CTI *Communication Technologies, Inc.*

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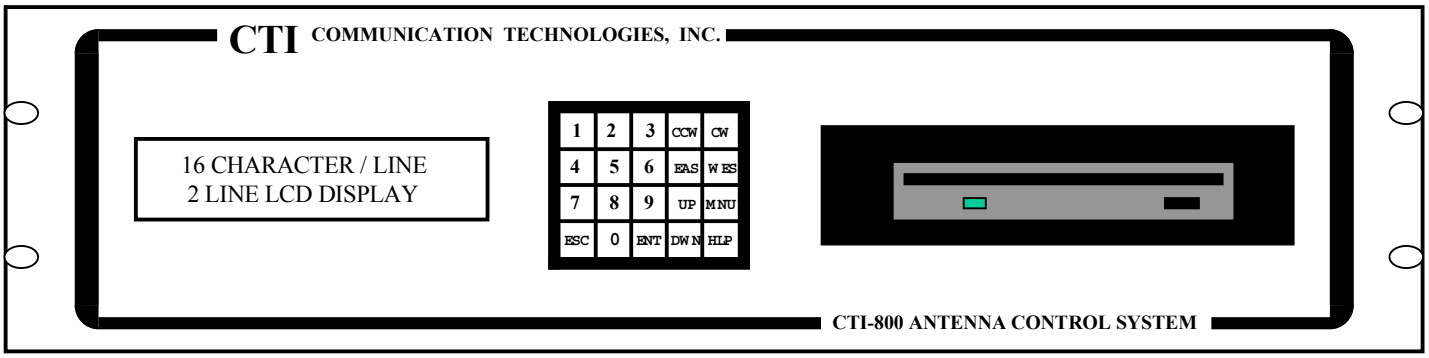
CTI-850 Antenna Controller



The **CTI-850 Satellite Antenna Control System** is a flexible, microprocessor-based satellite antenna controller capable of controlling as many as four satellite antennas.

The CTI-850 features three modes of operation:

- **DIRECT MANUAL CONTROL**: The user can control all antenna functions directly from the keypad.
- **CALIBRATED POSITION RECALL**: Up to 500 preset positions can be "calibrated" by the user. Once calibrated, the CTI-850 will move the antenna to any position on command. Preset positions can be recalled either by the Position Number or by satellite longitude.
- **DIRECT LONGITUDE ENTRY**: The CTI-850 will move the antenna to any specified orbital longitude, even if the desired satellite has not been calibrated.

Standard features:

- **Rack-Mounted Control Unit** mounts in a standard 19" equipment rack; requires 5¼" of rack space.
- **Built-in Illuminated Display and 20-Button Keypad** provide fast, easy access to all features.
- **Optical Encoders** permit precise control of the antenna and feedhorn.
- **Universal Antenna Compatibility** supports polar or AZ/EL antenna mounts.
- **Three-axis Capability** provides control over all antenna axes:
  Hour Angle or Azimuth
  Declination or Elevation
  Feedhorn Polarization
- **Choice of Hour Angle/Azimuth Motor Voltage** accommodates 24-volt DC, 36-volt DC, or 115-volt AC motors.
- **Choice of Declination/Elevation Motor Voltage** accommodates 24-volt DC, 36-volt DC, or 115-volt AC motors.
- **Choice of Polarization Motor Voltage** accommodates 24-volt DC or 36-volt DC motors.
- **Choice of AIU Serial Link (ASL)** accommodates direct coaxial cable, RS-232 link, RS-422 link, or dual-optical-fiber link.
- **Built-in Floppy Disk Drive** permits easy software upgrades, and accommodates tracking software packages.
- **Complete Instruction Manual** covers all installation and operational procedures.
- **One-year Warranty** includes telephone assistance for registered purchasers.

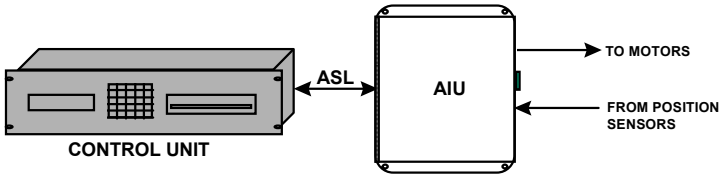
30014 5/17/99

CTI-850 Antenna Controller

Optional features:

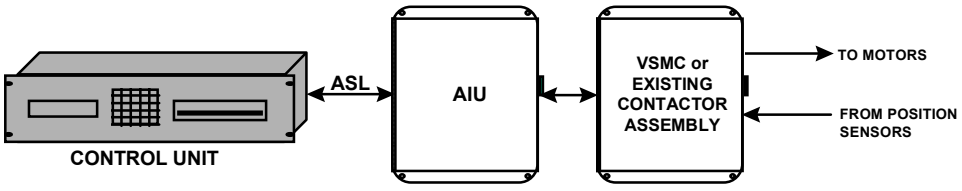
- **Optional Variable-Speed Motor Controller (VSMC)** permits precise operation of 230-volt AC antenna-drive motors.
- **Optional Multiple Antenna Feature** allows control of up to four antennas with one controller. Polar-mount and AZ/EL-mount antennas may be intermixed within the same installation.
- **Optional Retrofit Capability** allows the CTI-850 to be configured for older antennas from a variety of manufacturers. Antennas from different manufacturers may be intermixed within the same installation.
- **Optional Antenna Position Sensor Compatibility** allows the use of Hall Effect or reed switch sensors.
- **Optional Feedhorn Position Sensor Compatibility** allows the use of potentiometer sensors or pulse-width-modulated servos.
- **Optional *ComTrack* Tracking Software** tracks inclined-orbit or elliptical-orbit satellites, and maintains a log of all activity. Tracking can be referenced to receiver AGC level or external ephemeris data in Two-Line Element (TLE) format.
- **optional *ComSched for Windows* Remote Control Software** permits operation of the CTI-850 from an external IBM-compatible PC. Plug-in cards allow the user to select the desired remote-control interface: EIA-232, EIA-422, EIA-485 or telephone modem. Remote control can be implemented over fiber optic or microwave links.
- ***ComSched for Windows* Software** also permits advance scheduling of several hundred future events. Many satellite receivers of various types, and as many as four controllers can be scheduled. On special order, other devices such as VTRs, VCRs, or routing-switchers can be included in the schedule.

When used with an antenna equipped with 24-volt DC, 36-volt DC, or 115-volt AC motors, the CTI-850 consists of two units: a CONTROL UNIT and an ANTENNA INTERFACE UNIT (AIU). The control unit is installed in a 19" equipment rack, and the AIU is installed at the antenna. The two units are connected by a single cable called the AIU Serial Link (ASL):



The ASL can be implemented with a single run of coaxial cable, an RS-232 link, an RS-422 link, or a pair of optical fibers.

When used with an antenna equipped with larger motors (230-volt AC and/or current in excess of 4 amperes), an additional motor drive unit is required. On older antennas, an existing contactor assembly (if it is in satisfactory operating condition) can be used. For new antennas, CTI offers a Variable-Speed Motor Controller, model VSMC-1 (for polar-mount antenna) or VSMC-2 (for AZ/EL-mount antenna). The AIU and VSMC provide all motor-drive voltages. The AIU provides connections for optical encoders or other sensing devices. Optical encoders are available for all axes.



At multiple-antenna sites, up to four antennas can be operated from a single control unit.

Ordering Information:

- **Control Unit for one antenna ..... Model CTI-851**
- **Control Unit for up to four antennas ..... Model CTI-854**

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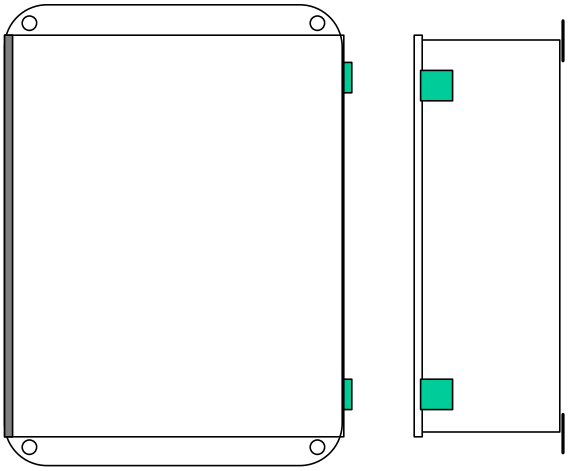
AIUs for non-CTI Contactor Assemblies

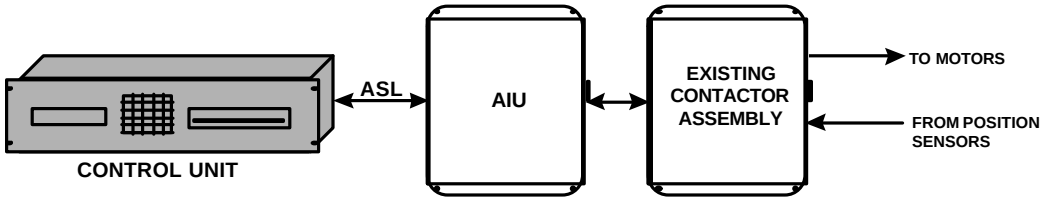
for use with

Model CTI-850 Satellite Antenna Controller



When an AIU is used with an antenna equipped with larger motors (230-volt AC and/or current in excess of 4 amperes), an **Auxiliary Motor Drive Unit** is required. On older antennas, an existing contactor assembly (if it is in satisfactory operating condition) can be used for this purpose.

The AIU is connected to the Control Unit over a cable called the "AIU Serial Link" or ASL. The standard ASL consists of a single run of coaxial cable. Up to four AIUs can be connected to a Model CTI-854 Control Unit over separate ASLs. On special order, interfaces for RS-232 links, RS-422 links, or fiber-optic links can be provided.



This AIU is housed in a weatherproof housing for installation at the antenna near the existing contactor assembly. It provides control signals necessary to drive the existing contactor assembly. The AIU is configured at the factory to match the specific contactor assembly involved. Contactor assemblies manufactured by the following companies can be accommodated:

- ADM
- Andrew
- BMS
- Comsat
- Comtech
- Harris
- Microdyne
- RSI
- Satcom Technologies
- Scientific-Atlanta
- Superior Satellite
- Vertex

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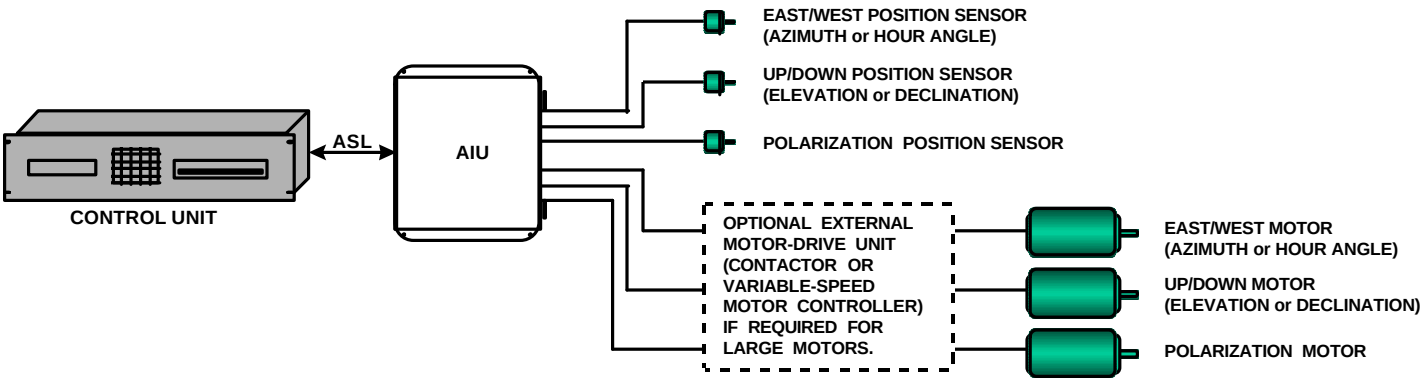
Optical Encoders
for use with
Model CTI-850 Satellite Antenna Controller

The CTI-850 Satellite Antenna Controller consists of the following components: a Control Unit, an Antenna Interface Unit (AIU), and a number of position sensors which monitor the motion of the antenna. Up to three position sensors can be connected to one AIU. These items are connected as follows:



The AIU can be configured to accommodate a variety of position sensors:

- Optical encoders
- Potentiometers
- Hall Effect sensors
- Reed switches
- Pulse-width-modulated feedhorns

The standard AIU is configured to accommodate optical encoders. CTI offers several types of optical encoders designed to accommodate antennas manufactured by a variety of vendors.

CTI specifies the resolution of many encoders by a factor called CPR, or counts per revolution. This factor specifies the number of counts generated by the encoder during one complete 360-degree revolution of its shaft.[*] In general, the larger the CPR value, the more accurate.

Each encoder is supplied with the following accessories:

- 1/4"-diameter shaft.
- 1/4" bellows-type flexible coupling.
- Mounting screws.
- 30-foot cable (other lengths are available on special order).
- Male 9-pin connector for direct connection to the AIU.

[*] Some encoder manufacturers specify encoder resolution by cycles per revolution rather than counts per revolution. One cycle equals four counts; thus, a 5,000-cycle encoder has a CPR value of 20,000.

Optical Encoders

Ordering Information:

CTI offers the following optical encoders for use with the CTI-850 controller:

AXIS	MODEL	CPR	DESCRIPTION	HOUSING
East/West (hour angle or or azimuth)	HAA-8-HG	20,000	Standard-resolution encoder for use on antennas up to 6 meters diameter.	Cylindrical 2.5" x 2.5" dia
	HAA-8-HG-HR	40,000	High-resolution encoder recommended for use on antennas larger than 6 meters diameter.	Cylindrical 2.5" x 2.5" dia
Up/Down (declination or elevation)	DEE-8-HG	20,000	Standard-resolution encoder for use on antennas up to 6 meters diameter.	Cylindrical 2.5" x 2.5" dia
	DEE-8-HG-HR	40,000	High-resolution encoder recommended for use on antennas larger than 6 meters diameter.	Cylindrical 2.5" x 2.5" dia
	DEE-8-DNJ	N/A	Special encoder for use on Duff-Norton declination actuator on some Comtech antennas.	Kit form for installation inside gearbox housing.
	DEE-8-JDJ	N/A	Special encoder for use on Joyce-Dayton declination actuator on some Comtech antennas.	Aluminum box 2.5"x2.0"x1.4"
	DEE-8-FH	N/A	Special encoder for use on "sliding feedhorn" declination adjustment on some Comtech antennas.	Aluminum box 2.5"x2.0"x1.4"
Polarization	POL-8-KIT	N/A	Standard encoder kit for use on most feedhorns.	Aluminum box 2.5"x2.0"x1.4"
	POL-8-FH	N/A	Standard encoder pre-installed on feedhorn.	As required by feedhorn.
	POL-8-HG	N/A	Special encoder to replace synchronous resolver on Harris (Vertex) feedhorn.	Cylindrical 2.5" x 2.5" dia

The following optional items are available with any encoder on special order:

- Encoder mounting brackets to fit specific antennas.
- Bellow Couplings.
- Extension shafts.

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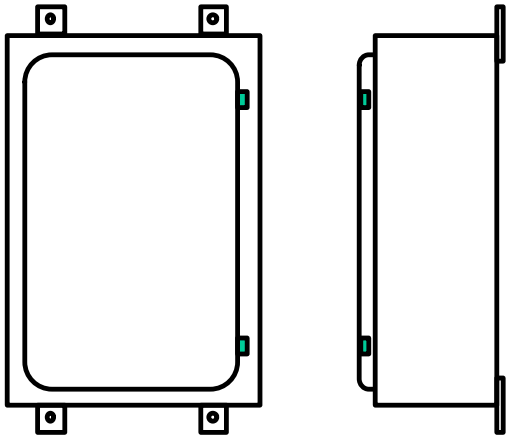
Variable-Speed Motor Controller

for use with

Model CTI-850 Satellite Antenna Controller



When an AIU is used with an antenna equipped with 230-volt AC three-phase motors, an auxiliary motor drive unit is required. CTI offers a **Variable Speed Motor Controller (VSMC)** for this purpose. It can be used on new antennas, or as a replacement for an existing outdoor contactor assembly on an older antenna.

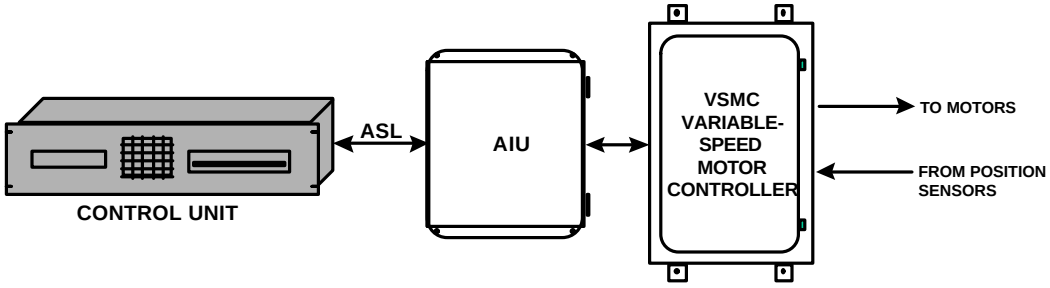
The VSMC provides precise control over the position, speed, and acceleration of the antenna drive motors:

- When a motor is started, the VSMC "ramps" it from 0% to running speed during a user-specified time interval.
- Two running speeds are available. The slow speed is used for precise positioning; the fast speed quickly moves the antenna across the satellite arc to a new position.

The VSMC is available in two optional configurations:

- Model VSMC-1 for a single-axis antenna (polar mount without declination adjustment).
- Model VSMC-2 for a dual-axis antenna (AZ/EL mount or polar mount with declination adjustment).

The VSMC is used in conjunction with an **Antenna Interface Unit (AIU):**



The AIU is connected to the Control Unit over a cable called the "AIU Serial Link" or ASL. The standard ASL consists of a single run of coaxial cable. Up to four AIUs can be connected to a Model CTI-854 Control Unit over separate ASLs. On special order, interfaces for RS-232 links, RS-422 links, or fiber-optic links can be provided.

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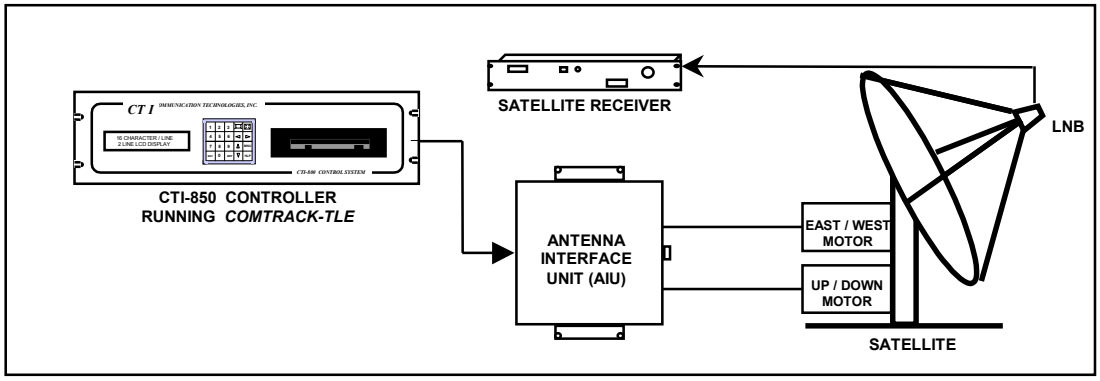
COMTRACK-TLE
INCLINED-ORBIT SATELLITE TRACKING SOFTWARE

ComTrack-TLE enables a CTI-850-controlled antenna to track a satellite operating in an inclined orbit by referring to "Two-Line Element" data published for each satellite. ***ComTrack-TLE*** incorporates all of the standard features of the CTI-850 ***CONTROL*** software, plus tracking. ***ComTrack-TLE*** runs directly on the CTI-850, replacing ***CONTROL***.

ComTrack-TLE is intended for use with a dual-axis satellite antenna. The antenna must be capable of acquiring an inclined-orbit satellite throughout its entire range of travel. The TLE tracking method does not require AGC voltage from a receiver and therefore functions independently of the type of receivers in use. It can be used in uplink-only situations or for tracking of non-geosynchronous satellites.



ComTrack-TLE ---- Typical Electrical Connections

To the operator, a CTI-850 Controller running the ***ComTrack-TLE*** software operates normally. Internally, if a non-inclined orbit satellite preset position is chosen, the antenna is moved as usual. If an inclined orbit satellite preset position is chosen, the precise location of the satellite is calculated using the TLE data and the antenna is moved according to the results of the calculation.

ComTrack-TLE can be used in conjunction with ***ComSched for DOS*** or ***ComSched for Windows®***, CTI's Satellite Antenna Scheduling and Remote Control software package. When ComSched issues a command ordering the CTI-850 Controller to go to the preset position of an inclined orbit satellite, the antenna moves to the satellite's predicted position as calculated by the ***ComTrack-TLE*** program.

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COMSCHED FOR WINDOWS®

ComSched for Windows® is a satellite-equipment scheduling program intended to run on a dedicated IBM-compatible personal computer which is electrically connected to one or more EC8 or CTI-850 satellite antenna controllers.

ComSched for Windows® is designed to control the following equipment:

- One or more (up to sixteen) motorized satellite antennas. Each motorized axis must be equipped with a position sensor such as an optical encoder or potentiometer.
- One or more (up to sixteen) motorized feedhorns, one per antenna. Each feedhorn must be equipped with an optical encoder or potentiometer.
- One or more (up to four) EC8 or CTI-850 Satellite Antenna Controllers.
- One or more (up to 64) satellite receivers. Compatible satellite receivers include:
  Drake ESR-1250, ESR-1252, ESR-1255
  ICS/DX DIR-657, DIR-657B
  Scientific Atlanta 7500
  Standard MT810, MT830

  Receivers of different types may be intermixed within a single control unit.

ComSched for Windows® allows the user to set up and execute a schedule of future events, called the MASTER SCHEDULE. Several hundred "events" can be stored on disk. Each event may consist of any or all of the following:

- Move any antenna to any specified satellite.
- Adjust the antenna feedhorn to the proper polarization.
- Assign receiver settings (transponder number, visual carrier frequency, aural subcarrier frequency, C/Ku input relay, and H/V input relays).

ComSched for Windows® automatically executes events in chronological order, so events may be entered in any random order.

ComSched for Windows® allows the user to adjust the antenna and the receivers directly from the PC keyboard.

ComSched for Windows® is configured to run on an IBM compatible Personal Computer (PC). Two PC options are available:

- The PC can be supplied by the user. The PC must be equipped with keyboard, monitor, mouse, accurate on-board time-and-date clock, hard disk drive, floppy disk drive, Microsoft ***Windows® 95*** (or later), and at least one serial communication port.
- A rack-mounted PC, with 14" rack-mounted color monitor, is available from CTI.

ComSched for Windows® operates over an electrical connection called the Remote Serial Link (RSL) between the PC and the controller. This link can be implemented with any of the following circuits:

RS-232
RS-422
RS-485
Telephone line, either leased or dial-up
A two-wire full-duplex audio circuit
A pair of subcarriers on a microwave STL

ComSched for Windows® and ***ComTrack*** can be used together on the same antenna. Any satellite for which ***ComTrack*** has been allowed to establish a tracking history can be scheduled in the ***ComSched for Windows®*** MASTER SCHEDULE. Whenever ***ComSched for Windows®*** moves the antenna to the satellite, ***ComTrack*** takes over and uses the stored historical information to locate the satellite.

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*Customized ComSched for Windows*â

On special order, ***ComSched for Windows***â can be customized to control a wide variety of additional devices. Special versions of ***Customized ComSched for Windows***â can be designed to control just about any kind of electronic equipment. Examples of possible applications include:

- Control of VTRs and VCRs. Depending on the type of control interface provided by the manufacturer of the VTR/VCR, it can be controlled by an RS-422 connection or by relays. Relays can be closed momentarily to simulate pressing a button, or held open or closed indefinitely.
- Control of audio/video routing switchers. Routing switchers can be controlled explicitly or implicitly. With **explicit** control, switcher SOURCE and DESTINATION appear as separate columns in the MASTER SCHEDULE. With **implicit** control, ***ComSched for Windows***â deduces the SOURCE and DESTINATION from other scheduled information.

  A common example of implicit control occurs when a routing switcher is used to connect a group of satellite receivers with a group of VTRs and VCRs. In this case, ***ComSched for Windows***â *automatically directs the switcher to connect the output of the scheduled receiver to the input of the scheduled VTR/VCR.*
- Control of coaxial relays or coaxial switchers. Coaxial control can be explicit or implicit. With **explicit** control, a dedicated column appears in the MASTER SCHEDULE. With **implicit** control, ***ComSched for Windows***â deduces the correct relay and switcher settings from other scheduled information. In multiple-antenna installations, elaborate "trees" of relays can be controlled implicitly.

  A common example of implicit control occurs when a coaxial switcher is used for LNB switching at the input to a group of satellite receivers. In this case, ***ComSched for Windows***â *selects the LNB which matches the scheduled transponder.*
- Control of scan converters and similar devices such as digital video decoders. Control can be explicit or implicit. With **explicit** control, a "SCAN" column appears in the MASTER SCHEDULE. With **implicit** control, ***ComSched for Windows***â deduces the scanning standard from the scheduled satellite and transponder information.
- Control of satellite receivers not accommodated in the standard version of ***ComSched for Windows***â. Control can be implemented over RS-232, RS-422, or parallel BCD links.

Special versions of ***Customized ComSched for Windows***â can be designed to monitor equipment (and report alarm conditions) at unattended antenna sites. Examples of possible applications include:

- Status monitoring of audio/video routing switchers. The switcher is represented by a graphical grid; each closed crosspoint is represented by an "**X**".
- Status monitoring of support equipment. Such equipment can include:
  - Dish heater status.
  - Heating and air conditioning equipment.
  - Room air temperature.
  - Tower-lighting on/off status.
  - Door and gate position.
  - Utility power status and voltage.
  - Heat, smoke, and fire alarms.
  - Standby generator status and fuel level.
- Alarm reporting. ***Customized ComSched for Windows***â can be configured to report alarm situations in a variety of ways:
  - A text message on the PC or fax machine.
  - A text message to an alphanumeric pager.
  - A synthesized-voice telephone message.
- Logging. ***Customized ComSched for Windows***â can be configured to maintain a log (on floppy disk or hard copy) of all status-monitoring and alarm activity.

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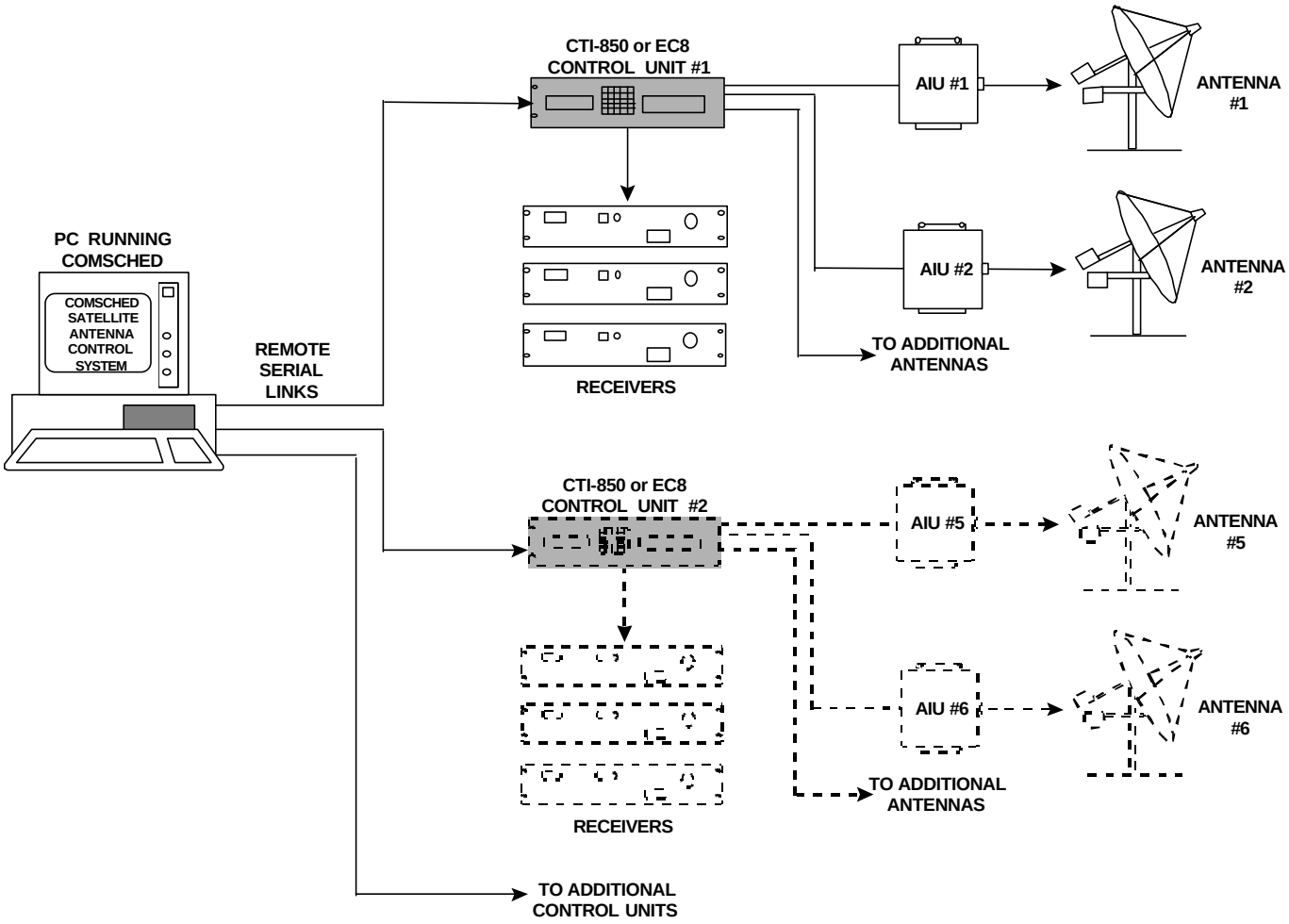
ComSched for Windows is a satellite-equipment scheduling program intended to run on a dedicated IBM-compatible personal computer which is electrically connected to one or more EC8 or CTI-850 satellite antenna controllers.

ComSched is designed to control the following equipment:

- One or more (up to 16) motorized satellite antennas. Each motorized axis must be equipped with a position sensors such as an optical encoder or potentiometer.
- One or more (up to 16) motorized feedhorns, one per antenna. Each feedhorn must be equipped with an optical encoder or potentiometer.
- One or more (up to four) EC8 or CTI-850 Satellite Antenna Controllers.
- One or more (up to 32) satellite receivers.

On special order, peripheral equipment, such as video routing switchers, L-band routing switchers, and VCRs, can be controlled.



Typical equipment setup for *ComSched for Windows*

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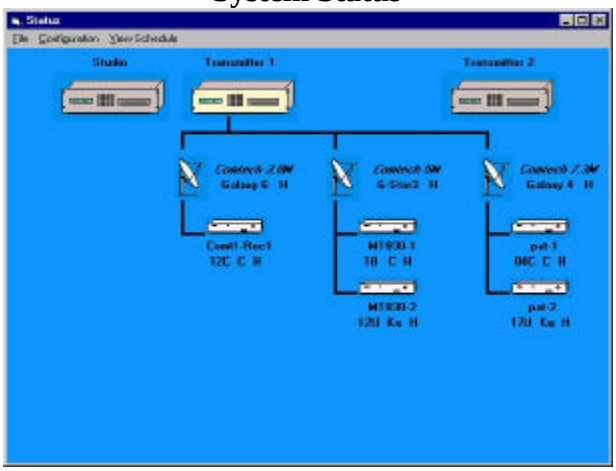
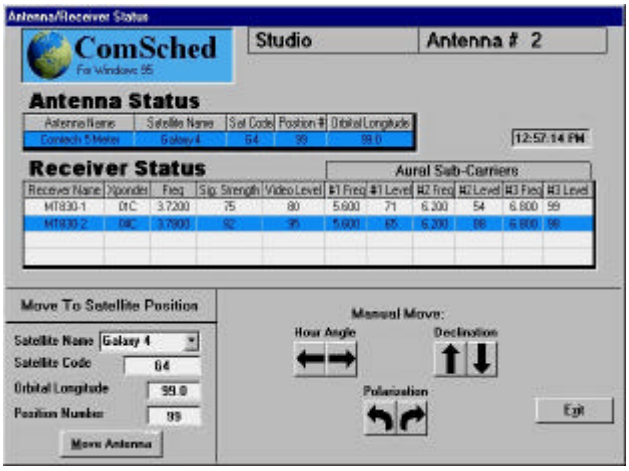
*COMSCHED FOR WINDOWS*ò
SCREENS

- **Scheduling and Remote Control Software**
- **Automated Downlinking, Automatic Control of All Ancillary Equipment**
- **Control Antennas, Receivers, Routers, VTR's**
- **Configure For Any Make, Model, or Age Equipment**
- **Easy To Use, Intuitive Interface**
- **Modular Add-On's For Future Equipment Additions**
- **Telco, Microwave, Or Fiber Connection To Remote Sites**
- **Cost-Effective, Labor Saving, Unattended Operation**

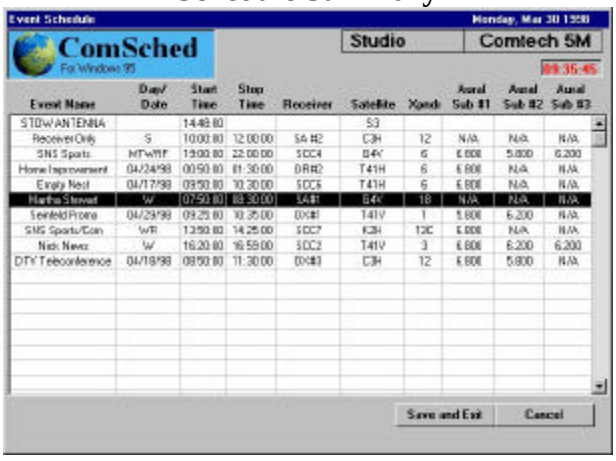
System Status



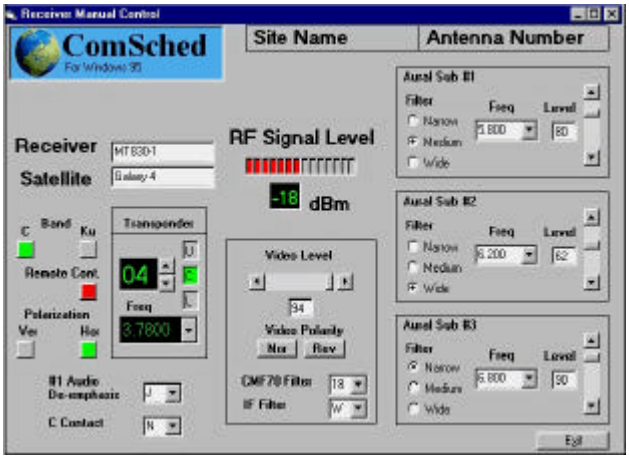
Antenna/Receiver Status



Schedule Summary



MT-830 Receiver



For More Information, Check Our Web Site At www.CTIinfo.com
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*COMSCHED FOR WINDOWS*ò
OPERATION

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- Move any antenna to any specified satellite.
- Adjust the antenna feedhorn to the proper polarization.
- Assign receiver settings (transponder number, visual carrier frequency, aural subcarrier frequency, C/Ku input relay, and H/V input relays).

Events may be entered in any random order; ***ComSched*** automatically executes them in chronological order.

ComSched is configured to run on an IBM compatible Personal Computer (PC). Two PC options are available:

- The PC can be supplied by the user. The PC must be equipped with keyboard, monitor, accurate on-board time-and-date clock, floppy disk drive, Microsoft Windows operating system, at least one serial communications port, and an optional printer port.
- An optional rack-mounted PC, with 14" rack-mounted color monitor, is available from CTI.

ComSched allows the user to adjust the antenna and the receivers directly from the PC keyboard.

Compatible satellite receivers include:

- Drake Models ESR-1250 series.
- ICS/DX Communications, Inc. Models DIR-657, DIR-657B
- Scientific Atlanta Model 7500
- Standard Communications Corporation Models MT810 and MT830

ComSched operates over an electrical connection called the Remote Serial Link (RSL) between the PC and the controller. This link can be implemented with any of the following circuits:

- EIA/RS-232
- EIA/RS-422
- Telephone line, either leased or dial-up
- A two-wire full-duplex audio circuit
- A pair of subcarriers on a microwave STL

For tracking inclined-orbit satellites, ***ComSched for Windows*** and ***ComTrack*** can be used together on the same antenna . Whenever ***ComSched*** moves the antenna to the satellite, ***ComTrack*** takes over and uses the stored historical or emphemeris (TLE) information to locate the satellite and track it.

CTI

Communication Technologies, Inc.

6213 Middleton Springs Drive
Middleton, WI 53562-2273

email: CTI@CTIinfo.com
Internet: www.CTIinfo.com

Phone: 608-831-4636
800-818-1511
Fax: 608-836-1840

General Information

Customer Service:

During normal business hours (8:00 AM - 5:00 PM Central Time), call 800-818-1511.
No voice mail. Hardware and software assistance will be available.

After business hours, weekends, and holidays, leave a message on the telephone answering machine. Messages are checked hourly from 8:00 AM to 10:00 PM. Calls will be returned within two hours.

CTI can also be reached by fax at 608-836-1840 and by e-mail at cti@CTIinfo.com

Delivery Schedule:

Equipment is normally shipped within thirty days after receipt of a purchase order. We can generally accommodate requirements for shorter delivery times, particularly with items in our standard product line.

Shipping Methods:

All items are shipped FOB Middleton, Wisconsin. The usual method of shipment is UPS Ground unless the customer specifies otherwise. The quoted prices do not include shipping charges or taxes. These items will be invoiced separately.

Terms:

A 50% payment is required with the order. The balance is due 30 days after the final invoice date. A monthly late payment fee of 1.5% will be added to all invoices that remain unpaid thirty days after invoicing.

Warranty:

All equipment furnished by CTI is covered by a one-year limited warranty. Equipment must be returned to CTI for warranty repairs. The customer is responsible for the payment of shipping expenses in both directions.

Repairs:

Repair service for out-of-warranty equipment is available from CTI for a nominal charge.

Proposal Expiration:

This proposal is valid for 60 days from the date of issue.