INSTALLATION AND OPERATION MANUAL
SEA TEL DUAL WeSat
SATELLITE WEATHER / DBS SYSTEM

This manual applies to the following systems

Model 3294	Dual WeSat System
Model 4094	Dual We Sat System
Model 4894	Dual WeSat System

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1. DESCRIPTION AND TECHNICAL DATA

1.1. GENERAL

This manual describes the installation and operation of the Sea Tel Weather-at-Sea Dual WeSat Systems installed as an add on to the Sea Tel Model 3294, 4094 and 4894 Shipboard Satellite Receiving Systems. The WeSat system provides the yacht owner with the capability to receive weather satellite images directly from geostationary and polar orbiting satellites.

Weather satellite imagery is transmitted from several types of satellites maintained by various countries around the world. The weather signals are free to any user that has the equipment necessary to receive these signals. The Sea Tel WeSat system will receive and process the weather signals from all types of weather satellites currently in operation.

1.2. SYSTEM DESCRIPTION

The WeSat system consists of customized antennas and amplifiers to receive the weather image signals, specialized receivers to decode the signals and a personal computer with appropriate software programs to process and display the weather images. These major components and the appropriate mounting brackets and cabling are supplied with the Sea Tel WeSat system. Refer to the system block diagram at the end of this manual for an overview of the various components.

The geostationary satellite reception portion of the WeSat System utilizes the stabilized antenna platform of the Sea Tel DBS Satellite TV Receiving system to keep the high gain directional antenna precisely pointed at the distant geostationary weather satellites. A special feed assembly installed on the antenna allows reception of the L-Band weather satellite signals without interfering with the reception of the Ku-Band DBS TV signals. A separate omnidirectional antenna is used to receive the lower frequency VHF signals from the polar orbiting weather satellites. The polar satellite capability is an option and may not be part of your system.

1.3. DBS SATELLITES

There are numerous types of satellites around the world that provide TV services that can be received with small aperture antenna systems. These services are usually restricted to the Ku and DBS bands because of the higher antenna efficiencies at the higher frequencies. In the US the DBS services include DirecTV, USSB and Dish Network. These signals can be received with antennas as small as 20 to 24 inches in diameter. In Europe and the Middle East: high power Ku Band services are provided by Astra, Eutelsat and Orbit. Reception of these signals requires a 32 to 48 inch antenna depending on the vessel location. Galaxy Latin America provides services in Latin America:. Reception of these signals requires a 32-inch antenna. The WeSat system can be added to the Sea Tel 32, 40 and 48 inch DBS Shipboard Satellite Receive systems with full functionality.

1.4. POLAR ORBIT WEATHER SATELLITES

There are two types of weather satellite systems in operation that the Sea Tel WeSat system is capable of receiving. These systems are the polar orbiting and the geostationary satellites. The Polar orbiting system was developed first as it required smaller rockets to place the satellites in their lower orbits. In the United States, the National Oceanic and Atmospheric Administration (NOAA) maintains and operates two satellites in polar orbit. The high resolution imagery from these satellites is used for national and international weather forecasting by the National Weather Service which is a part of NOAA. The satellites orbit the Earth approximately every 100 minutes passing North to South or descending on one side of the Earth and South to North or ascending on the opposite side. Since each orbit takes 100 minutes to complete, the Earth will have rotated slightly allowing the satellite to see a new slice of the Earth's surface on each pass. The satellite altitude is about 500 miles and is visible from any point on the surface of the Earth for about 15 minutes. The satellite is maintained in an orientation so that it "looks" straight down at the Earth's surface with an East to West view of about 3200 miles.

An instrument called the Advanced Very High-Resolution Radiometer produces the image of the cloud cover and the Earth's surface. The image is generated in a manner similar to a television picture. The radiometer scans from side to side across the satellite track on the Earth to provide the horizontal sweep. The forward motion of the satellite increments the scan to provide the vertical displacement. The radiometer has five sensors that are responsive to visible and infrared light. The outputs from two of the sensors are processed on the satellite and modulated onto a VHF carrier signal of either 137.5 or 137.62 MHz. This type of weather satellite imagery transmission is called Automatic Picture Transmission or APT for short.

The APT signal is transmitted down to the Earth's surface and is received by the WeSat system's omnidirectional antenna when the satellite is in view. Each APT image pass lasts about 15 minutes or less. The next image pass of the satellite will occur in approximately 100 minutes and will appear a few thousand miles to the west of the current track. The NOAA satellites are sun synchronous, which means that the plane of the satellite orbit rotates approximately one degree per day or 360 degrees per year. This rotation keeps the orbit plane in a fixed orientation with respect to the sun so the images are captured with the same solar illumination all year long.

Russia has launched a series of weather satellites called Meteor. They operate similarly to the NOAA satellites and can be received by the Weather-at-Sea WeSat system through the APT omnidirectional antenna.

1.5. GEOSTATIONARY ORBIT WEATHER SATELLITES

The second type of weather satellites are the geostationary satellites. These are newer than the polar orbiting satellites and were developed after larger rockets were available which were capable of pushing these satellites out to an altitude of 22,242 miles. Geostationary satellites orbit in a west to east direction directly above the equator. At that altitude, it takes 23 hours 56 minutes and 4 seconds or one sidereal day to complete one revolution. This corresponds to the exact time a point on the Earth's surface takes to complete one revolution. To an observer on Earth, the satellite appears to be stationary over the equator. Geostationary satellites require onboard maneuvering fuel to counteract the effects of the sun and the moon's gravity and keep them positioned in their precise orbits. When the satellites age and use up their fuel they must be replaced to provide continued service.

The United States operates two weather satellites in geostationary orbit:: GOES East at 75 degrees west longitude and GOES West at 135 degrees west longitude (GOES stands for Geostationary Orbit Environmental Satellite). The European countries operate Meteosat5 at 0 degrees East longitude and Meteosat presently over the Indian Ocean. Japan operates GMS at 140 degrees East longitude. These satellites provide the cloud cover imagery that is shown on all TV weather broadcasts and they provide the continuos monitoring of hurricanes which improves the forecasting accuracy of these destructive foes. The Sea Tel Weather-at-Sea WeSat system allows you to receive these same images directly from the satellites and to create animation loops of the cloud cover images. Reception of the GMS satellite signal requires an additional receiver option.

The GOES satellites are three axis stabilized so that they continually view the hemisphere of the Earth directly below them. Each satellite has a telescope and scanning system that allows it to produce images of the cloud cover and the Earth's surface of that hemisphere. The NOAA command and control station at Wallops Island, VA, can control the area viewed. Weather images are taken in the visible and infrared spectral regions. The data is transmitted to Wallops Island and relayed to a processing center near Washington, DC. The data is used to produce three types of images; visible, infrared and water vapor. The images from each group can be stored sequentially. When a loop of these images is viewed, the motion of the cloud formations can be seen providing an indication of the future location of the associated weather systems. Low-pressure systems are areas of rising air that rotate counter clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere. The rising air mass produces clouds and precipitation. Visible images will show the cloud formations by reflected sun light. The brightness of the image will indicate the cloud thickness. Infrared images show the temperature of the clouds and the surface. The hottest surfaces will the darkest in the image. The desert southwest will be very dark on a hot summer day. Clouds will usually be colder the higher they are in the atmosphere and will appear whiter than low clouds. Cirrus clouds will appear very white in infrared images, as they are very high and cold, but will not appear very bright in visible images, as they don't reflect much light. Low level clouds may not appear very white in infrared images if they are close to the ground, but will be fairly bright in visible images, as they will reflect sun light. Water vapor images show the moisture conditions at high elevations and show the circulation patterns of the upper atmosphere.

The WeSat system uses the GOES satellite's data retransmission capability to relay processed images to receiving stations. The data that has been received and processed is forwarded to Wallops Island where it is sent back to the satellite. The satellite transmits the signal back to Earth at an L-Band frequency of 1691 MHz. This signal can be received at any location that has a look angle to the satellite of 5 degrees or more. The reception of the weak satellite signals requires a sensitive dish antenna that has to be accurately pointed at the satellite. The Sea Tel Weather-at-Sea WeSat System uses the accurate Ku Band / DBS stabilized antenna platform to maintain the correct antenna orientation for optimum signal reception.

The geostationary satellites not only transmit imagery produced by that particular satellite, but can relay images produced by the other geostationary satellites, the polar orbiting satellites and weather charts from the National Weather Service in the US and meteorological services in other countries. This broadcast in called Wefax in the US, LR Fax in Japan and SDUS from Meteosat.

1.6. SYSTEM COMPONENTS

The WeSat system for the Sea Tel model 3294, 4094 and 4894 DBS pedestals consists of two major groups of equipment: an above-decks group and a below-decks group. The above-decks group of equipment consists of the antennas, feeds, low noise amplifiers block down converters and interconnect cables. The below-decks equipment consists of the receivers, antenna controller, and the computer. Below is a detail list of the components associated with each group.

1.6.1. DBS TV RECEPTION COMPONENTS

Stabilized antenna pedestal assembly:
Ku Band / DBS Feed Assembly
Low Noise Amplifier and block down converter, LNB
Multiplex switch
Satellite receivers and Video monitors
TAC-92 Tracking Antenna Controller
Pedestal to TAC-92C control cable
Pedestal to multiplex switch RF cables
Multiplex switch to receiver cables
Receiver to Monitor cables

1.6.2. GEOSTATIONARY SATELLITE RECEPTION COMPONENTS

Stabilized antenna pedestal assembly (shared with DBS system):
Ku Band / DBS Feed Assembly (shared with DBS system)
WeSat LNA assembly
WeSat satellite receiver
Feed to LNA cable
Pedestal to receiver cable
Receiver to input card cable

1.6.3. APT RECEPTION COMPONENTS (Optional)

Omnidirectional antenna
Preamplifier
Polar orbiting satellite receiver
Satellite signal input card
Antenna to preamplifier cable
Preamplifier to receiver cable
Receiver to input card cable

1.6.4. WeSat PROCESSING and DISPLAY COMPONENTS

Personal computer
High Resolution Monitor,
Mouse and keyboard
WeSat Geostationary data input card
WeSat Polar data input card

1.6.5. COMPUTER SPECIFICATIONS:

Sea Tel normally provides a complete computer system fully configured with all the necessary hardware and software components installed with the purchase of a WeSat system. If you prefer to supply you own computer system, here are the minimum requirements:

CPU:	Pentium 166
RAM:	32 MB
Disk Drives:	2.5 GB Fast Access hard drive 6x or faster CD ROM drive 3.5 inch floppy drive
Comports:	2 Local Comports in addition to the two Timestep data interface cards
Expansion Slots	2 ISA slots for data interface cards
Display Driver	1024 x 768 SVGA interface card
Monitor	15 or 17-inch SVGA monitor
Operating System:	Windows 95

1.7. CABLES

The following cables are required to interface the above decks and below decks equipment groups. Sea Tel can supply all of these cables if desired.

1.7.1. SIGNAL CABLES

DBS IF (2 or 4)	RG-11, RG-6 for 50 feet or less
WeSat RF (1)	RG-11, RG-6 for 50 feet or less
APT RF (1)	RG-11, RG-6 for 50 feet or less

1.7.2. GPS INTERFACE

Type:	Shielded twisted pair
Number of wires:	4 (2 pair)
Wire Gauge:	24 AWG or larger

1.7.3. CONTROL CABLE

Type:	Individually shielded twisted pairs with overall foil/braid
Number of wires:	3 twisted pairs for ACU/PCU M&C 1 twisted pair for DC power
Wire Gauge	20 AWG up to 100 ft. See 1.7.4
Connectors:	DE-9S at ACU end AMP 9 pin CPC Female at PCU end

1.7.4. GYRO COMPASS INTERFACE CABLE

Number of wires	4 Conductors for Step-By -Step Gyro 5 Conductors for Synchro Gyro
Wire Gauge:	18 AWG Typical
Insulation:	600 VAC

2. INSTALLATION

2.1. GENERAL

This section describes the unpacking, final assembly and installation of the Sea Tel Dual WeSat System. The Sea Tel Models 3294, 4094 and 4894 systems are designed and built so that minimal final assembly at the pier or aboard the vessel is required. Installation should be done by an authorized dealer. Improper installation may result in degraded system performance or component damage and may void the warranty.

2.2. OVERVIEW

The mounting of the major components are covered in the detailed installation instructions that accompany the Sea Tel DBS TV receive system. Adding the WeSat capability involves running two additional coax cables (one if APT Polar Orbit reception is not installed) from the above decks equipment group to the below decks equipment group and interfacing these cables to the computer image processing system. Refer to the WeSat / DBS Dual Receive System Block Diagram drawing at the end of this manual for a complete system overview. This drawing supersedes the System Block Diagram in the DBS TV Receive System manual for the 3294, 4094 or 4894 systems. Refer to the Radome Installation drawings in the DBS TV Receive System manual for component mounting details.

2.3. UNPACKING SYSTEM COMPONENTS

Exercise caution when unpacking the Dual WeSat System. Carefully inspect the radome's exterior surface for any sign of shipping damage. Remove the radome top and inspect the stabilization platform and antenna. All hardware should be secure and there should not be any sign of damage. Unpack the remaining system components, checking for any sign of damage.

2.4. SITE SELECTION

The radome and the optional APT omnidirectional antenna should be installed on the vessel where:

1. The antenna has a clear line-of-sight view of as much of the sky as practical.

2. Direct radiation into the antennas from the vessel's radar and high power short wave transmitting antennas is minimized.

3. The antennas are at least four to five feet away from a steel mast or magnetic objects such as public address speakers or hailers.

4. The antennas are no more than 50 feet from the below decks equipment. Longer distances require lower loss cables to prevent unacceptable signal attenuation.

5. Access to the vessel's gyrocompass from the below decks equipment group if the vessel has a steel hull.

6. Easy visual access to the PC monitor and keyboard for viewing the satellite weather data. The TAC92C antenna controller can be mounted so that it is normally out of view but can be easily accessed.

These conditions cannot always be entirely satisfied, and site selection must inevitably be a compromise between the various considerations.

2.5. PEDESTAL and RADOME MOUNTING

The stabilized pedestal contains the feed and LNA required to receiver the geostationary weather satellite data along with all the components to receive the satellite TV signals. Refer to the DBS TV System Installation manual for detailed instructions on mounting the pedestal and radome.

2.6. APT ANTENNA INSTALLATION

Attach the polar orbit satellite omnidirectional antenna to a mast or railing in the vicinity of the geostationary stabilized pedestal antenna assembly. Mount the antenna to the ship using the standard 1 x 14 marine pedestal mount hardware. Attach the pre-amplifier to the antenna support with cable ties or cable clamps.

2.7. GPS ANTENNA INSTALLATION

Mount the GPS antenna in any convenient location with a clear view of the sky above. Route the GPS antenna cable to a weather protected location and mount the terminal strip at this location.

2.8. CABLE INSTALLATION

The control and RF cables must be routed between the antennas and the below deck equipment locations through the deck and various vessel spaces. The cables must be handled with care to prevent damage. When pulling the cables avoid sharp bends, kinking and the use of excessive force. After placement, seal the deck penetration gland and securely tie the cables.

To allow cable runs longer than the standard 50 foot control cable supplied, cut the ends off the standard cable and terminate the 4 pairs on and 8 pin terminal block inside a junction box. Use 22 AWG or larger wire for the signal pairs and wire from the following table for the 24V DC power.

Cable Run Length	Minimum Wire Size
Up to 100 Ft	18 AWG (1.0 mm)
Up to 150 Ft	16 AWG (1.3 mm)
Up to 250 Ft	14 AWG (1.6 mm)
Up to 350 Ft	12 AWG (2.0 mm)

2.8.1. RADOME CABLE INSTALLATION

The control and RF cables supplied with the system are connected to the antenna in the base of the radome as follows. Refer to the WeSat / DBS Dual System Block Diagram for details.:

1. Remove the sealing nut and the rubber gland from the large control cable strain relief mounted in the radome base. Pass the round circular connector on the control cable through the sealing nut.

2. Insert the control cable connector up through the strain relief body and attach the control cable to the mating connector on the radome base pan. Press the ground wire quick disconnect over the tab on the connector mounting plate.

3. Press the rubber gland over the control cable at the location where the cable passes through the strain relief. Thread the sealing nut onto the strain relief and tighten the nut against the rubber gland. Be sure that the cable run does not interfere with the antenna pedestal as it rotates in the radome.

4. Remove the sealing nut and rubber gland from the small strain relief in the radome base. Pass the two DBS IF cables and WeSat RF cable through the strain relief. Connect the two DBS cables to the type-F connectors marked on the connector mounting plate. Connect the WeSat RF cable to the remaining type F connector. Tightened all type F connectors with a 7/16 wrench to ensure a proper ground connection.

5. Press the rubber gland over the RF cables at the location where they pass through the strain relief. Thread the sealing nut onto the strain relief and tighten the nut against the rubber gland. Be sure that the cables do not interfere with the antenna pedestal as it rotates in the radome.

2.8.2. APT ANTENNA CABLE INSTALLATION

1. Connect the Pre-amplifier to the antenna with the short length of RF cable supplied.

2. Connect the APT RF cable to the type F connector on the pre-amp output.

2.8.3. GPS ANTENNA CABLE INSTALLATION

1. Route the GPS antenna cable to the weather protected location determined above and terminate the wires at the terminal block as shown in drawing 112791.

2. Connect the 4 wires from the shipboard interface cable to the terminal block as shown in drawing 112791.

2.8.4. BELOW DECKS CABLE INSTALLATION

1. Connect the control cable to the 9-pin connector, J1, on the back of the TAC-92C. Be sure to secure the two retaining screws to prevent the cable from pulling out.

2. Connect the two DBS IF cables to the matrix switch splitter inputs (Labeled “LNB A” and “LNB B”). Connect the 6-foot cable supplied from one of the multiplex switch outputs to the TAC-92C jack labeled “RF IN A”. Connect a cable from each receiver jack labeled “SATELLITE IN” to one of the multiplex switch outputs.

3. Connect the AUDIO and VIDEO outputs from each DSS receiver to a TV video monitor. You may need to refer to the DSS receiver manual for specific instructions on how to interface the receiver to your specific type of monitor.

4. Connect the 4 wires from the GPS data cable to the terminal block on the Terminal Mounting strip as shown in drawing 112791.

5. If the optional gyro interface is used, connect the ship’s gyro compass output to TB1 or TB3 on the Terminal Mounting Strip. Use TB1 if the gyrocompass is a Step-By-Step type and match the connections to A, B, C and COM with the gyro compass output. Use TB3 if the gyrocompass is a Synchro type and match the connections to R1, R2, S1, S2 and S3 with the gyro compass output.

6. Connect the WeSat RF cable to the type-F connector on the Meteosat / GOES WeSat satellite receiver. Connect the receiver output cable between the circular connector on the side of the receiver and the COM1 data card in the PC. Connect the speaker cable to the COM1 data card.

7. Connect the blue and black AGC wires from the WeSat Receiver to the X1 and X2 terminals on the terminal mounting strip. The blue wire connects to X1 and the black wire to X2.

8. Connect the APT RF cable to the type F connector on the APT receiver. Connect the receiver output cable between the circular connector on the side of the receiver and the COM2 data card in the PC.

9. Connect the 25-pin ribbon cable from the terminal strip to J3 on the back of the TAC-92C. Connect the 9-pin ribbon cable from the terminal strip to J13 on the back of the TAC-92C.

10. Connect J11 on the back of the TAC-92C to the PC COM3 using cable 116670, RS-232 Cable Assembly.

11. Attach the WeSat software Execution Key (Dongle) to the LPT1 printer port on the PC computer. If a printer is connected, attach it to the output of the Execution Key. Connect the mouse, keyboard and monitor to the PC.

12. IF GPS input to the computer is desired, connect the 4 wires of the GPS interface cable to the terminal mounting strip as shown in drawing 116295. Connect the other end of the GPS cable along with the RS422 adapter to COM4 of the computer.

2.9. PC HARDWARE INSTALLATION

The PC supplied by Sea Tel comes with all the hardware and software already installed so no further installation is required. Proceed to section 2.11, Functional Checks. If you are using you own computer, you will need to configure the two internal serial port addresses and install the two TimeStep data cards. Here are two recommended configurations:

CONFIGURATION A (Asus Mother Board non conflict)

WeSat Data Card	COM1	IRQ5
APT Data Card	COM2	IRQ3
Internal Serial Port #1 (PCDAC)	COM3	IRQ4
Internal Serial Port #2 (GPS Input)	COM4	IRQ10

CONFIGURATION B (standard Comm. configuration)

Internal Serial Port #1 (PCDAC)	COM1	IRQ4
Internal Serial Port #2 (GPS Input)	COM2	IRQ3
WeSat Data Card	COM3	IRQ5
APT Data Card	COM4	IRQ7

Sea Tel supplied units are normally set up with configuration A. Using one of the tables above, perform the following steps:

1. Turn off power to the computer.

2. Set the Serial port configuration jumpers on the TimeStep data cards as shown in the table above and install them into 2 free ISA slots in your computer. The jumper functions are clearly marked on the boards.

3. Mark the outside of the computer case with the comm. address of each data card so they can be differentiated when the case cover is installed.

4. Turn on power to the computer, Open **My Computer**, then **Control Panel**, then **Add New Hardware** icons. Click **Next**, **Next** and **Next** to have windows automatically detect the new serial ports installed.

5. When complete, open the **My Computer**, **Control Panel**, and **System** icons then click on the **Device Manager** tab. Open the "**Ports**" icon and verify that 4 com ports are shown. If more than 4 appear, Remove them all and repeat step 4.

NOTE: To view the IRQ resources in use to assist in selecting the IRQ assignments, open the **My Computer**, **Control Panel**, then **System** icons. Select the **Device Manager** tab then double click on **Computer**. Select the **View Resources** tab and the **IRQ** radio button.

2.10. PC SOFTWARE INSTALLATION

The PC supplied by Sea Tel comes with all the software already installed and no further installation is required. Proceed to section 2.11, Functional Checks. To install the TimeStep software and the Sea Tel PCDAC software, follow these instructions:

1. Insert the TimeStep Install disk #1 into your floppy disk drive. Click on the **Start** button then select **Run.** Type **A:INSTALL** and click **OK.**

2. Follow the on-screen instructions, inserting the remaining disks when requested.

When the installation has completed, a new Program Group called **TimeStep PROsat** will be created. This group contains the **PROsat** satellite image reception program and the **Track II** polar orbit satellite tracking and prediction program.

3. Insert the Sea Tel PCDAC Install disk #1 into your floppy disk drive. Click on the **Start** button then select **Run.** Type **A:SETUP** and click **OK.**

4. Follow the on-screen instructions and press the on screen INSTALL button when prompted

When the installation has completed, a new Program Group called **PCDAC** will be created. This group contains the remote antenna control program **PCDAC**.

2.11. FUNCTIONAL CHECKS

The following procedures provide instructions to allow verifying the proper operation of the system after the installation is complete.

2.11.1. ANTENNA CONTROL UNIT AND PEDESTAL OPERATION

1. Turn on the main power switch on the back of the TAC-92. Press RESET and the display will show "**Sea Tel Inc -Master"** and the current version number.

2. After six seconds verify the display shows "**Sea Tel Inc-Remote Initializing**." This confirms the control cable connections to the pedestal are functional.

3. During initialization, the antenna pedestal will rotate clockwise to the azimuth end stop. It will attempt to drive past the stop a few times in order to be certain the stop has been reached. The level cage that contains the antenna position sensors will rotate clockwise to its stop. The antenna will then be positioned horizontal in elevation and cross-level. After 2 minutes when initialization is complete, the TAC92C display will show the system model number and software version.

4. Press the **SAT** key 4 time to select the Receiver Selection window. Press the **NS/EW** key until **IN A** appears. Verify the **AGC** display is 800 counts or greater. This confirms the coax connections from the TAC-92C to the DBS LNB's.

5. Press the **NS/EW** key again until **EXT AGC** appears. Verify the **AGC** display is now 600 counts or greater. This confirms the External AGC connections to the WeSat receiver and its RF input connections. Note, you will need to turn power to the PC on to get the AGC counts to increase for the EXT AGC input.

6. Press the **SHIP** key on the TAC-92C 2 times to select the latitude entry mode. Verify the **LAT** display agrees with the GPS latitude information. Key in a different latitude value and press **ENTER**. Verify the display changes back to the correct latitude after a few seconds. This confirms the GPS antenna connections to the TAC-92C.

2.11.2. PC OPERATION

1. Acquire a geostationary satellite signal as follows:

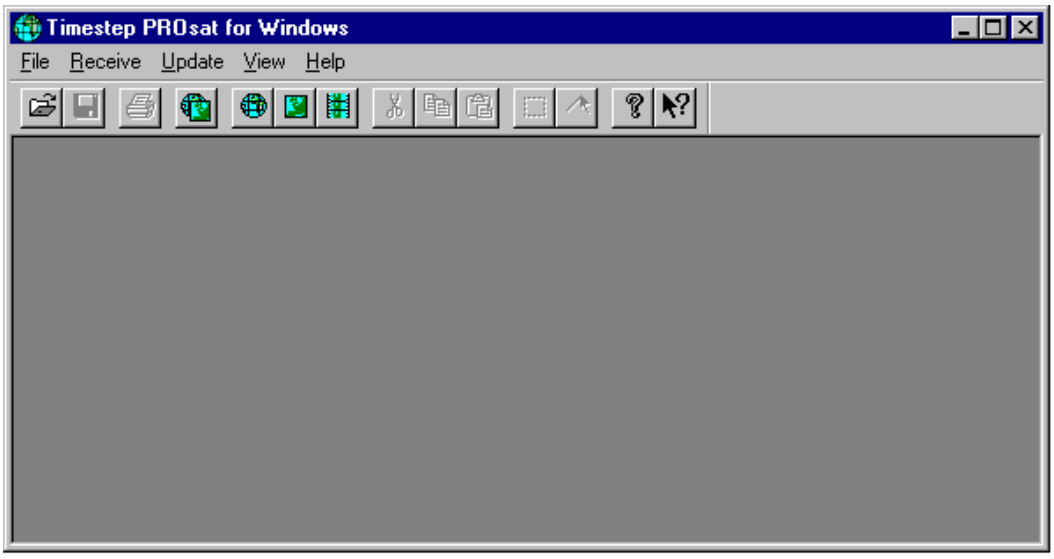
2 Press **SHIP** and verify the **LAT** and **LON** display readings are correct. If GPS is not connected and the readings need adjustment, press the **ENTER** key to select **LAT** and enter the correct Latitude from the numeric keypad. Press the **NS/EW** key to select the correct hemisphere. Press **ENTER** to store the new value. Press **ENTER** again to select **LON** and enter the correct Longitude. Press **ENTER** to save the new value.

3. Press **SAT** to display satellite information. Press **ENTER** to allow Satellite Longitude entry. Key in the latitude for one of the following satellites:

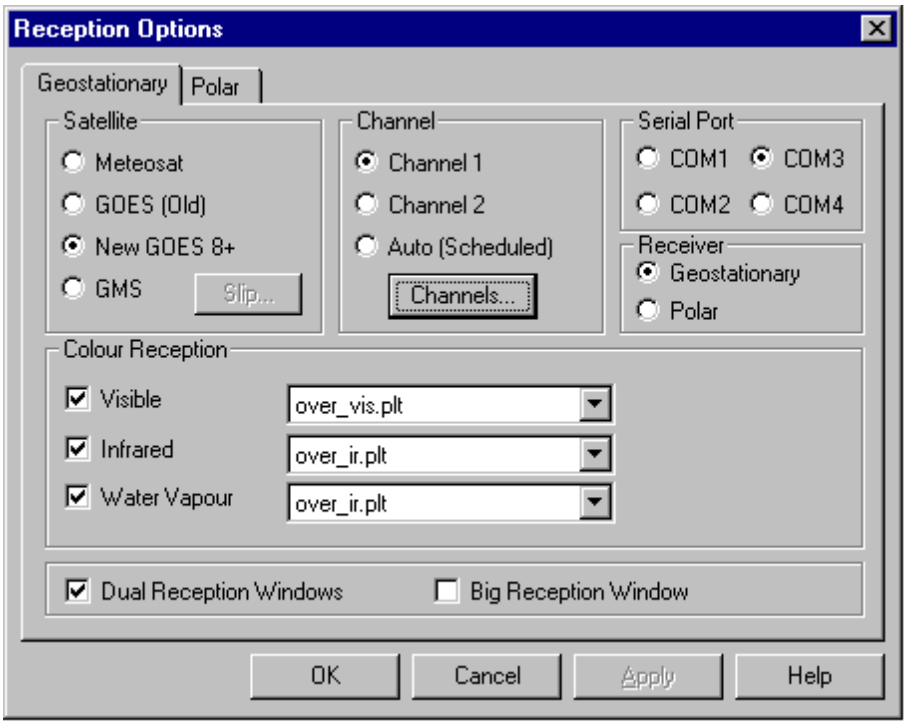
Longitude	Satellite Name	Geographic Coverage
75 W	GOES East	Eastern US, South America
135 W	GOES West	Western US
0 W	Meteosat	Europe
140 E	GMS	Far East, Australia

Be sure to press the **NS/EW** key to correctly enter east or west longitude for the satellite. This procedure will target the antenna to the geostationary satellite selected and the TAC-92C should lock onto and track the selected satellite.

4. Open the TimeStep program on the PC (click **Start**, then select **Programs**, **TimeStep32**, **PROsat**). The screen should look something like this:



5. Click on **Receive** to open the Receive drop down menu and select **Options**. The display should now look like:

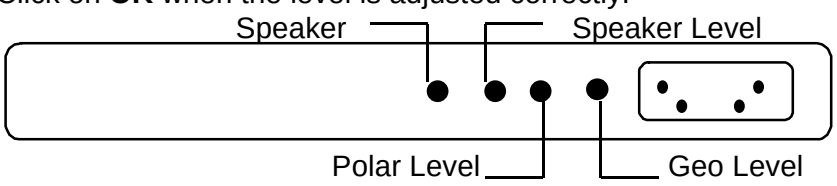


On the **Geostationary** Tab, select the following:

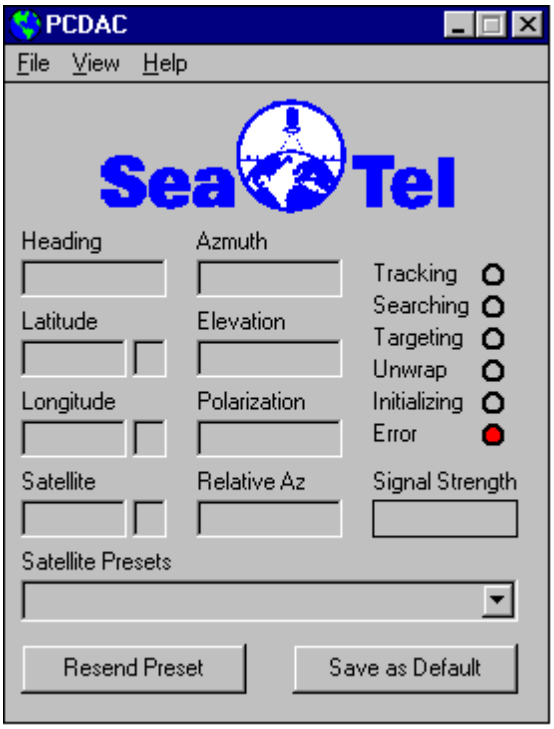
Satellite: New Goes 8+ (or appropriate satellite type)
Channel: Channel 1
Serial Port: COM3 (or comport selected for WeSat data card)
Receiver: Geostationary
Dual Reception Windows: Checked

Click on **OK**

6. Open the **Receive** drop down menu again and select Geostationary. Two Geostationary windows will appear in the main program window. Open the **Receive** drip down menu again and click on **Set Level**. The satellite signal should be present on the speaker as a " Ding, Ding, Ding" sound repeating at a rate of 4 per second. The satellite data signal is not continuous, so it may be necessary to wait a minute or so for resumption of the transmission. With the signal present, adjust the signal level control next to the 9-pin connector on the WeSat Geostationary data card for a reading of 245 to 250counts. Click on **OK** when the level is adjusted correctly.



8. Open the PCDAC program on the PC (Click **Start** then select **Programs**, **Pcdac**, then **PCDAC** or **PCDAC 32**) The display should look like this:

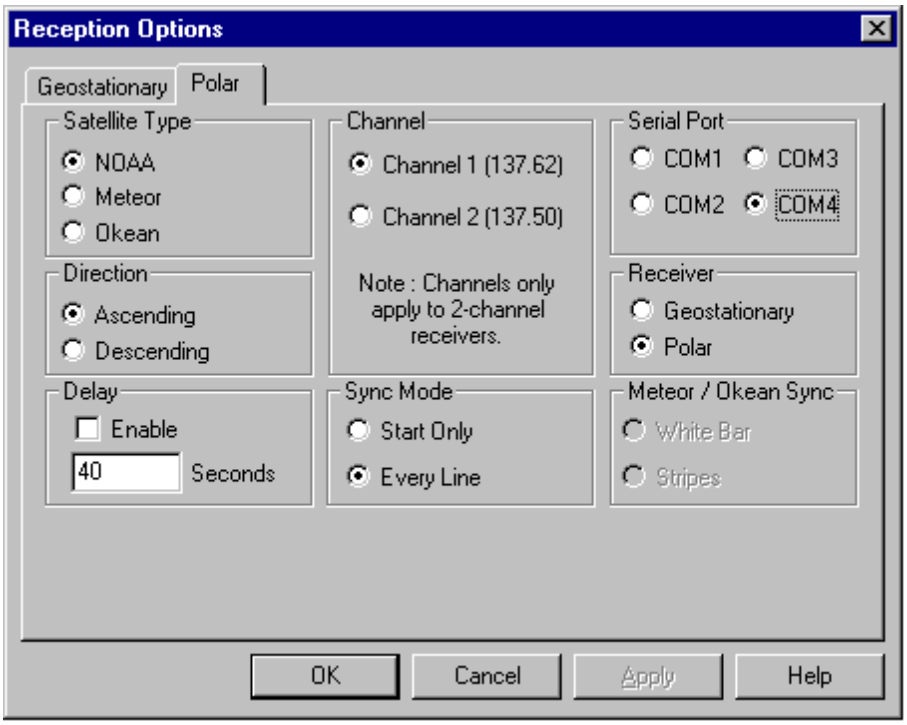


Verify that the AZ, EL and Heading windows change colors form gray to white indicating proper communication with the TAC-92C Antenna Control Unit. If the PCDAC windows are not responding correctly, Open the **File** drop down menu and select **Edit Configuration**. Verify the correct comport is identified in the configuration file. Change this value if required then save the configuration, exit the program and re-start.

9. If you have installed the APT polar orbit receive capability, perform the following steps to verify proper APT polar orbit operation. Otherwise proceed to section 3.

10. Open the TimeStep program window or restart the program if it was terminated. Close any Geostationary reception windows that are open by clicking on the “X” in the upper right hand corner of the window.

11. Open the **Receive** drop down menu and select **Options**. Click on the **Polar** Tab. The display should now look like:



On the **Polar** tab, select the following:

Satellite:	NOAA (or appropriate satellite type)
Channel:	Channel 1
Serial Port:	COM4 (or comport selected for APT data card)
Receiver:	Polar
Direction	Ascending
Sync:	Every Line

Click on **OK**

12. Open the **Receive** drop down menu again and select **Polar**. A single polar reception window will appear in the main program window. Open the **Receive** drop down menu again and click on **Set Level**. You will need to wait until a polar satellite is in reception range. The Track II program can predict the exact time the satellite will be in range but generally there are two mid morning passes and two late afternoon passes that are usable. When that occurs, the satellite signal will be present on the speaker as a “Ching-Dok, Ching-Dok” sound. With the signal present, adjust the signal level control one position away from the 9-pin connector on the APT data card for a reading of 245 to 250 counts. See drawing in Geostationary section above. Click on **OK** when the level is adjusted correctly.

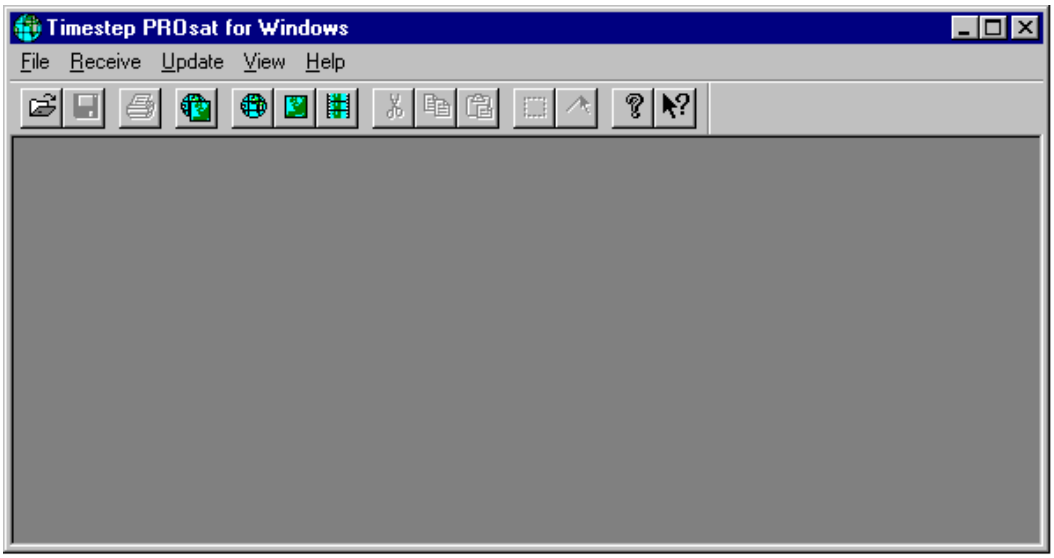
3. OPERATION

This section contains detailed instructions on the operation of the Timestep PROsat and Sea Tel PCDAC software. For detailed instructions on how to operate the 3294, 4094 or 4894 systems, refer to the system manuals provided with those systems. For additional details on the Timestep software, refer to the Timestep WeSat manual.

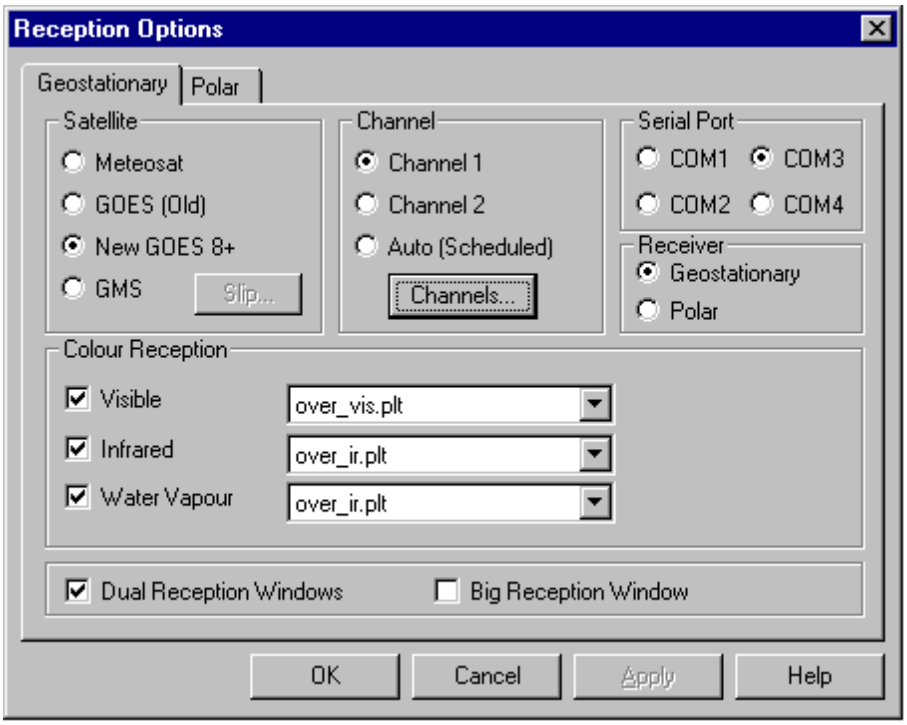
3.1. WeSat GEOSTATIONARY OPERATION

3.1.1. GEOSTATIONARY SETUP

1. Open the TimeStep program on the PC (click **Start**, then select **Programs**, **TimeStep32**, **PROsat**). The screen should look something like this:



2. Click on **Receive** to open the Receive drop down menu and select **Options**. The display should now look like:

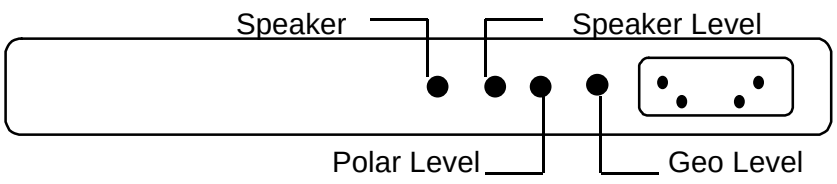


On the **Geostationary** Tab, select the following:

Satellite: New Goes 8+ (or appropriate satellite type)
Channel Channel 1
Serial Port: COM3 (or comport selected for WeSat data card)
Receiver: Geostationary
Dual Reception Windows Checked

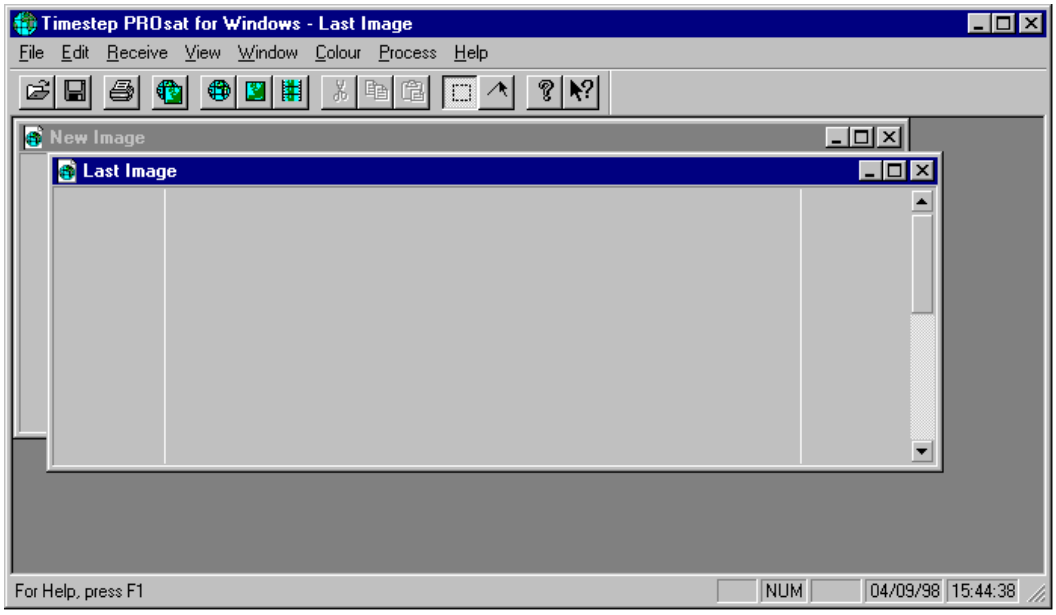
Click on **OK**

3. Open the **Receive** drop down menu again and select **Geostationary**. Two Geostationary windows will appear in the main program window. Open the Receive drop down menu again and click on Set Level. The satellite signal should be present on the speaker as a " Ding, Ding, Ding" sound repeating at a rate of 4 per second. The satellite data signal is not continuous, so it may be necessary to wait a minute or so for resumption of the transmission. With the signal present, adjust the signal level control next to the 9 pin connector on the WeSat data card for a reading of 245 to 250counts. Click on OK when the level is adjusted correctly.



3.1.2. GEOSTATIONARY IMAGE RECEPTION

Open the **Receive** drop down menu and select **Geostationary**. Two Geostationary windows called New Image and Last Image will be visible as shown below:

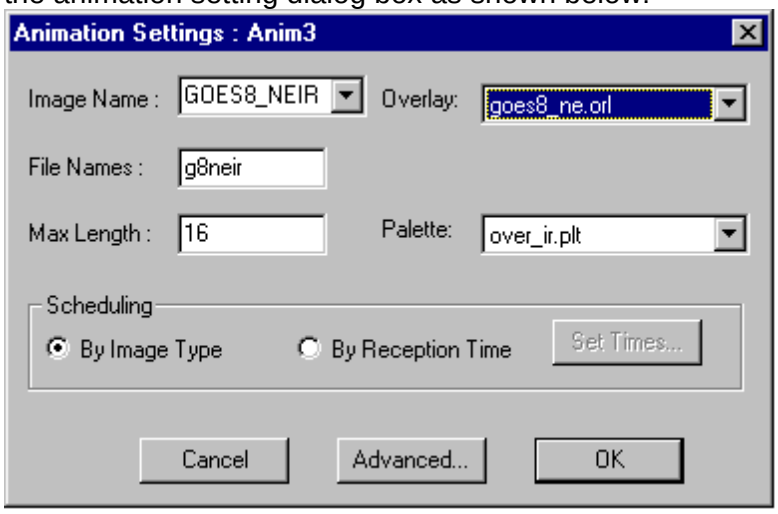


Arrange the windows side by side by selecting **Window**, **Tile Vertically**. When a new image is started it will appear in the New Image window. When completed, the New Image will transfer to the Last Image window and the next image will appear in the New Image window. Any image in the Last Image window will be deleted. This process will continue as long as new images are collected.

3.1.3. GEOSTATIONARY ANIMATION LOOPS

Animation loops of geostationary satellite images is one of the main features of the WeSat system. The loops show the motion of weather systems that could pose a danger to the safe operation of your vessel. Since the images transmitted from the geostationary satellites consist of many images type, the program must filter out only the desired image types and string them together to form an animation loop. This section provides a step by step procedure to set up your desired animation.

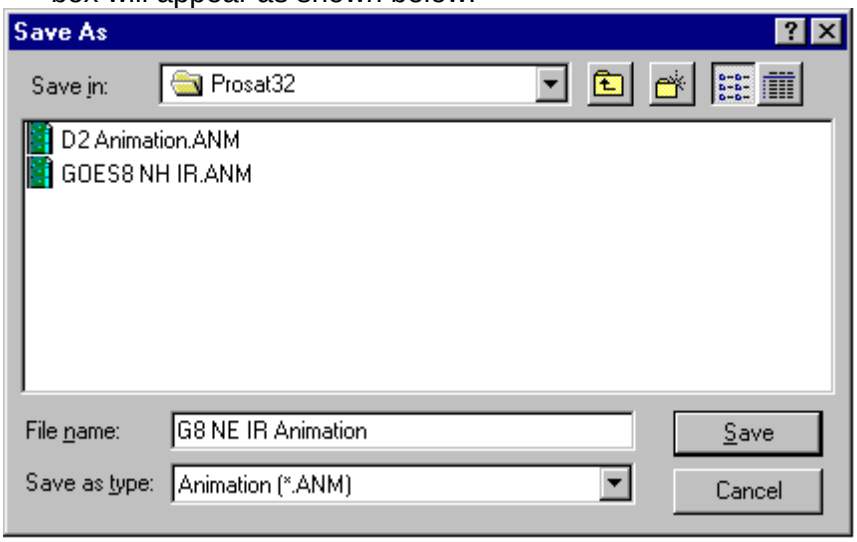
1. Open the **File** drop down menu. Select **New Sequence** to open the animation setting dialog box as shown below:



2. Make the following selections.
   Image name GOES8_NEIR.
   File Names: g8neir
   Max Length: 16 (maximum number of images in animation)
   Overlay: goes8_ne.ovl.
   Palette: over_ir.plt (color palette for the images)
   Scheduling: By Image Type

3. Verify the proper selections have been made and click on **OK**. A window titled **Anm1** will open. The WeSat System will decode the image header and add all images of the selected type as they are received forming the desired animation in the Anm1 window.

4. To save the animation settings, open the **File** drop down menu of the Timestep program and select **Save As**. The Save As dialog box will appear as shown below:



5. Make the following selections:
   Save in: Prosat32
   File name: G8 NE IR Animation
   Save as type: Animation

When you click **Save** the name on the Anm1 window will change to "G8 NE IR Animation" and the GOES8_NEIR animation will be added to the stored selections available. Click on the minimize box at the top right of the Animation window to let this loop acquire data in the background. You may set additional loops to acquire multiple animation of various specifications simultaneously.

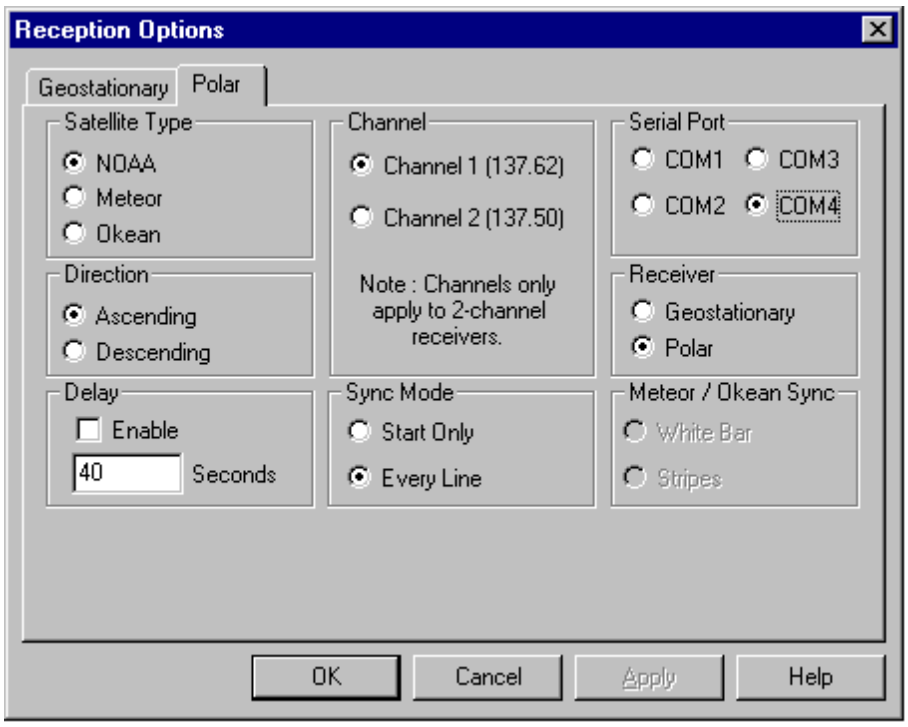
NOTE: We recommend you use lower case letters for the name of image files and upper case letters for the names of Animation Loop Setups as an aid in distinguishing file types.

3.2. APT POLAR ORBIT OPERATION

3.2.1. APT POLAR SETUP

1. Open the TimeStep program on the PC (click **Start**, then select **Programs**, **TimeStep32**, **PROsat**). Close any receive windows by clicking on the X in the upper right hand corner

2. Open the **Receive** drop down menu and select **Options**. Click on the **Polar** Tab. The display should look like this:

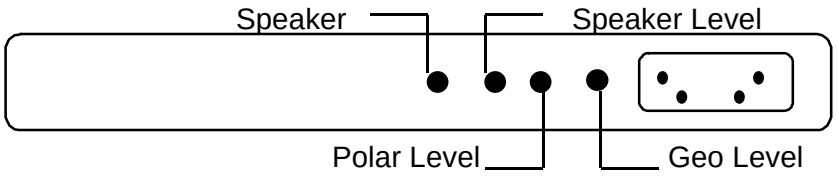


On the **Polar** tab, select the following:

Satellite:	NOAA (or appropriate satellite type)
Channel:	Channel 1
Serial Port:	COM4 (or comport selected for APT data card)
Receiver:	Polar
Direction:	Ascending
Sync:	Every Line

Click on **OK**

3. Open the **Receive** drop down menu again and select **Polar**. A single polar reception window will appear in the main program window. Open the **Receive** drop down menu again and click on **Set Level**. You will need to wait until a polar satellite is in reception range. The Track II program can predict the exact time the satellite will be in range but generally there are two mid morning passes and two late afternoon passes that are usable. When that occurs, the satellite signal will be present on the speaker as a "Ching-Dok, Ching-Dok" sound. With the signal present, adjust the signal level control one position away from the 9 pin connector on the APT data card for a reading of 245 to 250 counts. Click on **OK** when the level is adjusted correctly.



3.2.2. POLAR ORBIT IMAGE RECEPTION

Open the **Receive** drop down menu and select **Polar.** A single polar reception window will appear in the main program window. When a satellite is in reception range the program will begin acquiring a picture in the polar window. A polar orbit autosave feature allows the program to automatically acquire images from polar orbiting satellites without user intervention.

3.3. TIMESTEP MENU FUNCTIONS

The WeSat operating software uses drop down menus for operation selection. Pressing the F1 key at anytime will give context sensitive help on the current function. Note that not all menu functions are available at all times. The menus change depending on the currently selected image type or mode. The Menu appears at the top right of the screen.

FILE:

Open Opens existing files. The file type selections are made at the bottom of the box, then the available file list appears.

Close Closes the open active window.

Save Saves an opened image file with the same file name.

Save As Saves an image file with a new name selected before the image is saved. Geostationary images can also be stored as Windows Bitmap (.BMP) files.

Load Configuration Loads a previously saved configuration. (Files and window position)

Save Configuration Saves the current configuration. (Open files and window positions etc.)

New Sequence Creates a new animation loop. No images are available until they are received and added to the loop.

New Tracking Window Allows the addition of a new satellite tracking window. No satellites are loaded when opened.

Print- Prints an image.

Print Preview Displays the image on the screen as it will appear when printed.

Print Setup Selects a printer and sets the printing options.

Options Allows selection of save settings, time and temperature.

Exit- Exits Prosat32. Be sure to save wanted image files first or they will be lost at closing. Animation sequences are automatically saved.

EDIT: Standard Windows Edit functions. Not normally available in most dialog boxes.

RECEIVE:

Geostationary Opens a new window and receives the next geostationary satellite (GOES/Meteosat/GMS) image.

Polar Opens a new window and receives the next polar orbiting satellite (NOAA/Meteor) image.

Set Level Displays the bar graph showing the peck input signal level to correctly adjust the gain control on the input card.

Schedule Geostationary- Allows selections of reception times for geostationary satellite images.

Schedule Polar- Allows setting the reception schedule for the polar orbiting satellites.

Autosave: Geostationary Starts the automatic reception of images. Inactive if you have already selected animation loops and they are active.

Autosave: polar Opens a window for the next polar image as set up in the Polar Schedule section.

Options Opens the receive options dialog box for both geostationary and polar orbiting satellite reception. These selections have to be entered to enable reception.

VIEW:

Toolbar Selects or deselects the toolbar just below the menu bar. The “check” symbol selects the toolbar.

Status Bar Selects or deselects the Status bar at the bottom of the screen. Recommend that both the Tool Bar and Status Bar be selected

Reception Status Selects or deselects the reception status bar for geostationary, polar and GPS inputs. The status bars appear just below the tool bar.

Image Info Selects or deselects the Image Information box. This box contains information about the image at the mouse cursor point. Geostationary images will have the co-ordinates and intensity. NOAA and Meteor infrared images will have the temperature and where possible, polar images will have the latitude and longitude displayed.

Point Sets the mouse drag mode to Point/Area. Dragging the mouse pointer across the image selects a rectangular area which is used by the Set Colors functions etc.

Transect Sets the mouse drag mode to Transect. Dragging the mouse pointer across the image will produce an intensity profile of the image along that line.

Controls (Animation only) Selects or deselects the Animation Controls bar. This bar has the controls for pausing and stepping through animation loops. A Pause box and a slider will appear just above the animation loop image. Click on **Pause** to stop the loop. Click again to restart it.

Show Boundaries Enables or disables drawing of country and political boundaries on Meteosat still frames and animation loops. The Use Offscreen Buffer option selected in the advanced animation options menu, must be enabled for boundaries to be drawn.

The View drop down menu will have the following options for the satellite tracking window.

Ground Track Selects or deselects the ground track of the satellite. Useful in fast mode.

Footprint Selects or deselects the reception footprint for the satellite.

Name Label Selects or deselects the satellite for ease of identification.

Rise/Set Sounds Enables or disables the audible beeps that indicate the rise or set of a satellite.

Alternate Map Switches between the “standard” (Europe-Africa-Middle East-Eastern USA) and “ alternate” (Australia-Japan-Western USA) map display.

WINDOW:

Cascade Arranges open windows so that they overlap.

Tile Arranges open windows as non-overlapped tiles.

Arrange Icons Arranges icons of minimized windows at the bottom of the screen.

Zoom In Zooms in to the open image to show greater detail. Side and bottom slide bars allow selection of the portion of the image of interest.

Zoom Out Zoom out of the open image to show more of the image, but with less detail.

3D Display Displays a 3D projection of an open geostationary image. For best results, use the Median Filter command first.

Invert Image Rotates the open image 180 degrees if it was received upside down.

Swap Section Switches between the visible and infrared images of NOAA satellite passes.

Save Section Saves part of a NOAA or Meteor image as a section file (.NSC) for further processing. Alternatively, the section can be saved in Window bitmap (.BMP) format.

Temperature Slice Shows temperature variations using bright colors for NOAA and Meteosat images including animation loops.

Save Contents Saves the exact window contents as a 24-bit Windows Bitmap (.BMP) file. Be sure that nothing (dialog boxes, etc.) is obscuring any portion of the image.

Window 1,2 etc. Changes the display to the selected window.

COLOR:

Load Palette	Loads an existing color palette.
Load Default	Loads the default color palette. The default is the color palette with the same title as that of the open image window.
Save Palette	saves the current color palette.
Color On	Enables or disables the color overlay.
Set Colors	Opens the Set Color box so that a color palette can be created or modified. See the Color Setting portion of this section for more detailed instructions.
Auto Set	Sets the colors automatically. Only works for good visible light images with no overlays.
Equalize	Creates an equalized gray scale palette for quick enhancement.
Contrast	Opens the Contrast Curves box for non-linear contrast enhancement of gray scale images.

The image processing functions smooth, edge enhance and median filter are only available for single frame geostationary images. The add/remove overlay functions are only for geostationary images.

PROCESS:

Smooth	Applies a smoothing filter to the open image. Useful for removing noise. Will remove some image detail.
Edge Enhance	Applies an edge enhancement filter to the open image. This highlights edges and other image detail. It will also enhance any noise present in the image.
Median Filter	Applies a median filter to the image. This removes spot noise with less blurring than the smoothing filter function. It is also useful for removing the country outlines from Meteosat images.
Add Overlay	Adds a land/sea overlay to geostationary satellite images that are received without one. Select the appropriate overlay from those listed.
Remove Overlay	Removes the land/sea overlay from the image.

The Grid menu functions below are only available for polar orbiting satellite images.

Grid

Calculate Grid Calculates the grid position using the current satellite orbital elements.

Grid On Displays or hides the grid lines.

Adjust Grid Allows the calculated grid and outlines to be adjusted to exactly fit the image.

Load Elements Loads the satellite orbital elements from those available. Select the appropriate satellite.

Save Elements Saves the current orbital elements into the image file.

Edit Elements Displays the stored orbital elements so checked and edited as necessary.

Marker on Shows or hides the User position marker on the received image.

Draw outlines Draws land outlines and country boundaries for easier image location. This may take some time to complete on slower computers. You can increase the speed of the outline drawing by reducing the detail level with the Grid Options command.

Options Allows you to change the gridding and outline option settings.

Outline Detail The detail level used for the outlines can be set to high (default), medium and low. Outline drawing is significantly faster at lower detail levels.

Draw Boundaries Selects whether or not country boundaries are drawn in the image overlay.

Redraw outlines This option lets you select whether the outlines should be redrawn every time the image is redisplayed. Note that redrawing the outlines every time can make scrolling and zooming very slow. To print images with outlines included, this setting must be enabled.

1 Degree Grids When enabled grid lines are drawn at 1 degree intervals for more accurate location. This can make gridding rather slow and may somewhat obscure the image.

The animation menu commands are only available when displaying an animation sequence.

ANIMATE:

Receive Enables or disables reception of the current animation sequence.

Options Displays the Animation Options box so that the sequence length, overlay etc. can be changed.

Speed Sets the animation loop playback speed. Slower computers may not be capable of the maximum speed. Selecting a slower speed may result in a move even playback.

Delete sequence Deletes all the images from the current sequence to allow starting again with new images.

Delete Frame Deletes a single image from the current sequence. Useful if an image is corrupted or incorrect for any reason.

The update menu commands are available unless a geostationary image or an animation is selected. Every month or so the satellite orbital elements have to be updated. The satellites are not in a perfect orbit and hence drift in time. A month may represent up to a 3 minute error. You can obtain the orbital elements from the Time step World Wide Web sites at www.timestep.com/elements and also from other sites. A computer file with the latest elements can also be obtained from Timestep BBS telephone number 44-1440-820002. Up to 28800 baud 8n1 PC type format, suggested file transfer protocol is XMODEM.

If you select the Auto -Via Internet option, you will be asked to confirm the location of the file. The Internet connection will then be made and the file down loaded automatically. You may have to disconnect manually.

UPDATE

Auto (from File) Updates the orbital elements automatically.

Multiline AMSAT On the Timestep BBS as Elements. Select the required file from the list.

NASA 2 line On the Timestep BBS as Twoline.

Auto (**via Internet**) Updates the orbital elements automatically from a file on the Internet.

Multiline AMSAT On the Timestep WWW site at: www.timestep.com/elements/elements.

NASA 2 line On the Timestep WWW site at: www.timestep.com/elements/twoline.

Track.Sat file On the Timestep WWW site at: www.timestep.com/elements/track.sat. Note that the Track.Sat file is a complete copy of the satellite database file including all current weather satellites. If you have added any other satellites for other purposes they may be lost when you download this file.

Manual Allows manual editing of the orbital elements. Not recommended unless there is no other way of updating the elements as a file.

Add Satellite Allows addition of a new satellite to the database.

Delete satellite Allows deletion of a satellite from the database.

Export Elements Converts files for other programs.

User Positions Allows you to select or edit one of six available user locations.

GPS- Setup Allows you to configure the optional GPS input function for accurate time and position information.

HELP

Help Topics Displays the main help topics.

About PROsat Shows the Version and release date for the software.

3.4. TRACK II OPERATION

The Track II program allows you to predict the passing of the polar orbit satellites to establish a schedule for acquiring data from these satellites. The program can show several satellites simultaneously and can save 4 blocks of multiple satellite configurations.

To load the program from within the Timestep display program, select **File**, **New Tracking Window**.

To load the program as a separate standalone program, select **Start**, **Programs**, **Timestep 32**, **Track II**.

The program will display a world map with your location shown as an X. Select **Update**, **User Positions** to verify correct latitude and longitude information. A summary of the selected satellite position data and the hours, minutes and seconds to satellite rise time is shown in the lower left of the display. Select **Satellite**, **New Satellite** to add another satellite to this list. Add as many satellites as are active for the data configuration you are interested in (NOAA-11 and NOAA-14 for US operation for example).

Select **File**, **Save Block** to save the current array of satellites to one of four selectable blocks. Select **File**, **Load Block** to load a saved block of satellites to view.

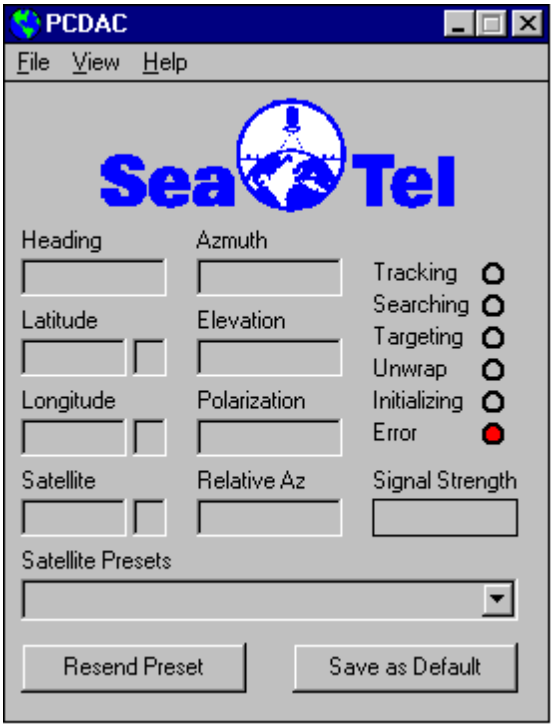
Press the **Fast** button on the Track II Time window to see a speed up animation of the satellite coverage areas. Press **Realtime** to restore the display to the current time. Press **Enable** to allow you to scroll forward or backward in time by hours, minutes, seconds, days, months or years. Press **Disable** to restore the display to the current time.

3.5. PCDAC OPERATION

The PCDAC program provides complete remote control capability of the TAC-92C Tracking Antenna Control Unit over a digital communication link to the computer, hence the name PCDAC (Personal Computer Digital Antenna Controller). All normal front panel operating functions are available via the PCDAC in addition to the ability to save and recall any number of satellite presets. All of the necessary TAC-92C configuration changes are handled by the PCDAC making the job of switching from DBS operation to Geostationary WeSat operation as easy as clicking on a satellite name. In future releases of PCDAC you will be able to set up an automatic schedule to change the antenna from one satellite to another allowing complete automatic data acquisition.

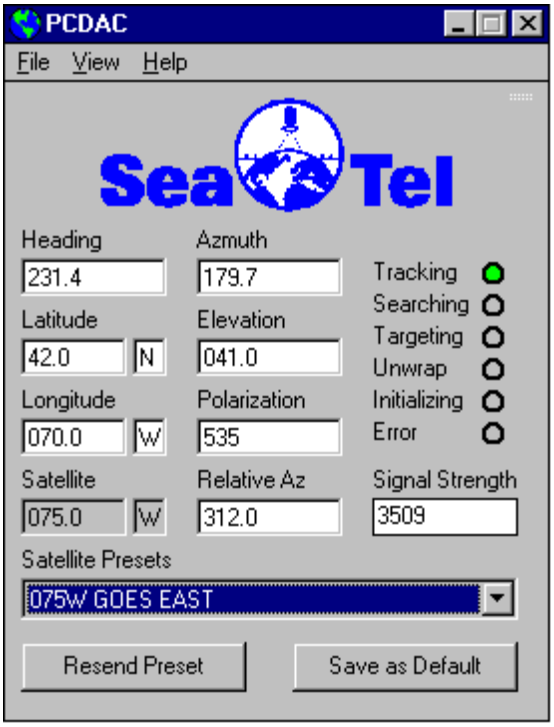
3.5.1. PCDAC SETUP

Open the PCDAC program by selecting **Start**, **Programs**, **Sea Tel** or **Pcdac** then chose **PCDAC** from the program group. The display should look like this:



Within a few seconds, the Azimuth, Elevation and Heading windows should change color to white and display information. If this does not occur, then you will need to change the PCDAC configuration settings. Open the File drop down menu and select Edit Configuration. On the line that defines the Comport, enter the correct comport number. Exit the editor and save the file. Close PCDAC and restart the program.

The PCDAC program screen should now look like this:



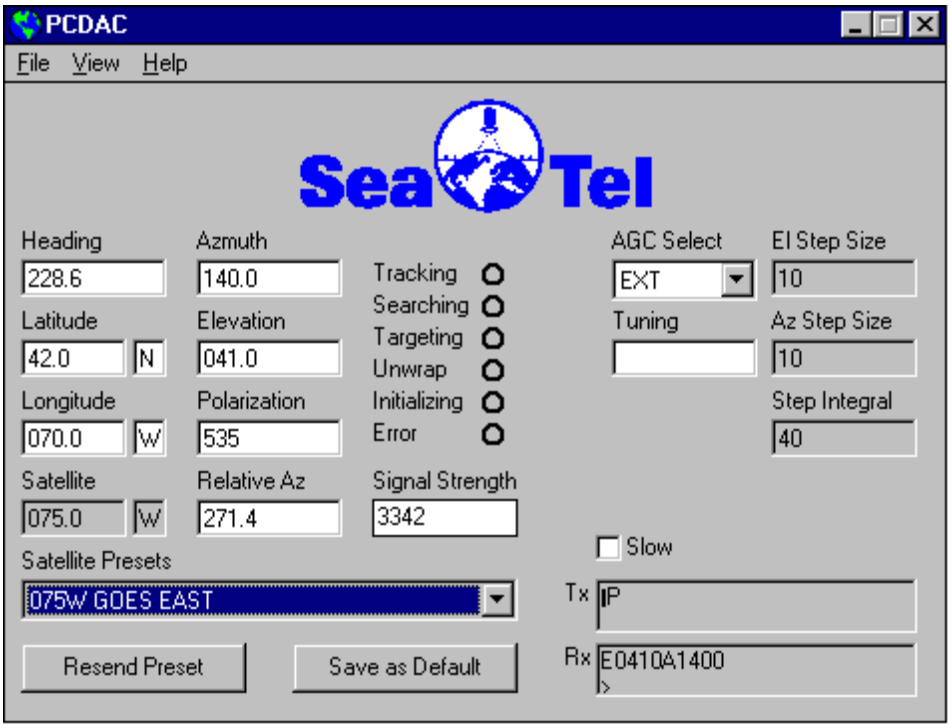
3.5.2. PCDAC OPERATION

To select a satellite for viewing, open the **Satellite Presets** drop down dialog box. Scroll through the available satellite entries and select the one you want. When you select a satellite, the PCDAC will send Azimuth, Elevation, Satellite Longitude and Tracking configuration setups to the TAC-92C. You will see the satellite Longitude number appear in the **Satellite** window.

If the desired satellite is already in the **Satellite Presets** window, press the **Resend Preset** button to re-target the satellite. When the antenna has moved to the correct position, the **Tracking** enunciator should illuminate green and the **Signal Strength** window should show an increased reading. If the **Tracking** enunciator is yellow, this indicates that the antenna is either Searching, Targeting, or Unwrapping.

You can manually send any command such as Azimuth or Elevation from the PCDAC to the TAC-92C by clicking on the appropriate window and typing in a value. When you press enter, the command is sent to the TAC-92C. You do not need to select the whole display in the window, just click anywhere within the window.

If you open the **View** pull down menu and select **Full,** you will get the following display that shows the tracking information details and a diagnostic window showing the actual commands being sent and received by the PCDAC:



3.5.3. PCDAC SATELLITE CONFIGURATION

If you wish to add, delete or change the available satellites shown in the **Satellite Presets** dialog box, you need to edit the configuration file. Open the File pull down menu and select **Edit Config File** You will see a window that has the following information:

[PCDAC CONFIGURATION]
commport=1

[135W GOES WEST]
agcsel=0
tuning=0
elstep=10
azstep=10
stepint=40
satellite=135w
command=!W

All entries in square brackets except for [PCDAC CONFIGURATION] are satellite names that will appear in the **Satellite Presets** dialog box. The entries below the satellite name are the command settings for the TAC-92C as follows:

agcsel 0 indicates External AGC
1 indicated IN A from DBS satellite LNB
2 indicates IN B from DBS satellite LNB
3 indicated IF narrow band receiver (N/A)

tuning AGC receiver tuning frequency in MHz. Required for DBS satellite reception. Typically set to 1100.

elstep Elevation Step Track size. Set to 10 for Lband Geostationary satellites. Set to 2 for Ku band DBS satellites.

azstep Azimuth Step Track size. Set to 10 for Lband Geostationary WeSat satellites. Set to 2 for Ku band DBS satellites.

stepint Step Track Integral. Set to 40 for all satellites.

satellite Satellite Longitude in degrees west. For satellites with East longitude descriptions, subtract their longitude from 360 and enter as west longitude.

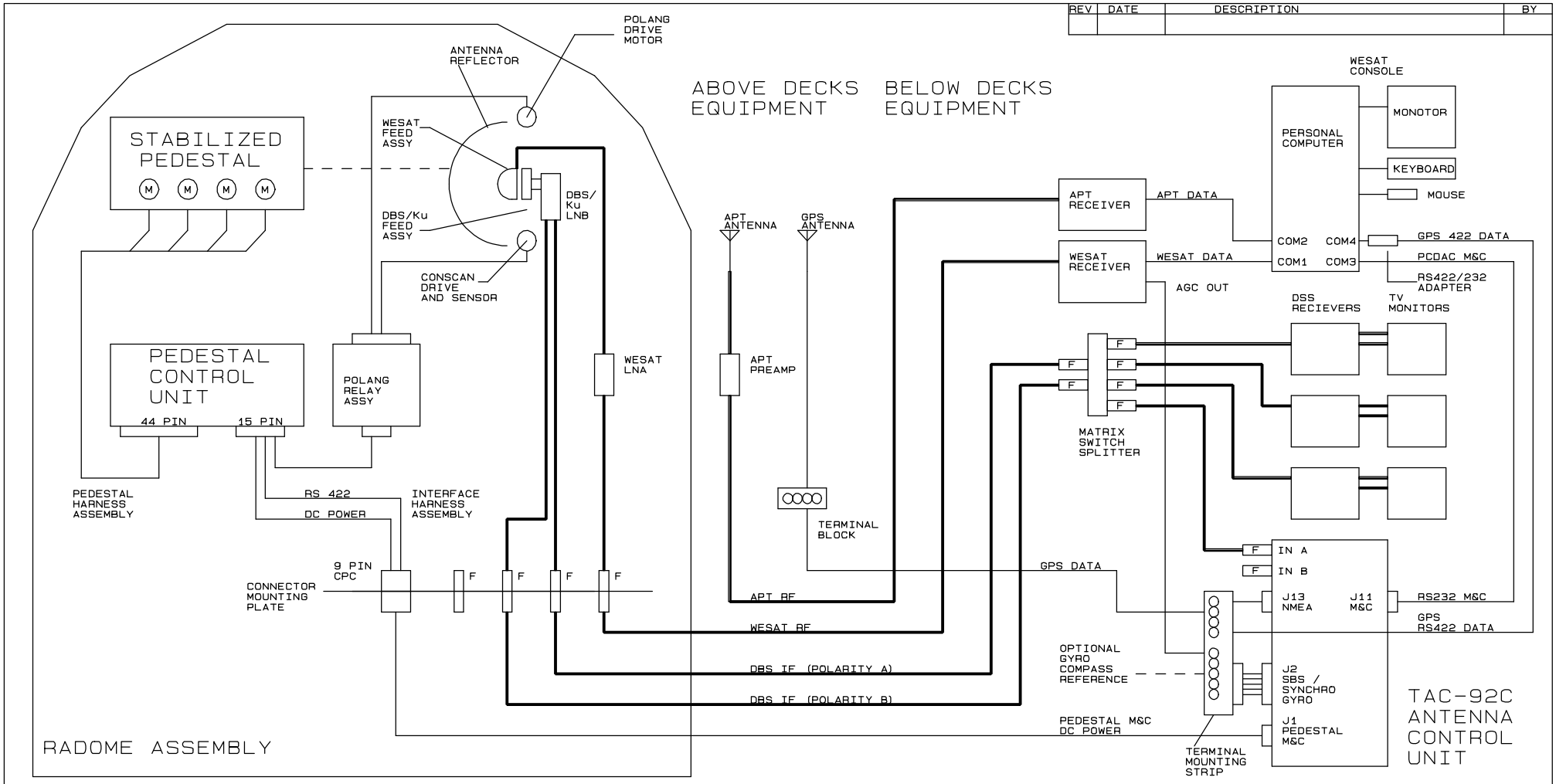
command Any valid serial command string to the TAC-92C can be entered here. This allows expanding the script to perform whatever functions you can imaging. Any number of command lines may be entered. Refer to the TAC92/DAC97 command set description drawing No 114493 for further details.

You can add as many satellites to the configuration file as you desire or change the parameters of any existing satellites with the editor. When finished making changes, exit the editor, save the changes to the configuration file then close the PCDAC program and re-start it. On later versions of the PCDAC program, the configuration file is automatically updated when you exit the editor so this step is not required.

4. DRAWINGS

The following drawings are provided to assist in the installation and understanding of the operation of the WeSat Dual Satellite receive system:

Drawing	Title
116163	System Block Diagram WeSat / DBS Dual Receive
116670	RS-232 Cable Assembly TAC-92 to PC
116295	Interface Cable Diagram GPS to ACU plus AUX
114493	User Interface Description TAC-92C / DAC97.



REFERENCE DRAWINGS

116083	GENERAL ASSY, MODEL 3294
116117	GENERAL ASSY, MODEL 4094
115464	GENERAL ASSY, MODEL 4894
115203	3 AXIS PEDESTAL SCHEMATIC

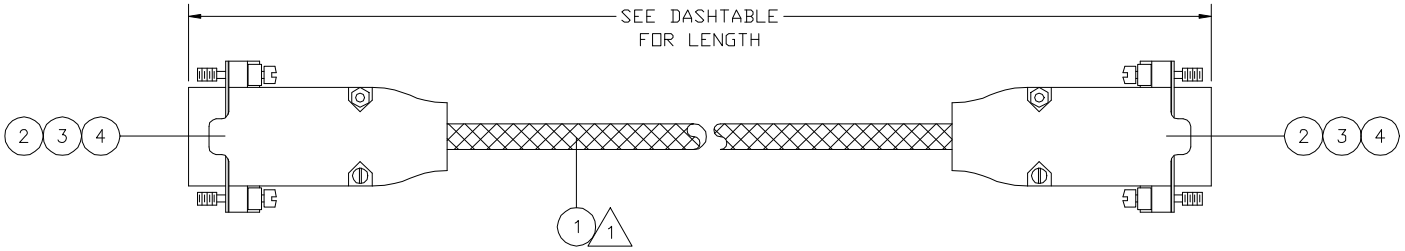
Sea Tel, Inc.
CONCORD, CA

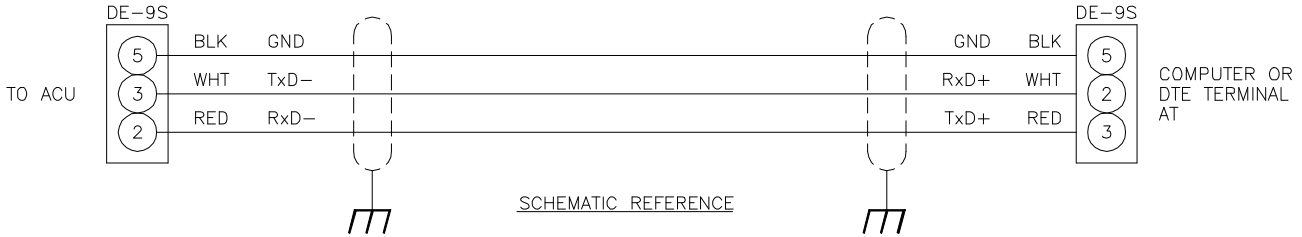
SCALE:	APPROVED BY:	DRAWN BY PGB
DATE: 6-2-98		REVISED

SYSTEM BLOCK DIAGRAM
WESAT/DBS DUAL RECEIVE

3294, 4094, 4894 | SHEET 1 OF 1 | DRAWING NUMBER 116163-0

REV.	ECO#	DATE	DESCRIPTION	BY
0		5-6-98		MAB
A	1854	3-11-99	ADDED DASHTABLE	JT





ITEM	QTY	SEA TEL PART NO.	DRW SZ	DESCRIPTION	VALUE	REFERENCE/NOTES
1	1			SHIELDED CABLE		CONSOLIDATED P/N: E140356
						SUBST. BELDEN 9502, OR 9302
2	2	110935-36	A	DE-9S CONNECTOR HOUSING		AMP #205203-1
3	2	112570-11	A	BACKSHELL, DE, DIE CAST		AMP #748676-1
4	6	112267-13	A	DB CRIMP & SNAP SOCKETS	24-20 AWG	AMP #66504-9

DASH	LENGTH
-1	25'
-2	12'
-3	6'

NOTES:
1. SOLDER SHIELD TO CONNECTOR HOUSING (ITEM 2), BOTH SIDES.

A	1		
REV.	SHT.	REV.	LM
REV. STATUS			

TOLERANCES
UNLESS OTHERWISE SPECIFIED
X.X = ± .050"
X.XX = ± .020"
X.XXX = ± .005"
ANGLES = ± 30'
3rd ANGLE PROJECTION

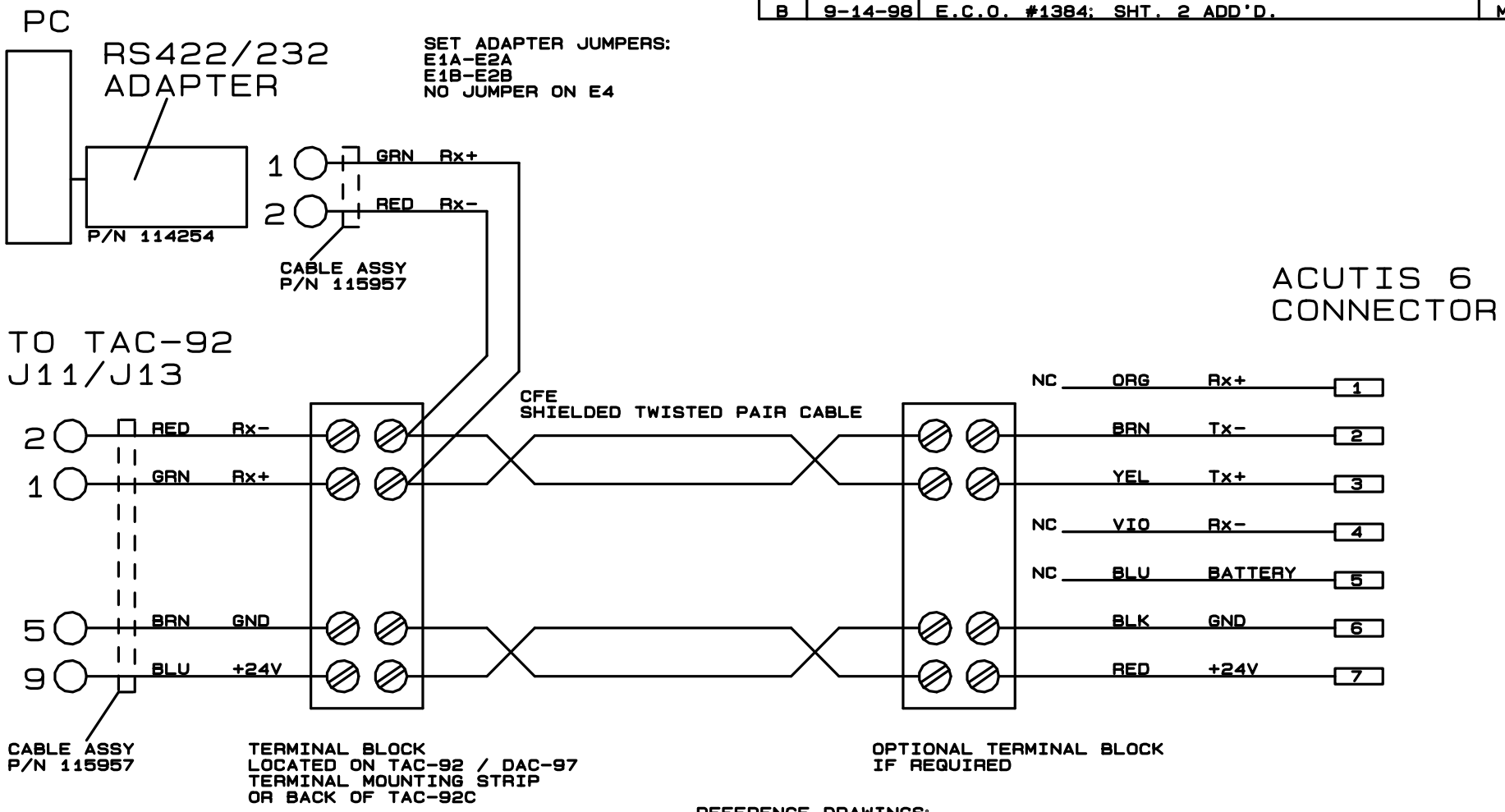
STATUS:
Sea Tel, inc.

SCALE: NONE | APPROVED BY: | DRAWN BY: MAB
DATE: 5MAY98 | DOC. NO.: 117084 REV. A

TITLE: RS-232 CABLE ASSEMBLY

MODEL: TAC-92 TO PC | SHEET: 1OF1 | SIZE: B | DRAWING NUMBER: 116670 -A

REV	DATE	DESCRIPTION	BY
A	8-10-98	E.C.O. #1305, WIRE CALL-OUTS ADD'D TO 115957.	MAB
B	9-14-98	E.C.O. #1384; SHT. 2 ADD'D.	MAB



REFERENCE DRAWINGS:

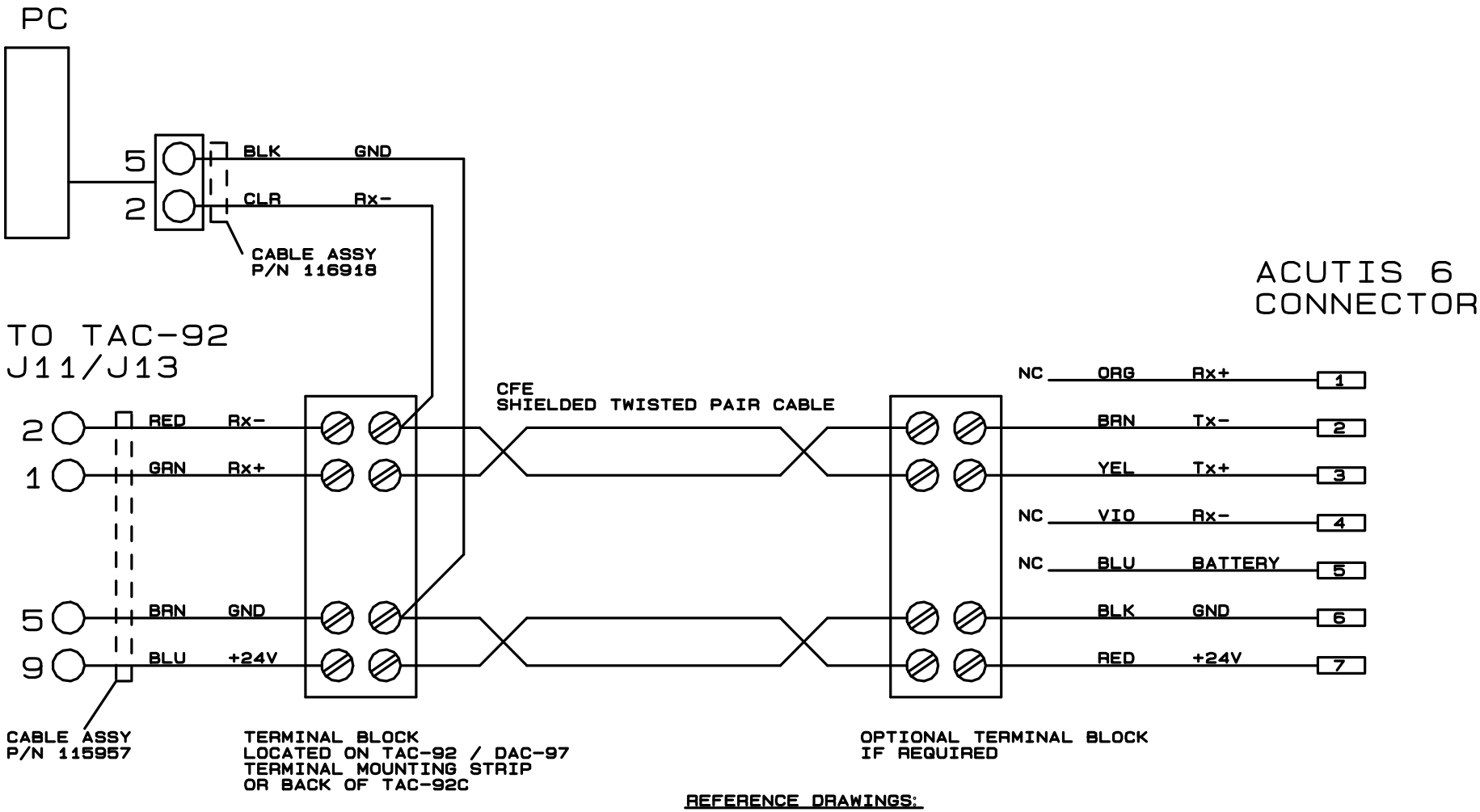
112791 INTERFACE CABLE DIAGRAM GPS TO ACU
114791 ACU TO BCU CONTROL CABLE DIAGRAM

Sea Tel, Inc.
CONCORD, CA

SCALE:	APPROVED BY:	DRAWN BY PGB
DATE: 11-25-97		REVISED

INTERFACE CABLE DIAGRAM GPS TO ACU WITH AUX TAP

RS 422 SHEET 1 OF 2 DRAWING NUMBER 116295-B



REFERENCE DRAWINGS:

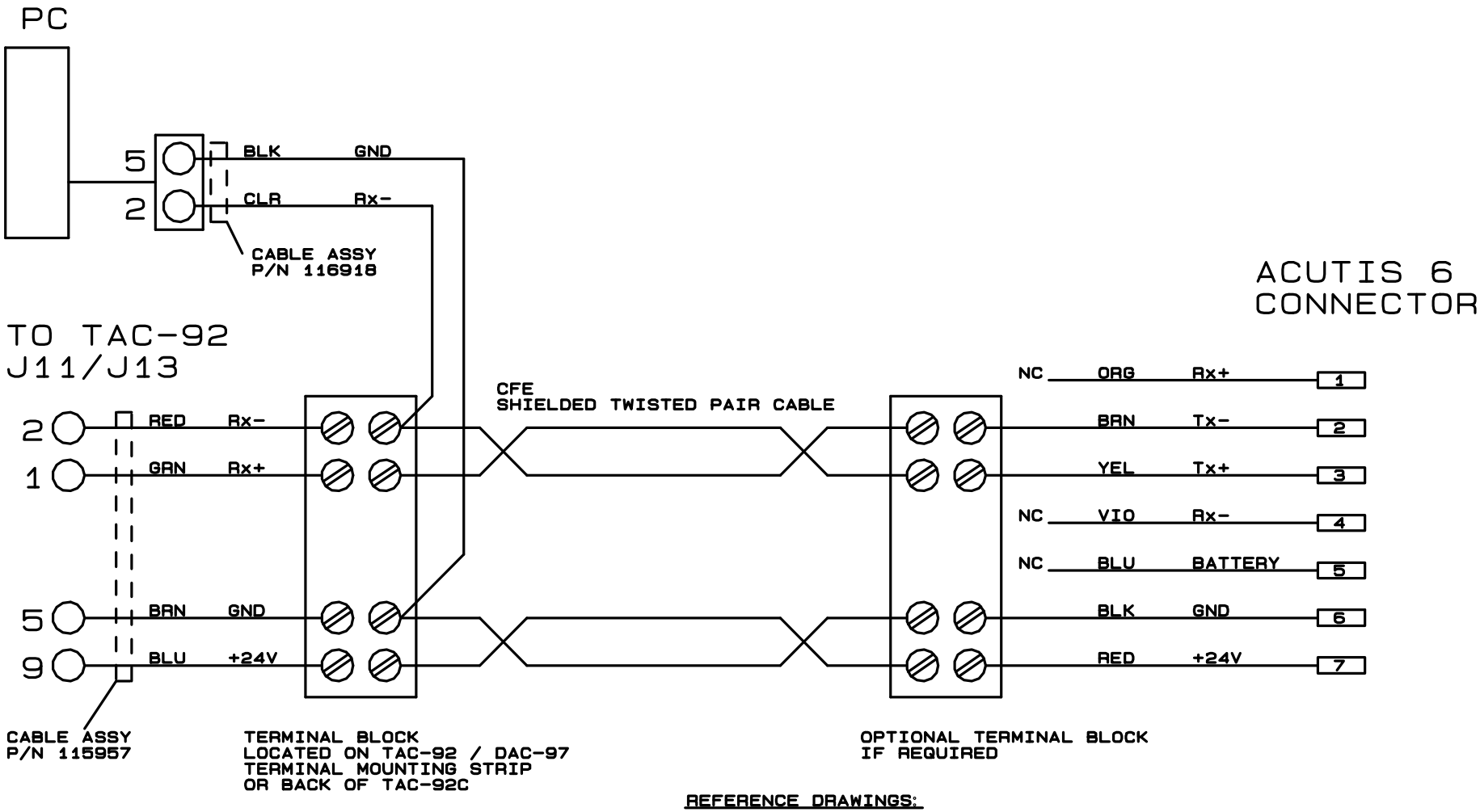
112791 INTERFACE CABLE DIAGRAM GPS TO ACU
114791 ACU TO BCU CONTROL CABLE DIAGRAM

Sea Tel, Inc.
CONCORD, CA

SCALE:	APPROVED BY:	DRAWN BY MAB
DATE: 9-14-98		REVISED

INTERFACE CABLE DIAGRAM
GPS TO ACU WITH AUX TAP

RS 232 SHEET 2 OF 2 DRAWING NUMBER 116295-B



REFERENCE DRAWINGS:

112791 INTERFACE CABLE DIAGRAM GPS TO ACU
114791 ACU TO BCU CONTROL CABLE DIAGRAM

Sea Tel, Inc.
CONCORD, CA

SCALE:	APPROVED BY:	DRAWN BY MAB
DATE: 9-14-98		REVISED

INTERFACE CABLE DIAGRAM
GPS TO ACU WITH AUX TAP

RS 232 SHEET 2 OF 2 DRAWING NUMBER 116295-B

1.0 COMMAND SUMMARY (2nd Serial port commands)

CONTROL CODES:	FUNCTION	
6	Azimuth CW one step	(Not available in 3.00)
4	Azimuth CCW one step	"
8	Elevation UP one step	"
2	Elevation DOWN one step	"
Aaaaa{}	Move AZ to aaa.a deg. true or magnetic	
Baaaa{}	Set ships heading to aaa.a degrees	
cnnnn{}	Set MHz/CHA tuning to nnnn MHz	
dnnnn{}	Set KHz/CHB tuning to nnnn KHz/MHz	
C	Tracking (Step Track / Conscan) ON	
D	Tracking (Step Track / Conscan) OFF	
Eeeee{}	Move EL to eee.e degrees	
gnnn{}	Set 24v polang position to nnn	
hnnn{}	Set 5v PWM polang position to nnnn	
Jrrrr{}	Move azimuth to ship relative position	
Nnnn{}	Set step track integral	(0-255)
nnnnn{}	Set remote “N” parameters to Nnnnn	
Onnn{}	Output data to EME equipment	
R	Begin Spiral search	
s	Advance AGC input selection (Ext, ChA, CHB, IF)	
Taaaa{}	Move to satellite at aaa.a degrees	
U	Force cable unwrap	
W	Write parameters to NV RAM	
Xnnn{}	Set azimuth step track / conscan sensitivity to nnn steps	(0-255)
Ynnn{}	Set elevation step track / conscan sensitivity to nnn steps	(0-255)
$mmmmm{}	NMEA Latitude / Longitude input (GPGLL format)	
^nnnn{}	Send remote Utility command ^nnnn to PCU	
esc	Cancel Pending Command	
!	Enable NVRAM writes	

MONITOR CODES	FUNCTION	TAC RESPONSE
H	Relative Az,Ship Heading	RrrrrHaaaa CR,LF,>
M	Tracking Parameter Dump	Xnnn Ynnn Nnnn CR,LF,>
P	Az/EL Position	EeeeeAaaaa CR,LF,>
S	TAC Status	Snn CR,LF,>
V	Software Version	TAC-92C VER N.NN CR,LF,>
q	Read Tuning Frequencies	Qnnnn nnnn s CR,LF,>
u	Read Temperature, polang	GnnnnUuuuu CR,LF,>
%	Read Signal Strength	Lnnnn CR,LF,>
@	Report Lat / Lon Position	NeeeeWaaaa CR, LF, >
&	Read/Clear Error Status	NOT IMPLEMENTED
?a{}	Remote Monitor Request	remote response to “a” CR

ABBREVIATIONS:

eeee	=	Elevation angle 0000 to 0900.
aaaa	=	True/Magnetic Azimuth 0000 to 3599 range
rrrr	=	Relative azimuth 0950 to 6250 range
x	=	ASCII hex I/O data
nnnn	=	ASCII decimal number (0000-9999)
nnn	=	ASCII decimal number 0 to 255
uuu	=	ASCII decimal number 0 to 999
nn	=	System Status two ASCII words defined below:
e	=	Error status
{}	=	Carriage return

2.0 CONTROL CODE DETAILS

For the following descriptions, one step equals 1/24 degree for standard pedestal.

6,4	Azimuth CW,CCW one step. TAC Response: None
8,2	Elevation UP/DOWN one step. TAC Response: None
Aaaaa{}	Move AZ to aaa.a degrees magnetic. May cause antenna to move more than 180 degrees if shorter path will place antenna within 90 degrees of an end stop. TAC Response: CR,LF,">" when command is accepted.
Baaaa{}	Set ships compass heading to aaa.a degrees. Sets Heading Valid flag (Bit 3, word 2). Resets calculated azimuth position (P command) to ships heading + azimuth relative position modulo 360.0 degrees. The ships heading is automatically updated by the gyro compass inputs to the ACU. Not valid for 1:1 gyro compass interface. TAC Response: CR,LF,">" when command is accepted.
C	Step track ON. Sets Steptrack ON status flag (bit 3 word 1). Enables step track movements synchronized with "L" signal strength updates. Default state OFF. TAC Response: None.
D	Step track OFF. Clears Steptrack ON status flag (bit 3 word 1). Disables tracking. TAC Response: None.
cnnnn{}	Sets CHA tuning for IN A receiver or MHz tuning for IF receiver to nnnn MHz. TAC Response: CR,LF,">" when command is accepted.
dnnnn{}	Sets CHB tuning for IN B receiver to nnnn MHz or KHz tuning for IF receiver to nnn KHz. TAC Response: CR,LF,">" when command is accepted.
Eeeee{}	Move EL to eee.e degrees. TAC Response: CR,LF,">" when command is accepted.
gnnn{}	Set 24v Polang position to nnn. For 24v polang systems 30 to 210 corresponds to approximately -90 to +90 degrees from vertical. For flip antenna systems, 000 corresponds to the flat plate array, 128 corresponds to the horn antenna. TAC Response: CR,LF,> when command is accepted.
hnnn{}	Set 5v PWM Polang position to nnn. For 5v polang systems 50 to 200 corresponds to a probe angle of approximately -90 to +90 degrees from vertical. TAC Response: CR,FL,> when command is accepted.
Jrrrr{}	Move azimuth to ship relative position. Azimuth stabilization, Unwrap and and Tracking mode remain active after a J command. TAC Response: CR,LF,">" when command is accepted.

Nnnn{}	Set number of signal strength updates to accumulate for each trial step for step track operation. "N" should be set for a 2-6 second step track interval. Allowable range is 0 to 255. A setting of 0 disables step track and enables Conscan. TAC Response: CR,LF,">" when command is accepted.
nnnnn{}	Sets Remote PCU parameters to Nnnnn. Used to set pedestal system type, adjust individual axis gains and set reference offsets. TAC Response: CR,LF,">" when command is accepted.
Onnn{}	Output data to EME equipment. Changes logic state of output lines DO0-DO3. Data is sent as ASCII hexadecimal. Allowable range of nnn "0" to "7" TAC Response: CR,LF,">" when command is accepted.
R	Starts two axis spiral search pattern for satellite (SEARCH2). Sets Searching status flag (bit 0, word 2) and Steptrack ON status flag (bit 3 word 1). Search pattern size and increment is pre-set by the TAC-92 Setup parameters. Search is terminated by signal level above threshold, end of search pattern or a new Az or EL position command. If no signal is found then antenna is returned to its original azimuth and elevation position. TAC Response: None
s	Advance AGC input selection by one. Selection of External, RF in A, RF in B or IF receivers corresponds to an "s" value of 0, 1, 2 or 3 respectively. The current "s" value is reported by the "q" Monitor Code. TAC Response: none
W	Write all setup parameters to NV RAM. TAC Response: None
Xnnn{}	Set azimuth step track size or conscan sensitivity to nnn steps. Allowable range is 0 to 255. The maximum conscan sensitivity setting is 0. Increasing the conscan setting by one decreases the system sensitivity by a factor of 2. TAC Response: CR,LF,">" when command is accepted.
Ynnn{}	Set elevation step track size or conscan sensitivity to nnn steps. Allowable range is 0 - 255 steps. Setting "Y" to zero disables elevation step track doubling the speed of the azimuth step track. See Xnnn setting for conscan information. TAC Response: CR,LF,">" when command is accepted.
$mmmmm{}	NMEA Latitude / Longitude input. Sentence format as follows: GPGLL,YYYY.YY,N,XXXXX.XX,W (,UTC optional) YYYY.YY = Latitude in Degrees, Minutes, Decimal minutesN = North, S = South Latitude XXXXX.XX = Longitude in Degrees, Minutes, Dec Minutes E = East, W = West Longitude

3.0 MONITOR CODE DETAILS

H Relative AZ / Ships Heading position report. Reports simultaneous value of Antenna Relative position and Ships heading position in tenths of degrees. Relative azimuth range is 0950 to 6250. Ships heading range is 0000 3599.
TAC Response: "RrrrrHaaaa",CR,LF,">"

M Not implemented in this version.
Parameter Dump. Response is one line of ASCII characters representing the X,Y and N step track parameters.
TAC Response: "Xnnn Ynnn Nnnn",CR,LF,">"

P Az/EL Position. Response is one line of ASCII characters representing the antenna elevation and true azimuth position in tenths of a degree. Elevation range is 0000 to 0900. Azimuth range is 0000 to 3599.
TAC Response: "EeeeeAaaaa",CR,LF,">"

S TAC Status. Response is two ASCII characters representing the system status according to the following table. This command can be issued at any time and is not locked out by pending I/O commands.
TAC Response: "Snn",CR,LF,">" nn Status Words:

WORD1	WORD 2
Bit 0 = Remote Alarm Bit 0	Bit 0 = Searching
Bit 1 = Remote Alarm Bit 1	Bit 1 = Initializing
Bit 2 = Unwrap in progress	Bit 2 = Error Detected
Bit 3 = Steptrack On	Bit 3 = Heading Valid
Bit 4 = spare	Bit 4 = Elevation targeting
Bit 5 = Auto Unwrap On	Bit 5 = Azimuth targeting
Bit 6 = 1	Bit 6 = 1
Bit 7 = 0	Bit 7 = 0

V Software Version. Response is ASCII string defining software model and version number.
TAC Response: "TAC-92 VER N.NN",CR,LF,">"

q Tuning Frequency. Response is Channel A tuning, Channel B tuning and receiver selection. For IF receiver selection, response is MHz portion , KHz portion of the tuning frequency and receiver selection. Receiver selection of External, RF in A, RF in B or IF receivers corresponds to an "s" value of 0, 1, 2 or 3 respectively.
TAC Response: "Qnnnn nnnn s",CR,LF,">"

u Polang / AUX read. Response is polang position (nnnn) and Auxiliary A/D reading (uuuu) from remote PCU. Reads polang pot for 24 volt polang systems and polang PWM output for 5v systems. For flip antenna systems, 000 indicates primary antenna, 128 indicates secondary antenna. Aux A/D reading is 0000-4095 for 0 to 5v input. If Aux Read is temperature, Degrees C = 2.0 + .032 x uuuu - 3271 / uuuu.
TAC Response: "GnnnnUuuuu",CR,LF,">"

% Signal Strength. Response is average signal strength over N sample intervals in ASCII hex characters. Allowable range of response is 0000 to FFFF.
TAC Response: "Lssss",CR,LF,">"

@ Latitude / Longitude Position Read. Reports North/South Latitude and East/West Longitude read from GPS receiver in tenths of a degree.
TAC Response: “NeeeeWaaaa”,CR,LF,”>“

?a{} Request Remote Status. Sends the “a” Status Request command to the PCU and echoes the PCU response less checksums. ?S{} gets PCU status, ?V{} gets PCU Version Number.
TAC Response “PCU status response” + CR,LF,”>”.

4.0 GENERAL NOTES

The CR,LF,">" echo indicates that the TAC has accepted a command and is ready to process the next command. Any additional commands will not be accepted until after the TAC echoes CR,LF,">".

The normal command latency for Monitor or Control commands is 25 mili Seconds.

Temperature in degrees C = 2.0 + .032 x uuuu - 3271 /uuuu.