ANTENNA CONTROLLER

NGC2 INDOOR UNIT (IDU)

OVERVIEW

The Kratos NGC2 Antenna Control System is the new advanced level antenna control system intended for applications with demanding tracking requirements, complex geometries, and dynamic conditions.

The NGC2-IDU is designed to operate on GEO/LEO/MEO/EOS satellites.

The NGC2 Antenna Control System offers precise, user-friendly control over the basic motorization kits for Kratos antennas with sizes 2.4 meters and up.

The NGC2-IDU features a SmarTrack® predictive tracking mode that utilizes a patented Three-Point Peak Algorithm that saves wear on the antenna motors and jacks.

The NGC2-IDU provides convenient features such as straightforward color graphics, LCD touch screen interface, and a number of powerful remote control software protocol options, the NGC2 Antenna Control System is an ideal solution for medium- to large- sized earth stations requiring complex pointing and tracking functions.

DESIGN FEATURES

- **Graphical User Interface** – Common shared interface design between controller, handheld, remote software package. Enables ease of use, reduced training, and advanced graphical operations & diagnostics.
- **Open, Standards Based Platform** – Non-proprietary hardware and software design based on proven and reliable technology. User customizable open source license User Interface.
- **Connectivity & Control** – Full complement of hardware interfaces for legacy and next generation technologies providing flexible accessibility for system networking, monitoring, control and maintenance.
- **Flexible Modular Upgrade Architecture** – Designed for field upgradable drop-in flexibility of hardware and software enhancements for expanded functionality.
- **Fiber Optic Interfacility Link** – One Optical (100baseFX) interface to the NGC-ODU or NGC2-ODU for secure and reliable communications, and protection against lightning, interference and transient voltage.

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NGC2 INDOOR UNIT (IDU)

NGC2 SYSTEM DESCRIPTION

The NGC2 system is physically divided into an Indoor Unit (NGC2-IDU) and an Outdoor Unit (NGC-ODU or NGC2-ODU), connected by a dedicated multimode optical fiber link.

The Indoor Unit is a site control element that can control one antennas (multiple antennas in future software), and serve as a gateway to the customer's management and control plane.

The rack-mounted Indoor Unit appliance (NGC2 IDU) is a Linux-based industrial control device that occupies 4RU and contains a multi-core ARM processor, display, networking switches, storage, and control software to manage the local user interface and provide control/management plane interfaces. This may be selected if a site needs low IT presence, if the customer is uncomfortable with more complex IT, or if the installation/operation process needs to be more 'plug and play'.

The NGC2 IDU is more tolerant of environmental variation than most blade servers, so it could be the appropriate selection if the "indoor" equipment is in fact located out-of-doors.

All tracking functions are isolated to the NGC2-IDU, which as mentioned is indoors, where the beacon receiver or other signal measurement device will be located.

All motion control functions are isolated to the NGC2-ODU, which is located on positioner or pedestal, allowing termination of all local control cables after short runs and minimizing interconnection between indoor and outdoor to AC power, transmit and receive signals, and a single control fiber pair.

The Kratos NGC2-IDU is a modular, scalable, adaptable advanced-level antenna pointing and tracking controller intended for motorized satellite earth station antennas used with LEO, MEO, GEO, EO communications satellites.

The NGC2 provides the following basic and optional features:

- Motor control for two- and three-axis motor systems complying with the standard Kratos interface, using sub amplifiers for VFDs for driving the Az and El axes
- Support for single speed AC or DC Pol rotators
- Automatic positioning of antennas to pre-programmed look angles
- The IFL is SFP based so it can be fiber or ethernet
- Local control from the indoor unit through an advanced touch screen LCD
- Automatic installation commissioning assistance
- 10/100/1000 BaseT Ethernet interface for external M&Cs (via the IDU)
- Remote control through network-based protocols, including RESTful API, MQTT and SNMP v1, v2c, and v3
- Optional integral beacon receiver interfaces to support Kratos patented three-point peaking step-track and SmarTrack® hybrid feedback/predictive program tracking algorithms
- NORAD and Intelsat program tracking
- Optional Monopulse tracking for Ka-band applications
- Optional integrated subreflector tracking (SRT) capability for high-accuracy Ka-band tracking, including hybrid main dish and SRT positioning and tracking

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NGC2 INDOOR UNIT (IDU)

USER INTERFACE

NGC2-IDU Front Panel

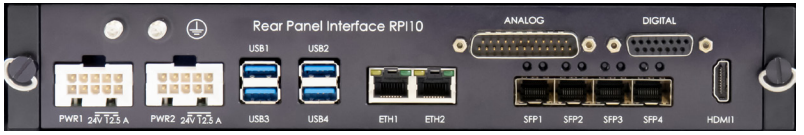
The NGC2-IDU front panel has an 1920x720 24-bit color screen. From this interface, the user can perform all functions to configure, control, and monitor operation of the antenna.
The front panel also includes USB, HDMI, Ethernet and Headset ports.

NGC2-IDU Touch Screen Display

The touch screen display is the key component to control the NGC2-IDU. By its optimized design the NGC2 provides intuitive and easy to use menus.

NGC2-IDU Interface

The NGC2-IDU has also an Open Source Interface this allows experienced customer to customize the interface for specific applications.



NGC2-IDU Back Panel

The NGC2-IDU provides four USB ports used to connect human interface devices such as a mouse, keyboard or other peripheral devices, two Ethernet 10/100/1000 ports to connect to a customer-provided Ethernet LAN, one Analog port to interface with a beacon receiver, one HDMI port to connect an external monitor and four SFP Ports to support Ethernet SFP modules for fiber optic or copper connection.
The NGC2-IDU Back Panel provides also multiples slots for hardware expansion without the need of opening the unit to install these modules.
Wide bay dims are approx. 11.3” Width x 8.25” Deep x 1.75” High
Small bay dims are approx. 4.65” Wide x 8.25” Deep x 1.75” High

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NGC2 INDOOR UNIT (IDU)

SATELLITE MEMORY and TRACKING

SATELLITE DATABASES FUNCTIONS

The NGC2-IDU can hold up to 300+ satellites in its working table for ready access and keep a database of 5000+ satellites in its global set. Satellites can be easily moved to and from the working table. The global satellite table can be updated from a Celestrak or Space-Track.org geo.txt file, including NORAD TLEs, using a USB flash jump drive or from the network.

Note: The Ephemeris tables should be manually updated periodically.

BEACON RECEIVER INTERFACE

The NGC2-IDU can interface to any analog beacon receiver with a 0-10V DC output. Other output ranges are not recommended and may in fact be harmful.

The NGC2-IDU's built-in spectrum analyzer can serve as a beacon receiver in many applications, please consult Kratos about the suitability of this option.

TRACKING ALGORITHMS

The NGC2-IDU supports several tracking algorithms based on software license options.

- Three-point peaking step-track.
- SmarTrack® hybrid feedback/predictive program tracking
- NORAD ephemeris predictive tracking
- Intelsat Ephemeris predictive tracking
- Monopulse for Ka band application (option)

The NGC2-IDU automatically calculates expected 3dB beamwidth from antenna size and downlink frequency. The stepsizes can be configured as a fraction of the 3dB beamwidth. The sensitivity of the tracking algorithms can be configured.

The NGC2-IDU will perform limited signal processing on the tracking signal. This includes wild-point removal, and averaging to eliminate fluctuations. These functions are parameterized and can be customized for the application from the front panel. For analog interfaces, significant oversampling is used to statistically detect scintillation and reduce its effects.

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NGC2 INDOOR UNIT (IDU)

NGC2 MONITOR AND CONTROL

ETHERNET TCP/IP

The NGC2-IDU includes an Ethernet 10/100/1000 interface running TCP/IP. The NGC2-IDU must be configured with a static IP4 address. The current product does not support IPv6 but this will be implemented in a future software release.

SNMP

The NGC2-IDU supports management through the SNMP v1, v2c and V3 protocols.
The security community (SNMPv1 v2c) and passwords (SNMPv3) can be altered from the front panel. Set functions can be locked out from the front panel, although the SNMP manager can override this by changing that setting, to prevent unnecessary site trips.
The SNMP interface is extremely powerful and necessarily lacks some of the safeguards built into the front panel user interface.

OTHER PROTOCOLS

The NGC2-IDU also supports management through RESTful API, and MQTT.

TIME

The NGC2-IDU supports the Network Time Protocol and can use this feature to keep its local time synchronized. It can also use an optional GPS with 10MHz output, or the AS-1 module installed outside, to synchronize time. All system time is in UTC, no local time zones are used or supported.

REMOTE CONTROL

A version of the NGC2-IDU front panel software suitable for running on Windows PCs is available as an option (remote GUI).

FAULT LOGGING

The NGC2-IDU keeps lists of current, latched, and acknowledged (ACO) alarms, and keeps a time-based history of alarms and other significant events.
These logs can be viewed from the user interface.

DATA EXPORT

The NGC2-IDU can import and export all configuration files via the USB jump drive, and can save internal log files to the USB jump drive on request.
The NGC2-IDU keeps position, tracking, event/fault, and audit logs for up to one year, but rovides an automatic purge function for file management. These files are stored as comma-separated-value (CSV) files and are thus compatible with common office suites for analysis and evaluation.

SOFTWARE UPDATE

Software Update of the NGC2-IDU is typically accomplished using the jump drive. The NGC2-IDU can also retrieve installation packages using using FTP if necessary or through manual installation with SSH and SCP.

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NGC2 INDOOR UNIT (IDU)

STANDARD SOFTWARE FEATURES

STEP TRACKING SOFTWARE (NGC2-101)

The step-track algorithm uses the patented “three point peaking” (3PP) approach, where the antenna is peaked by fitting measured signals to the parabolic loss curve. This gives greater resolution than traditional signal-balancing step-track in less time.

REMOTE ACCESS SOFTWARE PACKAGE (NGC2-106)

This software delivered free of charge with every NGC2-IDU gives access your NGC2 from anywhere on your network. The remote screen is identical to the NGC2 touch panel, controllable just as the front panel using the keyboard and mouse..

OPTIONAL SOFTWARE FEATURES

SMARTRACK TRACKING SOFTWARE (NGC2-102)

This software is standard with the NGC2-IDU The SmarTrack® algorithm is based on building a mathematical model of observed satellite orbit from the history of Az & El readings during tracking. Once sufficient data is collected to build a reliable model, the system switches to a predictive mode and uses occasional peaking to update the model. The quality level of this model is measured and provided in dB by computing the RMS error between the model’s predictions and actual peaking points on the tracking status screen.

PREDICTIVE TRACKING SOFTWARE (NGC2-103)

This software is standard with the NGC2-IDU. The predictive NORAD or Intelsat tracking mode, regenerates periodically a new angle from the loaded model. The rate at which this happens depends on how much the model indicates satellite appears to be moving.

FULL CAPABILITY TRACKING SOFTWARE (NGC2-104)

This software includes NGC2-101, NGC2-102, NGC2-103.

ACQUISITION ASSIST SOFTWARE (NGC2-105)

The acquisition assist is a feature that allows TriFold® antennas to search for likely satellites that match the configured parameters. It requires hardware options such as beacon receiver, DVB-S receiver, sensor package.

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NGC2 INDOOR UNIT (IDU)

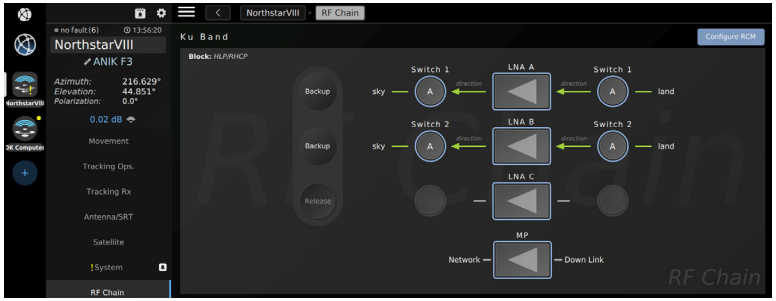
OPTIONAL SOFTWARE FEATURES

SPECTRUM ANALYZER ENHANCED USER INTERFACE (NGC2-107)

This software option provides additional operational capabilities to the spectrum analyzer card giving access to functions available to test equipment such as: CF, Span, VBW, Absolute Power Measurement Functions. It allows to record, store, & recall historical plots, output data in CSV file format. It requires the NGC2-002 option.

EXTERNAL DEVICE SWITCHING SOFTWARE (NGC2-109)

This software option is used in conjunction with NGC2 Redundancy or NGC2 waveguide switch matrix control. This option enables the display and control of components and waveguide/coax switches, eliminating the need for dedicated component redundancy controllers. A complete range of LNAs and LNBs are available in various frequency bands.
Refer to the Kratos product bulletins for more information.

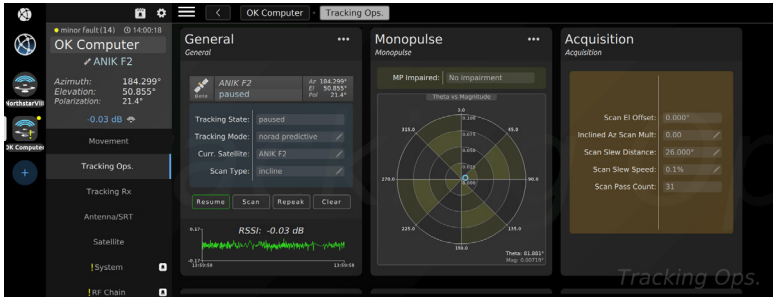


SAND/DUST DEVIATOR FEATURE SOFTWARE (NGC2-111)

This software option is used in conjunction with the precipitation deviator and periodically forces high velocity air across the feed window to remove sand or dust. This option requires the Precipitation Deviator and the NGC2-AESC Kits.

MONOPULSE TRACKING SOFTWARE (NGC2-116)

This software option provides monopulse tracking capabilities to the NGC2-IDU.This option requires a Kratos monopulse feed system installed on the antenna.



HIGH AVAILABILITY SYSTEM REDUNDANCY (NGC2-119)

This software option provides redundancy for the NGC2-IDU. The master NGC2-IDU will periodically synchronize all parameters with the slave unit at user selected intervals. If a failure is sensed, a fault will occur and the service will revert to the slave.

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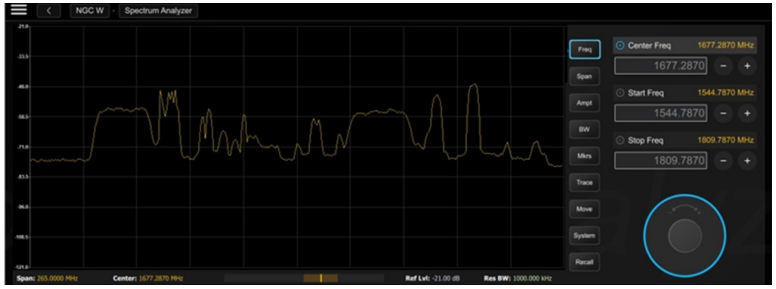
NGC2 INDOOR UNIT (IDU)

OPTIONAL HARDWARE FEATURES

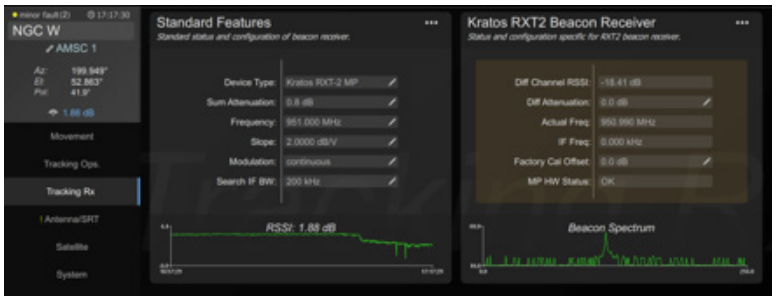
SPECTRUM ANALYZER CARD - ANALOG (NGC2-002)

This option allows to use the optional internal L band spectrum analyzer card as a beacon receiver while simultaneously monitoring the L band spectrum.



BEACON RECEIVER (NGC2-004-03)

This single input L band internal beacon receiver is entirely controlled by the IDU, the system can select one of the two inputs and configure all the RF parameters. this beacon receiver is also capable of monopulse tracking.



10 MHZ REFERENCE SOURCE (NGC2-007)

This GPS reference option provides a 10MHz timing source for the NGC2-IDU, and provides this signal on the rear panel (Insert level, accuracy spec here if you have it) for distribution to system components requiring external reference requirements.

REDUNDANT POWER SUPPLY (NGC2-008)

In addition to the external power supply provided with the NGC2-IDU, a second unit can be installed to add PS redundancy capabilities

RACK SLIDES (NGC2-009)

These rack slides are required when using deep rack units, they secure the IDU unit during maintenance or configuration

OPTIONAL EXTERNAL HARDWARE FEATURES

ENVIRONMENTAL SYSTEM CONTROLLER (NGC2-AESC)

This option is connected to the NGC2-ODU via the NGC2 Bus, and provides monitor and control capabilities of the de-ice system, precipitation deviator, feed heater, hub heater and can be connected to an optional weather station. All the information are controlled and displayed from the NGC2-IDU touch screen display.

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NGC2 INDOOR UNIT (IDU)

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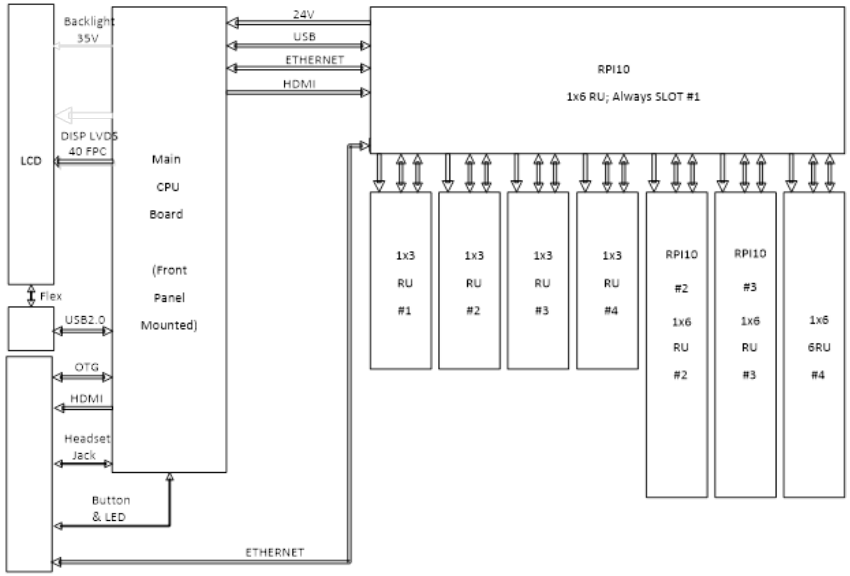
INDOOR UNIT PHYSICAL HARDWARE

The NGC2 IDU hardware platform consists of

- An SCP10 main processor board with an NXP I.MX-based quad core processor running the Linux operating system with a solid state disk for log and data storage, and display interface capability

- An RPI10 rear panel interface board containing
  - a 14-port network switch that supplies four (4) SFP ports, two Gigabit ethernet ports, and up to 8 internal Gigabit Ethernet ports. These switches can be connected together to form an extended switching platform. Each board's Ethernet switch can use transparent VLANs to segment the network into security domains.
  - Four USB Type A jacks for accessory connection externally and 8 USB Type A jacks for accessory connection internally.
  - Redundant 24VDC power supply inputs
  - Relay contact closure outputs

- Four (4) narrow- and three(3) wide-format expansion slots, which may be used for
  - NGC2-004-03 beacon receiver
  - NGC2-002 spectrum analyzer
  - Other future options



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NGC2 INDOOR UNIT (IDU)

NGC2-IDU Options

Indoor	
NGC2-IDU	NGC Rack Mounted Antenna Controller W/LCD Touch Panel, 4 RU Unit
NGC2-IDU-1	NGC Rack Mounted Antenna Controller, 1 RU Unit
NGC2-IDU-2	NGC Rack Mounted Antenna Controller, 2 RU Unit
NGC2-002-06	NGC2-IDU Spectrum Analyzer Card - Analog; 1 X 6 Multi-Input Switch
NGC2-002-EDR	NGC2-IDU Spectrum Analyzer Card - Analog; Enhanced Dynamic Range
NGC2-002-EDR-06	NGC2-IDU Spectrum Analyzer Card - Analog; 1 X 6 Multi-Input Switch; Enhanced Dynamic Range
NGC2-004-03	NGC2 IDU, L-Band Internal Beacon Receiver
NGC2-006	NGC2-IDU Emergency Stop Button
NGC2-007	NGC2-IDU 10 MHz Reference GPS Based Source
NGC2-008	NGC2-IDU Power Supply
NGC2-009	NGC2-IDU Rack Slides
NGC2-100	NGC2-IDU HEO Tracking Software
NGC2-101	NGC2-IDU Step Tracking Software
NGC2-102	NGC2-IDU Smartrack Software
NGC2-103	NGC2-IDU Predictive Tracking Software
NGC2-104	NGC2-IDU Full Tracking Capability Software
NGC2-106	NGC2-IDU Remote Access Software Package
NGC2-107	NGC2-IDU Enhanced Spectrum Analyzer Function Software
NGC2-108	NGC2 Receive Pattern Testing Tool
NGC2-109	Redundancy/Switching Control Software
NGC2-111	Sand/Dust Deviator Feature
NGC2-112	Carrier Monitoring
NGC2-116	Monopulse Tracking Software
NGC2-119	NGC2 Redundancy Control Software

NGC2-IDU Specifications

Dimensions	Width 19 inches x Height 7 inches x Depth 17.25 inches Rack Mountable 4RU
Weight	25 lbs (approx.)
Weatherproofing	IP32
Operational Temp.	-30 deg to +55 deg Celsius
Storage Temp.	-40 deg to +85 deg Celsius
Humidity	0 - 95% RH Non Condensing
Shock	ISTA 1A
Vibration	IEC 60068-2-6 NEBS Zone 4 Earthquake
AC Power	90 – 264 VAC; 47-63Hz; Single Phase; @115VAC < 3.0A RMS @230VAC < 1.5A RMS @115VAC Better than 0.95 Power Factor @230VAC Better than 0.90 Power Factor

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