential differences and surge events.
9. Stainless steel ball bearings for improved corrosion resistance.
10. Less EMC sensitivity.
11. Lower failure risk.
12. Longer service life.

- Only three motor phase wires.
- No brushes.
- No Hall sensors.
- No encoder connectors.
- No weak signal contacts.
- No moisture-sensitive feedback electronics inside the motor.
- A simple, robust and long-life motor concept for solar trackers.

From encoder counting to absolute tracker angle measurement

Older systems measured the position indirectly on the motor with a Hall quadrature encoder. This means that the controller had to count motor pulses and calculate tracker position from motor rotation. In demanding outdoor solar tracker installations, this can become a weak point. Long motor cables, high starting currents, electromagnetic interference, moisture, condensation or water ingress into the motor can disturb the encoder signals.

This can cause:

1. Wrong pulse counting.
2. Lost position.
3. False feedback signals.
4. Positioning errors.
5. EMC-related failures.
6. Damage to Hall encoder electronics.
7. Complete failure of the weak low-voltage sensor circuit inside the motor.

The new BLDC-SL retrofit system does not measure position on the motor anymore. Instead, the real tracker angle is measured directly by the inclinometer integrated on the PICO-G positioner board. This gives direct absolute tilt feedback from the tracker control unit and eliminates motor encoder pulse counting errors.

- No Hall encoder.
- No missed pulses.
- No encoder communication errors.
- No weak sensor electronics inside the motor.
- No position loss due to motor cable interference.
- Direct measurement of the real tracker angle.
- The old system counted motor movement.
- The new system measures the real tracker angle.

PICO-G BLDC-SL retrofit kit for SAT solar trackers, incl. Jbox1, LoRa, clamp, cable, BLDC-SL motor**Why sensorless motor control is better for solar trackers**

In solar trackers, motor cables often run over long distances and can be exposed to strong electrical disturbances. With Hall sensors or quadrature encoders, low-voltage feedback signals can be affected by:

- High motor starting currents.
- Electromagnetic interference.
- Parallel routing of power and signal wires.
- Long cable runs.
- Moisture inside the motor.
- Condensation.
- Water ingress or flooding.
- Ageing of sensor cables and connectors.

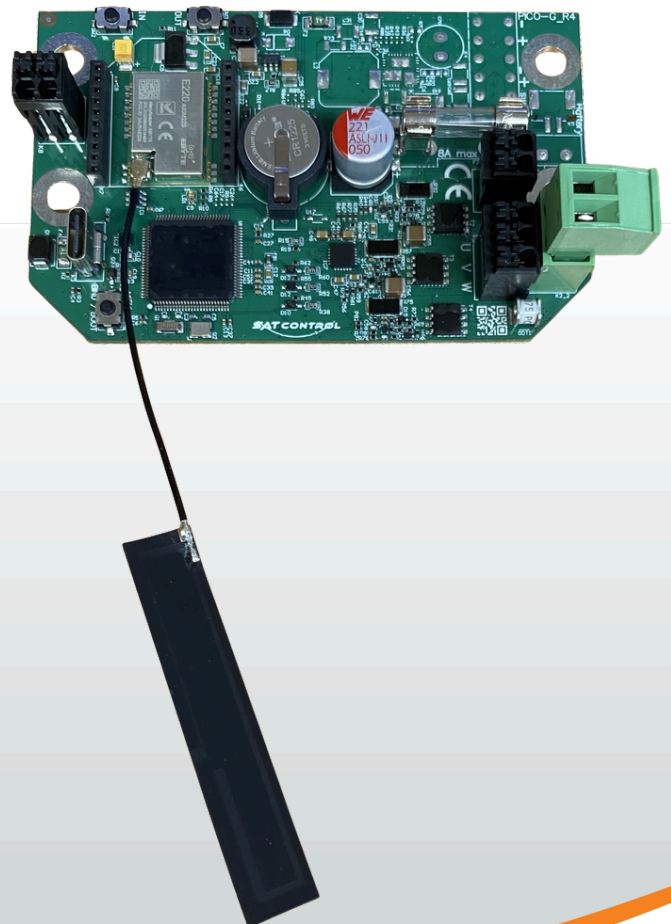
The BLDC-SL concept removes this weak point completely. The motor has no internal position sensor and no encoder signal cable. The PICO-G positioner drives the motor through a sensorless BLDC algorithm and measures the real tracker angle with its integrated inclinometer. This is a major reliability improvement for outdoor solar tracker applications.

PICO-G positioner - compact controller for modern retrofit

The PICO-G positioner is the core of the upgrade kit. It controls the BLDC-SL motor with an advanced sensorless motor algorithm and is designed for single-axis solar tracker applications.

Main functions:

1. Sensorless BLDC motor control.
2. Three-wire motor connection only.
3. Integrated inclinometer on the PICO-G positioner board for direct tracker tilt feedback.
4. Integrated LoRa wireless communication as standard.
5. USB-C interface for configuration, service and firmware upgrade.
6. Sigma server compatibility.
7. Manual motor control buttons.
8. Power fail detection.
9. Electro-mechanical failure alarming.
10. Parameterized tracker geometry.
11. Parameterized Stow, Snow, Storm and Clean positions.
12. Standalone operation or Sigma server mode.
13. OTA firmware upgrade or USB-C firmware upgrade.
14. Optional RS485 Modbus extension.



PICO-G BLDC-SL retrofit kit for SAT solar trackers, incl. Jbox1, LoRa, clamp, cable, BLDC-SL motor.**Designed for harsh solar tracker environments**

Solar trackers operate outdoors for decades. They are exposed to heat, cold, humidity, condensation, dust, lightning-related disturbances, cable ageing and mechanical vibration. The BLDC-SL retrofit concept is designed exactly for this environment.

- No brushes - no brush wear.
- No Hall sensors - no weak signal feedback inside the motor.
- No encoder cable - fewer EMC problems.
- No fragile low-voltage electronics inside the motor.
- Three-wire motor connection only.
- Robust 24 VDC drive concept.
- Direct absolute tilt measurement by integrated inclinometer.
- Reliable control through PICO-G positioner.
- Standard LoRa communication.
- Suitable for long-term operation in existing solar plants.
- Designed for long service life.
- Target lifetime: 25 years or more, depending on operating conditions.
- Optional extended warranty up to 10 years.

Key advantages for plant owners

This upgrade is not just a spare part replacement. It is a strategic lifetime extension of the existing solar tracking plant.

The customer gets:

1. Lower upgrade cost compared to complete actuator replacement.
2. Higher reliability compared to brushed DC motor systems.
3. No brush maintenance.
4. Reduced EMC sensitivity.
5. Reduced moisture-related motor feedback failures.
6. No encoder pulse counting errors.
7. Direct absolute tracker angle measurement.
8. Compatibility with existing SAT CONTROL Sigma infrastructure.
9. Standard LoRa wireless communication.
10. Faster installation and lower downtime.
11. Long expected operating life.
12. Future-ready service interface through USB-C and PICO-G.

Smart upgrade for ageing solar tracker fleets

Many older solar tracking systems still have a good mechanical structure and usable actuator mechanics. The weak point is often the old motor and motor feedback system. The SAT CONTROL BLDC-SL Upgrade Kit replaces this weak point with modern brushless sensorless motor technology and direct tilt measurement. It keeps the existing investment alive, reduces technical risk and brings old SAT CONTROL trackers into a new generation of motor control - without unnecessary mechanical replacement. Upgrade the drive. Keep the tracker. Extend the lifetime.