Modular and flexible

NPC SYSTEM's new generation controller provides reliable satellite tracking for fixed and transportable applications.

The NEYRPIC® ACU550 is NPC SYSTEM's **new generation of microprocessor-based Antenna Control Unit** (ACU) for tracking geostationary and low orbit satellites. Its innovative modularity allows for a high flexibility of its core to fit multiple applications while remaining fully featured and environment friendly. In its indoor cabinet, it equips fixed antennas. In its outdoor cabinet, it mounts at the pedestal of the antenna. It is also offered in its smaller package to target OTP and OTM applications. It is the first product of the 550 line.

The NEYRPIC® ACU550 is the fifth generation of tracking system with 40 years of proven track record. Though various M&A, NEYRPIC® satellite Tracking systems have gone from NEYRPIC to Alstom to General Electric and finally to NPC SYSTEM.

Features	
Web server: backup/restore parameters, software updates, I/O monitoring, raw data points recording	ARM Cortex™A8 600 MHz processor-based architecture with Linux Operating system
Step track, monopulse and AI prediction tracking (IPOP)	256 Mb 32 bits DDR RAM, 800 x 600 24-bit color touch screen
Beacon signal variation compensation	Xilinx Spartan 6 FPGA with dual CAN controller 4 dual Ethernet controllers 3 IP FPGA encoders and 4 UART RX/TX IP FPGA
Position sensor non-linearity compensation	Ports: 2 SPI, 1 LCD, Keypad, USB Host, SD, GPIO with PWM, 4 Ethernet
Automatic movement detection faults	3 axes position encoders: SSI, CAN, Ethernet, analog signals, resolver, optical encoders (13, 18, 19, 21)
Orbital parameters: Intel Sat, CNES, EPHEMERID AZ/EL/T, X/Y/t, NORAD 2 lines	Same core in multiple form factors suitable for stationary and mobile applications
64 satellite configurations, 64 position configurations, 128 RF configurations	Time and localization connection options: GPS and magnetic compass, IRIG-B devices, NTP server
Multi-band: Automatic satellite tracking and search parameter setting	Remote Control interface: Ethernet interface, RS232, embedded web server
Tracking receiver control: Ethernet link, alarm, auto-phasing, automatic frequency settings, Doppler	Ethernet links: Power drive unit communication, receiver link and M&C
Dynamic mount tilt compensation, Beacon signal variation compensation	Input/output options: 6 RF switches control and monitoring, 2 LNA contacts monitoring, auto-phasing I/O, customer I/O

New technology, new possibilities

The web server runs on the Linux-based ARM Cortex A8-600Mhz microprocessor. Only a network cable and the IP address of the ACU are needed to connect to the system though a PC's web browser. This feature enables access to functions without dedicated software

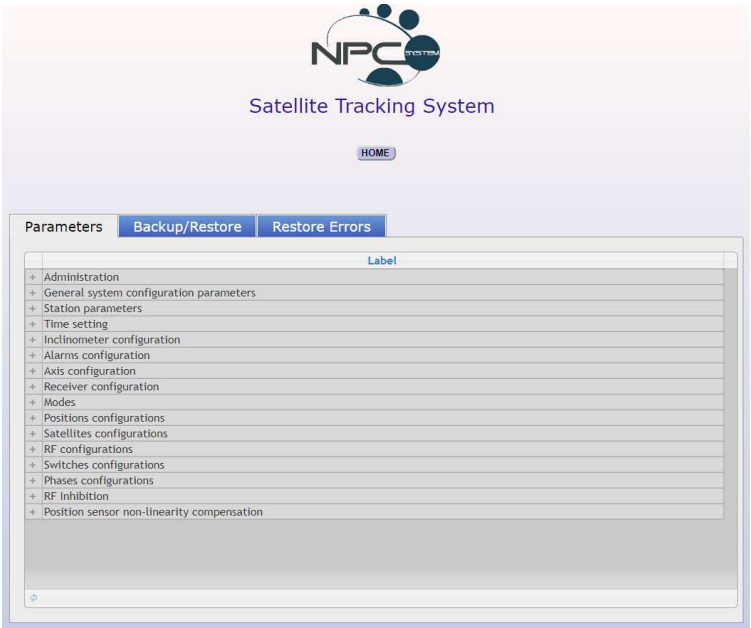
All parameters are contained in a file which can be backed up or restored. Parameter values can be dynamically modified and errors resulting during parameter editing are logged and displayed.

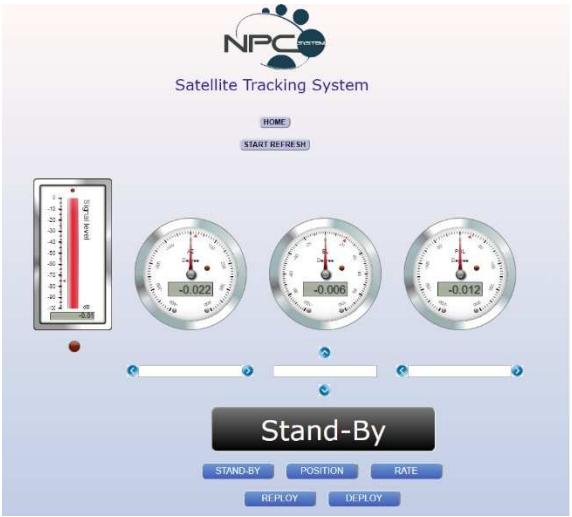
Users can easily update the ACU550 software by selecting it on the host PC and uploading it onto the system.

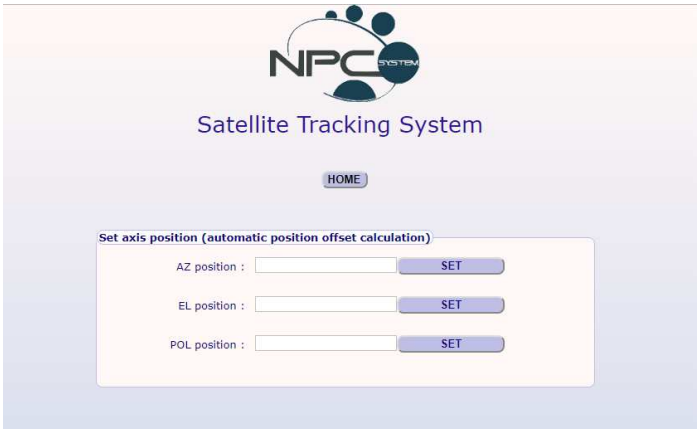
Multiple software versions can coexist on the system and they can be activated with a click. The system language can be changed.

Each system I/O can be monitored for detailed system diagnosis and they can be retrieved at once or continuously. They can also be filtered to only select data points from a specific region of interest.

For further performance analysis or proactively detecting faults, all system variables can be recorded in a file at a user-defined rate. This file can easily be exported into any graphical software on a separate PC for graphing.







Optimizing satellite tracking

USB port and SD card reader

Tracking on ephemeris data has become a widely-used tracking method when working with major satellites. Alstom implemented a USB port and a SD card reader to facilitate download to the ACU ephemeris data in INTELSAT or NORAD two-line element (TLE) format.

Signal variation compensation

The ACU550 has an algorithm to prevent noisy beacon signal such
as in EHF band. Using running averages and RMS value over a user- defined period, the ACU550 will detect and eliminate any low or high frequency noise. It will first calculate the average value of the beacon signal over a period and compare it with the average of the next period.

A standard deviation is also calculated within each period. The “Noisy signal” Alarm is triggered if the calculated values are above user-defined thresholds. The ACU550 will proceed with its prediction tracking model and stop recording tracking points for future prediction if the beacon signal is noisy. Normal tracking will resume when the alarm disappears.

Dynamic reference level adjustment

Optimal tracking often relies on maintaining appropriate satellite beacon signal strength. The signal can be attenuated due to antenna mispointing and atmospheric conditions. Readjusting the reference level according to variations in signal strength is necessary to prevent any loss in satellite tracking.

The reference level for the beacon signal strength can be manually adjusted on the beacon receiver but may be a cumbersome task when it needs to be done continuously. The NEYRPIC®ACU550 can dynamically adjust the reference level between -10 and -110 dBm to always ensure the highest signal strength range and allows for an optimum antenna positioning.

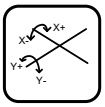
Satellite Acquisition

The ACU550 combines two scan methods to offer the best acquisition performance. During the first satellite acquisition, the system performs a raster scan to validate the station location previously entered. For all other acquisitions, the spiral scan method is performed to favor speed.

Receiver control

The ACU550 can fully control the most popular tracking receiver using digital and analog lines as well as an RS232 serial link. Via the ACU550, users can easily programmed receiver auto-calibration, frequency band, tracking slope phases for monopulse tracking and recall any satellite configuration number manually stored in the receiver.

Technology and expertise to secure reliable transmissions



Tilt compensation

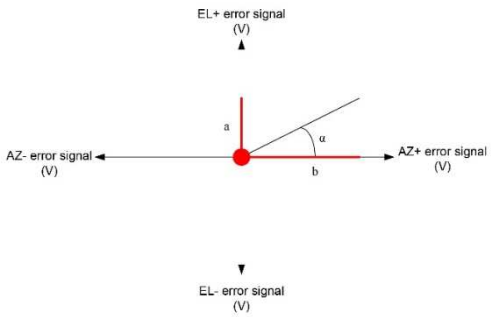
The ACU550 offers two options to compensate for any roll or pitch of the mount and provides connection for a dedicated two axis inclinometer. For new fixed antennas with any tilt angle or for transportable applications where the antenna is not mounted on a perfectly horizontal or vertical plane, users will select static tilt compensation.

With this option, the value of the inclinometer is read once when the system is turned on and all azimuths of elevation commands will then be compensated. For transportable antennas where the mount might change during operation due to wind gusts, for example, users should select dynamic compensation. The value of the dedicated inclinometer will then be read continuously up to every 20 ms.

Auto-phasing

The process of nulling cross talk between AZ and EL axis known as
auto-phasing is a necessity in monopulse tracking to avoid antenna pointing misalignment. On some systems this process can be done
manually or requires an external device to be executed automatically. The ACU550 has this feature built-in and is executed before each monopulse auto- tracking phase.
The ACU550 controls a monopulse receiver using RS232 communication and uses the AZ and EL dc error channels from the receiver. After a satellite transfer and before monopulse tracking can start, the auto-phasing process is automatically launched.

The process starts with pointing errors on the AZ and EL axis, shown as “a” and “b” respectively in the axis error graph. In a couple of minutes, the powerful algorithm cancels pointing errors on each axis and nulls the crosstalk between them. At the end of the process, the receiver is programmed with the correct phase compensation for an optimal monopulse auto-tracking.



Artificial intelligence made it better

Intelligent Progressive Orbit Prediction: IPOP

The ACU550 benefits from the latest algorithms developed and improved by NPC System engineers over 35 years.

It has one of the best tracking prediction algorithms leading to the lowest beamwidth Radial Error (BRE) on the market today. During the learning phase, the system will record satellite positions using the highest signal level. After only 3 hours of recording, the system is ready to accurately predict future satellite positions in case of signal loss. If a beacon signal is acquired, the prediction model will refine itself over time to accuracy under 5 % of the BRE.

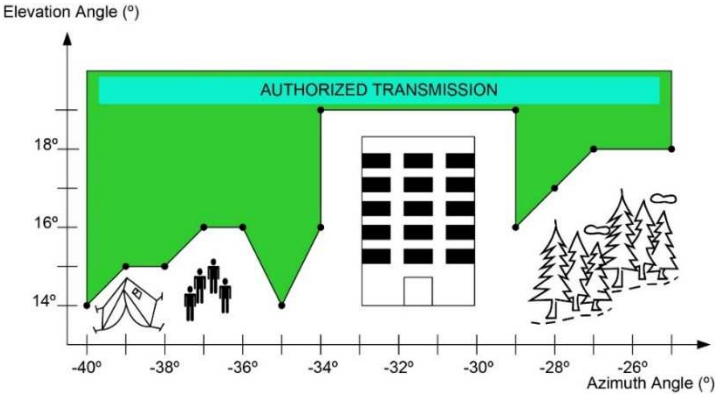
DIAMETER AND FREQUENCY	3dB BW	TRACKING BRE (%)	MAXIMUM INCLINATION (°)
5m C band	1.18	<5	11.8
9m C band	0.59	<5	11.8
16m C band	0.33	<5	11.8
5m Ku band	0.39	<5	11.8
9m Ku band	0.2	6.8	11.8
13.5m Ku band	0.13	9.9	11.8

Station longitude: 1° — Station latitude: 45° — Satellite longitude: 359.976°

RF inhibition

The ACU550 can store RF transmission profiles. According to the landscape surrounding the antenna, users may configure an elevation angle below which the RF transmission is prohibited for each azimuth angle. RF transmission profiles can reflect landscape features such as mountains or trees as well as buildings or temporary military sites where human safety is at stake.

The ACU550 has the ability to control a switch implanted in the RF source channel. This RF inhibition switch is activated according to the transmission profile.



When activated, this same switch inhibits the RF transmission in transport, deployment, stow satellite transfer and acquisition and in manual rate mode.

Performance by design, innovative architecture

Automatic movement fault detection

The ACU550 continuously monitors axis movement to detect any faults. Movement alarms will only go off if an axis exceeds a minimum speed defined by the user. When an axis receives a command to move and no movement is detected within the programmable time, the ACU550 sets of an alarm.

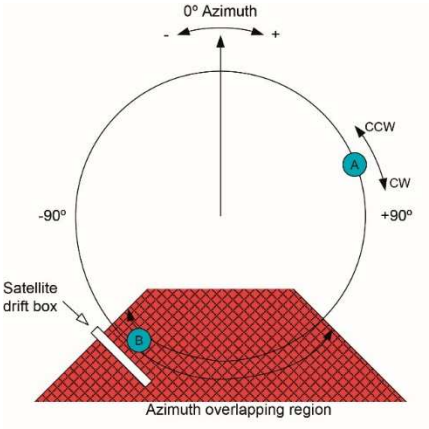
The user can configure the minimum angle before the fault is detected. When a movement, beyond a user-defined angle, is detected without a command, the ACU550 will set off an alarm. All alarms need to be acknowledged before proceeding with any further antenna movement.

Movement management

When antennas have azimuth travel beyond 360°, moving the antenna into the overlapping region and selecting the correct direction could be an issue especially if the satellite drift box bleeds outside the overlapping region.

If the system is currently tracking satellite in position A, there are two possible options to transfer the satellite to position B. Per the satellite drift box defined in the configuration of the ACU550, the path selected will not be the shortest path in the CW direction but rather the path in the CCW direction.

The ACU550 algorithm will then prevent any transmission interruption when tracking the satellite along its drift box.



Position sensor non-linearity compensation

Nonlinearity is an intrinsic property of the construction of a resolver.

There will always be slight variations between physical rotor angle and the stator using the sine and cosine voltages. Users can store in a table of the ACU550 a value per degree (0° to 359°) for each resolver used in the system to replace resolver measurements. A linear interpolation is calculated between each point preserving linearity in compensation for any major resolver reading variations. This compensation can also be applied to encoders.

RF switch control

The ACU550 can control up to 6 RF switches (SPDT) using 2 control lines and a common for each switch. These switches are part of the Satellite RF configuration and all can be set when setting each of the 128 RF configurations. Users can easily drive individual RF switches using their own supervisory control.

System accessibility made easy

Position sensor offset nulling

Prior to use with the ACU550, a new position sensor needs to be calibrated. This task is performed on a remote PC connected to the ACU550 via the web server interface. Once installed, the value from the position sensor is read and can be changed to reflect the true antenna position.

Additional customer digital I/O

Using a remote PC connected to the system via the web server, additional digital inputs and outputs lines can be monitored and controlled. The ACU550 can monitor state changes on 24 digital lines and forward their status to the user. The system has the ability to switch 10 form C (SPDT) relays upon user request.

550 product line overview

NEYRPIC® ACU550

First product of the 550-product line. It is offered in a 19 in rack. The ACU550 can be sold as part of the NEYRPIC®5100 complete tracking system which includes a servo drive unit.

NEYRPIC® ACU550MB

Mother board of the ACU550. This mother board is installed in the outdoor cabinet part of the NEYRPIC®5100 system when the whole system is mounted at the antenna pedestal. It is also offered to OEM antenna manufacturers to be installed directly in their systems. Some customization is possible.

NEYRPIC® ACS550TR

Complete tracking system including the ACU550 and a 3-axis motorization board with servo drive controllers for DC motors (brush or brushless). An external power source is needed to supply power to the motors. The ACS550TR comes is 19 in rack

NEYRPIC® ACS550TC

The ACS550TR counterpart is offered in a small outdoor box tailored to flyway and quick-deploy antennas. Connectors and features of the ACS550TC can be customized to fit specific customer applications.

550 software versions

All 550 products above are offered in 3 software versions.

BASE:
This version is intended for step tracking.

MNP:
All functions from base version plus dedicated features for monopulse tracking

ZEN:
All functions from MNP version with control of third axis with zenithal pass

Proven technology

They trusted us with their satellite tracking

Regulations and standards

IEC 60068-2-1 :2007
IEC 60068-2-2 :2007
EMC Directives 2004/108/EEC
Low Voltage Electrical Equipment Directives 2006/95/EEC
ISO 9001:2002
ISO 14001:2004 version
CE Marking

Physical characteristics

19 in x 2U

3.5 Kg

90 to **264** VAC
47 to 440 Hz

Operating
-10°C to **+60°C**
Storage: -40°C to 75°C

<50% at **40°C**
90% at 20°C
no condensation

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