www.satlantic.com

INSTRUMENT OPERATION MANUAL

Operation Manual for the
HyperPro

Document # SAT-DN-00130
Revision A, December 2001

System Boundaries

The HyperPro Operation Manual discusses the start up and operation of the HyperPro system. For information on the optical sensors, refer to the OCR-3000 series operation manual(s). For information on the provided software, refer to the SatView, SatCon, and ProSoft software manuals. For information on calibration and for the disk copy and hard copy of the calibration file, refer to the calibration folder.

Operation Manual For: HyperPro
Document Number: SAT-DN-00130

Prepared by:

Satlantic Incorporated
3481 North Marginal Road,
Richmond Terminal, Pier 9
Halifax, Nova Scotia
B3K 5X8
Tel (902) 492-4780
Fax (902) 492-4781

A. OVERVIEW

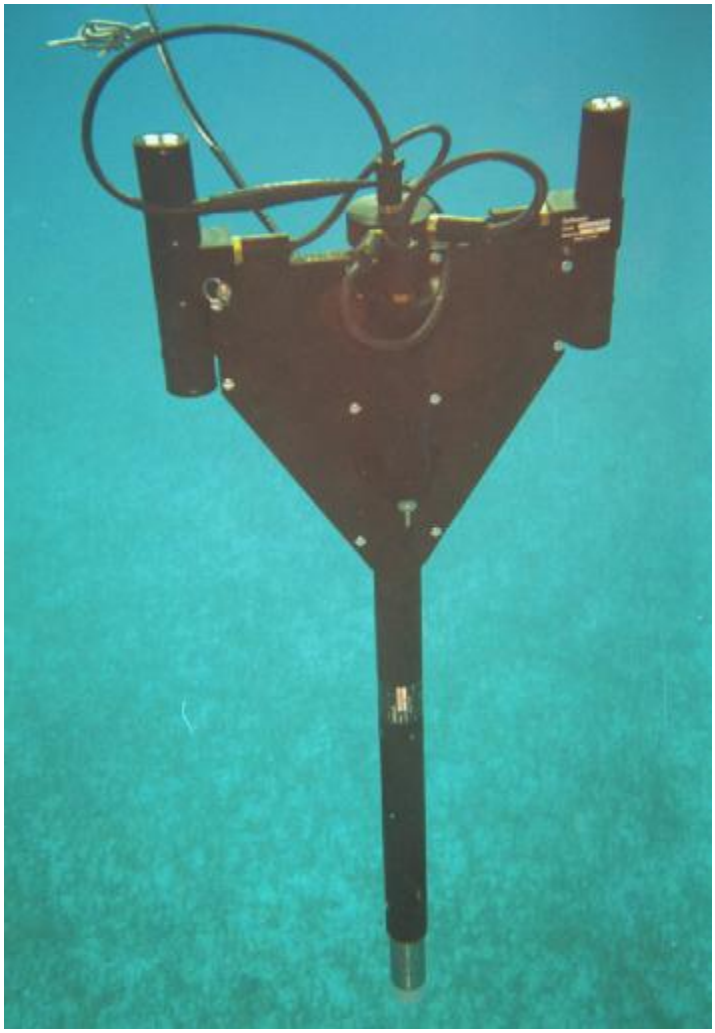


Figure A-1: The Free-Fall HyperPro

Purpose

The HyperPro is a lightweight profiling device available as a standard free-fall profiler or mounted on a lowering frame.

See Figure A-1, The Free-Fall HyperPro

The HyperPro is specifically designed to use the new hyperspectral OCR-3000 series optical sensors to provide a versatile profiling platform for measuring the apparent optical properties of the ocean. The system addresses the issues of self-shadowing and ship induced disturbances while offering a wide dynamic range in an easy to deploy package.

Background

The primary goal of the HyperPro design was to allow data to be collected with a high spatial resolution in the regions around a field station on a typical oceanographic cruise. A secondary goal for the instrument was to support experiments in case-2 waters that are often found in the near-shore and littoral environments. Water conditions in these areas are such that light levels below 100 meters depth (generally below six optical depths) are extremely low, difficult to measure, and provide little significant information in terms of the satellite validation mission being performed. In addition, attenuation levels are high enough that it becomes important to have downwelling irradiance and upwelling radiance sensors located close to the same depth.

The HyperPro design builds on the experience gained by Satlantic on previous generations of profiling instruments. Significant improvements have been made in size and weight reduction, and the system electronics has undergone a high degree of integration. The HyperPro utilizes the OCR-3000 series of digital optical sensors in a networked configuration, greatly increasing the systems versatility and flexibility.

Features

- Available as a free-falling profiler or on a lowering frame
- Small package
- Lightweight
- Easily deployed
- Low power requirement
- Minimal amount of surface equipment required
- Easy to use
- Uses Satlantic's OCR-3000 MiniSpec Hyperspectral Radiometers in a network configuration

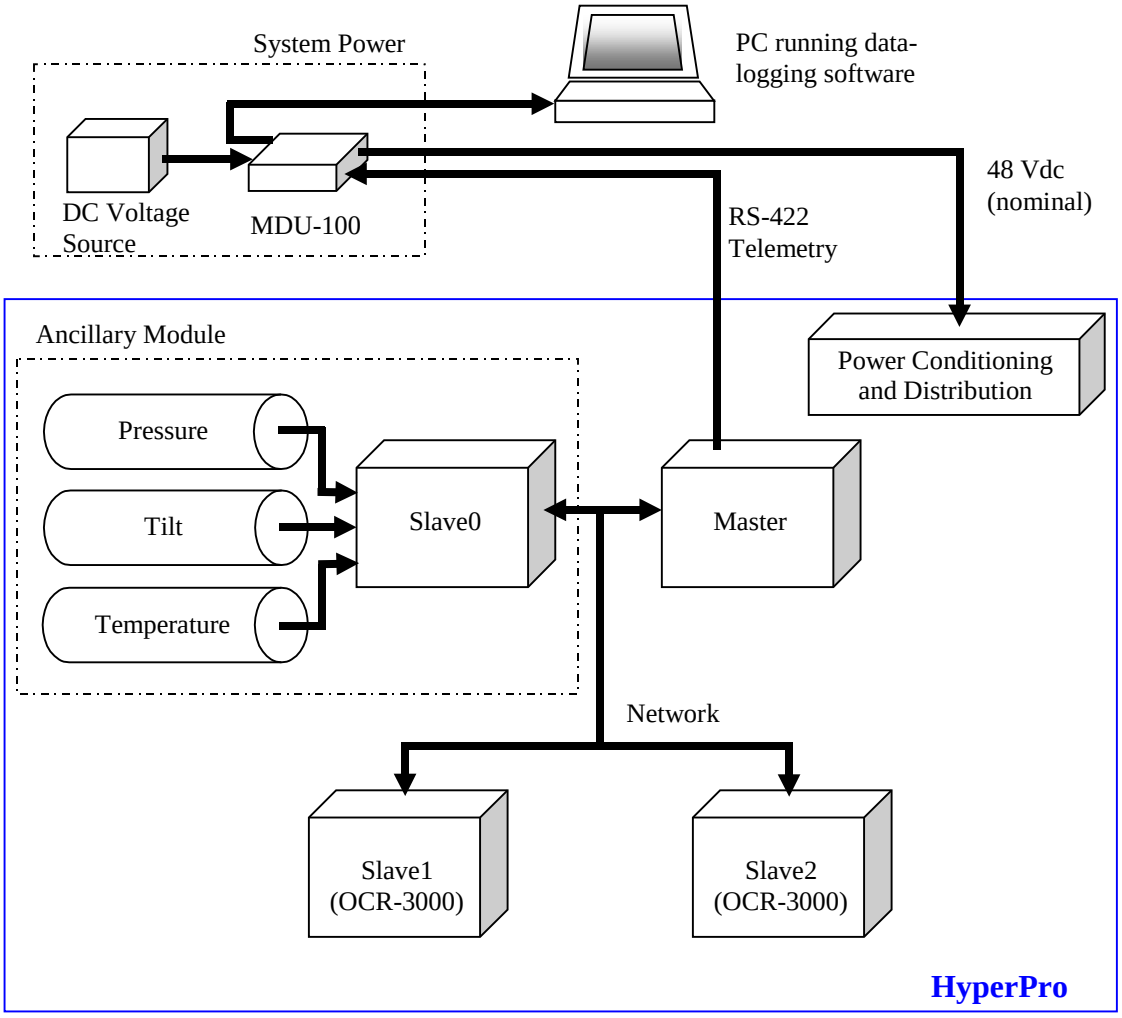


Figure A-2: HyperPro System Block Diagram

HyperPro System

The HyperPro system can be viewed as a grouping of modules. This modular design greatly increases the system's versatility and re-configuration potential. The basic modules are the system power module, the master module, the ancillary slave module and the optical sensor slave modules.

See Figure A-2, HyperPro System Block Diagram

The system power module is comprised of a 12 volt (nominal) DC power supply, usually a battery, and Satlantic's MDU-100 deck unit. Another deck unit with the same capabilities as the MDU-100 may be used. The DC power supply delivers a voltage in the range of 10 - 20 V dc to the MDU-100 deck unit where it is converted to 48V and sent through the power/telemetry cable to power the HyperPro. The deck unit also converts RS-422 telemetry from the HyperPro to RS-232 levels so that it can be sent to the computer.

The main housing of the HyperPro body contains the master module and the ancillary slave module. The master module is a microcontroller that uses a common two-wire bus to communicate with the slave modules. The master module's responsibilities are:

- To coordinate network access
- To issue sample commands to the slave modules
- To retrieve data from the slave modules
- To broadcast the data frames on the serial up-link

The ancillary slave module is also a microcontroller in the main housing of the HyperPro body. The ancillary slave module may obtain measurements from pressure, tilt and/or temperature sensors. The ancillary module operates in a slave configuration, and responds only to commands from the master module to obtain data from its sensors. Analog measurements with the ancillary module are made using an 8-channel precision 16-bit Analog-to-Digital Converter (ADC).

On a typical system, two OCR-3000 slave modules are attached to the HyperPro body outside of the main housing. These slave modules obtain and report data when requested by the master module.

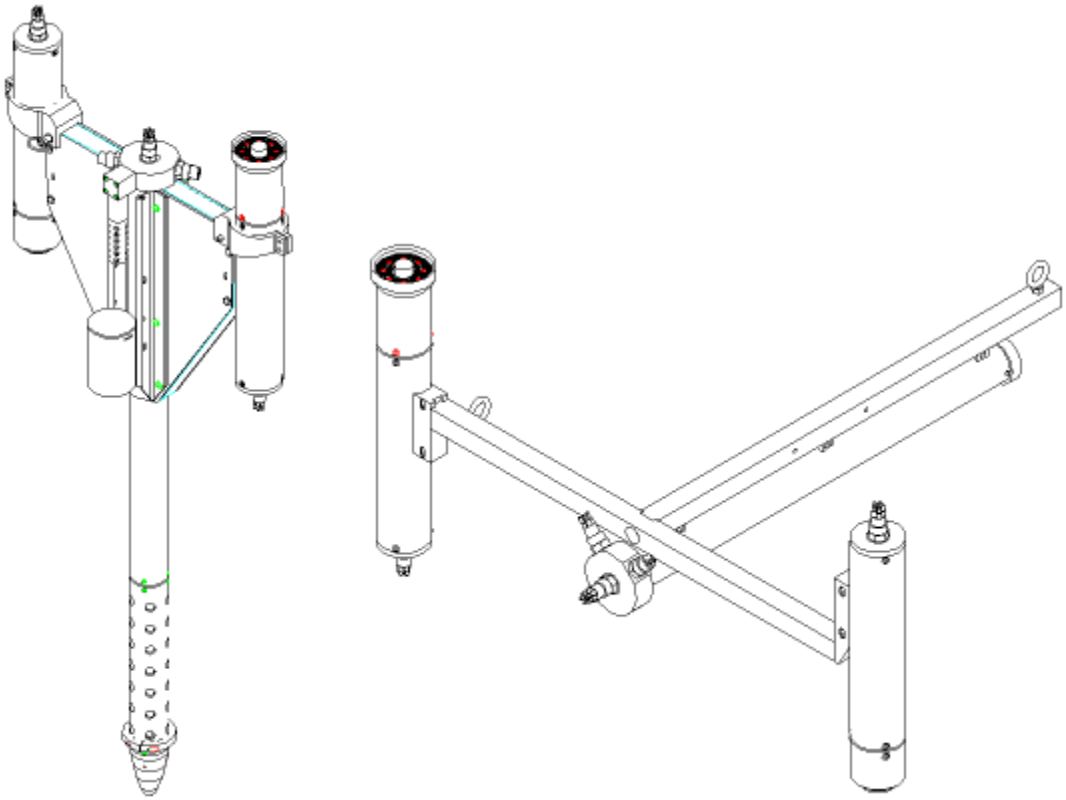


Figure A-3: HyperPro Free-Fall and Frame Mounted types

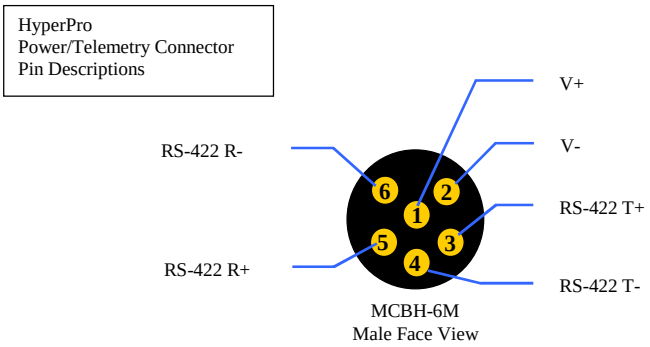


Figure A-4: HyperPro Power/Telemetry External Interface

Major Components

The major components of the HyperPro are the instrument body, sensors, deck unit, cables, power supply (typically a 12 volt battery) and computer. The user supplies the computer, and possibly the power supply.

HYPERPRO INSTRUMENT BODY

The modular design of the HyperPro allows the system to be configured in a number of ways. Currently, the system can be configured by Satlantic to be either a free-falling profiler or mounted on a lowering frame.

See Figure A-3: HyperPro Free-Fall and Frame Mounted types

Free-Fall Type

The HyperPro *free-fall* profiling design builds on the experience that Satlantic has gained in earlier generations of profiling instruments. The primary advantage of this deployment technique is that it provides a straightforward method of making measurements away from the ship being used to deploy the instrument and away from the measurement errors that its shadows create. With a main pressure housing diameter of only 48 mm and a weight of about 5 kg, this new design minimizes the size and weight of the profiler, allowing rapid deployment from even small inflatable boats. The free-fall descent rate of the instrument is fixed at 0.3 m/sec.

Frame Mounted Type

Configuring the HyperPro for use on Satlantic's rugged stainless-steel lowering *frame* allows the irradiance and radiance sensors to be mounted in the same plane, if desired. This is an ideal situation in waters with high attenuation levels. In addition, the frame configuration allows the user to suspend the HyperPro at a particular depth without concern for the vertical stability of the instrument, as in the case for the free-fall profiler.

Power/Telemetry Cable Connection

The instrument body is connected to the power/telemetry cable through an electrical connector, as shown in the *Figure A-4: HyperPro Power/Telemetry External Interface*. There is also a mechanical connection between the instrument body and the power/telemetry cable to allow the HyperPro to be deployed and recovered without straining the electrical connection.

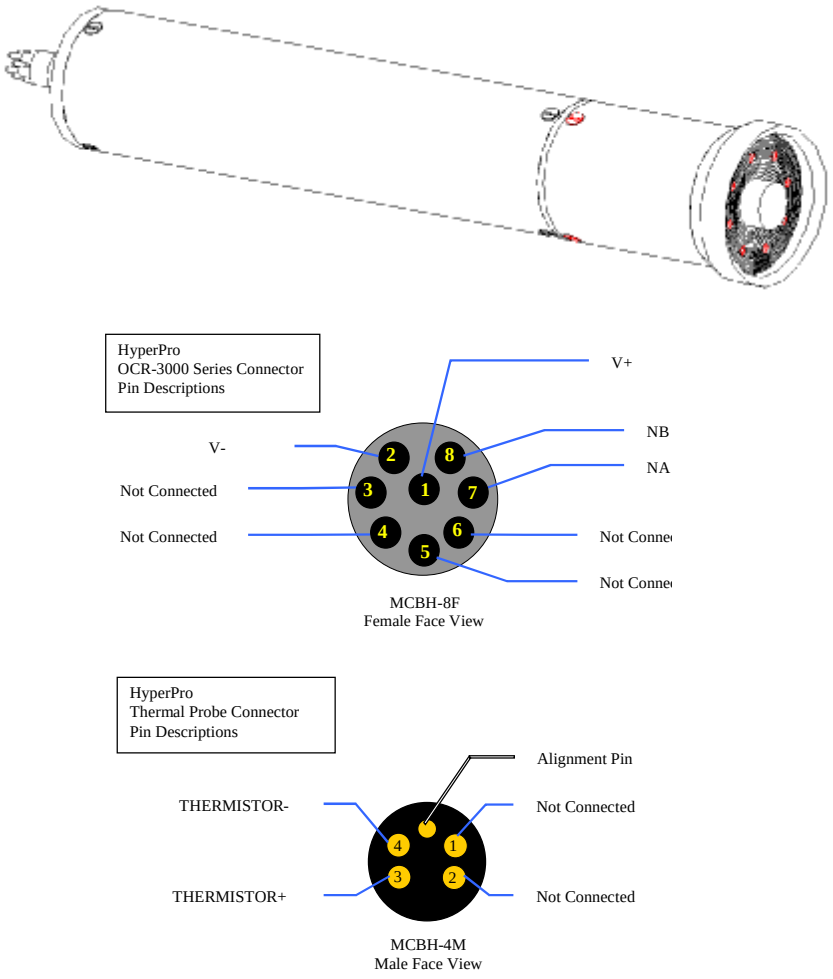


Figure A-5: OCR-3000 Miniature Hyperspectral Radiometer (MiniSpec) Sensor and Sensor Connectors

SENSORS

Specifications for any of the HyperPro sensors may be obtained by contacting Satlantic. A brief description of each sensor is provided below.

Optical Sensors

The OCR-3000 MiniSpec sensors are configured as slave modules for use in the HyperPro system. The main purpose of the OCR-3000 slave is to collect hyperspectral optical data. These sensors are connected to the instrument body through the connector shown in the figure above. Please refer to the OCR-3000 Instrument Operation Manual for more details on the optical sensors.

See Figure A-5, OCR-3000 Optical Sensor and Sensor Connectors

Pressure Sensor

The Entran Series EPXM pressure sensor is a small, ratiometric sensor providing an analog signal to the ancillary module's ADC. This pressure sensor provides accurate depth data (0.25% full-scale typical). The EPXM series is available in a variety of pressure ranges and may be chosen to match the application.

Tilt Sensor

The HyperPro is available with a miniature bi-axial clinometer (tilt sensor). This sensor provides an analog voltage representation to the ancillary module's ADC for tilt measurements in both the X- and Y-axes. This sensor provides a linear operating range of 6458, with an accuracy of 0.28.

Thermal Probe

The HyperPro is available with an external thermal probe that is used to determine the water temperature T_W. The analog signal from the probe thermistor is linearized and then measured by the ancillary module's ADC. The thermistor is thermally calibrated by Satlantic and provides 0.15% full-scale accuracy over an operating range of -2.58C to +408C. The thermal sensor is connected to the instrument body through the connector shown in the figure.

MDU-100 Deck Unit Power Supply

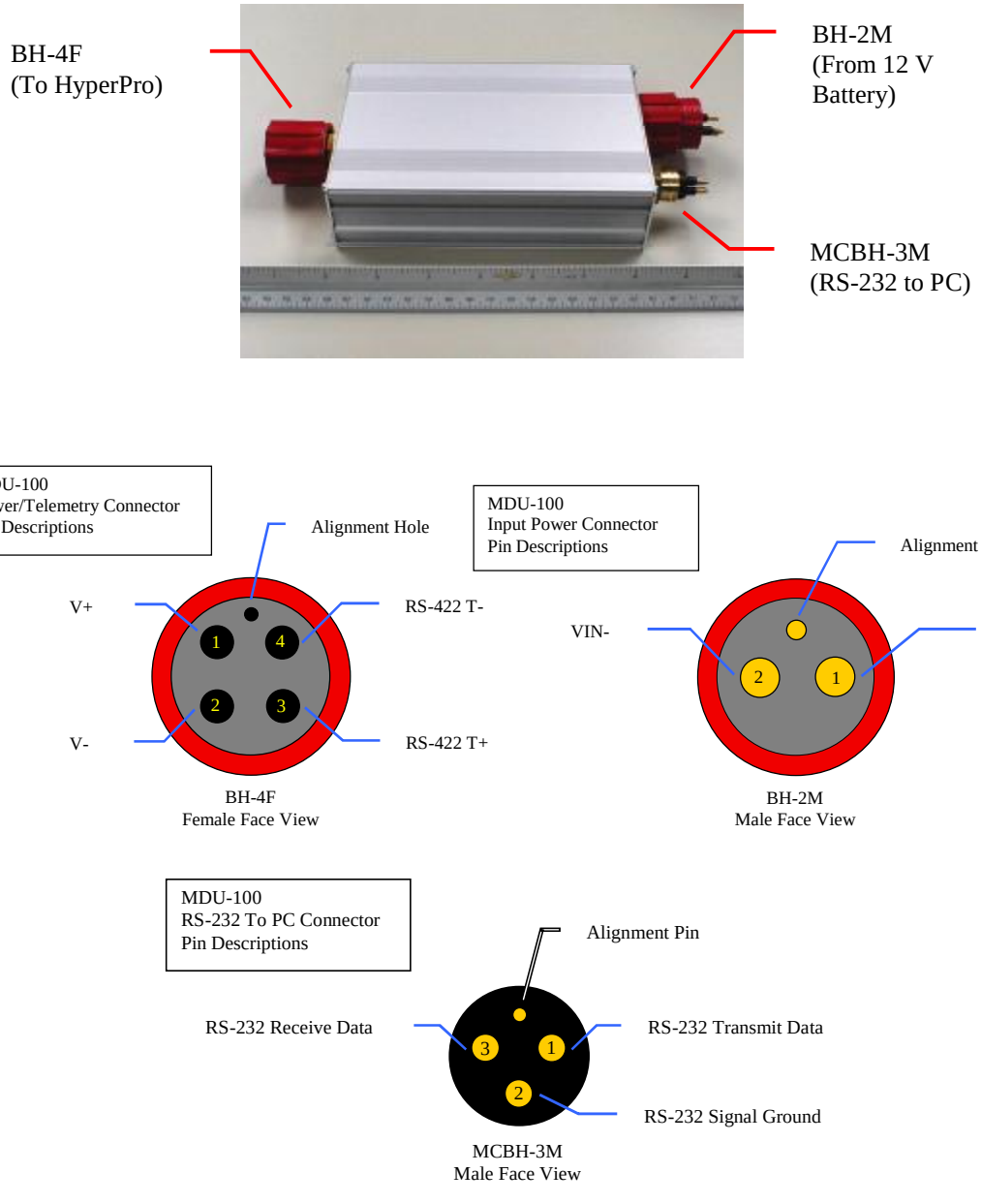


Figure A-6: MDU-100 Deck Unit

DECK UNIT

The deck unit, MDU-100, serves as both a nominal 48 volt DC power source for the HyperPro and as a RS-422 to RS-232 level converter. It is connected to the battery, the instrument body and the computer, through three connectors. Connector details are shown in the figure.

See Figure A-5, MDU-100 Deck Unit

A major design goal for the HyperPro was low-power operation. Although power requirements vary with system configuration, a typical system has a steady-state current draw of between 1 and 1.5 amps at 12 VDC into the MDU-100. This is a power requirement of 12-18 watts. If you are planning on using a power supply instead of a battery to power the MDU-100, the supply should be capable of at least 3 A to guarantee reliable operation.

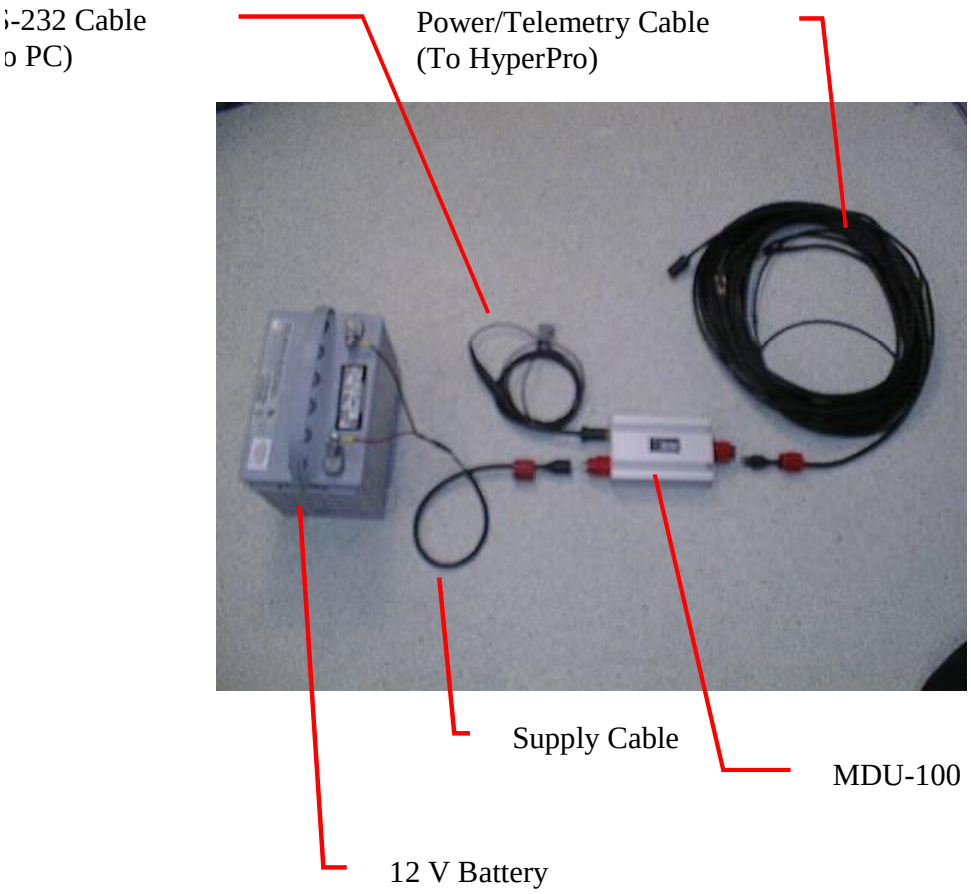


Figure A-7: Cables

CABLES

The **Power/telemetry cable** runs from the deck unit to the instrument body.

See Figure A-7: Cables

The power/telemetry cable acts as a mechanical and electrical tether, providing a flexible, high strength connection between the vessel and the instrument and providing a channel to transport telemetry to the deck unit. The cable weighs 700g/100m in water. The mechanical terminations can withstand 750kg of tension and prevent electrical termination damage and instrument loss.

The **Supply Cable** or Battery Cable runs from the battery to the deck unit.

The **RS-232 Cable** runs from the deck unit to the computer.

The **Interconnect Cables**, typically one for each sensor depending on the system, connect sensors to the main housing on instrument body.

POWER SUPPLY

The power supply is normally a battery, but may be any dc power supply in the range of 10-20 VDC at 3 A. However, in a battery-powered system we recommend using a fairly large battery (i.e. 50 Ah gell cell). This allows a laptop computer to use the same power supply as the HyperPro.

COMPUTER

The user must supply a computer in order to view and log HyperPro telemetry. SatView, Satlantic's data logging and display program, should operate on any IBM compatible computer running Windows 95 or 98 with 5 MB of free disk space and a free RS-232 serial port (additional ports are required for reference instruments). Additional disk space is required to log data from the HyperPro - allow several Megabytes. Please refer to the SatView manual for more details.

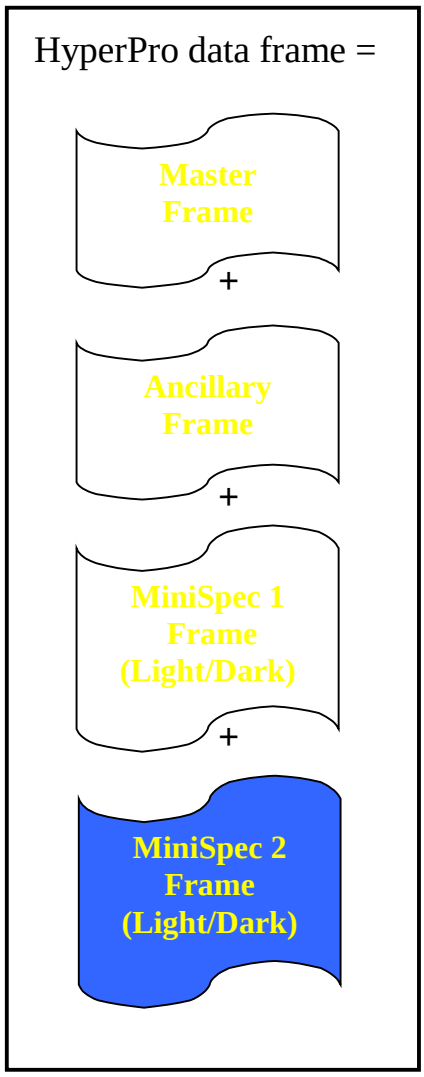


Figure A-8: Telemetry Data Frames

Telemetry Format

Telemetry from the HyperPro is organized into frames. The HyperPro provides a frame synchronization string or "header" (a "unique" sequence of bytes) to allow Satlantic software to detect the beginning of a data frame. The frame itself consists of a number of binary data "fields", as defined by the HyperPro's calibration file.

See Figure A-8: Telemetry Data Frames

The HyperPro's data frame is actually a *macroframe*, assembled from several *subframes*. The subframes are the data frames from the slave devices on the network. For this reason, the size and format of the macroframe will change from one HyperPro instrument to another, depending on how the MiniSpecs are configured. The macroframe can be more easily understood if the individual subframes are looked at individually.

MASTER FRAME

The master frame is the data from the master controller in the HyperPro. The master's data frame format will not change with the instrument configuration.

Field	Field Size (bytes)	Field Name	Description
1	10	HEADER	The frame synchronization string marking the beginning of the data frame. The first six characters denote the type of instrument (SATNPR for Satlantic Hyperspectral Profiler) followed by the instrument's 4 digit serial number.
2	2	SV-NPR	This sensor represents the system's internal voltage. If this voltage for some reason does not remain constant, there may be a problem with the instrument and sensor data integrity should be considered compromised.
3	1	FRAME COUNTER	Frame counter that increments with each frame sent, from 0 to 255. When 255 frames are sent, the counter resets to 0. The frame counter is a useful tool for determining when and where data loss occurs.
4	10	TIMER	This sensor indicates the number of seconds elapsed since the instrument was first powered up and telemetry output began. The value of each reading coincides with the beginning of the sensor-sampling period.
5	1	CHECK SUM	Causes sum of bytes in this frame to be 0. May be useful for later error checking.
6	2	CRLF	Carriage return and line feed terminator.

ANCILLARY FRAME

Field	Field Size (bytes)	Field Name	Description
1	10	HEADER	The frame synchronization string marking the beginning of the data frame. The first six characters denote the type of instrument (SATPNC for Satlantic Profiler Ancillary) followed by the instrument's 4 digit serial number.
2	2	V ANALOG	Voltage rail measurement of the analog sensor components.
3	2	V ENTRAN	Voltage rail measurement of the ENTRAN pressure sensor.
4	2	T PCB	Temperature measurement of the controller board.
5	2	AUX1	Unused 16-bit ADC channel.
6	2	AUX2	Unused 16-bit ADC channel.
7	2	AUX3	Unused 16-bit ADC channel.
8	2	PRES	16-bit measurement of Entran pressure sensor, if present
9	2	TILT X	16-bit measurement of x tilt sensor, if present
10	2	TILT Y	16-bit measurement of y tilt sensor, if present
11	2	TEMP TILT	16-bit measurement of tilt sensor temperature (if present).
12	2	T W	16-bit measurement of water temperature, from external thermistor (if present).
13	4	FRAME COUNTER	4 byte frame counter.
14	10	TIMER	This sensor indicates the number of seconds elapsed since the instrument was first powered up and telemetry output began. The value of each reading coincides with the beginning of the sensor-sampling period.
15	1	CHECK SUM	Causes sum of bytes in this frame to be 0. May be useful for later error checking.
16	2	CRLF	Carriage return and line feed terminator.

OPTICAL SENSOR FRAMES

For information on the OCR-3000 MiniSpec frame format, refer to the OCR-3000 Instrument Operation Manual. These instruments are pre-configured by Satlantic for use in a HyperPro.

DATA FORMAT

The HyperPro data format is fixed at 57600 baud with no parity, 8 data bits, and 1 stop bit. No hardware handshaking is used. Data transmission should be automatic when the power is applied to the instrument, after a short delay.

B. SAFETY & HAZARDS

- The operators of the profiler and reference should always remain aware of the cable. Any cable or line released from a ship can be dangerous. Keep a safe distance from the cable coil on deck when the instruments are being used.

Instruments

- Do not leave instruments in direct sunlight on deck when not in use. Extreme heat (35°C or greater) can potentially damage them.
- Closely monitor depth during profiler casts to ensure that depth changes do not cause the profiler to contact the ocean floor when in shallow water or exceed the system depth rating when in deep water.
- When using an in-water reference with the HyperPro, do not leave the reference unattended. Boat drift can entangle the cable and cause damage or instrument loss.

Cable

- Ensure the power/telemetry cable is not pinched or bent to a radius less than 18 cm, to prevent damage to the conductors within the Kevlar™ strength member.

Connections

- Handle electrical terminations carefully, as they are not designed to withstand strain. Disconnect the cables from the components by pulling on the connector heads and not the cables. Do not twist the connector while pulling, as this will damage the connector pins.
- Do not use petroleum-based lubricants on connectors. Connectors should be free of dirt and lightly lubricated before mating. We recommend using DC-111 silicone grease (made by Dow-Corning) on the male pins prior to connection.

Deployment

- When using a block to let the cable out during deployment, ensure the gap between the roller and the housing is sufficiently small to prevent the cable from skipping off the roller and getting caught or damaged.

- Take care to prevent the power/telemetry cable from being drawn into the vessel's propellers or thrusters when maneuvering. The cable weighs only 700g/100m in water but will sink and is very strong and extremely difficult to cut.

Troubleshooting

- While checking voltages with a multimeter, extreme care should be used so as not to short the probe leads. A shorted power supply or battery can output many amperes of current, potentially harming the user, starting fires, or damaging equipment.

Recovery

- Remember never to grab the electrical portion of the profiler or reference cable during recovery. This can cause damage to the power/telemetry bulkhead and the underwater splice.

- Lens caps should always be replaced as soon as the instrument comes back on board. This will help protect the heads from direct damage.

- Always disconnect the 10 - 20 Vdc power source (i.e. the battery) from the MDU-100 before disconnecting the power/telemetry cable from the HyperPro.

- Be sure to rinse the instrument with fresh water prior to storage. Corrosion resulting from failure to do so is not covered under warranty.

C. START UP

Figure C-1: Frame Mounted Assembly

Assembly Procedure

PREPARATION

In preparation for assembly, the HyperPro components should be checked against the packing list to ensure that all required items are included. There may be additional interconnect cables, weights and other supplies packed with the instrument. The dummy connectors and the optical sensors' vinyl end caps should be removed and stored so that they can be replaced after the HyperPro is recovered. The instrument packing should be retained and reused to prevent instrument damage during transport.

A user supplied computer, and possibly also a power supply is required. These can be unpacked and set up for connection to the HyperPro.

Additionally, lubrication for the male pins prior to connection is required. We recommend DC-111 silicone grease (made by Dow-Corning). Do not use a petroleum base lubricant. If the frame mounted HyperPro is being used, the deployment apparatus should be set up for operation.

CONNECT THE COMPONENTS AND CABLES

Connectors should be inspected to ensure they are free of dirt and then lightly lubricated before making connections. Connect the instrument body, the computer and the battery to the deck unit, as follows.

1. Mount any sensors to the instrument which are not already in place. If the HyperPro is not already fully assembled, usually only the optical sensors require mounting. For the free-falling configuration, the sensors are attached with positive locking quick release pins and secured with cable ties. For the frame mounted instrument, the optical sensors are locked into position by an index pin and secured with a cable tie. The instrument body is then cable tied to the frame, as shown in the figure.

Figure C-1: Frame Mounted Assembly.

2. Mount the two buoyancy cans to the bottom of the rails along the center axis of the instrument with the provided cable ties (see figure C-2).

Figure C-2: Position of buoyancy cans.

3. Connect the sensor cables on the instrument. Ensure the connectors match before attempting to connect them. There are different connectors for different sensors to ensure they are connected properly.

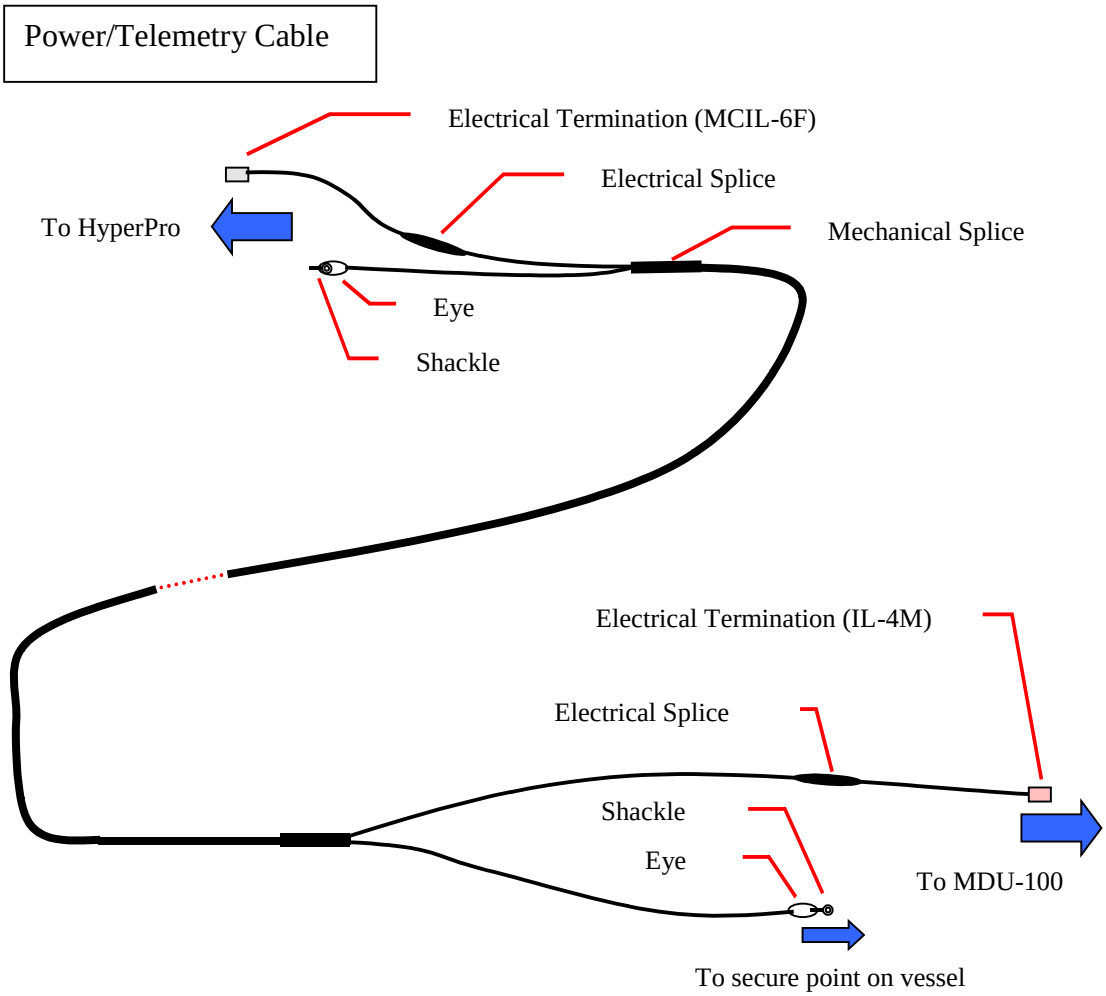


Figure C-3: Power/Telemetry Cable Connections

4. Connect the power/telemetry cable to the instrument. First connect the cable shackle to the instrument shackle and then connect the six pin electrical termination to the instrument. The shackle on the other end of the power/telemetry cable may then be connected to a hard attachment point on the vessel.

See Figure C-3, Power/Telemetry Cable Connections

5. Connect the power/telemetry cable to the deck unit.

6. Connect the RS232 cable to the deck unit and computer.

7. Connect the deck unit to the battery.

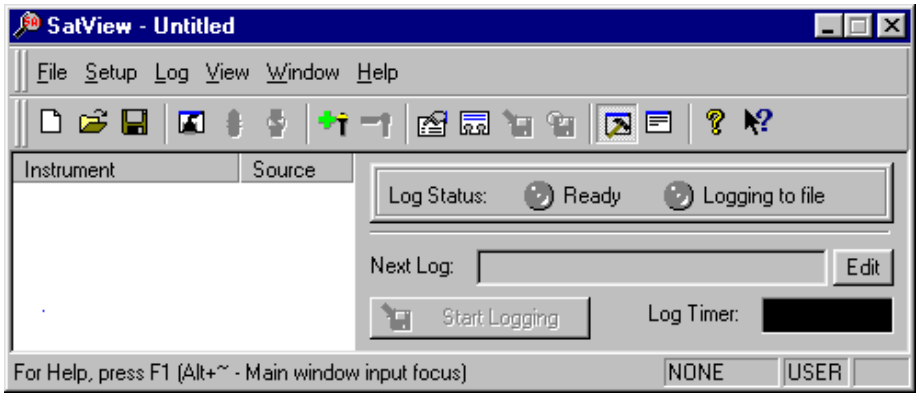
8. Turn on the computer.

CONDUCT A SIMPLE TELEMETRY TEST

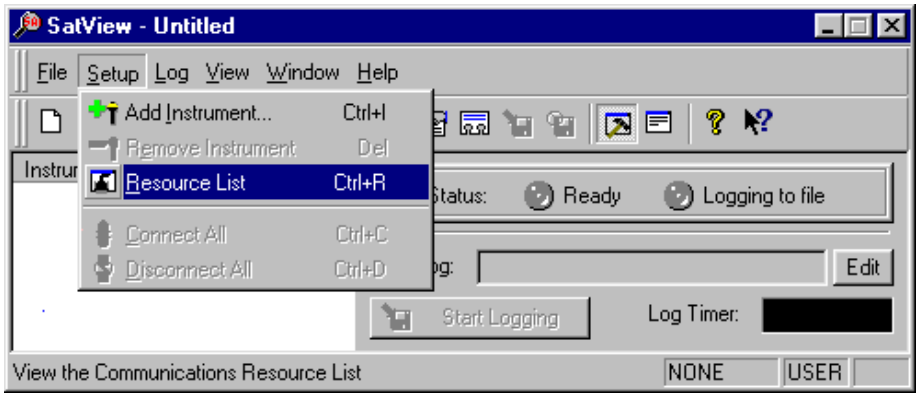
A simple telemetry test should be conducted to get familiar with the data logging software and to test the system for proper operation prior to deployment. HyperPro data can be viewed in real time and logged using SatView, Satlantic's Windows'95/98 based data logging and display software package. SatView is provided with the HyperPro on two 3.5" diskettes. The calibration files, on a 3.5" diskette, are also provided. Load the SatView program and copy the calibration files onto the computer prior to the test outlined below.

Note: The procedure outlined below is for use with Satlantic's MicroPro. The MicroPro is the multi-spectral version of the HyperPro. Although the procedure is generally the same, windows will appear slightly different when used with the HyperPro.

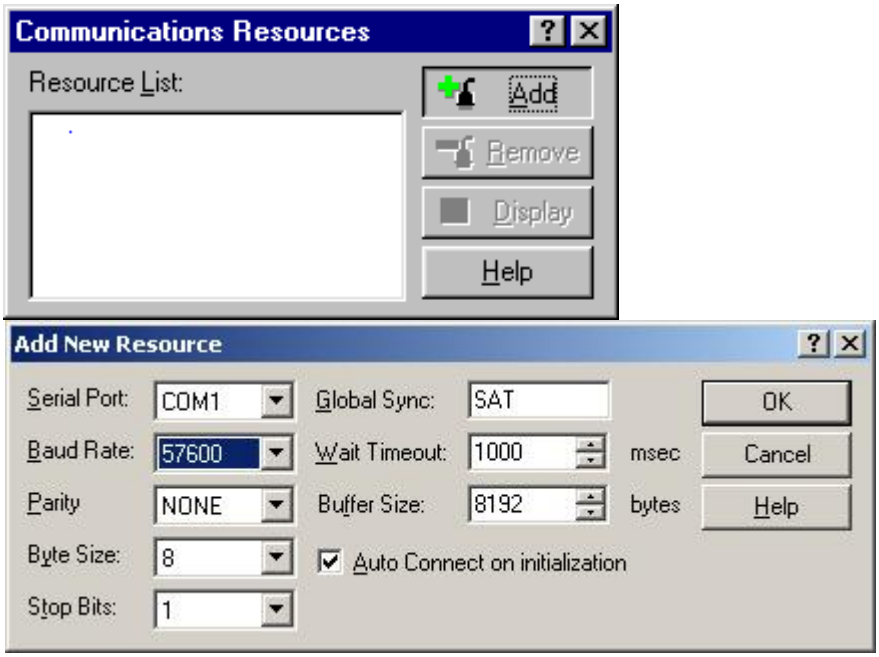
1. Start SatView by selecting **Start** -> **Programs** -> **Satlantic** -> **SatView**. You should see:



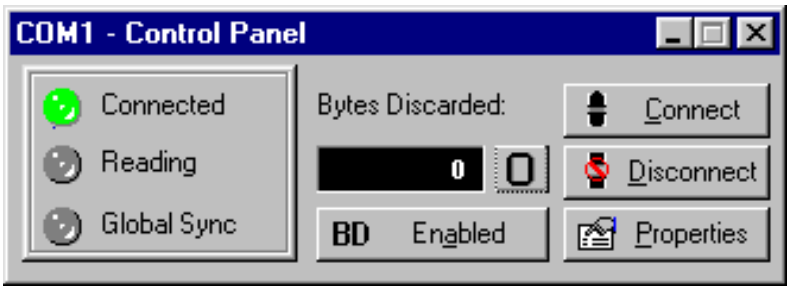
2. Select **Setup -> Resource List**, as shown:



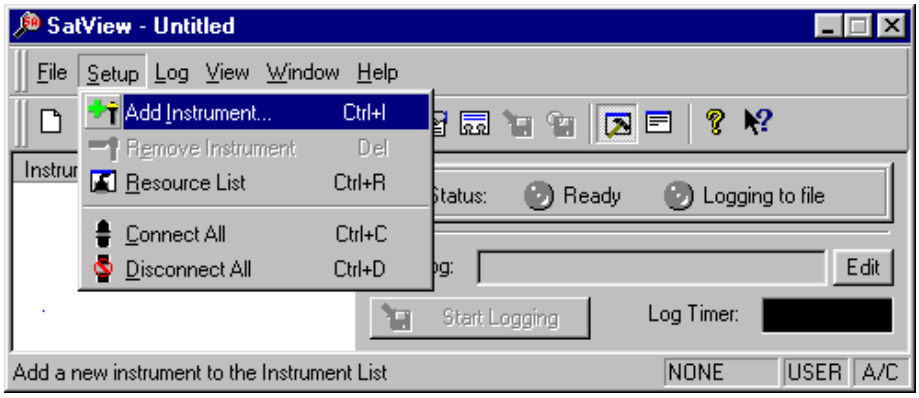
3. In the **Communications Resources** dialog, select the add button to add the communication port that will be used to log data. Here, COM1 is assumed. Setup the port for 57600 baud, as shown. As the HyperPro frame rate is considerably slower the its multi-spectral cousin, the *Wait Timeout* parameter should be increased to about 3000 msec or more.



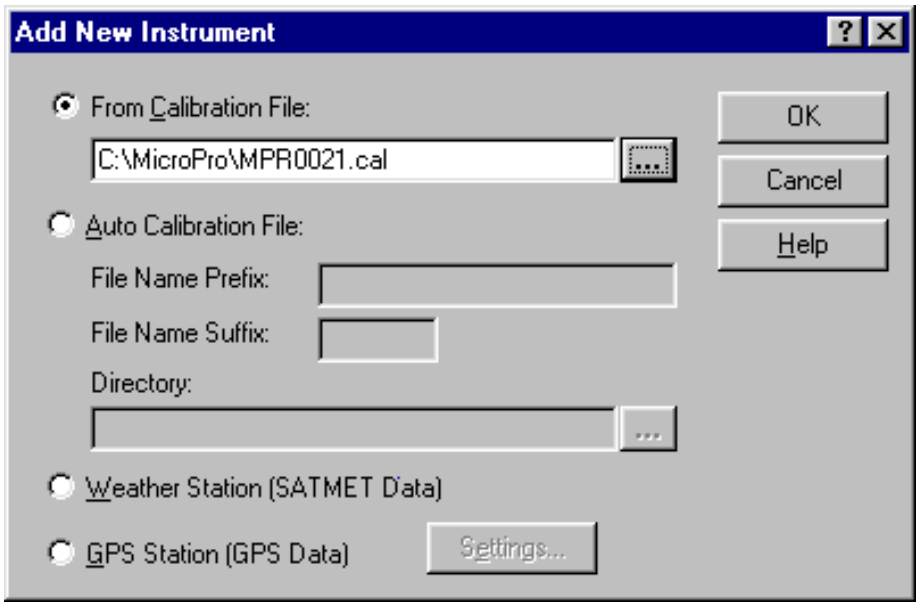
4. Select OK, then click the **Display** button in the **Communications Resources** dialog. You should see the **COM1 Control Panel**, as shown. Drag the window to a convenient location on the desktop, and close the **Communications Resources** dialog box.



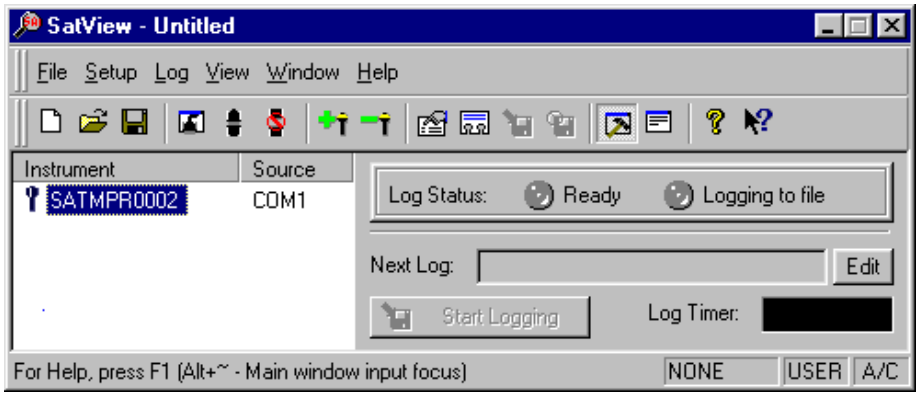
5. Next, you need to set up SatView with the calibration files supplied with the HyperPro. The calibration files you receive will be different than that shown here, but the procedure is the same. There should be 6 calibration files associated with your system. Although the order in which they are added to SatView is not important, the following order is suggested: Master, Ancillary, MiniSpec 1 Light, MiniSpec 1 Dark, MiniSpec 2 Light, MiniSpec 2 Dark. Select **Setup -> Add Instrument**.



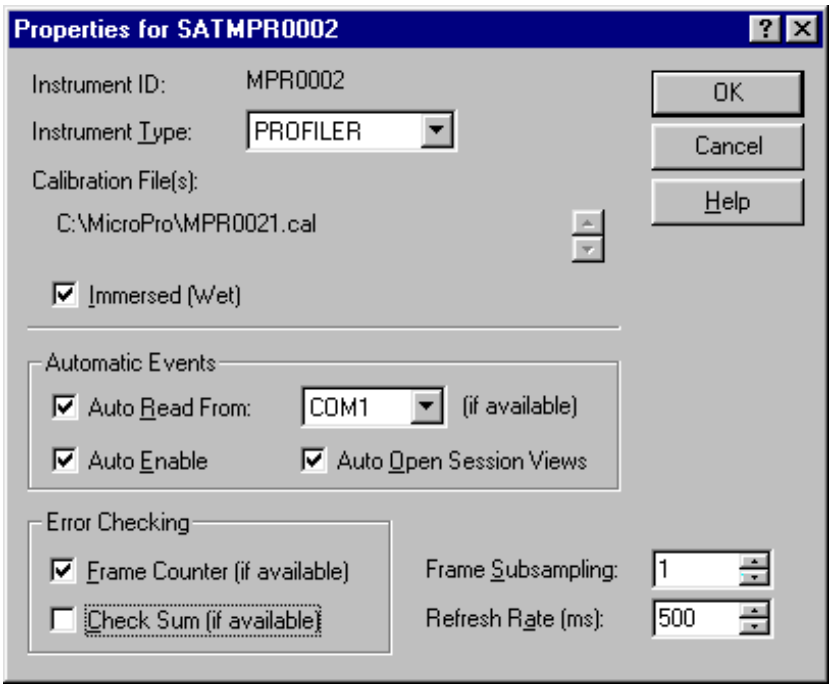
6. You should see the **Add New Instrument** dialog box. Select **From Calibration File**, and browse to the location of your calibration file, as shown. The name and location of your calfile will be different from that shown in the dialog.



7. The main SatView window should now appear as follows (there will be six instruments in the list for a HyperPro):

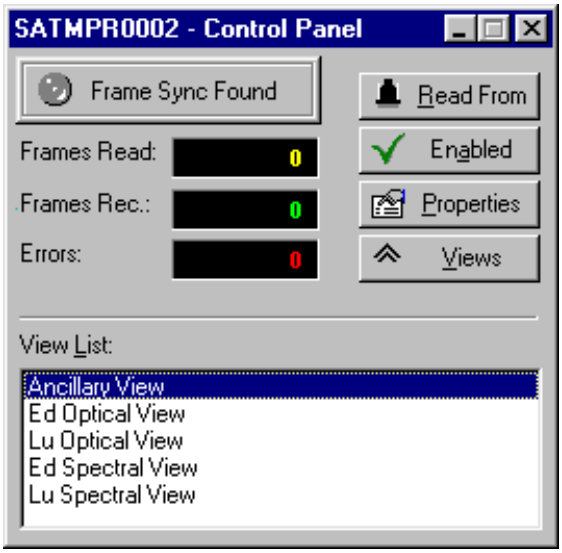


8. Right-click on the Ancillary "instrument" in the instrument list (SATPNCxxxx) and select **Properties**. Set up the dialog as shown. Make sure the Instrument Type is set for PROFILER as this will be needed to do a pressure tare. Also, make sure the Check Sum Error Checking check box is enabled.



9. If you are using a port other than COM1, select it from the drop down list. Select OK to close the dialog.

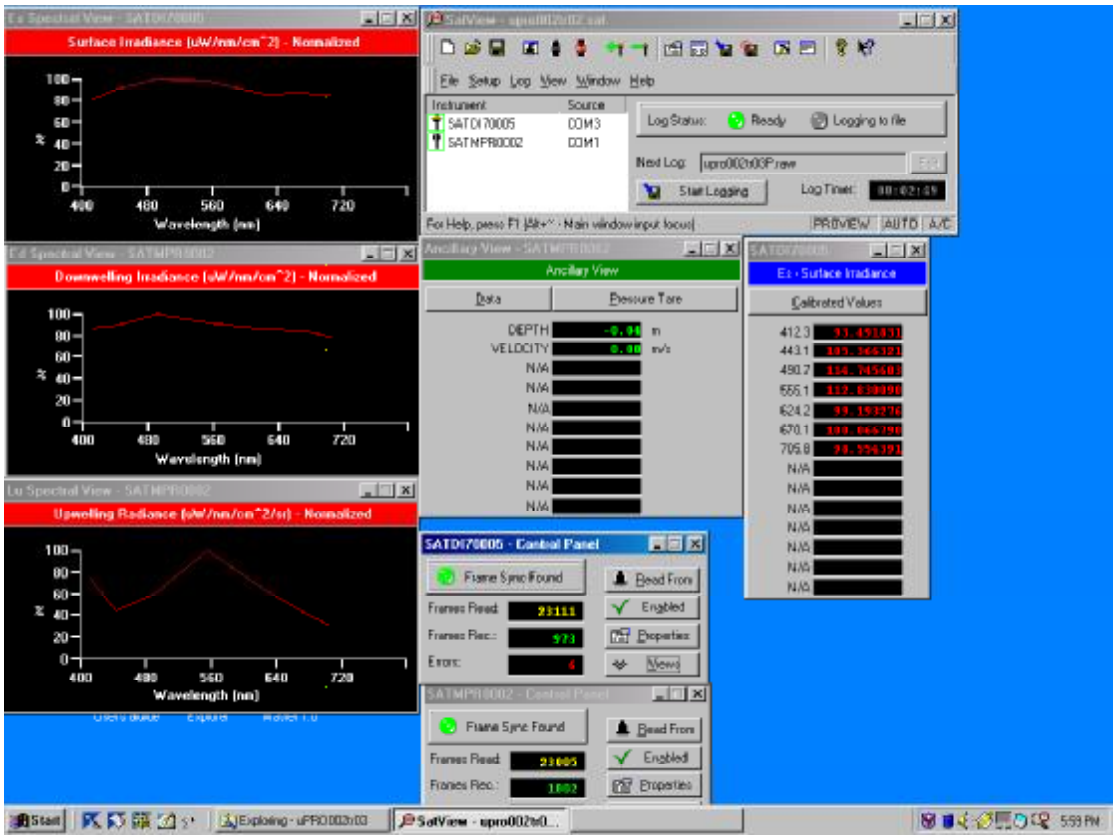
10. You may now open display panels for each of your "instruments". Double click on any instrument in the list to open the instrument's Control Panel. The following is a typical example:



11. Double-click on each of the views in the view list to display the data for that view. Arrange the windows as is convenient on the desktop.

12. As an extra convenience, SatView allows you to save this setup for the next time you use the HyperPro. Go to **File -> Save As** and save the setup in a convenient location with a descriptive name, such as **"HyperPro.sat"** in the SatView directory. The next time you wish to use the HyperPro with SatView, simply open this file and all settings will be restored. Please refer to the SatView manual for more details.

13. Shown on the next page is a typical SatView session.


Surface Irradiance (uW/nm/cm^2) - Normalized
Downwelling Irradiance (uW/nm/cm^2) - Normalized
Upwelling Radiance (uW/nm/cm^2/sr) - Normalized
Wavelength (nm)
File Setup Log View Window Help
Instrument
Source
SATDI70005
COM3
SATMPR0002
COM1
Log Status:
Ready
Logging to file
Start Logging
Log Timer:
Ancillary View
Data
Pressure Tare
DEPTH
VELOCITY
Ed - Surface Irradiance
Calibrated Values
SATDI70005 - Control Panel
Frame Sync Found
Read From
Frames Read:
Frames Rec.:
Errors:
Enabled
Properties
Views

D. OPERATION

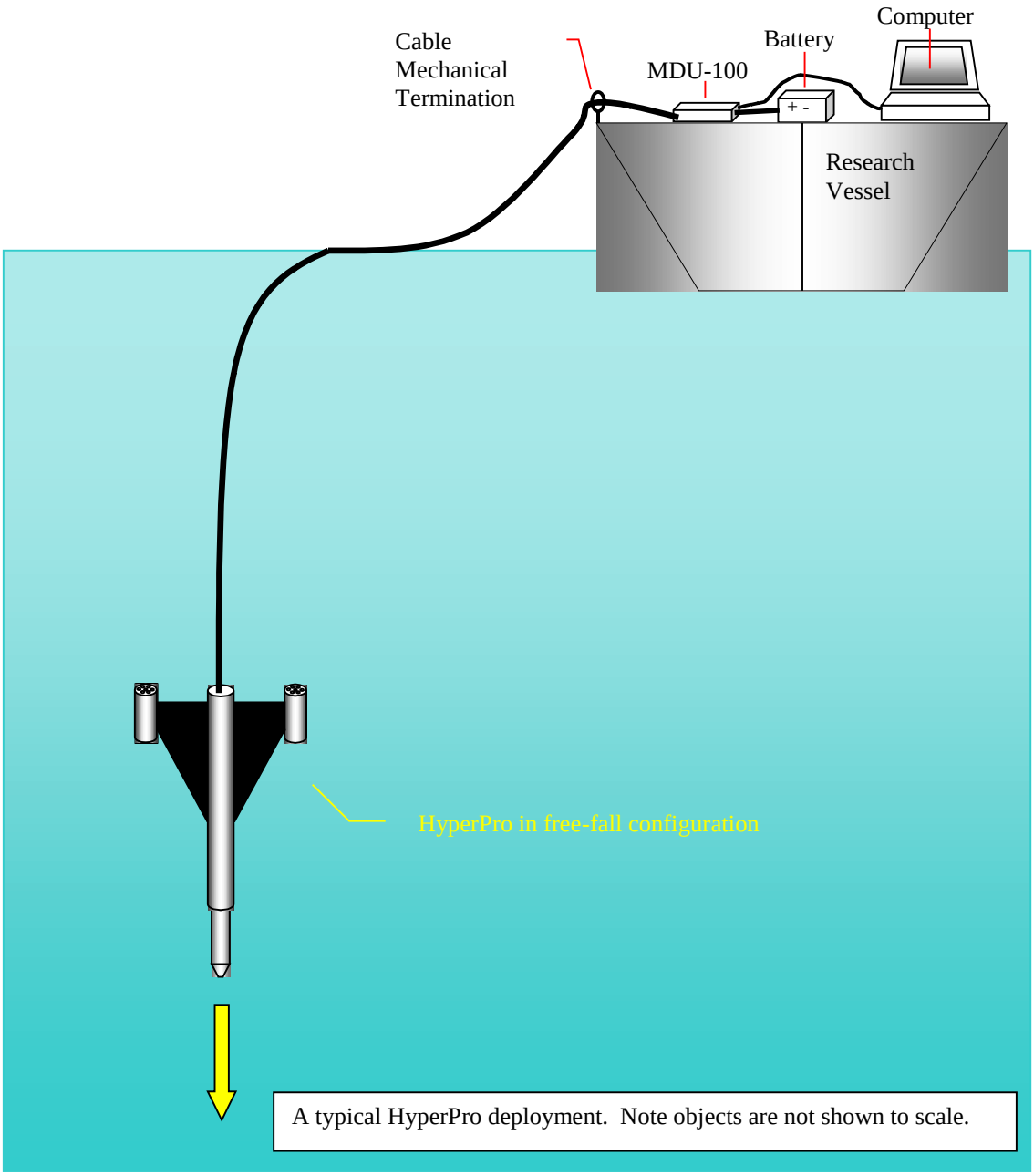


Figure D-1: Free-Fall Deployment

Deployment Procedure

FREE-FALL DEPLOYMENT

The primary advantage of the free-fall deployment technique is that it provides a straightforward method of taking measurements away from the ship being used to deploy the instrument and away from the measurement errors that its shadows create. The instrument is suspended on a cable and lowered alongside the vessel. The drop rate on the free falling HyperPro is fixed at about 0.30 m/s.

See Figure D-1: Free-Fall Deployment

The HyperPro instrument should be used at a minimum distance of 20 m from the boat. The HyperPro should be carefully lowered to the water by slowly releasing the cable. If the boat is drifting, the HyperPro can be set in the water on the windward side and held to the surface by the cable until it is far enough away to drop. If the boat is not drifting, the HyperPro should be set in the water at the stern so the boat propulsion can adequately separate the instrument from the boat. If there is difficulty in getting the instrument to move away from the boat, connecting the power/telemetry cable lower on the instrument may be helpful.

When the instrument is sufficiently far from the boat, the cable may be used to hold the instrument in position for the pressure tare. A pressure tare is usually performed with the irradiance sensor just below the surface of the water. Although it is not necessary to make a pressure tare on every cast, the instrument should be held in this position before every cast begins for about 10 to 15 seconds to allow the integration times of the MiniSpecs to settle to an appropriate level.

INCORRECT

CORRECT

Figure D-2: Frame Mounted Deployment

FRAME MOUNTED DEPLOYMENT

When using the frame mounted HyperPro, the length of the boom used dictates the distance that the instrument can be deployed from the boat. The complete avoidance of ship shadow is mandatory for all radiometric measurements to be incorporated into the SeaWiFS validation and algorithm database. The minimum deployment distance away from the ship can be calculated as per instructions in the "SeaWiFS Technical Report Series, Volume 25, Ocean Optics Protocols for SeaWiFS Validation", by James L. Mueller and Roswell W. Austin. This document is included with the HyperPro but is also available from the NASA Center for AeroSpace Information, 800 Elkridge Landing Road, Linthicum Heights, MD 21090-2934, (301)621-0390. The instrument should be deployed from the sunny side of the boat. When deploying from the stern, the boat should be positioned so that the instrument can be deployed from with the sun's relative bearing aft of the beam. Boom deployments are generally performed from either the port or starboard side of the boat.

See Figure D-2: Frame Mounted Deployment

First the power/telemetry cable should be wound onto the cable block, ensuring the secure attachment of the vessel end to a hard attachment point on the boat and the instrument end to the lowering harness of the frame. The block should ensure that the cable cannot skip off the roller and get caught. The instrument can then be guided over the side of the boat and lowered into the water. Before lowering the frame, ensure that the lowering harness connectors are seated properly in the eyebolts, as shown in the figure. When the instrument is in position, with the irradiance sensor just below the water's surface, it is ready to conduct a pressure tare.

Conducting a Pressure Tare

Two operators are required to deploy the free falling HyperPro, one to operate the computer and one to handle the instrument. The operators will need to communicate with each other during deployment, so if they are out of hearing range, radios or another communication means will be required.

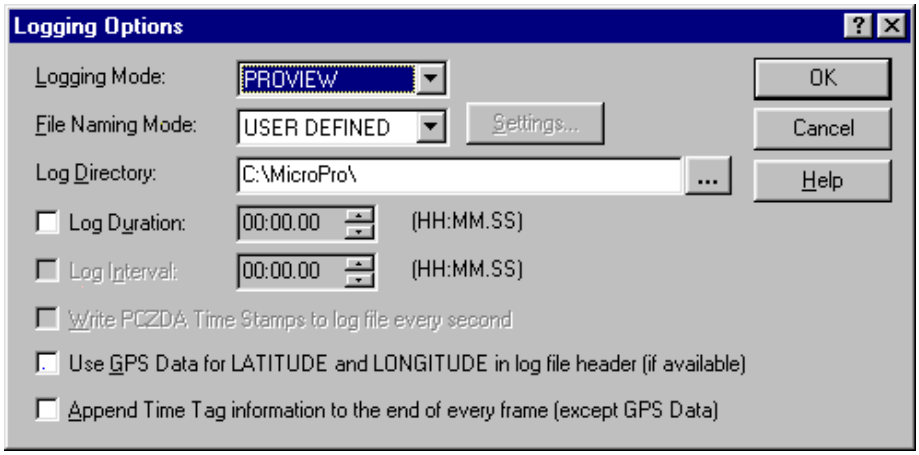
The pressure tare is conducted to zero the pressure sensor. When the instrument is in position with the irradiance sensor just below the water's surface, the operator handling the instrument informs the operator on the computer to perform the pressure tare. From the Ancillary View in SatView, click on the Sensor button, and then click the Pressure Tare button for the Ancillary instrument. The computer operator then informs the instrument operator that the pressure tare has been completed and that the system is ready for logging. Please see the SatView manual for more information.

After the pressure tare has been conducted, the instrument may be lowered if frame mounted or dropped if it is free falling. The instrument operator informs

the computer operator when to start logging so that the required data is obtained. The instrument operator will then pay out the cable until the desired depth is reached before informing the computer operator to stop logging data.

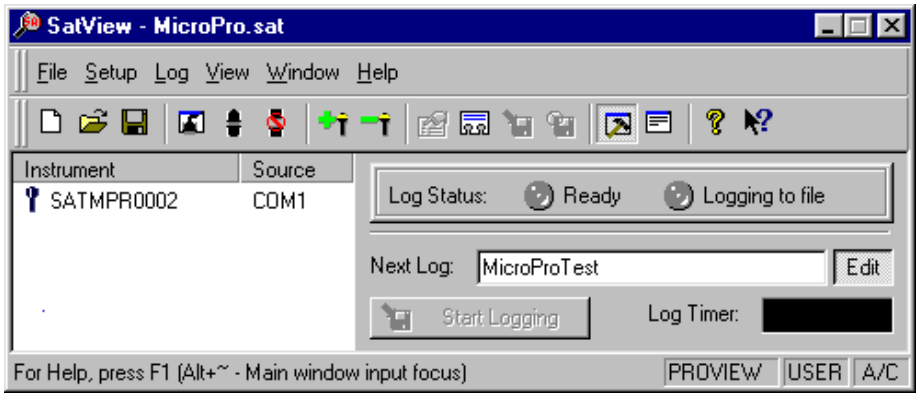
Logging Telemetry with SatView Software

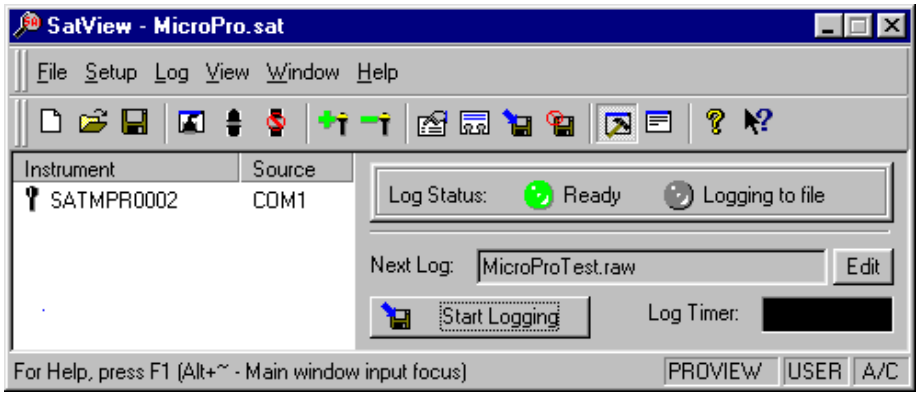
1. SatView provides a very simple method for logging HyperPro telemetry. After setting up SatView as described in the Start Up section, select **Log -> options** from the main SatView window. The **Logging Options** dialog should appear.



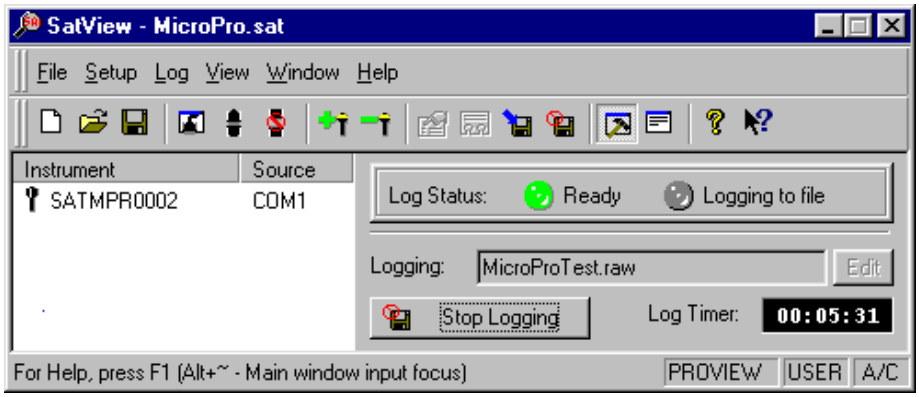
Set the logging mode to **NONE**, set the *Append Time Tag* check box, and set the log directory as desired. The window should appear similar to that shown. Select OK when complete.

2. In the SatView main window, click the **Edit** button next to the **Next Log** field. Type a name for our test log file, say **HyperProTest**, then hit enter (SatView will append *.raw* to the file name by default).

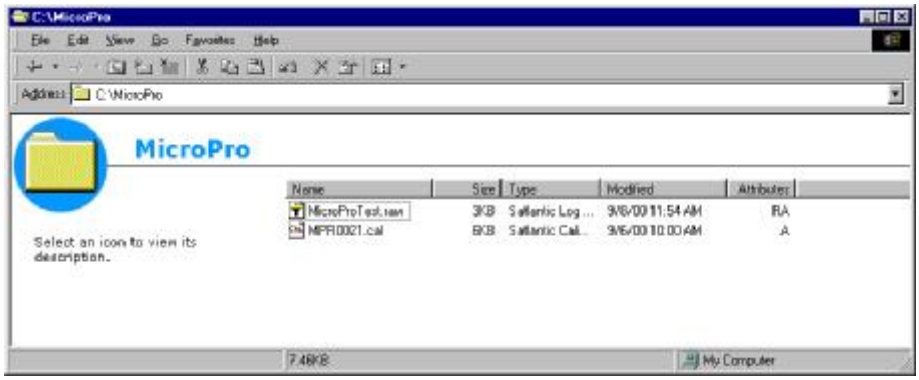




3. The **Start Logging** button is now available in the SatView window. When you are ready to begin logging, simply click this button. The log button should change to **Stop Logging**, and the **Log Timer** field will show how long SatView has been logging data. In the **Control Panel** window, the **Frames Rec.** (for frames recorded) field should be incrementing. When sufficient data has been logged (3 - 5 minutes) simply click the **Stop Logging** button.



As shown here, the logged raw file is present in the selected directory.



SatView provides many more telemetry logging options that are beyond the scope of this manual. Please refer to the SatView manual for more detailed instructions.

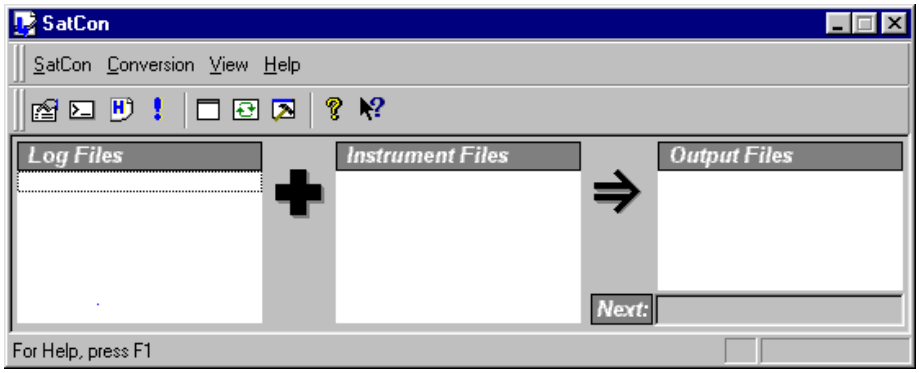
Data Processing with SatCon Software

After logging telemetry with SatView, the HyperPro data is stored in uncalibrated digital counts. Satlantic's SatCon data processing software is provided for converting the raw log file into a text format. SatCon reads the instrument calibration file, applies the appropriate conversion coefficients and formulae to the raw binary data and writes the data back out in calibrated physical units to an ASCII text file.

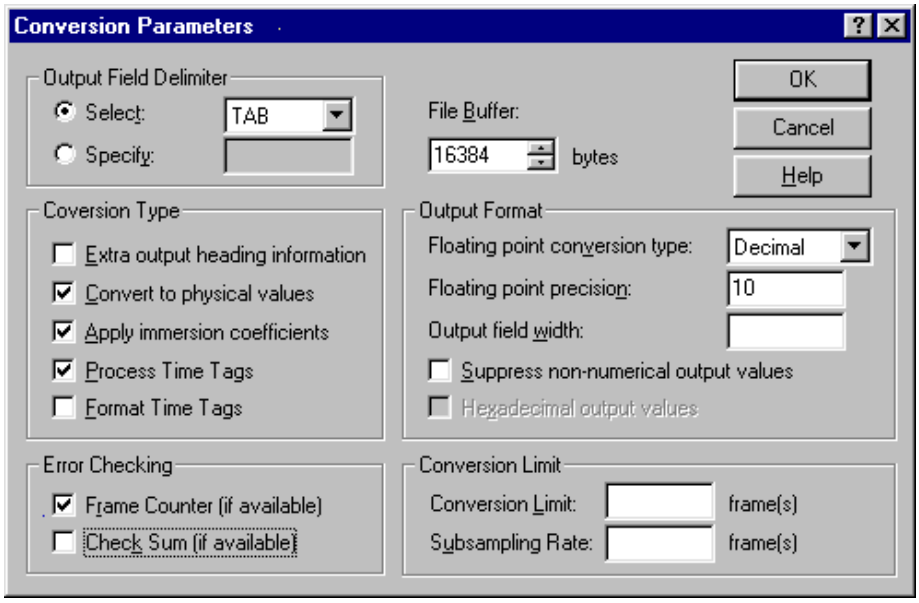
Satlantic's ProSoft (version 7.0 and later) data processing software can also be used to process HyperPro data. If this software is being used, please refer to the ProSoft manual for more details.

This section outlines the procedure to conduct a simple SatCon session, assuming that the file HyperProTest.raw was logged as outlined above. SatCon has a great number of features that are not discussed here; please refer to the SatCon manual for detailed operating instructions.

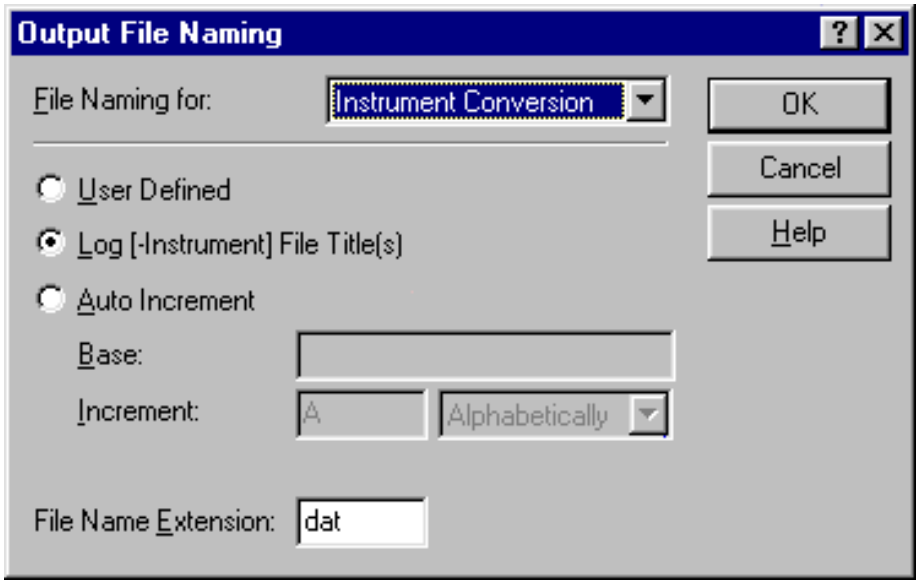
1. To start using SatCon, select **Start** -> **Programs** -> **Satlantic** -> **SatCon**. The main SatCon window should now be displayed, as shown below.



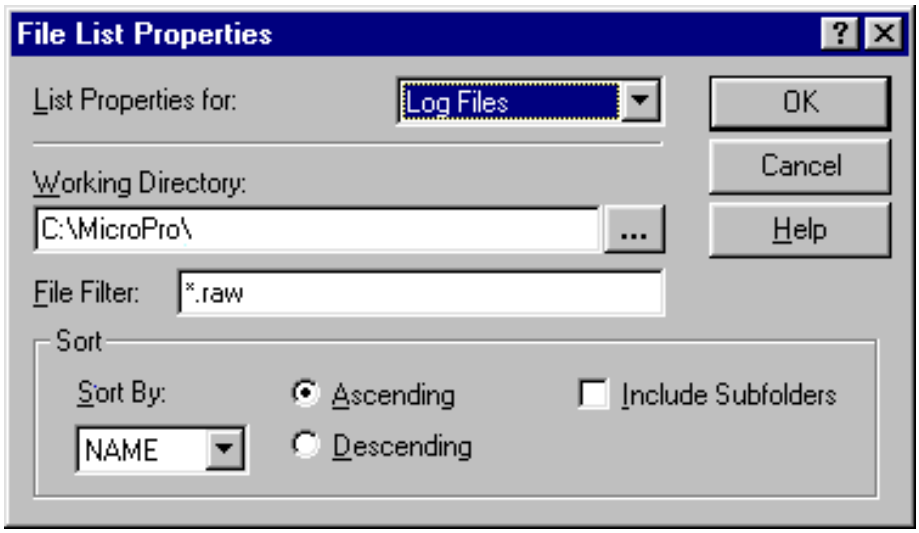
2. From the **Conversion** heading, select **Parameters**. The **Conversion Parameters** dialog box should be displayed. Set up the options as shown and enable Check Sum Error Checking, then click OK.



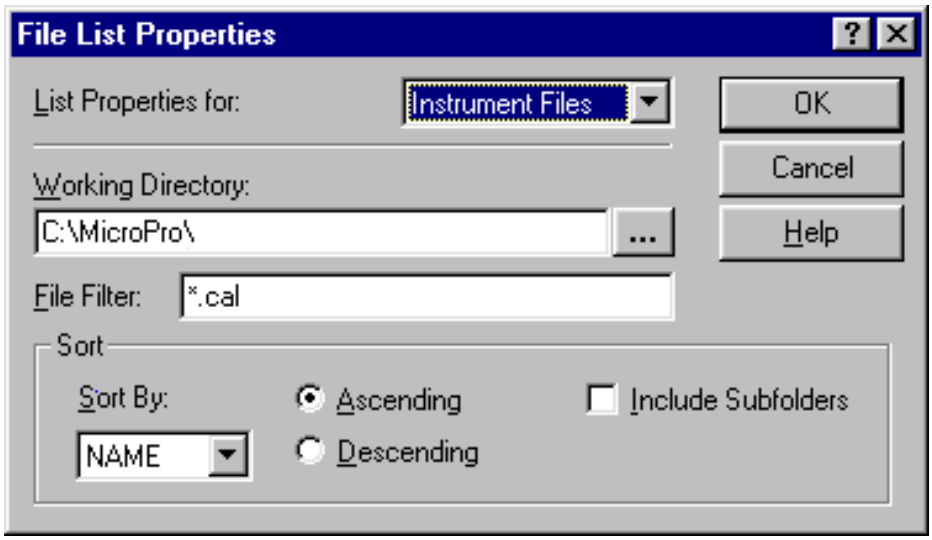
3. From the **Conversion** heading, select **File Naming**. The **Output File Naming** dialog should be displayed. Set up the options as shown below. This configures the output ASCII file to be named based on the calibration file name concatenated with the logged data file name, with a *.dat* extension. Select OK when complete.



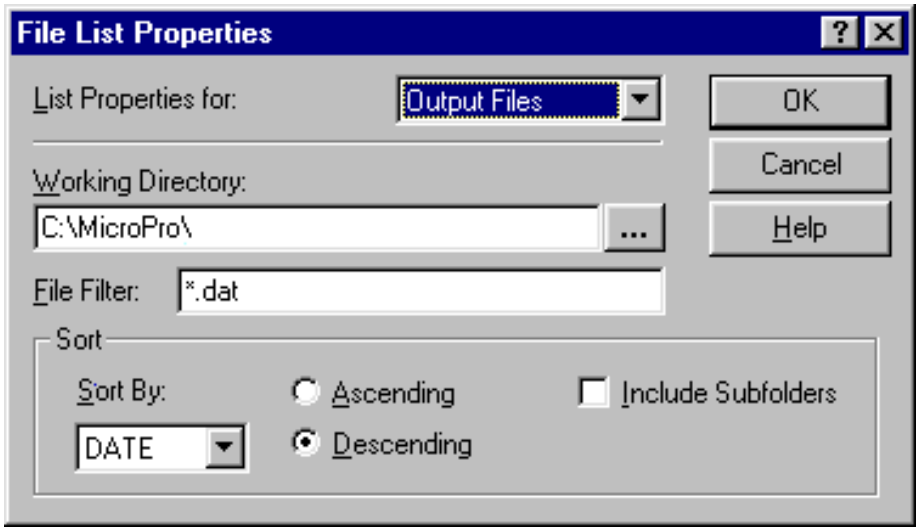
4. SatCon must be instructed as to where to look for the calibration file and log file, as well as where to put the output file. In this example, we will assume that the directory *C:\MicroPro* is being used. From the main SatCon window, select **View -> Properties**. The **File List Properties** dialog will be displayed. First, select **Log Files** from the drop down list, and change the working directory to wherever the logged data is stored. Don't exit the dialog yet.



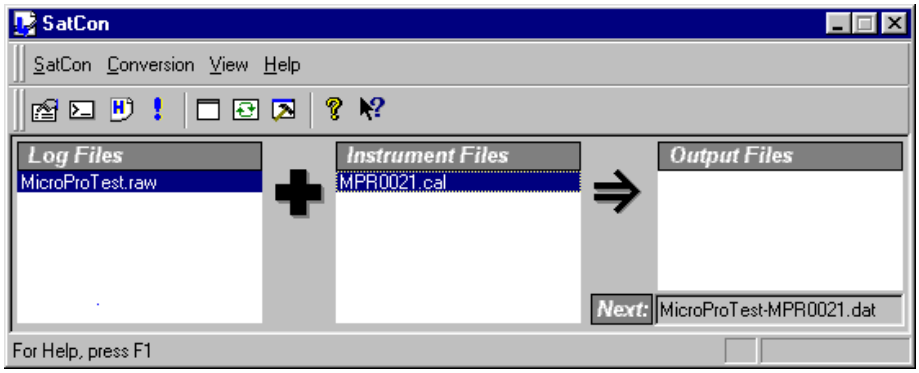
5. Select **Instrument Files** from the drop down list and again change the working directory to where the calibration file is stored. Don't close the dialog box yet.



6. Select **Output Files** from the drop down list and once again change the working directory to where you want the converted file to be placed.

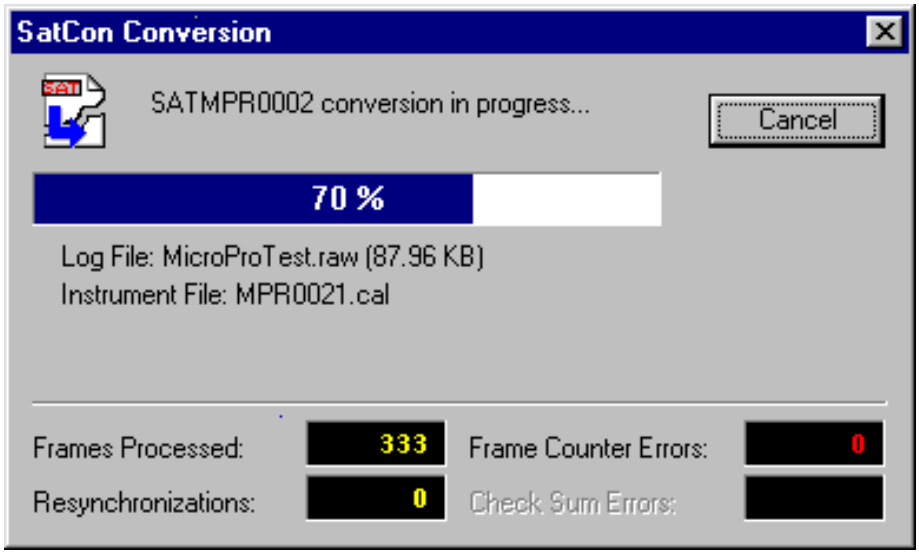


7. When you are happy with these settings, click OK. The main SatCon window should now look similar to the following:

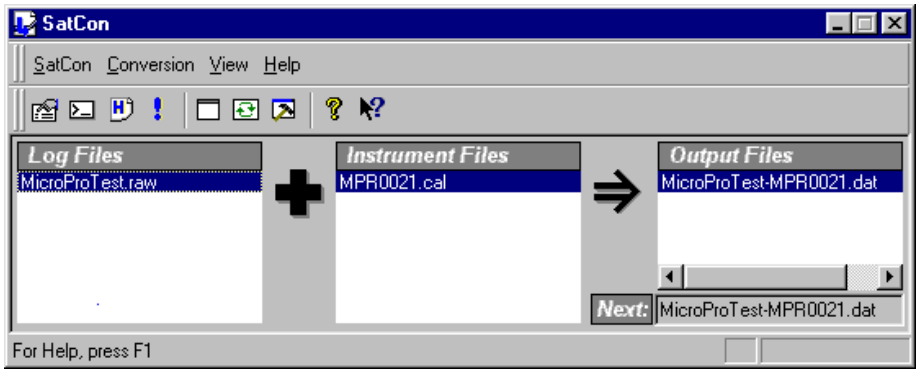


As you can see, the **Log Files** list contains the *.raw* file, the **Instrument Files** list contains the *.cal* calibration file(s), and there are no output files present since no conversion has been performed yet. Since multiple *.raw* and *.cal* files can exist in the same directory, the user must single-click the appropriate *.raw* and *.cal* file so that they are highlighted as shown. Notice that the **Next:** field contains the name of the output file that is about to be generated.

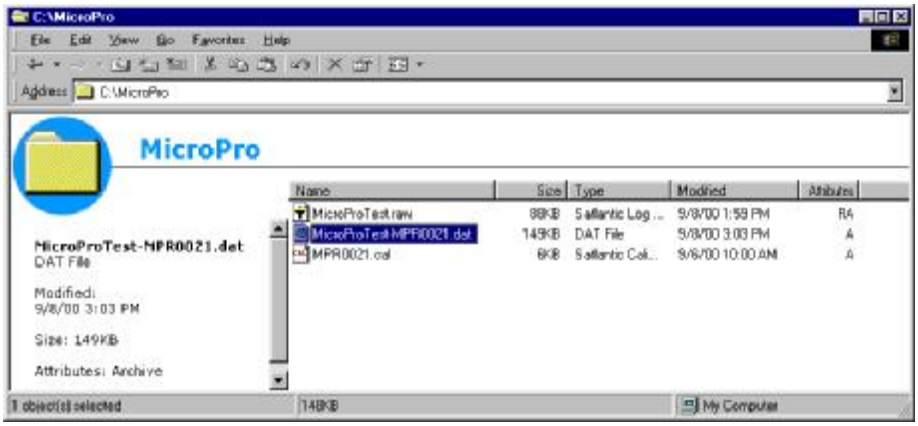
8. SatCon is now ready to convert the binary data into ASCII format. From the **Conversion** heading, select **Convert**. The **SatCon Conversion** dialog should be displayed, indicating the conversion progress, the number of frames processed, and any frame counter errors detected. Click OK when the conversion is complete.



9. The main SatView window should appear as shown. Notice the converted log file is shown in the **Output Files** list.



10. If you check the destination folder, you can confirm that the *.dat* ASCII output file is indeed present.



SatCon can now be exited and the output *.dat* file can be loaded into a spreadsheet or other data processing program.

E. RECOVERY

To recover the HyperPro, terminate data logging and pull the instrument back in using the power/telemetry cable. Take care not to jar the instrument, as the system may include sensors that are susceptible to shock damage.

Always be sure to rinse the instrument with fresh water prior to storage in order to prevent corrosion. If seawater is allowed to remain in contact with the instrument in storage, particularly around bolts and other contacts of dissimilar materials, corrosion may occur. To not properly rinse the instrument before storage is considered misuse and warranty claims cannot be made under such circumstances.

Remember to disconnect the input power supply from the MDU-100 before removing any other connections, and immediately replace the 2-pin dummy plug on the battery cable. Disconnect the cables from the components taking care to pull without twisting on the connector heads, not the cables. Ensure the dummy connectors are put back in place so that the male pins are not damaged and the female pins remain clean. Replace the vinyl end caps on the optical sensors. Then the instruments may be stored in the packing boxes, ensuring they are packed properly to protect them from damage during transport.

F. MAINTENANCE

Preventative Maintenance

The HyperPro requires virtually no maintenance. The life of the instrument will be prolonged by protecting it from impacts, rinsing it with fresh water after each use and properly storing the instrument with the dummy connectors and optical sensor end caps on when not in use.

If the instrument is not working properly the following troubleshooting techniques can be followed. If these are not successful, contact Satlantic for more information.

Troubleshooting with HyperTerminal

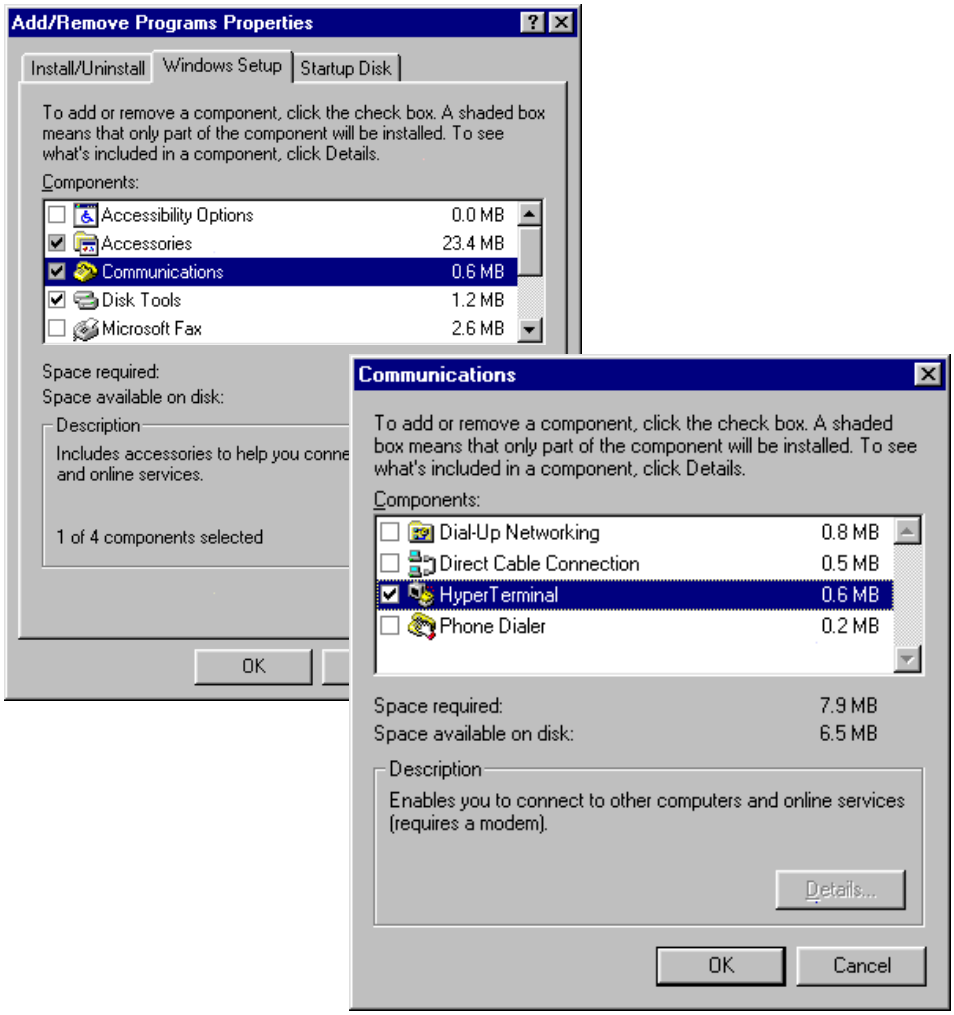
Occasionally, new SatView users may experience difficulty configuring the program properly in order to view and log HyperPro telemetry. Windows'9x includes the HyperTerminal program for serial data communication. This program provides a useful tool for quickly checking to see if telemetry is being received from the HyperPro.

CHECKING FOR HYPERTERMINAL INSTALLATION

HyperTerminal may not be installed on your computer. It is, however, a standard part of Windows'9x. Check to see if HyperTerminal is installed by entering **Start -> Programs -> Accessories**. If a **HyperTerminal** folder is visible in the **Accessories** folder, HyperTerminal is already installed.

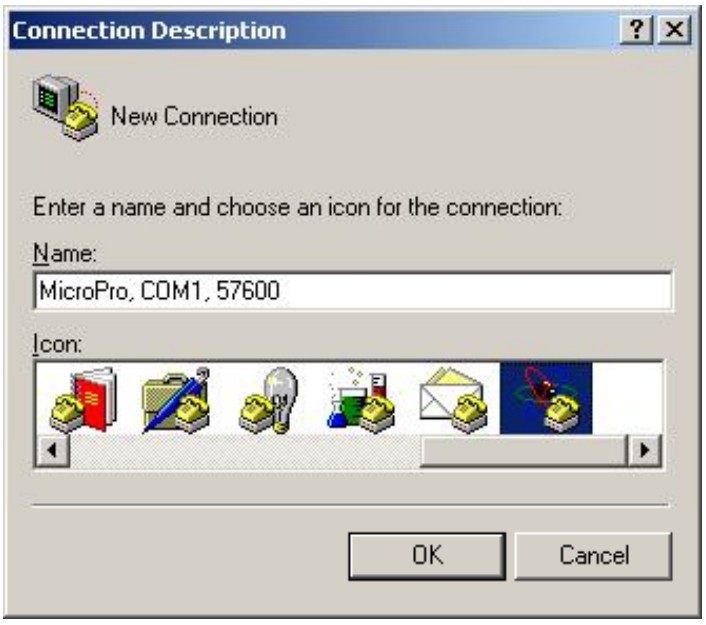
INSTALLING HYPERTERMINAL

Adding HyperTerminal is very straightforward; open up the **Control Panel** and click on the **Add/Remove Programs** item. Go through the dialogs as shown to install the program.

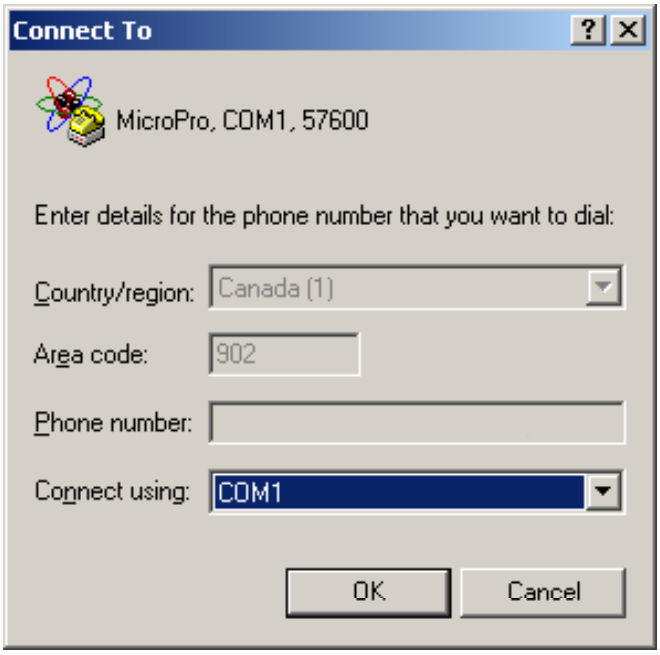


CONFIGURING HYPERTERMINAL

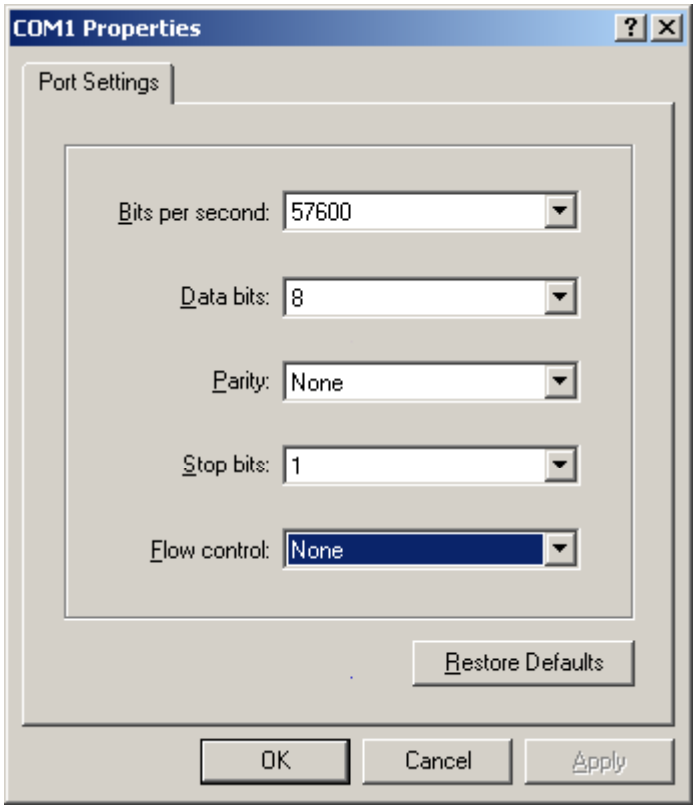
To start the HyperTerminal program, go to the Start menu and select Run, then type **hypertrm** in the Run dialog box. An alternative method is to enter the HyperTerminal folder through **Start ->Programs -> Accessories -> HyperTermina**l, then double-clicking on the **hypertrm.exe** icon. At startup, HyperTerminal initiates a configuration with a new connection dialog box. It is helpful to create an informative name for the connection we are about to create, as shown in the following figure. The name as shown indicates that we will have a connection to the HyperPro, on COM1, at 57600 baud.



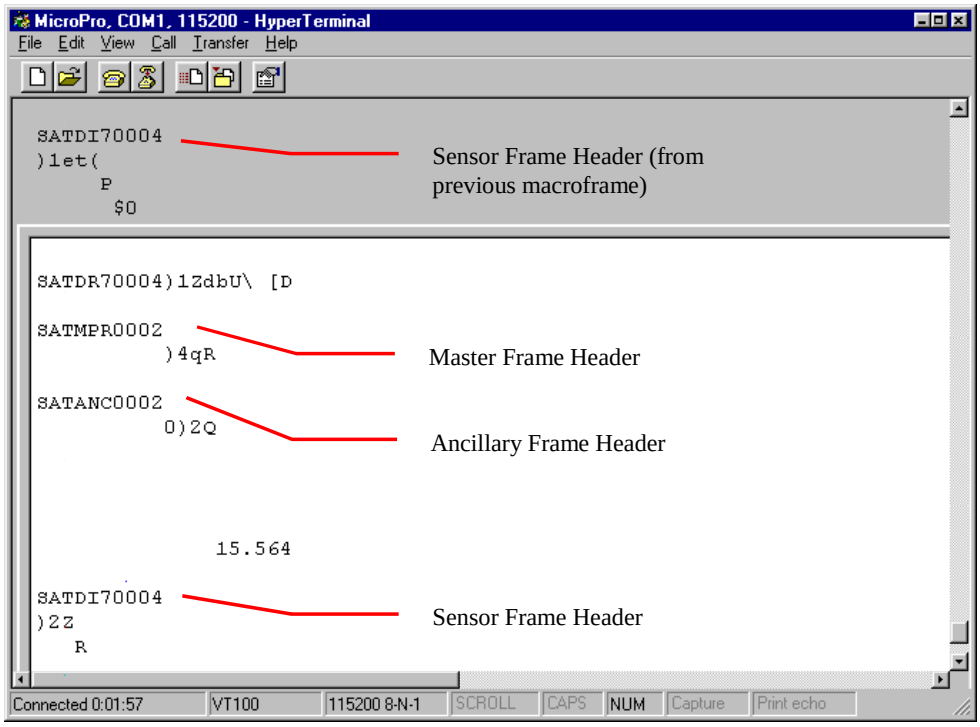
The phone number dialog box will then open. HyperTerminal is biased towards telephone and modem based connections, but for the HyperPro a direct connection is required. We need to avoid any automatic search by the program for a modem and select a direct COM port connection. Below we see that Com 1 has been selected.



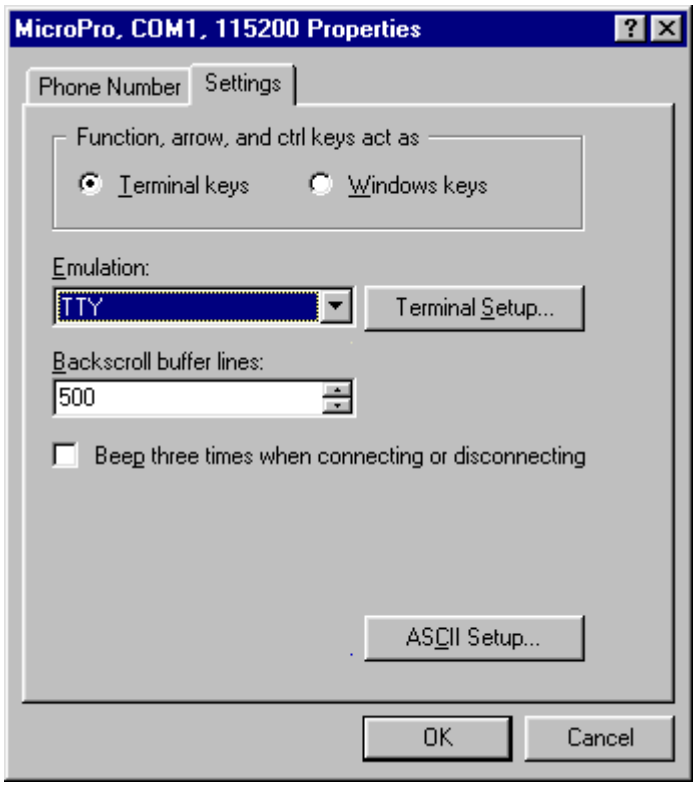
Finally HyperTerminal will ask for the asynchronous serial port communication parameters that will be used in the connection. This is shown in the COM1 Properties dialog box (below). The properties required for the HyperPro are as follows: 57600 bits per second, 8 data bits, no parity, 1 stop bit, and no flow control. You do not need to use the *Advanced* button in this dialog box (if present).



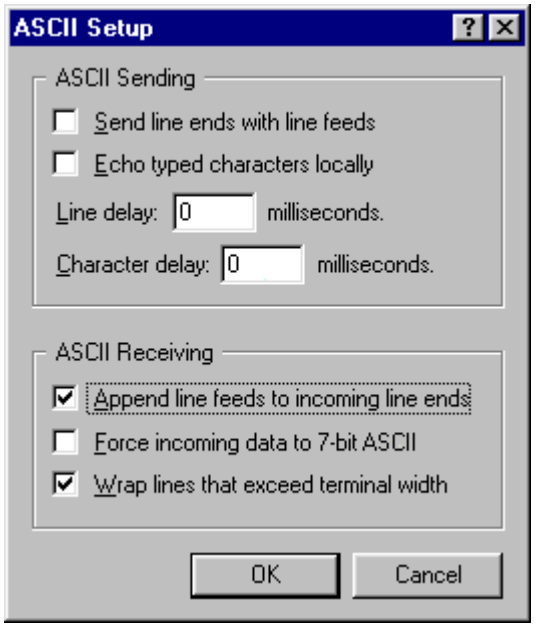
After completing this dialog and pressing the OK button, HyperTerminal's main window will be displayed, as shown below. If the HyperPro has been assembled correctly and is turned on, the output telemetry stream should now be visible, as shown.



At this point the connection will be established and it should be possible to see telemetry from the HyperPro. However, the configuration process is not yet complete. The program is currently configured to auto-detect the type of terminal that it should be emulating. This is inappropriate for use with the HyperPro and may cause problems. To correct this, from the **File** menu you should click the **Properties** selection and change the terminal type. Select the **Settings** tab of the dialog box and change the **Emulation** from **Auto Detect** to **TTY** as shown. Setting the emulation type to **VT100** also works well.



If the HyperPro has been set up properly, when you press the OK button you see telemetry as shown in the previous figure. Notice that the master, ancillary, and sensor headers are all visible. Sometimes you will not be able to see some or all of the headers; this is often due to carriage return characters being present in the data frame, causing HyperTerminal to overwrite the headers. Occasionally simply changing the emulation type to something else (such as VT100 instead of TTY) alleviates the problem. If not, you can also append line feeds to incoming line ends. From the same window where the emulation type was set, press the **ASCII Setup** button. Check the box that says "Append line feeds to incoming line ends", as shown below. This should allow you to easily see most headers.



Troubleshooting for Hardware Problems

If, after running Hyperterminal, telemetry is not visible in the HyperTerminal window, there could be a hardware problem. The connections can be checked and voltage checks can be conducted on the cables and components, as outlined below. To check voltages, a multimeter with DC voltage measurement, resistance measurement, and continuity check capability is required.

WARNING! *While checking voltages, extreme care should be used so as not to short the probe leads. A shorted power supply or battery can output many amperes of current, potentially harming the user, starting fires, or damaging equipment.*

CHECK CONNECTIONS

Procedure

1. Ensure power/telemetry cable is properly connected to MDU-100 and to HyperPro main housing.
2. Ensure all sensor interconnect cables are in place and properly connected.
3. Ensure power supply is properly connected to the MDU-100.
4. Ensure RS-232 cable is connected to the correct PC communications port (COM1 in the example given) and to the MDU-100.
5. Ensure no other programs are running that could be using the communications port.

CHECK THE SUPPLY VOLTAGE TO THE MDU-100

The MDU-100 deck unit is essentially a DC-DC converter. An input voltage in the range of 10 - 20 Vdc is converted to a regulated 48 Vdc. Voltages above the maximum input voltage of 20 Vdc may damage the MDU-100; voltages below the minimum operating voltage of 10 Vdc may cause the device to drop out of regulation. Thus the user should ensure the voltage input to the MDU-100 is within the allowed range of 10 - 20 Vdc.

Procedure

1. Set the multimeter to measure a DC voltage.
2. If using a battery as the power source, measure the voltage directly at the battery terminals with the multimeter. A new or fully charged 12 V battery usually measures in the 13 - 15 V range. If the voltage is low (under 11 V) then recharge or replace the battery. If using a DC power supply, set the output voltage in the range from 10 - 20 V, and check the voltage with the multimeter.
3. Connect the power supply cable to the power source.
4. **Being extremely careful not to short the probe leads**, measure the voltage between pins 1 and 2 on the IL-2F connector (on the supply cable). It should read approximately the same as the measurement taken in step 2. If the voltages are not the same, recheck the power supply cable connections. If they are still not the same, there is likely a break in the cable that requires repair (a wire break can be confirmed with a *continuity check*).
5. If the voltage is ok, connect the power supply cable to the MDU-100.
6. Again measure the voltage at the power supply terminals. The voltage should remain approximately the same as before, although there may be a small voltage drop when using a battery (battery voltage drops under load). If there is a significant voltage drop, disconnect the power immediately and check for shorts in the cable.

CHECK THE OUTPUT VOLTAGE FROM THE MDU-100

To check the output voltage from the MDU-100, a multimeter, as described above, is required. As previously mentioned, the MDU-100 outputs a regulated 48 Vdc (nominal) voltage. Use the following procedure to check this voltage.

Procedure

1. Set up the MDU-100 input power as outlined in the **MDU-100 Input Voltage Check** section.
2. Ensure the multimeter is configured to measure DC voltage.
3. **Being extremely careful not to short the probe leads,** insert the negative (black) probe lead in Pin 2 and the positive (red) probe lead in Pin 1 of the BH-4F connector on the MDU-100. The measurement should read approximately +48 Vdc. If it does, the MDU-100 is operating properly. If it does not, check all input connections to the MDU-100, and recheck the voltage. Also ensure that you are measuring between pins 1 and 2, and that the probe leads are making contact with the pin metal. If you still do not measure 48 V, the MDU-100 may need to be returned to Satlantic.

CHECK CABLES CONTINUITY

Often, system problems can be traced to cable breaks or shorts. Usually, these cable failures are a result of improper handling or storage. Cable continuity can be checked as outlined below. All cables should be disconnected from the instrument when performing these tests.

Note: All Satlantic cables used in the HyperPro are one-to-one, that is, pin 1 on the connector on one end of the cable is connected to pin 1 on the connector on the other end of the cable. On the power-telemetry cable, there is a 6-pin female connector on one end and a 4-pin male connector on the other. The unused pins on the 6-pin (pins 5 and 6) are simply not connected.

Procedure

1. Set the multimeter to measure continuity. The resistance measurement setting can also be used.
2. Check for continuity by measuring from pin 1 on one end of the cable to pin 1 on the other end. The meter should confirm that the connection is continuous by either giving an audible signal or measuring a low resistance. If there is not continuity, there is a break in the cable, requiring repair.
3. Repeat step 2 for all pins in the cable.
   Check for shorts from pin 1 to all other pins by keeping one probe lead on pin 1 and touching the other probe lead to each of the other pins in the same connector in turn. All pins should be isolated from each other. The meter should read this as open or measure a very high resistance. If any of the pins are not isolated, there is a short in the cable that requires repair.

G. WARRANTY

Warranty Period

The HyperPro is under *one-year* parts and labour warranty from date of purchase.

Restrictions

Warranty does not apply to products that are deemed by Satlantic to be damaged by misuse, abuse, accident or modifications by the customer. The warranty is considered void if any optical or mechanical housing is opened. In addition, the warranty is void if the warranty seal is removed, broken or otherwise damaged.

Provisions

During the one year from date of purchase warranty period, Satlantic will replace or repair, as deemed necessary, components that are defective, except as noted above, without charge to the customer.

Returns

To return products to Satlantic, whether under warranty or not, contact Satlantic, Customer Support Department and request a Returned Material Authorization (RMA) number and provide shipping details. All claims under warranty must be made promptly after occurrence of circumstances giving rise thereto and must be received by Satlantic within the applicable warranty period. Such claims should state clearly the product serial number, date of purchase (and proof thereof) and a full description of the circumstances giving rise to the claim. All replacement parts and/or products covered under the warranty period become the property of Satlantic Inc.

Liability

IF THE HYPERPRO SHOULD BE DEFECTIVE OR FAIL TO BE IN GOOD WORKING ORDER THE CUSTOMER'S SOLE REMEDY SHALL BE REPAIR OR REPLACEMENT AS STATED ABOVE. IN NO EVENT WILL SATLANTIC INC. BE LIABLE FOR ANY DAMAGES, INCLUDING LOSS OF PROFITS, LOSS OF SAVINGS OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING FROM THE USE OR INABILITY TO USE THE HYPERPRO OR COMPONENTS THEREOF.

H. CONTACT INFORMATION

If you have any problems, questions, suggestions or comments about the instrument or manual, please contact us.

Location

Satlantic Inc.
Richmond Terminal, Pier 9
3481 North Marginal Road
Halifax, Nova Scotia
B3K 5X8 Canada

PHONE: (902) 492-4780
FAX: (902) 492-4781.

Email: info@satlantic.com
Web: http://www.satlantic.com

Business Hours

Satlantic is normally open for business between the hours of 9:00 AM and 5:00 PM Atlantic Standard Time. The Atlantic Standard Time zone is one hour ahead of the Eastern Standard Time zone. Normally, in the winter, AST is UTC-4, but it changes to UTC–3 during the daylight saving time period in the summer. Daylight saving time is in effect from 2:00 AM on the first Sunday in April until 2:00 AM on the last Sunday in October.

Satlantic is not open for business during Canada's statutory holidays, which are as follows:

- New Year's Day — January 1st
- Good Friday — The Friday before Easter Sunday (Easter Sunday is the first Sunday after the full moon on or following March 21st , or one week later if the full moon falls on Sunday)
- Victoria Day — The first Monday before May 25th
- Canada Day — July 1st
- Halifax Natal Day — The first Monday in August
- Labor Day — The first Monday in September
- Thanksgiving Day — The second Monday in October
- Remembrance Day — November 11th
- Christmas Day — December 25th
- Boxing Day — December 2