Operation Manual for the OCR-504

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Operation Manual For: OCR-504
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A - OVERVIEW

Purpose

The OCR-504 Multispectral Radiometer is a member of Satlantic's line of micro-sensor instruments. The OCR-504 is a fully digital optical sensor package that combines precision optics and high performance microelectronics.

Background

The OCR-504 is a complete stand-alone instrument capable of generating spectral records of light collected in an ocean environment. The OCR-504 utilizes four customer-defined discrete optical wavelengths, selected from Satlantic's standard list. Two standard, non-isolated, telemetry (data) interfaces are provided. Each interface uses a different transmission medium. The RS-232 interface provides transmit and receive capabilities while the RS-422 interface is transmit-only. A non-isolated RS-485 interface is also provided for operating the instrument in a SatNet network environment. The OCR-504 must be powered from a +6 to +22 VDC supply voltage range (25mA nominal current draw). Instrument telemetry, which is transmitted from the instrument during normal operation, is compliant with the *Satlantic Data Format Standard*[1]. The format of the telemetry is dependent on the instrument configuration.

Features

- Compact size
- Light weight
- Low power consumption
- Minimal amount of support equipment required
- Stand-alone or SatNet Network capable operation
- Corrosion proof housing
- Easy to use

[1] For more information in this data format, refer to the *Instrument File Standard* document available from Satlantic.

OCR-504 Configurations

All OCR-500 series instruments are defined using a model numbering system. These numbers are composed of three fields containing four selectors, and have the following format:

`OCR-50x-tffm`

Where:

x NUMBER-OF-CHANNELS
- 4 (four channel radiometer)
- 7 (seven channel radiometer)

t TYPE-OF-RADIOMETER
- I (Irradiance)
- R (Radiance)
- I/R (coupled Irradiance and Radiance)

ff FIELD-OF-VIEW
- 10 (10 degrees half-angle)
- CS (cosine)

M MEDIA
- A (Air)
- W (water)

For example, an *OCR-504-R10W* is an OCR-500 series instrument with four radiance channels, each with a 10° half-angle FOV (Field-Of-View) and is intended for in-water use.

Please note that not all OCR-504 models are physically equivalent. Several different configurations have been developed, and are detailed in the following sections.

Standard OCR-504

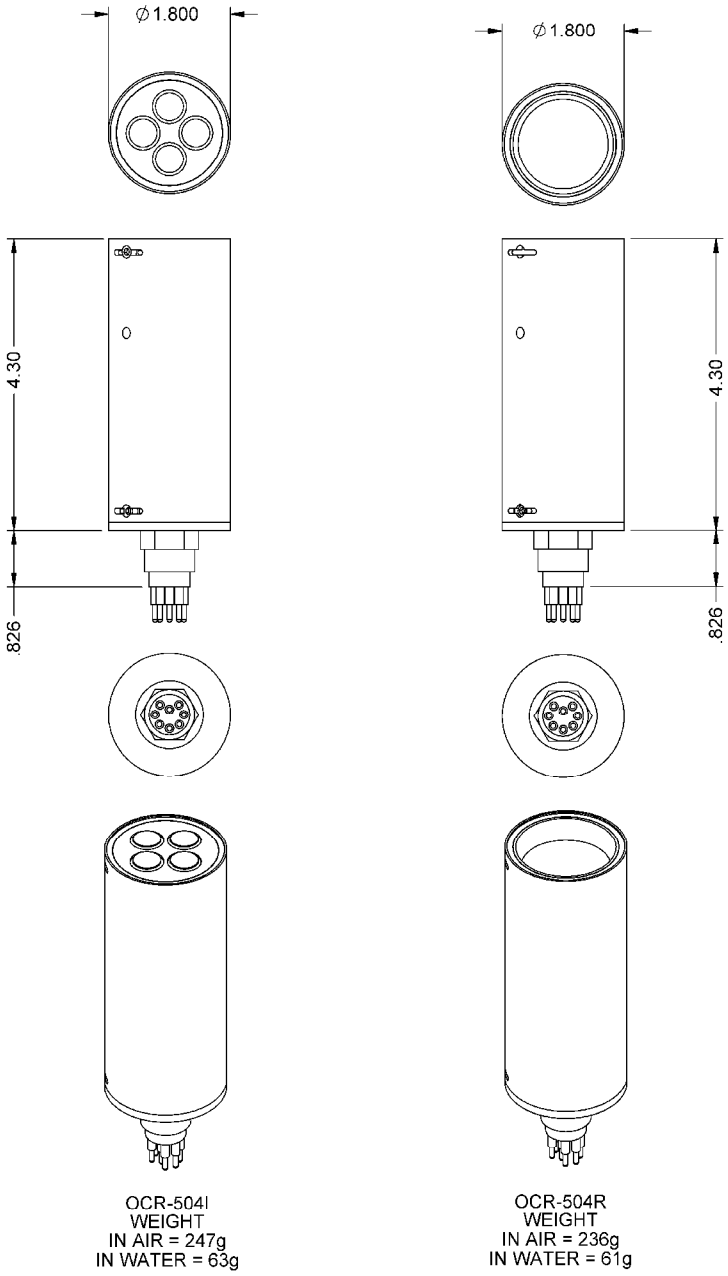

Figure 1 - Standard OCR-504 Configurations

The standard OCR-504 irradiance and radiance configurations are shown in Figure 1 (dimensions are in inches). In-air and in-water weights are approximate. The housing is constructed from Acetron® GP and has a depth rating of 200 m.

This configuration uses a Subconn MCBH8M connector. Figure 2 illustrates the connector pin configuration.

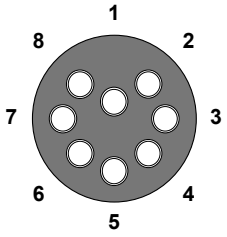

Figure 2 - Subconn® MCBH8M Male Face View

These pins are designated as follows:

Pin	Identification	Description
1	V+	DC Power Supply (6 to 22 Volts)
2	V-/SG	Power Supply Return / Signal Ground
3	TA	RS-422 Telemetry Interface (Transmit A). Balanced differential serial data from instrument to computer.
4	TB	RS-422 Telemetry Interface (Transmit B). Balanced differential serial data from instrument to computer.
5	Tx	RS-232 Telemetry Interface. Serial data from instrument to computer.
6	Rx	RS-232 Telemetry Interface. Serial data from computer to instrument.
7	NA	RS-485 SatNet™ Network Interface (A)
8	NB	RS-485 SatNet™ Network Interface (B)

Note: Some OCR-504 instruments have been retrofitted with a six-pin configuration for use in older systems. In these cases, the TA and TB signals are replaced with NA and NB.

Deep OCR-504ICSW

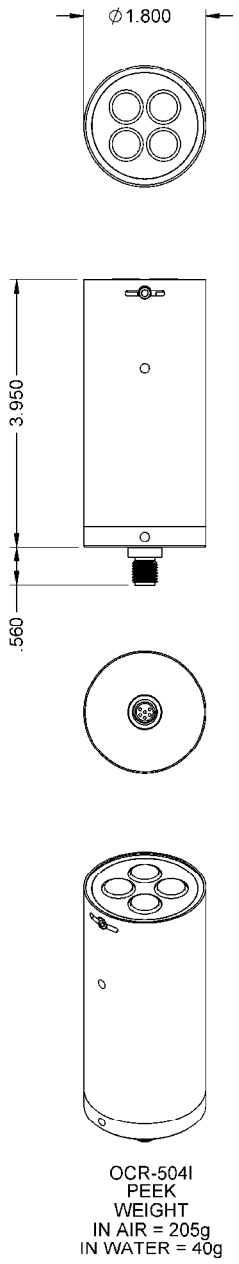

Figure 3 - Deep OCR-504ICSW

The deep version of the OCR-504ICSW is shown in Figure 3 (dimensions are in inches). The in-air and in-water weights are approximate. The housing is constructed from PEEK plastic and has a depth rating of 2000 m. This configuration is typically used with autonomous profiling floats.

This configuration uses a TELEDYNE-IMPULSE IE55-1206-BCR connector. Figure 4 illustrates the connector pin configuration.

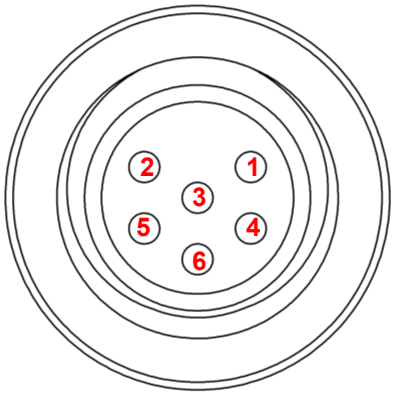

Figure 4 - TELEDYNE-IMPULSE IE55-1206-BCR

The pins are designated as follows:

Pin	Identification	Description
1	V-/SG	Power Supply Return / Signal Ground
2	Rx	RS-232 Telemetry Interface. Serial data from computer to instrument.
3	NC	Not internally connected
4	V+	DC Power Supply (6 to 22 Volts)
5	Tx	RS-232 Telemetry Interface. Serial data from instrument to computer.
6	NC	Not internally connected

Please note that the SatNet interface is not normally provided in this configuration.

AUV OCR-504ICSW

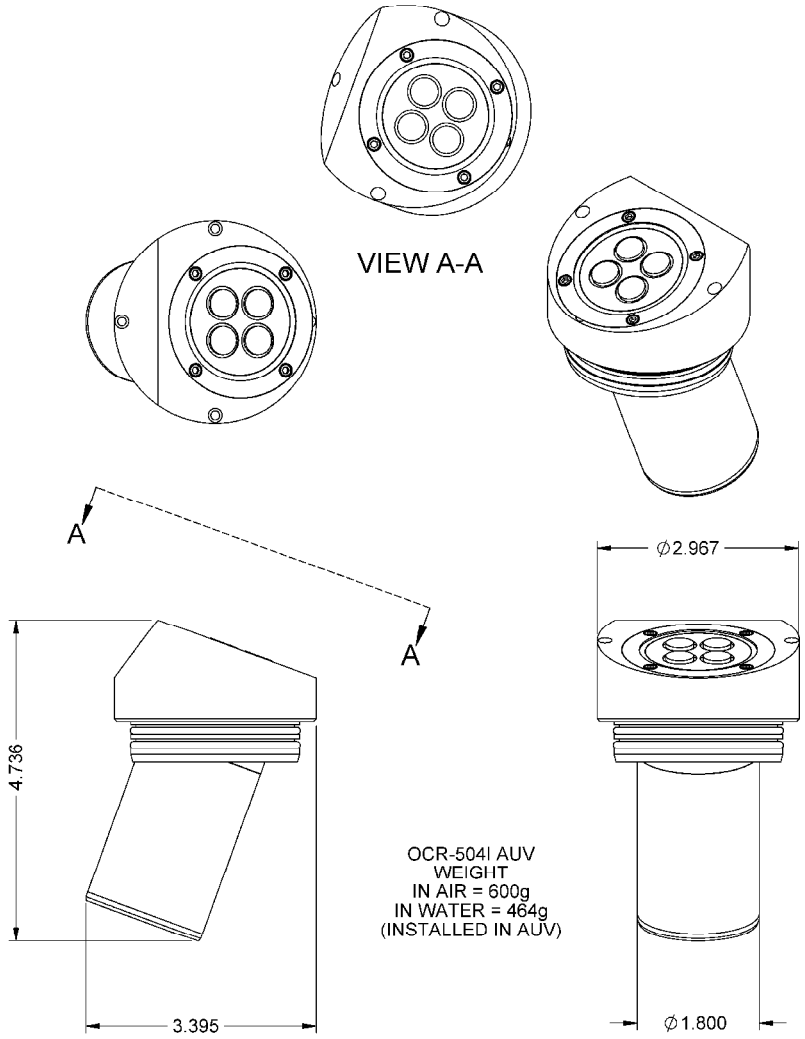

Figure 5 - AUV OCR-504ICSW

The AUV version of the OCR-504ICSW is shown in Figure 5 (dimensions are in inches). The in-air and in-water weights are approximate. The housing is constructed from anodized aluminum and has a depth rating of 1000 m. This configuration is typically used with Autonomous Underwater Vehicles, primarily gliders. The sensor is mounted in the glider science bay at an angle such that the optics are pointed straight up during ascent (or descent).

As the sensor extends into a watertight science bay, this configuration is normally provided with a potted wiring harness to provide power to the sensor and allow RS-232 communication with the sensor. The table below maps wire colour to function.

Wire Colour	Identification	Description
RED	V+	DC Power Supply (6 to 22 Volts)
BLACK	V-/SG	Power Supply Return / Signal Ground
GREEN	Tx	RS-232 Telemetry Interface. Serial data from instrument to computer.
BLUE	Rx	RS-232 Telemetry Interface. Serial data from computer to instrument.

When the sensor is used with the TELEDYNE WEBB RESEARCH Slocum Glider, a custom wiring harness (approximately 10” length) is provided:

Pin	Wire Colour	Identification	Description
Connector: Molex 22-01			
1	BLACK	V-/SG	Power Supply Return / Signal Ground
2	RED	V+	DC Power Supply (6 to 22 Volts)
Connector: Molex 35507-0500			
1	BLACK	V-/SG	Power Supply Return / Signal Ground
2	BLUE	Rx	RS-232 Telemetry Interface. Serial data from computer to instrument.
3	GREEN	Tx	RS-232 Telemetry Interface. Serial data from instrument to computer.
4	-	-	Not used
5	-	-	Not used

Integrated OCR-504 Configurations

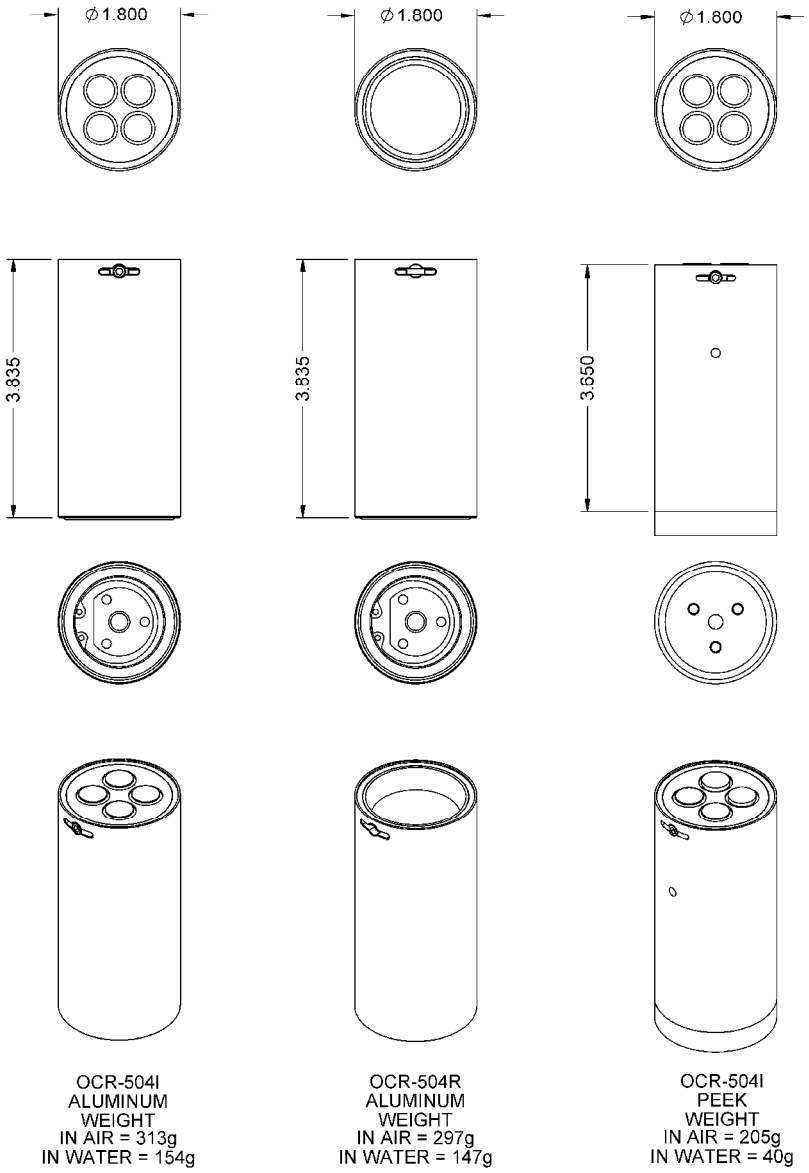

Figure 6 - Integrated OCR-504 Configurations

Several versions of the OCR-504 that have been integrated with other systems are shown in Figure 6 (dimensions are in inches). In-air and in-water weights are approximate. The three configurations shown have a depth rating of 2000 m.

As these sensors are normally mechanically integrated with other pressure vessels, they are normally provided with a potted wiring harness to provide power to the sensor and allow RS-232 communication with the sensor. The table below maps wire colour to function.

Wire Colour	Identification	Description
RED	V+	DC Power Supply (6 to 22 Volts)
BLACK	V-/SG	Power Supply Return / Signal Ground
GREEN	Tx	RS-232 Telemetry Interface. Serial data from instrument to computer.
BLUE	Rx	RS-232 Telemetry Interface. Serial data from computer to instrument.

Termination of the wire harness on a customer-specified connector may be available on request.

Specifications for Irradiance Configuration - Nominal Characteristics

Spatial Characteristics:

- Field of view: cosine response (spectrally corrected)
- Collector area: 86.0 mm^2
- Detectors: custom 17 mm^2 silicon photodiodes

Spectral Characteristics:

- Bandwidth range: 400-700 nm (standard - custom also available)
- Number of channels: 4
- Spectral bandwidth: 10 nm or 20nm
- Filter type: custom low-fluorescence interference

Optical Characteristics:

- Cosine response: within 3% 0°– 60° / within 10% 60°– 85°
- Typical NEI: $2.5x10^{-3}$ uW cm^{-2} nm^{-1}

Operating Characteristics:

- Operating temperature: -4 to +40 C

Specifications for Radiance Configuration - Nominal Characteristics

Spatial Characteristics:

- Field of view: 10°
- Detectors: custom 13 mm^2 silicon photodiodes

Spectral Characteristics:

- Bandwidth range: 400-700 nm (standard - custom also available)
- Number of channels: 4
- Spectral bandwidth: 10 nm or 20nm
- Filter type: custom low-fluorescence interference

Optical Characteristics:

- Out of band rejection: 10^{-6}
- Out of field rejection: $5x10^{-4}$
- Typical NER: $300x10^{-6}$ uW cm^{-2} nm^{-1}

Operating Characteristics:

- Operating temperature: -4 to +40 C

B - SAFETY & HAZARDS

Personal Safety

- The operators 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 when not in use. Direct sunlight can increase the internal temperature of the instrument beyond its maximum rating.
- Do not leave an in-water instrument unattended. Boat drift can entangle the cable and cause damage or instrument loss.

Cable

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

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 Subconn® connectors. Connectors should be free of dirt and lightly lubricated before mating. Satlantic recommends using DC-111 silicone grease (made by Dow-Corning®) on the male pins prior to connection.

Troubleshooting

- While checking voltages with a multimeter, extreme care should be used to not 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 instrument 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.
- Be sure to rinse seawater from the instrument with fresh water prior to storage. Corrosion resulting from failure to do so is not covered under warranty.

C - START UP

Assembly Procedure

PREPARATION

Your OCR-504 Multispectral Radiometer is a simple instrument to setup and operate. The instrument may be operated as a stand-alone device or in a networked environment as part of a larger system. Generally, requirements for operation are the same for both of these operating modes, although a networked environment may impose additional requirements. You will need the following items:

- DC power source. Refer to the specifications in section ***A - OVERVIEW*** for the power requirements of your instrument's configuration.
- Computer with a free serial communications port for telemetry acquisition.
- Power/Telemetry and/or Network interface cables (may be provided).
- Data acquisition and processing software compliant with the *Satlantic Data Format Standard*[1] (may be provided).
- The instrument's *calibration file*[2] (provided).

If you are not using your instrument in an embedded system, or you do not have your own data acquisition software, you may use the software provided by Satlantic. Two applications[3], *SatView* and *SatCon*, are available to you for any PC running Windows®[4] 95/98/NT/2000/XP. Both applications are compliant with the Satlantic Data Format Standard. SatView is a data acquisition and real-time display application. SatCon is a post processing application for telemetry logged with SatView.

Note that it is not necessary to use the software mentioned above to log the instrument telemetry. Any properly configured terminal emulator can serve this purpose. However, you will need the proper software to interpret any of the data.

In any case, there are a few standard communications settings needed for any computer application communicating with the instrument. All serial transmissions use 1 start bit, 8 data bits, 1 stop bit, and no parity. No flow control of any kind is used. Make sure that your software is configured with the baud rate specified for your instrument. These settings apply to both the RS-232 and RS-422 telemetry interfaces. For most applications, the default telemetry baud rate is 57600 bps.

[2] For more information on calibration files, refer to the *Instrument File Standard* document available from Satlantic
[3] For more information on these applications, refer to the user's manuals distributed with the software.
[4] Windows is a registered trademark of Microsoft Corporation.

IMPORTANT! Both the RS-232 and RS-422 telemetry interfaces transmit the same information. The RS-232 interface provides bi-directional communication while the RS-422 is transmit-only. Normally, the RS-232 interface is used for configuring and testing your instrument. The RS-422 interface would normally be used for telemetry acquisition in the field using longer cables. Most computer serial interfaces are RS-232. Therefore, if you are using the RS-422 interface on the instrument, a converter will be required to convert the output from the instrument to levels compatible with your computer. In most cases, only one of these telemetry interfaces is provided on a cable.

CONNECTING THE COMPONENTS

When making connections, proper alignment on the connector pins is critical to avoid damage. Visually ensure that the pins on the male connectors are properly aligned with (and partially seated into) the sockets on their female counterparts before pushing them together for final connection. Finally, ensure that the locking sleeve or locking strap is securely fastened after connection.

The following is a generic step-by-step procedure for setting up your OCR-504 Multispectral Radiometer. You may use this procedure with any Satlantic approved interface cable:

1. Ensure that, initially, the instrument is completely disconnected from the power supply.
2. Ensure that the power supply is setup for the proper voltage.
3. If possible, turn off the power supply.
4. Mount the instrument in the desired position.
5. Connect the instrument side of the interface cable to the bulkhead on the instrument.
6. Connect the telemetry-output side of the interface cable to the serial interface of the computer. Use an appropriate level converter if needed.
7. Configure any software for use with the instrument.
8. Remove the protective cover from the end of the OCR-504.
9. Connect the power-input side of the interface cable to the power supply.
10. Apply power to the instrument (turn on the power supply).

Once your OCR-504 has been properly connected and power has been applied, an initialization sequence will begin automatically to ready the device for normal operation. This sequence takes approximately 4 seconds to complete. Once finished, the instrument should begin normal operation. See the ***Conducting a Telemetry Test*** section below to make sure that your instrument is working properly. If this does not happen, remove power from the instrument and repeat the connection sequence. If you are still experiencing problems, contact a Satlantic customer service representative for assistance.

See section ***D - OPERATION*** for more information on operating your instrument.

See section ***F - RECOVERY*** for information on recovering and disconnecting your instrument after use.

NETWORK ASSEMBLY

The OCR-504 is capable of functioning as a stand-alone instrument or as one node in a network of other SatNet™ network capable instruments. Networking the instruments effectively allows one instrument (the *Network Master*[5]) to share its telemetry interface with all instruments in the network. In this way, only one serial connection is needed for an array of instruments. Alternatively, if these instruments were all operating independently, each one would require a dedicated serial port on the data acquisition computer.

OCR-504 instruments use a proprietary Satlantic networking protocol known as SatNet™. To create a SatNet™ network, all devices must be compliant with the protocols and at least one must be Network Master capable. One and only one instrument may behave as the Network Master at a time. This instrument, during normal operation, will be the only one with a useable telemetry interface**. OCR-504 instruments are NOT Network Master capable**.

If you are using your OCR-504 in a networked environment, the assembly procedure is a little more complex than the steps stated above. There are many possible physical configurations for networked instruments, so exact assembly procedures cannot be defined here. However, some basic tenets still hold true. Use the procedures stated in the previous section for mounting your instrument and connecting/disconnecting power. In most cases, Satlantic will provide you with the necessary cables and assembly instructions for connecting your instruments. The cables must ensure that the NA and NB pins of all networked devices are connected to each other. See section ***D - OPERATION*** for more information on operating your instrument in a network.

Conducting a Telemetry Test

Before using any instrument in the field, a simple telemetry test should be conducted to ensure that the instrument is functioning properly. This is also a good way to familiarize yourself with the software used with the instrument. The best way to conduct this test is to use SatView with the .sip (Satlantic Instrument Package) file provided with your instrument. A sip file is simply a binary file in zip format that contains a set of calibration and/or telemetry definition files. Setup SatView as described in the manual or on-line help. Next, complete the ***Assembly Procedure*** described above and ensure that SatView is receiving telemetry.

For a more comprehensive test, you will need to check the instrument status more thoroughly to ensure the telemetry received by SatView is correct. Below are a few guidelines to help you with the test:

[5] A Network Master is a Type A compliant SatNet™ device configured to operate as a master during network operation. See the operation manual of your Network Master device for more information.

- Enable SatView's *Frame Counter* and *Check Sum* error checking to confirm that the data integrity is stable.
- Look at the spectral output to make sure there are no glaring errors in the data, i.e. unexpected peaks and valleys in the spectrum.
- Look at the spectral output under varying light conditions to make sure the spectrum is adjusting accordingly.
- Log a few minutes of telemetry and process the log file with SatCon. Check for errors in the data and consistency in the optical sensor values.

This test assumes that the instrument(s) you are testing are operating with *free-running* telemetry. This means that telemetry from the system is broadcast on a continuous basis. See section ***D - OPERATION*** for more information on controlling your instrument's telemetry output.

Once you are satisfied that the instrument(s) are working correctly, the next step is to deploy it for fieldwork. Otherwise, if you are experiencing any problems receiving telemetry, see section ***G - MAINTENANCE*** for information on troubleshooting your instrument. If you are still experiencing problems, contact a Satlantic customer service representative for assistance.

D - OPERATION

To begin operation of your instrument, complete the ***Assembly Procedure*** described in section ***C - START UP***. Once power is applied, instrument operation begins automatically. The OCR-504 can operate in one of two primary operating modes – Autonomous or Network Operation. These operating modes are collectively called *normal operation* and are described in detail below. The instrument's configuration and physical environment determine which mode the instrument will operate in. This is done during the initialization sequence, which begins immediately after power is applied to the instrument. Once the initialization sequence completes, normal operation begins. This will continue until power is removed or the instrument is reset.

Initialization Sequence

Once power is applied to the OCR-504, the instrument begins a four-second window of operation called the initialization sequence. During this time, the on-board electronics are powered up, checked, and readied for operation. If the *silent mode configuration parameter*[6] is disabled, a start-up banner will be output on the telemetry interface, similar to the one shown below:

```
Satlantic OCR-504 Multispectral Radiometer
Copyright (C) 2011, Satlantic Inc. All rights reserved.
Firmware version: 5.1.0 - SatNet Type B
Instrument: SATDI4
S/N: 0001

Reset Source: Power
Press <Ctrl+C> for command console.
Initializing system. Please wait...
```

This banner is a simple text message that can be viewed in a terminal emulator. See section ***E - CONFIGURATION*** for more information on setting up a terminal emulator to monitor output from the telemetry interface.

The first section of the banner identifies the instrument. Specifically, the first line identifies the instrument type, OCR-504 Multispectral Radiometer. The firmware (or microcontroller software) version is identified on the third line. This line also defines the SatNet™ compliance used by the instrument. *Type A* compliance uses a dual processor control system capable of operating as a Network Master. *Type B* compliance is a smaller, single processor system without Network Master capabilities. The next two lines define the instrument type identifier and serial number used at the beginning of a telemetry frame. See the ***Telemetry Format*** section below for more information on the instrument's telemetry frames.

The next section of the banner gives additional information related to the initialization sequence. The first line identifies the mode in which the system was initialized. *Power* indicates that the instrument began operation after

[6] Configuration parameters are discussed in detail in section ***E - CONFIGURATION***.

power was applied. *Software* indicates that a *reset* command was issued to the instrument to reboot itself. *External* may mean that a brown out (or brief interruption in power input) occurred and the processor reset itself.

The next line of this section gives instructions on how to access the ***Command Console***. In most cases, the command console would be accessed during normal operation. If this is done during the initialization sequence, the instrument will be forced into autonomous operation before the console is displayed. This gives the ability to break into the command console even if the instrument is configured to run in a network. Note that the command console is not displayed until the initialization sequence completes. See section ***E - CONFIGURATION*** for more information on accessing and using the command console.

Once the initialization sequence has finished, normal operation begins. If silent mode is disabled, one of the following messages will be output, depending on which operating mode is enabled.

```
Autonomous operation enabled.
```

or

```
Network operation enabled.
```

Autonomous Operation

Autonomous, or stand-alone, operation for the OCR-504 is defined as the continuous operation of the instrument outside the scope of a network. This is the default mode of operation for the instrument. Autonomous operation uses only the telemetry interface for communication and telemetry output. The network interface is disabled.

During autonomous operation, the default behavior of the instrument is to continually sample its optical sensors and output telemetry on the RS-232 and RS-422 telemetry interfaces. When the instrument is used in the field, this telemetry would be collected and saved to a storage medium. Generally, a data acquisition application like SatView would be used. If you are using your OCR-504 in an embedded system, another mode of telemetry acquisition may be more appropriate. When telemetry output is free-running, as described above, no user input is required to operate the instrument.

However, telemetry output can also be controlled with simple commands sent to the instrument through the telemetry interface. As this involves two-way communication, only the RS-232 telemetry interface can be used. These commands are simple one-byte transmissions. In an embedded or larger scale system, the data acquisition software could use this feature to finely control telemetry output and instrument operation. These commands can also be sent directly by the user with a terminal emulation program, as discussed in section ***E - CONFIGURATION***.

The following table defines these command bytes and their effect on the instrument. All commands, which are standard with all SatNet™ compliant instruments, are ASCII control characters. They are not echoed back so if you are using a terminal emulator to send these commands, you will not see any command values on the screen. For example, in a terminal emulation

program, you would use the <Ctrl+C> command to access the command console. To do this, press and hold the Ctrl key followed by the C key. This is the same as sending the hexadecimal equivalent byte “03” to the instrument over the telemetry interface. This number is also indicated in the table.

Command	Hex	Description
<Ctrl+C>	03	This command interrupts normal operation of the instrument and invokes the ***Command Console***. See section ***E - CONFIGURATION*** for more information.
<Ctrl+S>	13	This command stops *free-running* telemetry output, enabling *polled* telemetry output.
<Enter> or <SPACE>	0D or 20	If the instrument is running with *polled* telemetry output, either of these commands will force the instrument to sample its sensors and return a telemetry frame.
<Ctrl+A>	01	This command stops *polled* telemetry output, enabling *free-running* telemetry output.
<Ctrl+P>	10	This command powers down the operational components of the instrument. This may reduce the instrument’s total power consumption, as any electronics associated with sensor operation will be turned off, if possible. The instrument is otherwise fully operational, so communication is still possible. When operational components are powered down, telemetry output is disabled, regardless of the telemetry output mode.
<Ctrl+U>	15	This command returns power to the operational components of the instrument if they were previously powered down. Telemetry output will resume based on the current telemetry output mode.
<Ctrl+R>	12	This command forces the instrument to reset itself. After a few seconds, the instrument will reboot and the initialization sequence will begin again.

With the exception of the <ENTER> and <SPACE> commands, repeatedly sending a command will have no effect. For example, you cannot power down operational components more than once.

The free-running and polled telemetry output modes described above are sub-modes of normal operation. When the instrument is free-running,

telemetry frames are output from the instrument according to the *maximum frame rate* configuration parameter.

Network Operation

Network operation for the OCR-504 is defined as continuous operation of the instrument within the scope of a SatNet™ network. Furthermore, standard network operation means that the instrument is **not** operating as a Network Master device. While operating in this mode, only the network interface is used for communication. The telemetry interface is disabled.

To enable network operation, a number of criteria must be met; otherwise operation will default to running autonomously. First, the *network mode* configuration parameter must be enabled. Secondly, the network interface pins, NA and NB, must be physically connected to another SatNet™ instrument operating as a Network Master device. These first two conditions will ensure that network operation is invoked. However, to ensure proper operation of the network, additional criteria must be adhered to. Namely, the *network baud rate* configuration parameter must be set to the same baud rate as the Network Master. Finally, the *network address* configuration parameter must be unique to all other instruments in the network.

During network operation, the OCR-504 is completely controlled by the Network Master. All communication is relayed through the network between the Network Master and the other instruments running in network operation mode. Instead of sending a telemetry frame through the telemetry interface, as is done in autonomous operation, each instrument sends its telemetry through the network interface to the Network Master. The Network Master then channels the telemetry through its telemetry interface where it can be collected by a data acquisition system.

The only way to gain control access of an instrument running in network operation mode is through the telemetry interface of the Network Master. A Network Master has a set of commands for controlling telemetry similar to that of an instrument running autonomously. These commands can also control other instruments in the network. For more information on the Network Master and its operational command structure, refer to the operating manual of your Network Master device.

While operating in a network, the OCR-504 accepts commands only from the Network Master. At the Network Master's discretion, instruments are either commanded to sample their sensors and compose a telemetry frame, or free run at their own frame rate setting. Instead of sending the telemetry frame through the telemetry interface, as is done in autonomous operation, each instrument sends its telemetry through the network interface to the Network Master. The Network Master then channels the telemetry through its telemetry interface where it can be collected by a data acquisition system.

Telemetry Format

The telemetry format for the OCR-504, as with all Satlantic instrumentation, follows the Satlantic Data Format Standard. This standard defines how Satlantic telemetry can be generated and interpreted. For every sample taken of the instrument's sensors, the instrument will compose and transmit one frame of telemetry containing all the relevant sensor information for that sample. The instrument's calibration file defines the specific format of this frame, including the center wavelengths represented by the optical channels. The format is the same for autonomous and network operation. The format of the telemetry frame varies depending on the sensor type (irradiance or radiance, as defined by the factory-configured *sensortype* parameter) as well as the *frametype* and *usecal* configuration parameters. These formats are described in the following sections. Please note that with the exception of the standard binary telemetry format, the telemetry formats described below are only available with firmware version 5.1.0 and later.

BINARY TELEMETRY

This is the standard telemetry frame format. Data is presented in a fixed-length binary format, with optical data provided as raw ADC counts.

Relevant configuration parameters:

frametype: binary

usecal: off

Field Name	Field Size (bytes)	Description
Instrument	6	A unique 6 character AS formatted string denoting the start of a frame of telemetry. For irradiance sensors, the instrument string is "SATDI4"; for radiance sensors, the string is "SATDR4".
Serial Number	4 (1 – 10 allowed)	An AS/AI formatted string denoting the serial number of the instrument. This field combined with the INSTRUMENT field uniquely identifies the instrument. This combination is known as the frame header or synchronization string. This is normally a four-character field.

TIMER	10	The field is an AF formatted string indicating the number of seconds that have passed since the end of the initialization sequence. This field is left padded with zeros and is precise to two digits after the decimal.
Sample Delay	2	A BS formatted value representing the number of milliseconds to offset the Timer value to give an accurate indication of when the frame's sensors were sampled.
Channel (λ_1)	4	A BU formatted value representing the sampled A/D counts from the first optical channel.
Channel (λ_2)	4	A BU formatted value representing the sampled A/D counts from the second optical channel.
Channel (λ_3)	4	A BU formatted value representing the sampled A/D counts from the third optical channel.
Channel (λ_4)	4	A BU formatted value representing the sampled A/D counts from the fourth optical channel.
Vin Sense	2	This field contains a BU formatted value indicating the regulated input voltage.
Int. Temp.	2	This field contains a BU formatted value indicating the internal temperature of the instrument.
FRAME COUNTER	1	A BU formatted data integrity sensor that maintains a count of each frame transmitted. The count increments by one for each frame transmitted from 0 to 255, at which point it rolls back to zero again.
CHECK SUM	1	This is a BU formatted data integrity sensor which implements a check sum on the telemetry frame.
TERMINATOR	2	This field indicates the end of the frame. The frame is terminated by a carriage return/line feed pair ($0D_{hex}$ and $0A_{hex}$).

BINARY TELEMETRY WITH ENGINEERING UNITS

Data is presented in a fixed-length binary format, with optical data provided in engineering units.

Relevant configuration parameters:

frametype: binary

usecal: on

Field Name	Field Size (bytes)	Description
Instrument	6	A unique 6 character AS formatted string denoting the start of a frame of telemetry. For irradiance sensors, the instrument string is "SATEI4"; for radiance sensors, the string is "SATER4".
Serial Number	4 (1 – 10 allowed)	An AS/AI formatted string denoting the serial number of the instrument. This field combined with the INSTRUMENT field uniquely identifies the instrument. This combination is known as the frame header or synchronization string. This is normally a four-character field.
TIMER	10	The field is an AF formatted string indicating the number of seconds that have passed since the end of the initialization sequence. This field is left padded with zeros and is precise to two digits after the decimal.
Sample Delay	2	A BS formatted value representing the number of milliseconds to offset the Timer value to give an accurate indication of when the frame's sensors were sampled.
Channel (λ_1)	4	A BF formatted value (single-precision floating point) representing the calibrated output (engineering units) from the first optical channel. For an irradiance sensor, the units are "uW/cm^2/nm"; for a radiance sensor, the units are "uW/cm^2/nm/sr".
Channel (λ_2)	4	A BF formatted value (single-precision floating point) representing the calibrated output (engineering units) from the second optical channel. For an irradiance sensor, the units are "uW/cm^2/nm"; for a radiance sensor, the units are "uW/cm^2/nm/sr".

Channel (λ_3)	4	A BF formatted value (single-precision floating point) representing the calibrated output (engineering units) from the third optical channel. For an irradiance sensor, the units are "uW/cm^2/nm"; for a radiance sensor, the units are "uW/cm^2/nm/sr".
Channel (λ_4)	4	A BF formatted value (single-precision floating point) representing the calibrated output (engineering units) from the fourth optical channel. For an irradiance sensor, the units are "uW/cm^2/nm"; for a radiance sensor, the units are "uW/cm^2/nm/sr".
Vin Sense	2	This field contains a BU formatted value indicating the regulated input voltage.
Int. Temp.	2	This field contains a BU formatted value indicating the internal temperature of the instrument.
FRAME COUNTER	1	A BU formatted data integrity sensor that maintains a count of each frame transmitted. The count increments by one for each frame transmitted from 0 to 255, at which point it rolls back to zero again.
CHECK SUM	1	This is a BU formatted data integrity sensor which implements a check sum on the telemetry frame.
TERMINATOR	2	This field indicates the end of the frame. The frame is terminated by a carriage return/line feed pair ($0D_{hex}$ and $0A_{hex}$).

ASCII TELEMETRY – RAW ADC COUNTS ONLY

Data is presented as tab-delimited ASCII text. Only optical channel data is provided, in raw ADC counts; this is known as the "short" frame type.

Relevant configuration parameters:

frametype: short

usecal: off

Field Name	Field Size (bytes)	Description
Instrument	6	A unique 6 character AS formatted string denoting the start of a frame of telemetry. For irradiance sensors, the instrument string is “SATAI4”; for radiance sensors, the string is “SATAR4”.
Serial Number	4 (1 – 10 allowed)	An AS/AI formatted string denoting the serial number of the instrument. This field combined with the INSTRUMENT field uniquely identifies the instrument. This combination is known as the frame header or synchronization string. This is normally a four-character field.
Tab	1	Tab delimiter.
Channel (λ_1)	10 typical/ max	An AU formatted value representing the sampled A/D counts from the first optical channel.
Tab	1	Tab delimiter.
Channel (λ_2)	10 typical/ max	An AU formatted value representing the sampled A/D counts from the second optical channel.
Tab	1	Tab delimiter.
Channel (λ_3)	10 typical/ max	An AU formatted value representing the sampled A/D counts from the third optical channel.
Tab	1	Tab delimiter.
Channel (λ_4)	10 typical/ max	An AU formatted value representing the sampled A/D counts from the fourth optical channel.
TERMINATOR	2	This field indicates the end of the frame. The frame is terminated by a carriage return/line feed pair ($0D_{hex}$ and $0A_{hex}$).

Example Telemetry:

SATAI400012684550016 2684315904 2684407360 2684127360

ASCII TELEMETRY – RAW ADC COUNTS WITH CALIBRATION COEFFICIENTS

Data is presented as tab-delimited ASCII text. Optical channel data is provided, in raw ADC counts, along with calibration coefficients. This is known as the "long" frame type.

Relevant configuration parameters:

frametype: long

usecal: off

Field Name	Field Size (bytes)	Description
Instrument	6	A unique 6 character AS formatted string denoting the start of a frame of telemetry. For irradiance sensors, the instrument string is "SATBI4"; for radiance sensors, the string is "SATBR4".
Serial Number	4 (1 – 10 allowed)	An AS/AI formatted string denoting the serial number of the instrument. This field combined with the INSTRUMENT field uniquely identifies the instrument. This combination is known as the frame header or synchronization string. This is normally a four-character field.
Tab	1	Tab delimiter.
Channel (λ_1)	10 typical/ max	An AU formatted value representing the sampled A/D counts from the first optical channel.
Tab	1	Tab delimiter.
A0 (λ_1)	14 (max)	The Satlantic OPTIC2 fit type *a0* coefficient for optical channel 1.
Tab	1	Tab delimiter.
A1 (λ_1)	19 (max)	The Satlantic OPTIC2 fit type *a1* coefficient for optical channel 1.
Tab	1	Tab delimiter.
Im (λ_1)	6 (max)	The Satlantic OPTIC2 fit type *Im* (immersion) coefficient for optical channel 1.
Tab	1	Tab delimiter.

Channel (λ_2)	10 typical/ max	An AU formatted value representing the sampled A/D counts from the second optical channel.
Tab	1	Tab delimiter.
A0 (λ_2)	14 (max)	The Satlantic OPTIC2 fit type *a0* coefficient for optical channel 2.
Tab	1	Tab delimiter.
A1 (λ_2)	19 (max)	The Satlantic OPTIC2 fit type *a1* coefficient for optical channel 2.
Tab	1	Tab delimiter.
Im (λ_2)	6 (max)	The Satlantic OPTIC2 fit type *Im* (immersion) coefficient for optical channel 2.
Tab	1	Tab delimiter.
Channel (λ_3)	10 typical/ max	An AU formatted value representing the sampled A/D counts from the third optical channel.
Tab	1	Tab delimiter.
A0 (λ_3)	14 (max)	The Satlantic OPTIC2 fit type *a0* coefficient for optical channel 3.
Tab	1	Tab delimiter.
A1 (λ_3)	19 (max)	The Satlantic OPTIC2 fit type *a1* coefficient for optical channel 3.
Tab	1	Tab delimiter.
Im (λ_3)	6 (max)	The Satlantic OPTIC2 fit type *Im* (immersion) coefficient for optical channel 3.
Tab	1	Tab delimiter.
Channel (λ_4)	10 typical/ max	An AU formatted value representing the sampled A/D counts from the fourth optical channel.
A0 (λ_4)	14 (max)	The Satlantic OPTIC2 fit type *a0* coefficient for optical channel 4.
Tab	1	Tab delimiter.
A1 (λ_4)	19 (max)	The Satlantic OPTIC2 fit type *a1* coefficient for optical channel 4.
Tab	1	Tab delimiter.

Im (λ_4)	6 (max)	The Satlantic OPTIC2 fit type *Im* (immersion) coefficient for optical channel 4.
TERMINATOR	2	This field indicates the end of the frame. The frame is terminated by a carriage return/line feed pair ($0D_{hex}$ and $0A_{hex}$).

Example Telemetry:

SATBI40001 2684550016 2147267103.1 2.03203332555e-007
1.368 2684315904 2147492578.4 1.95923384221e-007 1.410
2684407360 2147582763.7 2.03019013945e-007 1.365
2684127360 2147871011.6 1.97172313736e-007 1.354

ASCII TELEMETRY – OPTICAL DATA ONLY, IN ENGINEERING UNITS

Data is presented as tab-delimited ASCII text. Only optical channel data is provided, in engineering units; this is known as the "short" frame type.

Relevant configuration parameters:

frametype: short

usecal: on

Field Name	Field Size (bytes)	Description
Instrument	6	A unique 6 character AS formatted string denoting the start of a frame of telemetry. For irradiance sensors, the instrument string is "SATFI4"; for radiance sensors, the string is "SATFR4".
Serial Number	4 (1 – 10 allowed)	An AS/AI formatted string denoting the serial number of the instrument. This field combined with the INSTRUMENT field uniquely identifies the instrument. This combination is known as the frame header or synchronization string. This is normally a four-character field.
Tab	1	Tab delimiter.
Channel (λ_1)	10 typical/ max	An AF formatted value representing the calibrated output (engineering units) from the first optical channel. For an irradiance sensor, the units are "uW/cm^2/nm"; for a radiance sensor, the units are "uW/cm^2/nm/sr".
Tab	1	Tab delimiter.

Channel (λ_2)	10 typical/ max	An AF formatted value representing the calibrated output (engineering units) from the second optical channel. For an irradiance sensor, the units are "uW/cm^2/nm"; for a radiance sensor, the units are "uW/cm^2/nm/sr".
Tab	1	Tab delimiter.
Channel (λ_3)	10 typical/ max	An AF formatted value representing the calibrated output (engineering units) from the third optical channel. For an irradiance sensor, the units are "uW/cm^2/nm"; for a radiance sensor, the units are "uW/cm^2/nm/sr".
Tab	1	Tab delimiter.
Channel (λ_4)	10 typical/ max	An AF formatted value representing the calibrated output (engineering units) from the fourth optical channel. For an irradiance sensor, the units are "uW/cm^2/nm"; for a radiance sensor, the units are "uW/cm^2/nm/sr".
TERMINATOR	2	This field indicates the end of the frame. The frame is terminated by a carriage return/line feed pair ($0D_{hex}$ and $0A_{hex}$).

Example Telemetry:

SATFI40001 5.6134 8.9193 14.6706 22.4710

ASCII Telemetry – Optical Data in Engineering Units With Calibration Coefficients

Data is presented as tab-delimited ASCII text. Optical channel data is provided, in engineering units, along with calibration coefficients. This is known as the "long" frame type.

Relevant configuration parameters:

frametype: long

usecal: on

Field Name	Field Size (bytes)	Description
Instrument	6	A unique 6 character AS formatted string denoting the start of a frame of telemetry. For irradiance sensors, the instrument string is "SATGI4"; for radiance sensors, the string is "SATGR4".

Serial Number	4 (1 – 10 allowed)	An AS/AI formatted string denoting the serial number of the instrument. This field combined with the INSTRUMENT field uniquely identifies the instrument. This combination is known as the frame header or synchronization string. This is normally a four-character field.
Tab	1	Tab delimiter.
Channel (λ_1)	10 typical/ max	An AF formatted value representing the calibrated output (engineering units) from the first optical channel. For an irradiance sensor, the units are "uW/cm^2/nm"; for a radiance sensor, the units are "uW/cm^2/nm/sr".
Tab	1	Tab delimiter.
A0 (λ_1)	14 (max)	The Satlantic OPTIC2 fit type *a0* coefficient for optical channel 1.
Tab	1	Tab delimiter.
A1 (λ_1)	19 (max)	The Satlantic OPTIC2 fit type *a1* coefficient for optical channel 1.
Tab	1	Tab delimiter.
Im (λ_1)	6 (max)	The Satlantic OPTIC2 fit type *Im* (immersion) coefficient for optical channel 1.
Tab	1	Tab delimiter.
Channel (λ_2)	10 typical/ max	An AF formatted value representing the calibrated output (engineering units) from the second optical channel. For an irradiance sensor, the units are "uW/cm^2/nm"; for a radiance sensor, the units are "uW/cm^2/nm/sr".
Tab	1	Tab delimiter.
A0 (λ_2)	14 (max)	The Satlantic OPTIC2 fit type *a0* coefficient for optical channel 2.
Tab	1	Tab delimiter.
A1 (λ_2)	19 (max)	The Satlantic OPTIC2 fit type *a1* coefficient for optical channel 2.
Tab	1	Tab delimiter.
Im (λ_2)	6 (max)	The Satlantic OPTIC2 fit type *Im* (immersion) coefficient for optical channel 2.
Tab	1	Tab delimiter.

Channel (λ_3)	10 typical/ max	An AF formatted value representing the calibrated output (engineering units) from the third optical channel. For an irradiance sensor, the units are "uW/cm^2/nm"; for a radiance sensor, the units are "uW/cm^2/nm/sr".
Tab	1	Tab delimiter.
A0 (λ_3)	14 (max)	The Satlantic OPTIC2 fit type *a0* coefficient for optical channel 3.
Tab	1	Tab delimiter.
A1 (λ_3)	19 (max)	The Satlantic OPTIC2 fit type *a1* coefficient for optical channel 3.
Tab	1	Tab delimiter.
Im (λ_3)	6 (max)	The Satlantic OPTIC2 fit type *Im* (immersion) coefficient for optical channel 3.
Tab	1	Tab delimiter.
Channel (λ_4)	10 typical/ max	An AF formatted value representing the calibrated output (engineering units) from the fourth optical channel. For an irradiance sensor, the units are "uW/cm^2/nm"; for a radiance sensor, the units are "uW/cm^2/nm/sr".
A0 (λ_4)	14 (max)	The Satlantic OPTIC2 fit type *a0* coefficient for optical channel 4.
Tab	1	Tab delimiter.
A1 (λ_4)	19 (max)	The Satlantic OPTIC2 fit type *a1* coefficient for optical channel 4.
Tab	1	Tab delimiter.
Im (λ_4)	6 (max)	The Satlantic OPTIC2 fit type *Im* (immersion) coefficient for optical channel 4.
TERMINATOR	2	This field indicates the end of the frame. The frame is terminated by a carriage return/line feed pair ($0D_{hex}$ and $0A_{hex}$).

Example Telemetry:

```
SATGI40001    5.6134  2147267103.1   2.03203332555e-007    1.368
8.9193  2147492578.4   1.95923384221e-007    1.410    14.6706
2147582763.7   2.03019013945e-007    1.365    22.4710
2147871011.6   1.97172313736e-007    1.354
```

E - CONFIGURATION

Your OCR-504 Multispectral Radiometer has been pre-configured by Satlantic with standard configuration parameters. These parameters control many aspects of the instrument's operation to account for the wide variety of applications in which OCR-504 instruments are used. In addition to the operating modes described in section ***D - OPERATION***, a configuration mode is also available to modify configuration parameters and test various systems of the instrument. This configuration mode is implemented by the instrument's ***Command Console***.

In most cases, the command console would be accessed using a terminal emulation program. Terminal emulators are used in many applications involving serial communications, internet mail and news services, telnet and ftp services, etc. For communication with your OCR-504, you will need to make a direct connection to the serial port hosting the instrument. Connect the instrument using the RS-232 telemetry interface. You cannot use the RS-422 interface, as it is transmit-only. For communications software, use your favorite terminal emulator (Windows® XP and earlier versions came with one called HyperTerminal®[7]). Ensure that the serial connection to the instrument is at the *telemetry baud rate*. Use any ANSI or ANSI-compliant (i.e. VT-xxx) emulation. While operating in this mode, your OCR-504 uses simple character I/O with no control character interpretation. Therefore, most terminal emulators will do.

The command console can be accessed at any point during the instrument's operation. You can even access the command console of a remote or networked instrument through the Network Master. Methods for accessing the console are described in section ***D - OPERATION***.

Command Console

The OCR-504 command console was designed to resemble an MS-DOS® or UNIX® command prompt[8]. Although the actual functionality of the console is quite removed from these systems (it is actually far simpler), the basic design lends a certain degree of familiarity. When the console is first invoked, you will see a prompt on your terminal emulator screen similar to the one shown below:

```
OCR-504 Command Console
Type 'help' for a list of available commands.

[Auto]$
```

The first two lines are the command prompt header. They are not repeated unless you reset the console. The first line indicates the type of instrument for

[7] See Appendix A for more information on using HyperTerminal. HyperTerminal is a registered trademark of Microsoft Corporation.
[8] MS-DOS and UNIX are registered trademarks of Microsoft Corporation and The Open Group respectively.

which the console is being used. The next line helps new users to get acquainted with the system.

The actual command prompt ends with the "$" character. The characters between the [ ] brackets provide information on the operating mode of the instrument. In the example above, "Auto" indicates that the instrument is running in autonomous mode. If the instrument is running in network mode, which means the command console was accessed through the Network Master, the command prompt will look something like this:

```
[Remote:050]$
```

The "Remote" keyword indicates that the command prompt is for a remote or networked instrument. The numbers following the ":" character is the three-digit network address of the remote instrument. This gives the user the ability to quickly differentiate one remote instrument from another.

Using the command prompt is quite simple. Type in a command at the prompt followed by the <Enter> key. This will execute the command, displaying the results to the screen, if any. You can easily edit commands if you make a mistake. Use the <Backspace> key to delete characters in your command before you execute them. You can even recall the last executed command by pressing the <Esc> key on a clear command prompt. This is handy if you are repeatedly executing the same or similar commands.

The command console interprets all commands as case sensitive. This means that the command "exit" is different from "EXIT". Most commands require small case letters.

If this is your first time using the command console, a good starting point is the "help" command. As you probably noticed, the command prompt header suggests this command for novice users. Executing this command will display the following text:

```
The following console commands are available for this
instrument:

reset     Resets the command console.
id        Displays the instrument identification banner.
power     Turns operational power on and off.
set       Sets the instrument's configuration parameters.
show      Shows the instrument's configuration parameters.
save      Saves the instrument's configuration parameters.
sample    Samples the instrument's sensors and displays
          their values in ADC counts.
exit      Exits the command console.
exit!     Exits the command console and resets
          the instrument.

For more information on individual commands, type '-?'
after the command.
```

All commands available to the instrument are listed on the left, with descriptions on the right. For the most part, these descriptions adequately

define the purpose of each command. However, some commands are more complex and require a little more than a simple one-word entry. As indicated above, you can type a "`-?`" after a command to display additional help information. Make sure there is a space between the command and the "`-?`" parameter. If there is additional help available for the command, the text will be displayed. Otherwise, a message indicating, "`No more help is available.`" will be displayed.

Some commands require additional command line parameters. Executing one of these commands with missing or incorrect parameters will display a "`Usage:`" message. This is helpful in determining what parameters are acceptable for a particular command and how they should be formatted. For example, if you executed the "`power`" command without any parameters, the following message would be displayed:

```
Usage: power [operational power (on|off|?)]
```

This command requires one parameter, as indicated by the contents of the [ ] brackets. If the command required more than one parameter, additional sets of [ ] brackets with their parameter descriptions would be displayed. Parameters must always be separated by a space. Within the [ ] brackets is a description of the parameter followed by the list of acceptable parameter values, contained in the ( ) brackets. The values listed here are always separated by the "`|`" character. In this case, there are three accepted forms of this command; "`power on`", "`power off`", and "`power ?`".

Generally, the usage of the command console is self-explanatory. It should only take you a few moments to get a working knowledge of the system. Although the on-line help is fairly extensive, some commands need more detailed explanations that would be too cumbersome to include in the instrument itself. The following sections describe each command in more detail.

RESET COMMAND

The "`reset`" command resets the console, redisplaying the command prompt header described above. Any configuration parameters modified during the console session that were not saved will revert back to their previous values. This command requires no additional command line parameters.

ID COMMAND

The "`id`" command displays the identification banner for the instrument, as shown is the following example:

```
Satlantic OCR-504 Multispectral Radiometer
Copyright (C) 2011, Satlantic Inc. All rights reserved.
Firmware version: 5.1.0 - SatNet Type B
Instrument: SATDI4
S/N: 0001
```

The identification banner is also part of the start-up banner, which is displayed during the initialization sequence described in section ***D - OPERATION***. This command requires no additional command line parameters.

POWER COMMAND

The "`power`" command may be used to turn operational power on and off during a command console session. Operational power supplies electronic components in the instrument responsible for sensor data acquisition. Powering down these components may reduce the instrument's total power consumption, if possible (some components cannot be powered down). The instrument is otherwise fully operational, so communication is still possible. When operational components are powered down, sensor data acquisition is disabled.

This command requires one command line parameter. To turn on operational power, use the "`power on`" command. To turn off operational power, use the "`power off`" command. To query the operational power status, use the "`power ?`" command. This will display a message similar to the one below:

```
Operational Power: on
```

IMPORTANT! Operational power will remain in the state set by this command once the command console exits and normal operation resumes.

SET COMMAND

The "`set`" command modifies configuration parameters for the instrument. These parameters affect various aspects of the instrument's operation and can be modified by the user to customize the instrument. For an OCR-504, if you enter a "`set -?`" command, the following will be displayed:

```
Usage: set [parameter] [value]

set telbaud [telemetry baud rate (bps)]
set maxrate [maximum frame rate (Hz)]
set initsm [initialize silent mode (on|off)]
set initpd [initialize power down (on|off)]
set initat [initialize auto telemetry (on|off)]
set netmode [network mode (on|off)]
set netadd [network address (1-255)]
set netbaud [network baud rate (bps)]
set avg [on|off]
set usecal [on|off]
set immersed [on|off]
set latency [value]
set frametype [binary|short|long]
set a0ch[1-4] [value]
set a1ch[1-4] [value]
set imch[1-4] [value]
```

This command requires two command line parameters. The first parameter specifies the configuration parameter to modify. The second specifies the new value to assign to the parameter. A list of all available configuration parameters is shown above.

IMPORTANT! Be careful using this feature. Changes made to the OCR-504 configuration parameters affect the way the instrument operates. Before you modify any of configuration parameters, make sure you understand the consequences of the change.

For more information on these parameters and their effect on your instrument's operation, see section ***OCR-504 Configuration Parameters*** below.

SHOW COMMAND

The "`show`" command displays configuration parameters for the instrument. These parameters are modified by the "`set`" command explained above. If you enter "`show -?`" at the command prompt, the following message will be displayed:

```
Usage: show [parameter|all]

See help for the 'set' command for a list of
available parameters.
```

This command requires only one command line parameter, which is the same as the first parameter of the "`set`" command. Using the "`show`" command in this way displays the current value of the configuration parameter, even if it has not yet been saved. You may also use "`all`" as the command line parameter to show a complete list of all configuration parameters and their current values. For example, using the "`show all`" command on your OCR-504 would display something like this:

```
Sensor Type: irradiance
Frame Type: binary
Header: SATDI4
Telemetry Baud Rate: 57600 bps
Maximum Frame Rate: AUTO
Initialize Silent Mode: off
Initialize Power Down: off
Initialize Automatic Telemetry: on
Network Mode: off
Network Address: 100
Network Baud Rate: 76800 bps
Averaging: off
Immersed: on
Calibrated Output: on
Sensor Latency: 0
Cal coefficients:
```

```
 Optical Channel 1:
       a0: 2147582763.7 [2147582763]
       a1: 2.03019013945e-007 [2.03019e-07]
       a0: 1.365 [1.365]

 Optical Channel 2:
       a0: 2147871011.6 [2147871011]
       a1: 1.97172313736e-007 [1.97172e-07]
       a0: 1.354 [1.354]

Optical Channel 3:
       a0: 2147147734.9 [2147147734]
       a1: 2.20643967713e-007 [2.20644e-07]
       a0: 1.373 [1.373]

 Optical Channel 4:
       a0: 2147433859.4 [2147433859]
       a1: 2.03852332236e-007 [2.03852e-07]
       a0: 1.347 [1.347]
```

For more information on these parameters and their effect on your instrument's operation, see section ***OCR-504 Configuration Parameters*** below.

Show Calibration Coefficients

A special command to display all optical channel calibration coefficients is available. Typing "`show calcoeffs`" will display the calibration coefficients, similar to the following:

```
Cal coefficients:
 Optical Channel 1:
       a0: 2147582763.7 [2147582763]
       a1: 2.03019013945e-007 [2.03019e-07]
       a0: 1.365 [1.365]

 Optical Channel 2:
       a0: 2147871011.6 [2147871011]
       a1: 1.97172313736e-007 [1.97172e-07]
       a0: 1.354 [1.354]

Optical Channel 3:
       a0: 2147147734.9 [2147147734]
       a1: 2.20643967713e-007 [2.20644e-07]
       a0: 1.373 [1.373]

 Optical Channel 4:
       a0: 2147433859.4 [2147433859]
       a1: 2.03852332236e-007 [2.03852e-07]
       a0: 1.347 [1.347]
```

For each coefficient, the first value is the raw ASCII calibration string as entered by the user. The second value, in square brackets, is the calibration value as interpreted by the onboard microcontroller (IEEE single precision); this is the value used for on-board calculations, if enabled. Please note that earlier firmware versions (5.0.x) did not store the raw ASCII calibration string, and so only display the interpreted value. Also note that display of individual calibration coefficients (e.g. `show a0ch1`) is not currently supported.

SAVE COMMAND

Modifying configuration parameters with the "`set`" command does not necessarily mean that those parameters will be retained for use in the next session with the instrument. When the "`save`" command is issued, all configuration parameters are placed in persistent storage inside the instrument. If these parameters are not saved once they are modified, all changes will be lost when the command console exits or power is removed from the instrument.

The "`save`" command requires no additional command line parameters. Once the command is issued, it cannot be undone.

IMPORTANT! Once the instrument configuration parameters have been saved, the instrument must be reset before normal operation can resume.

SAMPLE COMMAND

The "`sample`" command can be used to test the operation of all sensors on board the instrument. This may be helpful in diagnosing problems with any of the instrument's sensors if some kind of abnormality occurs. Before using this command, make sure operational power has been applied.

When a sensor is sampled by this command, its value is displayed in hexadecimal format. This value is simply the number of counts measured by the sensor's Analog-to-Digital converter. These values do not represent sensor output in physical units.

This command takes one command line parameter, which specifies which sensor to test. If the parameter is a number between "`1`" and "`4`", the designated optical channel will be sampled and displayed. If the parameter is "`vreg`", the regulated input voltage sensor will be sampled and displayed. If the parameter is "`vana`", the analog rail voltage sensor (for operational power) will be sampled and displayed. The "`temp`" parameter will sample and display the internal temperature sensor. Using "`all`" as the command line parameter will sample all sensors; the display will look something like this:

```
Input voltage regulated: 012B
Analog voltage regulated: 00B1
Temperature sensor: 007A

Optical Channel 1: 9FF99540
```

```
Optical Channel 2: 9FFEE740
Optical Channel 3: 9FFBB280
Optical Channel 4: 9FFD33C0
```

EXIT AND EXIT! COMMANDS

The "exit" and "exit!" commands end the current command console session. Once the console exits, normal operation will resume in most cases. Otherwise, the instrument will reset itself before normal operation can begin. The only difference between the two versions of this command is that the "exit!" command forces a reset of the instrument, even if it isn't necessary.

There are two conditions that will cause the instrument to reset itself. One or both conditions must exist for this to occur. These conditions are:

1. The command console was invoked during the initialization sequence.
2. Configuration parameters have been modified and saved.

If you attempt to exit the console with modified configuration parameters that have not been saved, the following dialog will be presented:

```
The configuration parameters have been modified.
Save changes [y/n]?
```

Choose "y" for yes or "n" for no to answer this question. If you choose yes, the configuration parameters will be saved and the instrument will reset itself. Otherwise, any modifications to the configuration parameters will be lost. See the ***Save Command*** section above for more information on saving configuration parameters.

OCR-504 Configuration Parameters

This section describes, in detail, the function of each configuration parameter used by the OCR-504. The title of each section identifies the name of the parameter, as displayed by the "show" command. Also clearly identified in each section is the command line parameter keyword used in both the "set" and "show" commands.

See the descriptions of the "set" and "show" commands described in the ***Command Console*** section above for more information.

SENSOR TYPE

Command Line Parameter: `sensortype`

Value Parameter: `irradiance|radiance`

The `sensortype` parameter defines whether the sensor is physically configured as an irradiance or radiance sensor. This parameter is primarily used to determine the instrument header in the telemetry frame (see the

Telemetry Format section). This setting can not be modified by the user, but can be viewed with the `show` command.

TELEMETRY FRAME TYPE

Command Line Parameter: `frametype`

Value Parameter: `binary|short|long`

The `frametype` parameter determines the format of the telemetry frame. When modifying this parameter with the "`set`" command, you must enter "`binary`", "`short`", or "`long`" as the value parameter. Please refer to the Telemetry Format section.

TELEMETRY BAUD RATE

Command Line Parameter: `telbaud`

The telemetry baud rate defines the speed at which data is transferred on the telemetry interface. This should not be confused with the frame rate. Baud rates are specified in units of *bits per second* (bps). Any data acquisition or terminal emulation software must be configured to communicate with the instrument at this baud rate. Only certain standard parameter values are accepted, as shown in the table below:

Baud Rate (bps)
9600
19200
38400
57600
115200

When modifying this parameter with the "`set`" command, you must enter at least the first two digits of one of these baud rates as the value parameter.

Ideally, you would want the telemetry interface to run at the fastest baud rate available. However, certain restrictions, like cable quality or excessively long transmission mediums, may require a reduction in the telemetry baud rate. The data acquisition computer and/or software may also impose restrictions.

MAXIMUM FRAME RATE

Command Line Parameter: `maxrate`

This parameter allows you to define the maximum frame rate that the instrument will use during normal operation with free-running telemetry output. The frame rate defines how often a frame of telemetry is composed and

transmitted. If the instrument is running autonomously (autonomous operation), frames are transmitted through the telemetry interface. If the instrument is operating in network mode (network operation), these frames are transmitted through the network interface. However, the Network Master can be configured to override the frame rates of all other instruments, imposing its own frame rate on the system. See the operation manual of your Network Master device for more information.

Frame rates are specified in units of *frames per second* or *Hertz* (Hz). There are several factors involved in determining how quickly the instrument can transmit frames. On-board electronics, such as the Analog-to-Digital converters used to sample each sensor, may limit how fast a telemetry frame can be composed. Configuration parameters like the telemetry and/or network baud rates are important in determining how quickly one frame can be transmitted before the next. While in network operation, saturation of the Network Master's telemetry interface, caused by too many networked instruments broadcasting their telemetry at the same time, may slow down the frame rate of some or all instruments in the system. Therefore, the actual frame rate realized during normal operation cannot be any faster than the limitations imposed by these conditions. In addition, some of these factors may vary during normal operation, making the determination of a constant frame rate impossible. Providing a maximum frame rate slower than what the instrument is capable of providing will help pace the output of each frame evenly. Generally, an OCR-504 cannot exceed a frame rate faster than 7.5 Hz, even under the best of conditions.

Only certain standard frame rates are accepted by this parameter, as shown in the table below:

Frame Rate (Hz)
0.125
0.25
0.5
1
2
4
8
10
12
0 (AUTO)

When modifying this parameter with the "`set`" command, you must enter one of these numbers as the value parameter. Any numerical values that are in between the values in the table will be rounded up to the nearest standard frame rate. To specify an automatic (AUTO) frame rate, input "0" as the value parameter. This will cause the instrument to output frames as fast as possible.

Specifying a frame rate faster than is practically possible will not force the actual frame rate to that level. The instrument will only transmit as fast as possible for the given operating parameters. This is essentially the same as specifying an AUTO frame rate. In addition, frames are always transmitted as a whole as much as possible. Once a frame starts transmitting, it is transmitted continuously until the frame is completely output. Specifying a frame rate of, for example, 0.5 Hz does not mean that half a frame is transmitted every second. It means that every two seconds, a frame will begin transmitting.

INITIALIZE SILENT MODE

Command Line Parameter: `initsm`

Normally, just after the instrument is powered up or reset, a start-up banner will be output on the telemetry interface during the initialization sequence. The messages in this banner, among other things, identify the instrument and provide a copyright notification. If silent mode is enabled, this banner will not be displayed. This ensures that no data will be transmitted on the telemetry interface until, if running autonomously, normal operation begins and telemetry output is available. Enabling silent mode does not mean that the telemetry interface is disabled during initialization. The command console can still be engaged. See section ***D - OPERATION*** for more information on the start-up banner and the initialization sequence.

When modifying this parameter with the "`set`" command, you must enter either "`on`" or "`off`" as the value parameter to enable or disable silent mode.

INITIALIZE POWER DOWN

Command Line Parameter: `initpd`

Near the end of the initialization sequence, operational power is normally applied. However, the instrument can be configured to boot into a power savings mode. With the initialize power down parameter enabled, operational power will not be applied during initialization. This means that telemetry output will be disabled when normal operation begins. See section ***D - OPERATION*** for more information on the initialization sequence.

When modifying this parameter with the "`set`" command, you must enter either "`on`" or "`off`" as the value parameter to enable or disable the power savings mode.

INITIALIZE AUTOMATIC TELEMETRY

Command Line Parameter: `initat`

For instruments running in autonomous operation only, the telemetry output mode can be configured to start as free-running or polled once normal operation begins. This means that once normal operation has begun and this parameter is disabled (polled operation), telemetry output will not occur unless the instrument is polled with the <Enter> or <Space> key commands. Otherwise, telemetry output will be free-running in accordance with the maximum frame rate configuration parameter. Of course, if operational power is not applied, telemetry output is disabled altogether regardless of this parameter. See ***Autonomous Operation*** in section ***D - OPERATION*** for more information on telemetry output modes.

When modifying this parameter with the "`set`" command, you must enter either "`on`" or "`off`" as the value parameter to enable or disable automatic telemetry.

NETWORK MODE

Command Line Parameter: `netmode`

This parameter enables or disables network operation for the instrument. Although disabling this parameter will force the instrument to run autonomously, enabling it does not necessarily mean network operation will be invoked. The instrument's operating mode is determined during the initialization sequence. See ***Network Operation*** in section ***D - OPERATION*** for more information.

When modifying this parameter with the "`set`" command, you must enter either "`on`" or "`off`" as the value parameter to enable or disable network operation.

NETWORK ADDRESS

Command Line Parameter: `netadd`

The network address uniquely identifies an instrument on a network. All network transmissions use this parameter to identify the sender and receiver of the message. It is not important what value is assigned to the network address, as long as it is unique from other instruments in the network.

IMPORTANT! Make sure that each device on the network, including the Network Master, has a unique network address. If two or more devices have the same address, contentions may result and data could be lost.

When modifying this parameter with the "`set`" command, you must enter an integer from 1 to 255 inclusive as the value parameter.

NETWORK BAUD RATE

Command Line Parameter: `netbaud`

The network baud rate defines the speed at which data is transferred on the network interface. Baud rates are specified in units of *bits per second* (bps). Only certain standard parameter values are accepted, as shown in the table below:

Baud Rate (bps)
9600
14400
19200
28800
38400
57600
76800

When modifying this parameter with the "`set`" command, you must enter at least the first two digits of one of these baud rates as the value parameter.

IMPORTANT! Make sure that each device on the network, including the Network Master, is operating with the same network baud rate. Any devices in the network running at a baud rate different from the Network Master will be ignored.

Ideally, you would want to run the network at the fastest baud rate available. However, certain restrictions, like cable quality or excessively long transmission mediums, may require a reduction in the network baud rate.

OPTICAL DATA AVERAGING ENABLE

Command Line Parameter: `avg`

Value Parameter: `on|off`

This parameter enables or disables optical data averaging. The number of ADC samples used for averaging is fixed depending on the `maxrate` parameter as follows:

Frame Rate (Hz)	Number of Samples Averaged
0.125	60
0.25	30
0.5	15
1	7
2	3

4	1
8	1
10	1
12	1
0 (AUTO)	1

When modifying this parameter with the "set" command, you must enter either "on" or "off" as the value parameter to enable or disable averaging.

APPLY IMMERSION COEFFICIENT ENABLE

Command Line Parameter: immersed

Value Parameter: on|off

This parameter enables or disables the application of the stored immersion coefficient to the optical data in telemetry frames that use engineering units. The immersion coefficient should be "on" when the sensor is used in water and "off" when used in air.

APPLY CALIBRATION COEFFICIENTS ENABLE

Command Line Parameter: usecal

Value Parameter: on|off

This parameter enables or disables the application of the stored a0 and a1 calibration coefficients to the optical data. Together with the sensortype and frametype parameters, this setting determines the telemetry frame format; refer to the Telemetry Format section.

When modifying this parameter with the "set" command, you must enter either "on" or "off" as the value parameter to enable or disable use of the calibration coefficients.

TELEMETRY STARTUP LATENCY

Command Line Parameter: latency

Value Parameter: value (0 – 4294967296)

The Startup Latency parameter allows the user to add additional startup delay before sampling begins. This setting may be useful for synchronizing initial sampling with other instruments, or perhaps for allowing time for an optional Satlantic Bioshutter paddle to move out of the field of view of the OCR-504.

The latency value is entered in milliseconds.

CALIBRATION COEFFICIENT a0

Command Line Parameter: `a0ch[1-4]`

Value Parameter: `value`

Example: `set a0ch1 2147267103.1`

The Calibration Coefficient a0 setting allows the user to enter the a0 calibration coefficient for ADC channels 1 through 4 (`a0ch1`, `a0ch2`, `a0ch3`, `a0ch4`) as a decimal value. Up to 14 characters may be entered.

IMPORTANT! Do not change the calibration coefficients unless you have recalibrated the sensor or instructed to do so by Satlantic personnel. Incorrect calibration coefficients will generate invalid data in telemetry frames generating data using engineering units.

CALIBRATION COEFFICIENT a1

Command Line Parameter: `a1ch[1-4]`

Value Parameter: `value`

Example: `set a1ch1 2.03203332555e-007`

The Calibration Coefficient a1 setting allows the user to enter the a1 calibration coefficient for ADC channels 1 through 4 (`a1ch1`, `a1ch2`, `a1ch3`, `a1ch4`) as a decimal value, usually in scientific notation. Up to 19 characters may be entered.

IMPORTANT! Do not change the calibration coefficients unless you have recalibrated the sensor or instructed to do so by Satlantic personnel. Incorrect calibration coefficients will generate invalid data in telemetry frames generating data using engineering units.

IMMERSION COEFFICIENT

Command Line Parameter: `imch[1-4]`

Value Parameter: `value`

Example: `set imch1 1.368`

The Immersion Coefficient setting allows the user to enter the immersion calibration coefficient for ADC channels 1 through 4 (`a0ch1`, `a0ch2`, `a0ch3`, `a0ch4`) as a decimal value. Up to 6 characters may be entered.

IMPORTANT! Do not change the calibration coefficients unless you have recalibrated the sensor or instructed to do so by Satlantic personnel. Incorrect calibration coefficients will generate invalid data in telemetry frames generating data using engineering units.

F - RECOVERY

To recover the OCR-504 when it is used in water, terminate data acquisition and pull the instrument back in using the cable. You may then power down the instrument and disconnect all the cables from their corresponding components. When disconnecting a cable from the instrument or any supporting apparatus, like the power supply, grasp firmly on the connector head and pull off the cable. DO NOT TWIST THE CABLE OR PULL ON THE CABLE DIRECTLY AS THIS MAY DAMAGE THE CONNECTORS OR THE CABLE ITSELF. ALWAYS DISCONNECT THE POWER SUPPLY FIRST. Replace the dummy plugs to the connectors and the vinyl end cap to the instrument for protection during storage.

Always be sure to rinse the instrument with fresh water prior to storage in order to prevent corrosion. If there is any seawater in contact with the instrument for a prolonged period of time, particularly around bolts and other contacts of dissimilar materials, corrosion may occur. Not properly rinsing the instrument before storage is considered misuse and warranty claims cannot be made under such circumstances.

G - MAINTENANCE

Preventative Maintenance

The OCR-504 requires virtually no maintenance. Ensure the instrument is not impacted and that any seawater is rinsed off after use. The dummy plugs and vinyl end cap should be replaced before storage.

Troubleshooting with a Terminal Emulator

If you are experiencing problems receiving data with your data acquisition software, there may be a problem with the instrument, its configuration, or its physical setup. You can check to see if your OCR-504 is transmitting telemetry with a terminal emulator.

To do this, first complete the ***Assembly Procedure*** described in section ***C - START UP***. Connect the instrument to a computer running a terminal emulation program. See section ***E - CONFIGURATION*** for more information on setting up a terminal emulator. For this test, you may use either the RS-232 interface directly, or the RS-422 interface through an appropriate level converter. You can therefore use the same physical configuration you would use in the field. However, if at a later point you need to gain access to the instrument's command console, you will need to use the RS-232 interface directly.

Once the instrument is powered up and is in normal operation with free-running telemetry, you should see what looks like random characters being periodically output to the display. This is normal. The instrument telemetry may contain a lot of binary data, which is not normally processed by a dumb terminal. However, you should be able to periodically pick out the instrument's frame header or synchronization string. This series of characters appears at the beginning of every frame of telemetry, as defined in your instrument's calibration file. If you do not see the frame header, but you do see random characters, check that the baud rate of the terminal emulator is the same as for the instrument. If you so not see anything at all, make sure that no other application is using the serial port of the computer. If this checks out, there may be a hardware problem.

Troubleshooting for Hardware Problems

If a telemetry check using a terminal emulator failed to show any telemetry, you should check the physical connections of your instrument and supporting equipment.

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

The cable connections of the system should be checked for continuity and correctness. Make sure that all Subconn® connectors are free of dirt and lightly lubricated before mating. Do not use petroleum-based lubricants. Satlantic recommends using DC-111 silicone grease (made by Dow Corning®) on the male pins prior to connection. Also, ensure that the connections are complete and, if applicable, the locking sleeves are secure.

- Check that the power cable is properly connected to the power supply and the instrument
- Check that the RS-232 or RS-422 cable is connected to the correct PC communications port.

CHECK THE SUPPLY VOLTAGE TO THE OCR-504

Voltages above the maximum input voltage may damage the instrument and voltages below the minimum operating voltage may cause the device to drop out of regulation. Thus, you must ensure the voltage input to the instrument is within the allowed range, specified in the ***Assembly Procedure*** of section ***C - START UP***.

To check voltages, a multimeter with DC voltage measurement, resistance measurement, and continuity check capability is required.

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. If the voltage is low then recharge or replace the battery. If using a DC power supply, set the output voltage to within the proper range 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 the pins 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 the voltages are still not the same, the cable is likely broken and will need repair. A wire break can be confirmed with a *continuity check*, as outlined in the next section.
5. If the voltage is within tolerance, connect the power supply cable to the instrument.
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 CABLE 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. MAKE SURE ALL CABLES ARE COMPLETELY DISCONNECTED BEFORE PERFORMING THIS TEST.

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, which will require repair.
3. Repeat step 2 for all pins in the cable.
4. 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. Repeat this for all pins on the cable to make sure that all the pins are 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, which will require repair.

H - WARRANTY

Warranty Period

All Satlantic equipment is covered under a one-year parts and labor 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. This warranty does not include shipping charges to and from Satlantic.

Returns

To return products to Satlantic, whether under warranty or not, contact the 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 LP.

Liability

IF SATLANTIC EQUIPMENT 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 LP 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 EQUIPMENT OR COMPONENTS THEREOF.

I - CONTACT INFORMATION

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

Location

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

Tel: (902) 492-4780
Fax: (902) 492-4781

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

Business Hours

Satlantic is normally open for business between the hours of 9 AM and 5 PM Atlantic Time. Atlantic Time is one hour ahead of Eastern Time. Daylight saving time is in effect from 2:00 a.m. on the second Sunday in March through 2:00 a.m. on the first Sunday in November. Atlantic Standard Time (AST) is UTC-4. Atlantic Daylight Saving Time (ADT) is UTC-3.

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
Labour Day	The first Monday in September
Thanksgiving Day	The second Monday in October
Remembrance Day	November 11th
Christmas Day	December 25th
Boxing Day	December 26th

J - DECLARATION OF CONFORMITY

DECLARATION OF CONFORMITY

Company contact details:
Satlantic LP
Richmond Terminal, Pier 9, 3481 North Marginal Road, Halifax, Nova Scotia, B3K 5X8, Canada
Tel: +1 902-492-4780 Fax: +1 902-492-4781 Email: info@satlantic.com

Satlantic LP declares that their:
1) PAR Sensor - Photosynthetically Active Radiation Sensor
2) OCR-500 - Ocean Color Radiometer
3) HyperOCR - Hyperspectral Ocean Color Radiometer
4) SAT-THS - Tilt Heading Sensor.
5) Bioshutter
6) Profiler II
7) ISUS - In Situ Ultraviolet Spectrophotometer
8) STOR-X
9) Alkaline Battery Pack

are classified within the following EU Directive:
Electromagnetic Compatibility Directive 2004/108/EC

and further conform with the following EU Harmonized Standard:
EN 61326-1:2006

Dated: 12 October 2012
Position of signatory: President
Name of Signatory: Marlon Lewis
Signed below:
on behalf of Satlantic LP

K - MANUAL REVISIONS

Date	Author	Rev.	Comments
2000-12-18	WTD/SKF	A	
2001-08-29	SKF	B	
2003-07-22	SKF	C	
2005-03-24	SKF	D	
2007-05-23	KMB	D1	Warranty statement
2011-06-22	SKF	E	Configuration parameter updates. Frame definition updates. Added sensor mechanical configurations.
2011-06-23	SKF	E1	Corrected sample frames
2011-12-29	SKF	E2	Changed Satlantic Inc. to Satlantic LP
2012-12-10	KMB	F	Declaration of Conformity
2013-05-21	RVD	G	Updated NEI. Added operating temperature range.

L - APPENDIX A

Using Windows® HyperTerminal

Most Satlantic instrumentation uses serial communications for interfacing with the outside world. This type of interface is simple to operate and convenient for applications such as these. Although the instrument's telemetry interface is used mainly for broadcasting telemetry, it can also be used to establish a human user interface so you may configure and test the instrument's systems. To use this interface, or to monitor instrument telemetry directly, you will need a terminal emulation program. These programs have many common uses such as communicating with bulletin board services, remotely logging on to other computers on a network, or communicating directly with your modem. You can also use it for direct communications with a serial port, which is ideal for communicating with Satlantic instruments.

There are many types of terminal emulation programs. Most of these are suitable for this application, so you are free to use whatever terminal emulator you are comfortable with. If you are unfamiliar with terminal emulators, this tutorial will help you get started with the emulator program that is distributed with Windows® called *HyperTerminal*.

The first step in using HyperTerminal is to make sure you have it installed. One way of starting the application is to use the **Start** button on your desktop. Select "**Run…**" and type "hypertrm" in the space provided. If the program cannot be found, it has probably not been installed. You can also check for a HyperTerminal installation by selecting **Start -> Programs -> Accessories**. If a **HyperTerminal** folder is visible in the **Accessories** folder, HyperTerminal is already installed.

If HyperTerminal is not installed, it is an easy matter to install it now. In Windows 95/98, open the Control Panel by selecting **Start -> Control Panel**. Open the **Add/Remove Programs** control. When you have setup these dialog boxes as shown below, press the OK button in each one. Windows will now install HyperTerminal on your computer. You may need your Windows Setup Disks/CD for this to complete. Just follow the on-screen instructions.

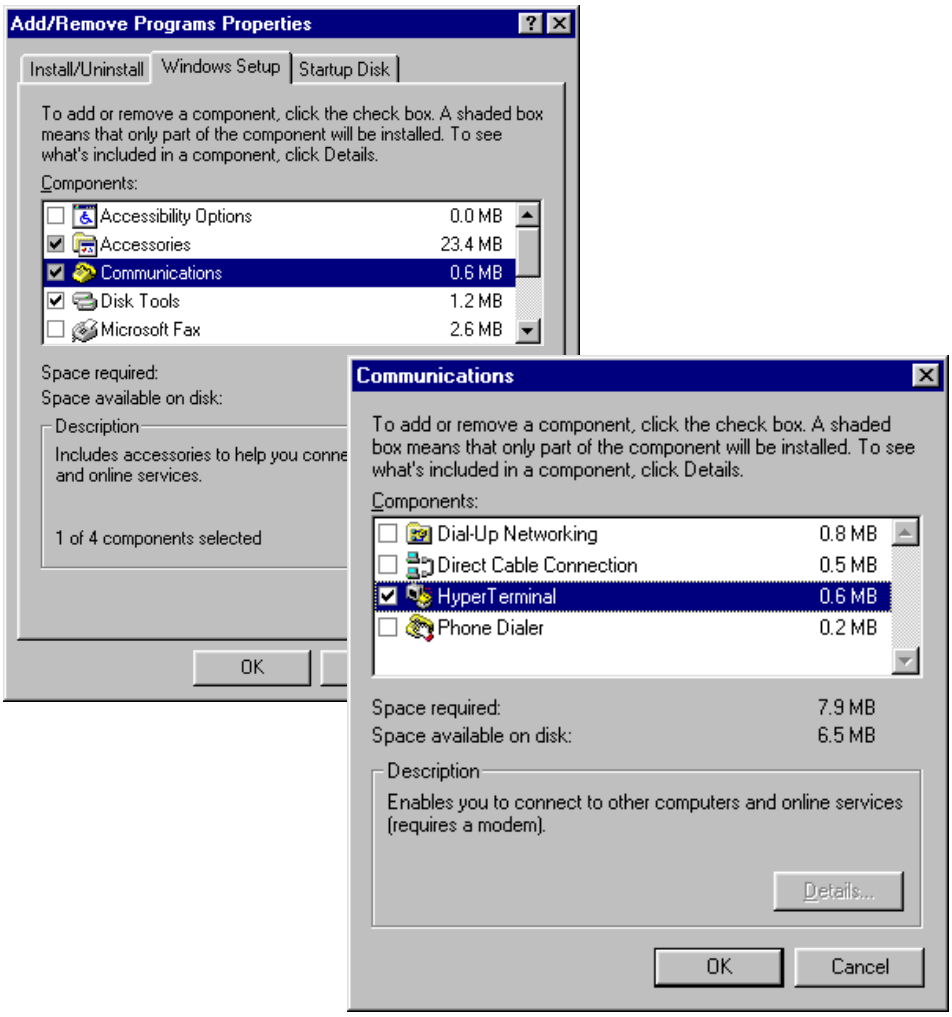

Figure 7 - Add/Remove Programs

When you run HyperTerminal with a new connection, the program will ask you for connection information so it can be saved for your next session. You should see the following dialog box.

Figure 8 - HyperTerminal Connection Description

Enter a name for your new connection in the space provided. The name should reflect the nature of the connections use. In this case, a good name would be “COM1 Direct” or “COM2 Direct”, depending on which serial port you are using on your computer. The word “Direct” indicates that you are making a direct connection to the port. You do not need a modem for a direct connection. When you have selected your connection name, press the OK button. This should invoke the “Connect To” dialog box, as shown below.

Figure 9 - HyperTerminal Connect To dialog box

As your connection does not involve a modem, only the “Connect using:” dropdown box is needed. Select a direct connection to your desired serial port as shown. After you make your selection, press the OK button. Finally, HyperTerminal will open a communications properties dialog box for the serial port you selected. An example dialog box, for COM1, is shown below.

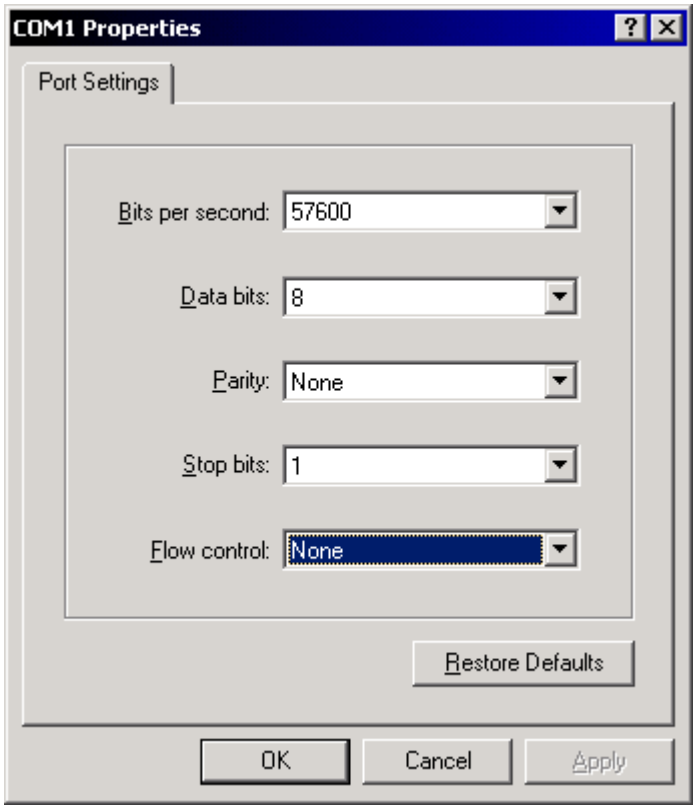

Figure 10 – Serial Port Properties dialog box

The parameters of this dialog box should be set to the specifications of your instrument’s telemetry interface. In most cases, this is 8 data bits, no parity, one stop bit, and no flow control. The “Bits per second:” dropdown box should be set to the baud rate of the telemetry interface. Keep in mind that you may change the properties of your connection at any time after your initial setup. Once you have chosen your settings, press the OK button. HyperTerminal will then connect to the serial port, which should be connected to your instrument, and display the main window.

You must now configure HyperTerminal’s emulation options for use with your instrument. Before you do so, you will have to disconnect HyperTerminal from the serial port. You can reconnect later when you are finished. Under the **Call** menu, select **Disconnect**. You can reconnect later with the **Call** menu item. To complete HyperTerminal’s configuration, under the **File** menu, select **Properties** to open the connection’s Properties dialog box. Select the “Settings” tab as shown below.

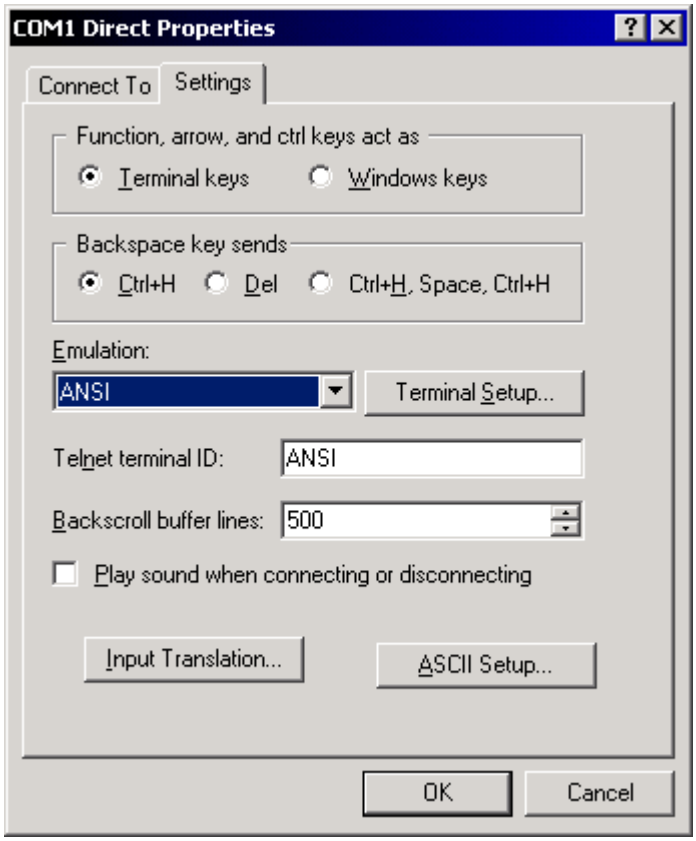

Figure 11 – Connection Properties dialog box

In the “Emulation:” dropdown box, select ANSI as the connection’s terminal emulation mode. The other settings of the dialog box should be set as shown. When you have completed setting these parameters, press the “ASCII Setup” button to open the ASCII Setup dialog box, as shown below.

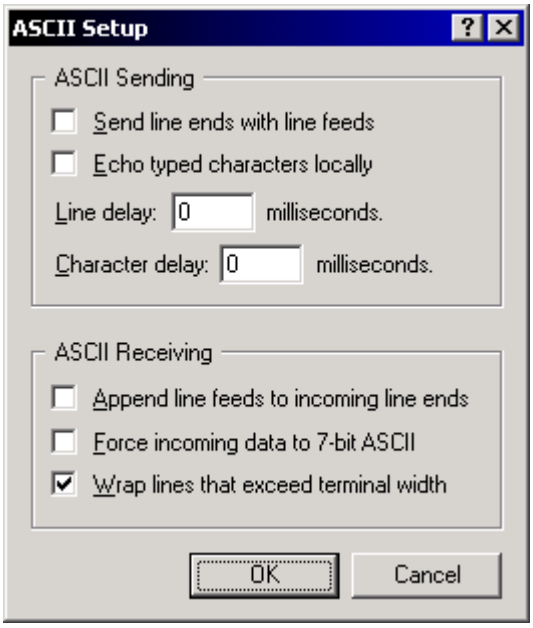

Figure 12 – ASCII Setup dialog box

Make sure this dialog box is setup as shown. These settings are important in maintaining proper character I/O with your instrument. You are now ready to use HyperTerminal to establish instrument communications.

You should only have to go through this setup process once. HyperTerminal will save all your connection information in a HyperTerminal file (*.ht). To reestablish your connection, simply open this file. HyperTerminal will open and automatically connect to the serial port with the saved settings.