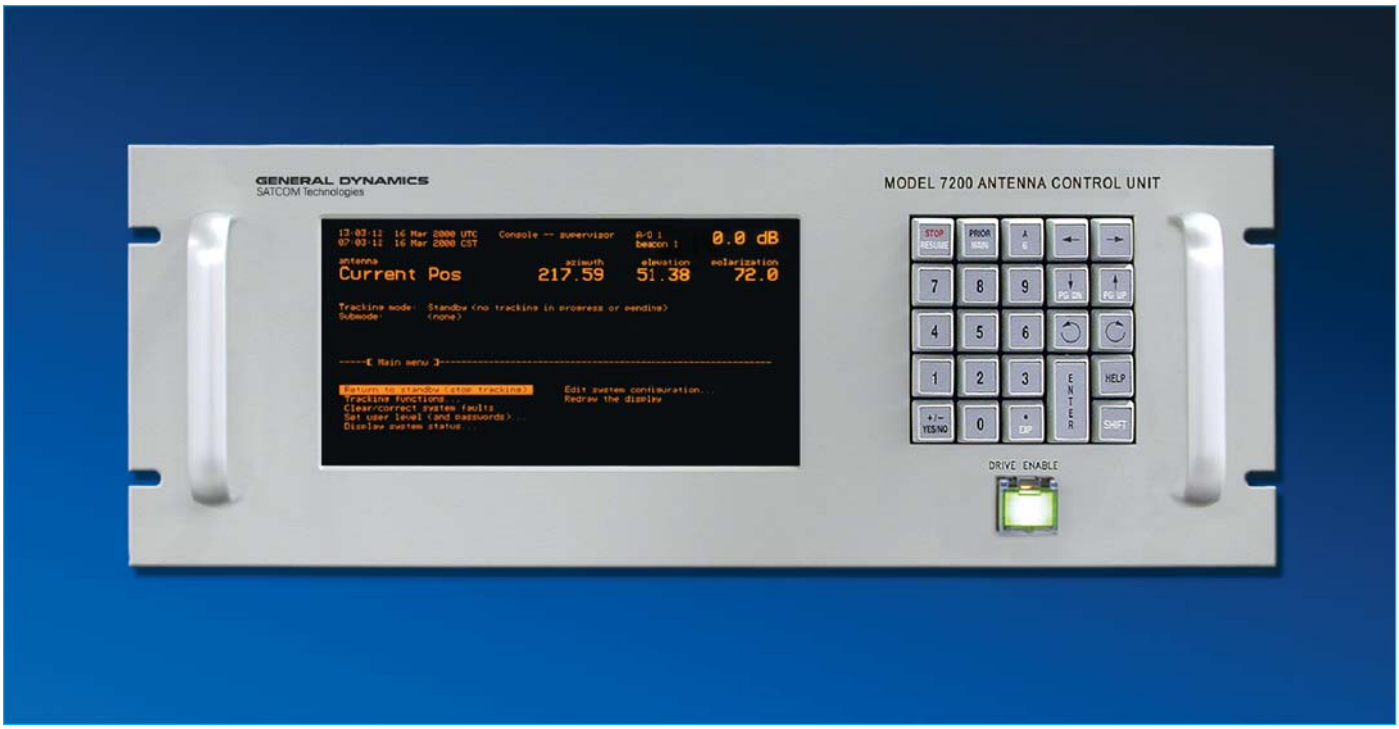
MODEL 7200

ANTENNA CONTROL SYSTEM



Key Features

- Field proven in hundreds of critical applications
- Unsurpassed autonomous predictive tracking performance with Orbit Prediction Track (OPT)
- Clean, efficient user interface
- Extensive, context-sensitive on-line help
- Highly reliable 68030 CPU/VME bus structure
- Remote control and data entry
- Battery-backed nonvolatile RAM
- Self diagnostics
- Multiple position feedback resolution/accuracy options

Product Description

The General Dynamics SATCOM Technologies (GDST) Model 7200 Antenna Control System is a state-of-the-art automatic positioning system which incorporates advanced control modes and an enhanced menu-driven user interface to provide accurate antenna positioning with minimum operator effort. Fully automatic tracking of inclined orbit satellites is accomplished with the revolutionary GDST Orbit Prediction Track (OPT) algorithm, which generates future AZ and EL pointing data by propagating a physically valid orbit through initial measured data to the time of interest. This type of ephemeris prediction offers increased efficiency and accuracy over methods which merely use measured data in a curve fitting routine to predict a trajectory.

The Model 7200 user interface employs a front panel graphics display which provides convenient menu-driven editing and control function selection. In addition, a "Target-Oriented" operating environment allows the system to have custom configured control modes for multiple satellites, with simultaneous maintenance of corresponding data bases for each.

The system is configured around the GDST Model 7200 Antenna Control Unit (ACU), contained in a 7-inch rack mountable cabinet. The system is controllable via Ethernet or RS-232E / RS-422 serial ports, allowing remote operation or integration with a supervisory monitor and control computer.

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7200 Standard Components

The standard product is provided as a 2-speed system for AZ and EL. This is accomplished by application of user-settable high and low speed control signals to variable speed AC drives (housed in the 7150 Antenna Drive Unit), which in turn control standard 3-phase induction motors. For 3-axis systems, circuitry is provided for the control of an AC synchronous stepping polarization motor. The AZ and EL motor controllers employ integral electronic protection, and the drive cabinet includes NEMA-rated circuit protection devices for each motor/motor controller, sized appropriately for each application. The drive cabinet housing is foot-mounted and comes standard as a NEMA 4X-rated enclosure for outstanding corrosion protection.

Orbit Prediction Track (OPT)

In OPT Operation, measured peak AZ and EL data is applied to orbital propagators which, rather than merely fitting a curve to the measured data, generate a valid orbit through the measured data, taking into account gravitational effects, sun radiation pressure, earth geopotential, and other factors to produce extremely accurate predictions of future peak positions. These predictions are valid over a longer period of time and with generally less initial step track data than with other prediction algorithms.

In OPT mode, the 7200 ACS initially operates in Step Track mode for approximately one to two hours, collecting peak position data as a function of time. The resulting data points are then applied to a "short term propagator," which in turn generates pointing data that is valid for at least 24 hours. OPT then follows the short-term solution while periodically step tracking to refine the model and detect antenna mispointing due to wind, etc. or a spacecraft maneuver.

The periodic step data is used to keep the "short-term" current as well as build a "long-term" solution when approximately 18 hours of data is available. The long-term solution is determined from a multibody full motion propagator which will provide valid pointing, independent of orbit inclination, for approximately seven days or until an external force changes antenna pointing or a spacecraft maneuver is conducted. The "long-term" and "short-term" solutions are then used in conjunction with periodic peaking operations and continuous monitoring of received signal strength to provide optimal pointing while keeping both models up to date in the event of a signal loss. In this manner, an optimum level of antenna drive system activity is achieved, and sufficient motion is provided to maintain accurate pointing without causing excessive drive component wear.

Target-Oriented User Interface

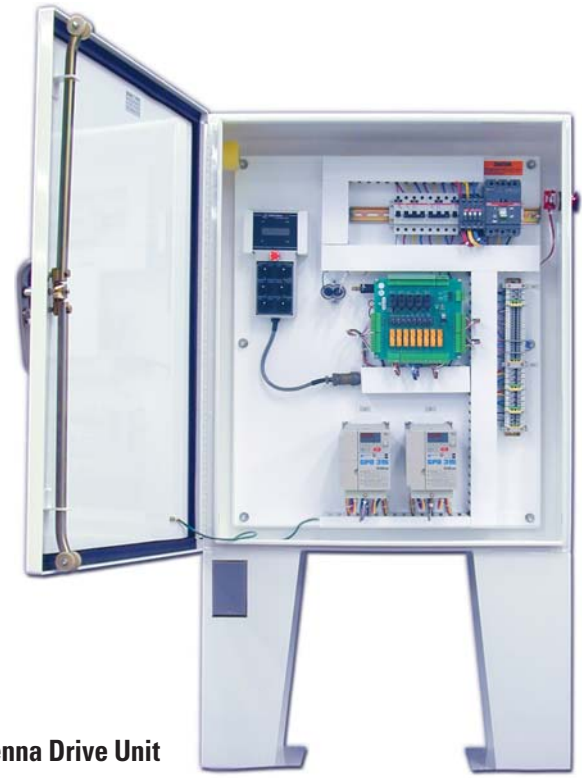
Familiarization with the 7200 system and its operation is extremely simple because of an enhanced menu-driven interface. The 8-inch by 4-inch graphics display provides clear, concise, and complete user prompts for control and edit functions, organized in logical order.

Fully menu-driven operation and direct data entry keys maximize mode selection and data input efficiency. Context-sensitive help messages aid the user in operation of the system, minimizing reliance upon reference manuals.

Although individual tracking modes are directly accessible, primary 7200 ACS operation is conducted in a "target-oriented" environment in which specific targets to be accessed by the system are individually configured with desired tracking modes, and multiple unique data bases are simultaneously maintained.

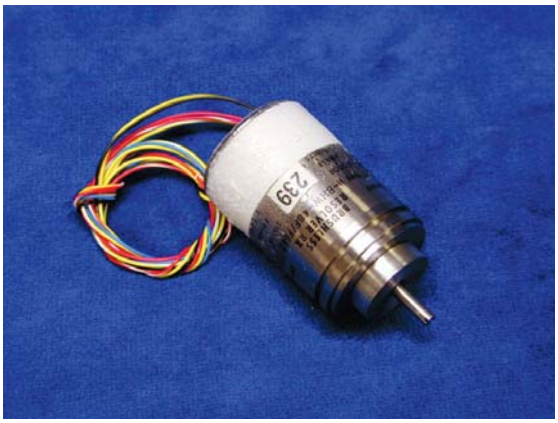
In this manner, normal day-to-day system operation becomes highly automated because the user only has to select the name associated with a given target to have the ACU automatically invoke the mode or series of modes and any predictive tracking data base(s) established for that target. This method offers significant advantages in time savings and required operator skill level when accessing multiple targets.

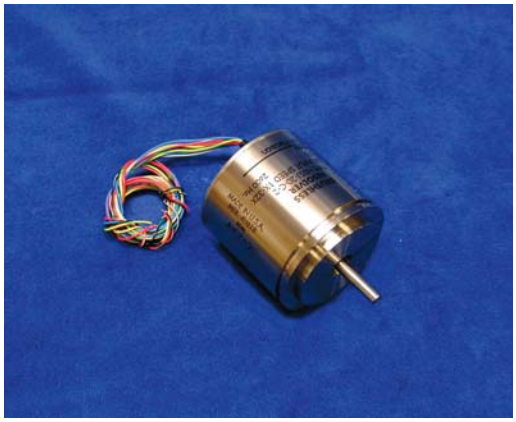
A "Target Scheduler" provides an added dimension by allowing the user to program a series of targets with corresponding dates and times at which tracking begins for each one. This method allows fully automatic tracking of a number of targets, each with its own preconfigured mode(s) of tracking.

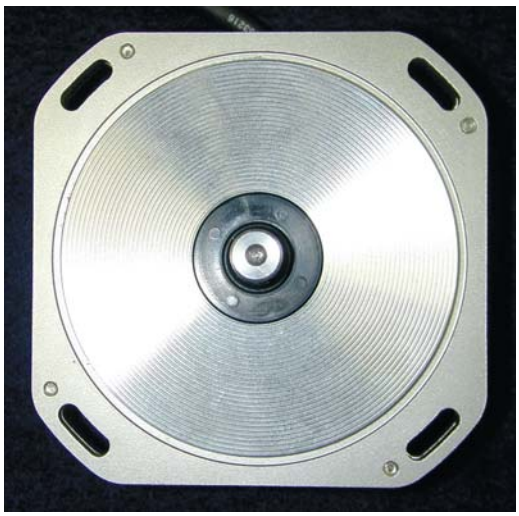


7150 Antenna Drive Unit

Manual	Two-speed AZ and EL positioning; single speed POL positioning.
Move to Look Angles	Automatic positioning to preprogrammed coordinates and/or direct entry coordinates for each axis.
Move to Longitude	Automatic positioning to AZ and EL angles calculated internally from user-provided longitude locations. User-entered POL angles are also accommodated.
Step Track	Automatic periodic pointing optimization by way of a predetermined AZ/EL scan pattern used to maximize signal strength (VertexRSI Adaptive Step Track).
Orbit Prediction Track (OPT)	Fully automatic pointing to AZ and EL coordinates along predicted ephemeris derived through application of recorded peak AZ and EL step track data to a sophisticated orbital propagator. The orbital model is periodically updated by refresh data obtained during occasional step track operations. POL angle correction is calculated automatically and updated as required.
Computer Track	Real-time automatic positioning based upon angle commands supplied via serial communications link.
INTELSAT Track	Automatic tracking to AZ and EL coordinate sets calculated internally from Intelsat 11 parameter coeff cients and site latitude and longitude data.
Space Command / NORAD Track (Optional)	Automatic positioning/tracking from Space Command/NORAD two card element sets.
Star Track	Automatic positioning to internally calculated AZ and EL locations for radio stars including Cassiopeia A, Taurus, Orion, Virgo, and Cygnus (or a user-defined target).
Moon Track	Automatic positioning to internally calculated AZ and EL locations of the moon.
Sun Track (Optional)	Automatic positioning to internally calculated AZ and EL locations of the sun.
Table Track (Optional)	Automatic positioning calculated by a smooth 3-point interpolation of an ephemeris table entered via the M&C interface.







The 7200 system offers 3 options for position encoding accuracy. Standard single speed brushless size-11 resolvers (top-right); 2-speed brushless size-20 resolvers (middle-right); and optical encoders (right).

7200 ACS Technical Specifications

Specifications	
Tracking Accuracy	Better than 10% receive 3 dB beamwidth, RMS, in Step Track mode. Nominally 5% receive 3 dB beamwidth, RMS, with valid model in OPT mode (independent of orbit inclination).
Position Encoding	1) (Standard) Absolute, single-speed, brushless resolvers (size 11) and 16-bit monolithic LSI tracking resolver-to-digital conversion IC's with 0.02° RMS accuracy. 2) (Optional) Absolute, electrical 2-speed, brushless resolvers (size 20) and paired LSI tracking resolver-to-digital conversion IC's with 0.01° peak accuracy. 3) (Optional) Absolute optical encoders with accuracies to 0.001° per special order.
Front Panel Position Display Resolution	0.01° Standard 0.001° Optional (available with high accuracy encoding system options).
Position Encoding Repeatability	Typically 1 LSB of resolver-to-digital conversion resolution.
Input Power Requirements	Drive Cabinet: 208-240, 460, or 380-415 VAC, 3-phase, 50-60 Hz, 5-wire WYE. Current requirements determined by motor horsepower. ACU: 100-240 VAC, 50-60 Hz, autosensing 100 VA (Nominal) * Other line voltage interfaces available per specification.
Horsepower Range	1 to 5 HP standard ; 7.5 to 20 HP special order
ACU Tracking Receiver Interface	0-10 VDC analog input, slope ≥ 0.2 V/dB Contact closure outputs for selecting up to 4 tracking signals. Serial interface for use with VertexRSI synthesized receivers.
Remote Communi-cations Interface	RS-232E or RS-422 serial communications for remote monitor and control. Ethernet interface also standard.
Summary Alarm Output	Normally closed dry contacts, rated 24 VDC at 1 amp.
Required System Interconnect Cabling (May be provided by GDST or CFE)	- ACU/Drive cabinet Interface (1) 25/C, #22 AWG - Resolver/ACU (2) 3-shielded pair, #22 AWG (2-axis systems) - (3) 3-shielded pair, #22 AWG (3-axis systems) * System includes 100 feet of interconnect cabling * Additional cabling available up to a max. length of 1500 ft. * 2-speed and optical encoding systems cabling requirements specified for each requirement

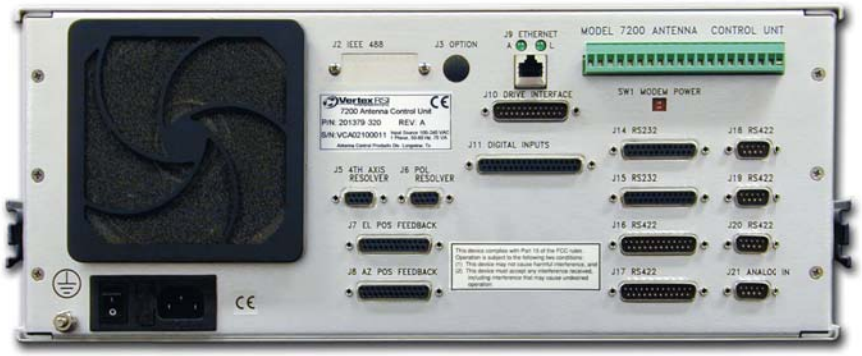
Physical (Standard Configuration)	
7200 ACU:	
Dimensions (in.)	7H 19W 19D
Weight	26 lbs.
7150 Drive Cabinet:	
Dimensions	36H 30W 10D (legs 18H)
Weight	100 lbs.

Environmental	
Rack-mounted Equipment	
Temperature	0 to 50° C
Humidity	90% Noncondensing
Outside Equipment	
Temperature	-40 to 50° C (Low temp. package necessary below -10°C)
Humidity	100% Condensing

Ordering Information

Specify:

1) The required position encoding system (options listed at left).
2) Single-phase line voltage and frequency for the ACU.
3) For the drive cabinet, specify 2-, 3- or 4-axis system and AZ and EL motor horsepower ratings as well as ambient temperature ranges. Specify 3-phase line voltage and frequency for the control system.
4) Specify length of cables required for the controller, drive cabinet and resolver interfaces (100 ft. provided).
5) Pol motor information (if equipped).



The rear panel of the 7200 accommodates all I/O for the unit including drive interface, serial communications, axis interfaces and communications with other tracking equipment.

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