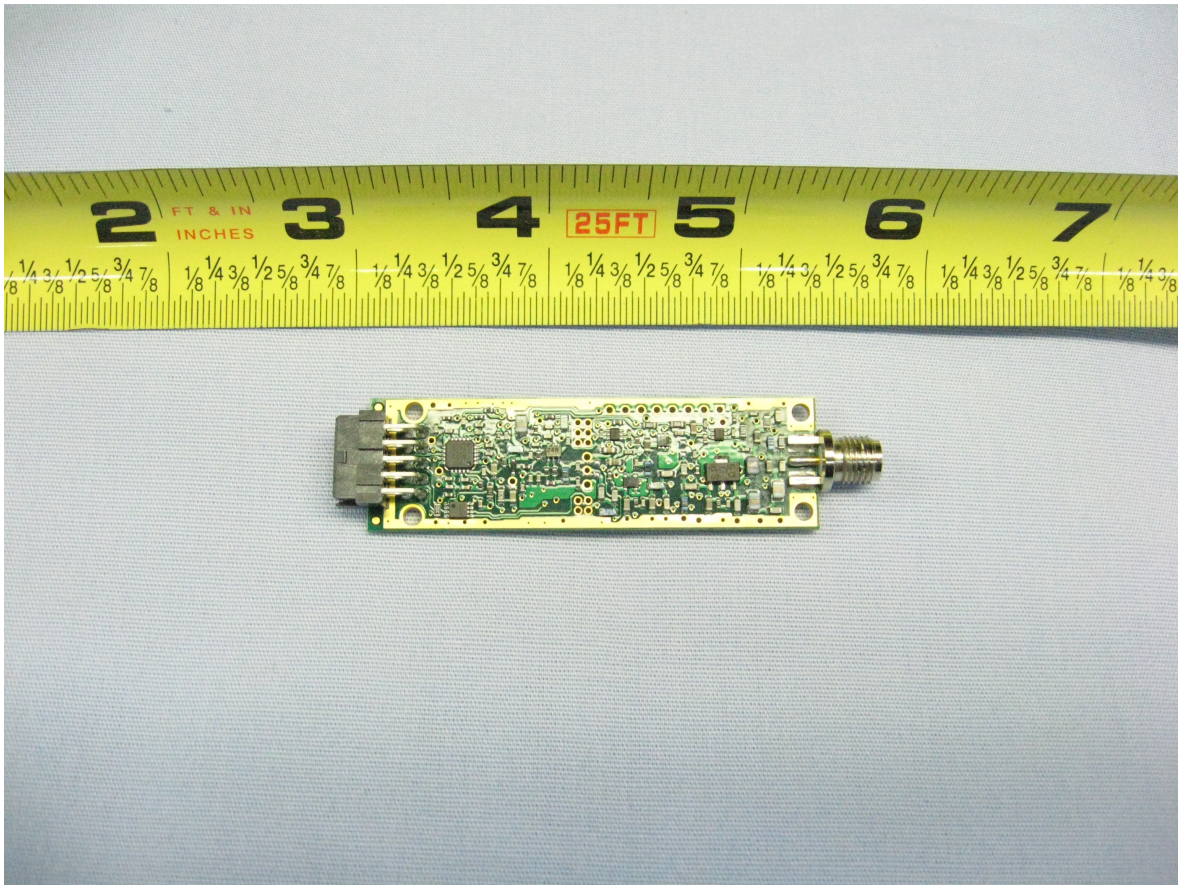
HAMMERHEAD

Argos Transmitter
(High Voltage) 7-24V

User Manual

Version 3.0
August 2011



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1 General Description

The Hammerhead is designed to protect your valuable assets and make their recovery even easier. The use of Argos makes your assets trackable from anywhere in the world. The Hammerhead is designed to meet or exceed you operational requirements for a stand-alone transmitter.

The Hammerhead is a fully functional Argos PTT (Stand-alone transmitter) that can be quickly integrated into mission specific packages, or used alone to gather Doppler based position information. The circuit board benefits from an incredibly small package and advanced power management, making it an ideal choice for long range, long term monitoring projects. Advanced firmware provides multiple options for remote sensors and data acquisition. The Hammerhead is field proven to provide excellent results in the harshest environments.

A water sensor feature can be implemented on the Hammerhead for specific applications. Contact Xeos Technologies Inc. for more information.

Xeos Technologies Inc. (Xeos) manufactures other products for multiple different applications.
See www.xeostech.com for details or call (902) 444-7650.

2 Working with Argos

2.1 Overview of Argos

Argos is a globally used location and data collection system. It can be used to find any mobile object, anywhere around the world, as long as it is fitted with a compatible Argos transmitter. Satellites orbiting close to the Earth receive messages transmitted from Argos compatible transmitters located on a deployed unit. These messages are then re-transmitted from the satellites to receiver stations located on the Earth. The receiver stations then re-transmit the messages to an Argos Processing Centre. The Argos Processing Centre measures the Doppler Effect (ie. the change in frequency of a wave relative to wave origin and observer) on the transmitted frequency. Using this measurement, position or original transmission can be calculated. The Argos Processing Centre will process any data collected and then send both the collected data and the unit position to the user. For more information related to Argos, see the Argos website at http://www.argos-system.org or an Argos manual can be found at http://www.argos-system.org/manual/ .

2.2 Account Setup

If the user does not already have an Argos account set up, or the unit to be deployed does not have an Argos ID number, an SUA (System Use Agreement) Form and/or an ID Number Request Form must be filled out and given to User Services. Both of these forms can be downloaded from https://www.argos-system.org/html/userarea/forms_en.html . Once the appropriate form has been processed, a Service Contract/Order Form and a Prices List will be sent back to the user. These forms will also need to be filled out and returned to User Services. Once the signed order form has been received, User Services will send a Program Overview to the user, and the device will be authorized for deployment using Argos.

2.3 Data Acquisition

There are many different ways of accessing positioning data from Argos. ArgosWeb is a secure website that displays the location of the unit using Google Maps and has an option to download all collected data. ArgosServer provides the user with remote access to Argos data with TELNET. ArgosDirect allows data to be sent to the user through E-mail, FTP (File Transfer Protocol), or CD-ROM. ArgosShare allows users to share any collected data with other personnel. ArgosMonitor monitors the position of unit, unit state, and any sensor data for changes in state. Any change in state will create an alert that is sent to the user by E-mail, SMS (Short Message Service) or Fax. For more information on Data Acquisition, view the Argos Manual (Ch 6 – How to access Argo data) at http://www.argos-system.org/manual/ .

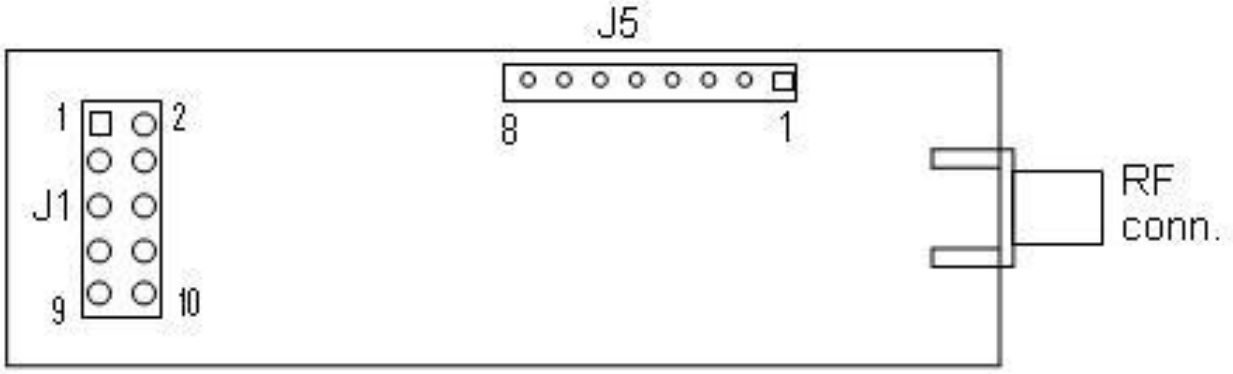
3 Hammerhead Pin Out

The following tables show the standard pin-out for the Hammerhead board. The location and orientation of the connectors is shown in the drawing below.

3v CMOS Logic levels only

J1 Connector Pin-out		
Pin Number	**Signal Name**	**Description**
1	Vbat+	Battery Voltage input
2	Vbat+	Battery Voltage input
3	Wtr Sns Pin	Water Sense input
4	RF ONP	Output(goes high during Argos transmission)
5	RSTL-B	CPU Reset pin(internally pulled high)
6	TX-ONP	Ouput(goes high during Argos transmission)
7	TXD1-B	Serial output from PTT
8	RXD1-B	Serial input to PTT
9	GND	Ground
10	GND	Ground

J5 Connector Pin-out		
Pin Number	**Signal Name**	**Description**
1	VDD	Internal 3V digital supply
3	TDO	JTAG programming pin
4	TCK	JTAG programming pin
5	TMS	JTAG programming pin
6	RESETL	Active low reset pin
7	GND	Signal ground
8	LED 1A	Optional LED drive output.



4 Programming

The Hammerhead may be powered up and configured using the included USB adapter. However it is not recommended that it be tested for RF transmissions when powered from the USB port since the 5V supply from the USB port is too low. Once it has been configured, switch the cable to operate from a 7.5V laboratory supply or battery pack. To use the adapter:

1. Connect the RF connector on the Hammerhead to a dummy load or antenna.

2. Plug the black 10-pin connector on the USB adapter into the Hammerhead connector (only fits one way).

3. Plug the USB connector into a computer. You may have to install a driver for the Silicon Labs CP2102 chip in the adapter. If necessary download the "VCP Driver Kit" for the computer operating system from the following web site: http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx

4. On the computer, run a terminal emulator such as HyperTerminal. Configure it to access the selected USB port and set the following parameters:
   Baud rate: 9600 baud
   Data bits: 8 bits
   Parity: None
   Stop bits: 1
   Flow Control: None

4.1 User Commands

There are two different protocols used for commands: Binary and ASCII commands.

4.1.1 Binary Commands

Some of the Hammerhead binary commands emulate the command protocol used in the X-Cat PTT, Wild-Cat, and Smart-Cat. Others were added at a later date to make it easier to send data, if you do not want to use the Legacy Protocol. Binary commands may include both printable ASCII characters, and non-printable 8-bit "binary" characters. A typical binary command has the following structure:

U$CCppp[k]m

where:

U	is an optional wake-up character = "U" (0x55). It is generally not required at baud rates of 9600 or lower.
$	Start Character = "$" (0x24) indicates the start of a command string. Any characters received prior to the start character are assumed to be wake-up characters.
CC	two ASCII letter characters which represent the command.
ppp	The number and type of parameters are defined by each command. Some commands do not have parameters. Parameters may be any byte value (0x00 to 0xFF).
[k]m	"m" is a command terminator byte. The terminator must have at least a carriage return or a line feed or both. However, "k"a checksum is optional. If you choose to include a checksum, it must come before the carriage return or line feed

Checksum: The least-significant byte of the arithmetic sum of all the bytes between the start character and the checksum (the start character and checksum are not included). If there is a checksum error, the command is rejected.

4.1.2 ASCII Commands

ASCII commands are similar to the binary command protocol except that:

1. They only use standard printable ASCII characters. This allows the user to send commands using a standard terminal emulator.
2. There is no checksum required.
3. Most of the ASCII commands are not case sensitive.

A typical ASCII command has the following structure:

U$CCppp<CR><LF>

The elements of the command are the same as those defined for binary commands.

4.2 Operating Modes

The Hammerhead has several modes of operation which can be grouped into two categories: "Command" modes and "Normal Operating" modes.

Command modes are used to configure the device and the Hammerhead will only respond to certain commands depending on the mode it is in. The two command modes are:

Binary Command mode – is used to configure the device with binary commands. This mode is selected with the $EC command.

ASCII Terminal mode – is used to configure the device with ASCII terminal commands. This mode is selected with the $ET command.

Normal Operating modes are used for transmitting ARGOS messages. Only some commands are available in these modes. Currently there are two Normal operating modes:

Mode 0: Position-Only PTT mode - where a short message with three data bytes (all zeroes) is sent. This mode is selected with the $M0 command.

Mode 1: User Data PTT mode – where the user loads data packets to be transmitted. This mode is selected with the $M1 command.

The commands available in each mode are described in the following sections.

4.3 Command Definitions

In the following command definitions "Binary" commands are shown with the letter *k* indicating that a checksum is optional as stated in the "Binary Commands" section. "ASCII" commands do not require a checksum.

The following commands may be issued in Normal Operating Modes:

$TO[*k*]m	"Transmit ON" - enables transmissions (case sensitive must be caps if using checksum)
$TF[k]m	"Transmit OFF" - disables transmissions (case sensitive must be caps if using checksum)
U$SDnddd[*k]m*	"Send Data" where: n = number of data bytes to be sent (1 to 31) ddd = data bytes (variable length set by n) k = terminator (See Section 5.3 for more info on this command)
U*nndddc	"Send Data" where: nn = number of data bytes to be sent (1 to 32) ddd = data bytes (variable length set by n) c = checksum *= start character (See section 5.4 for more info on this command.)

U$TKxddd[*k]m*	"Send Data" where: x = number of data bytes to be sent (1 to 31) ddd = data bytes (variable length set by x) k = terminator (see section 5.1 for more info on this command)
U$TNxddd[*k]m*	"Send Data" where: x = number of data bytes to be sent (1 to 31) ddd = data bytes (variable length set by x) k = terminator (See section 5.2 for more info on this command)
$ET	"Enter ASCII Terminal mode" allows ASCII commands
$EC<*CR*><*LF*>	"Enter Binary Command mode" allows binary commands

The following commands are only available in "ASCII Terminal Mode":

Note: **in these commands, integer values noted by n, are meant to be typed as one or more ASCII characters (in the range 0-9), not binary values. Commands that need to be terminated by a carriage return and linefeed<*CR*><*LF*> are labeled as such. For example $SF3<*CR*><*LF*> will set the frequency to channel 3; $SF12<*CR*><*LF* will set it to channel 12. Leading zeroes are also allowed.**

$SIxxxxxxx<*CR*><*LF*>	"Set ID" – where xxxxxxx is the ASCII representation of the digit hexadecimal ID
$SFn<*CR*><*LF*>	"Set Frequency" channel – where $1 \leq n \leq 14$
$SRn<*CR*><*LF*>	"Set Repetition" period – where $30 \leq n \leq 300$
$SLn<*CR*><*LF*>	"Set Lifetime" – where n is the number of hours to transmit
$SQ	"Settings Query" – displays the device ARGOS settings
$CD	Configuration Display – displays the device configuration
$M0	sets the device to Position-Only PTT mode.
$M1	sets the device to User Data PTT mode.
$EN	"Enter Normal mode" – switches unit to normal operating mode

The following commands are only available in "Binary Command Mode":

$SIxxxx*[k]m*	"Set ID" – where xxxx is the 4-byte hexadecimal ID (a leading 0 is required to make it 4 bytes)
$SFn[*k*]m	"Set Frequency" channel – where $1 \leq n \leq 14$
$SRn[*k]m*	"Set Repetition" period – where $30 \leq n \leq 300$
$RI[*k]m*	"Read hex ID" – the response is $RI=xxxx*k*<*CR*><*LF*> where xxxx is the 4-byte hexadecimal ID
$RF[*k]m*	"Read Frequency" channel – the response is $RF=n*k*<*CR*><*LF*> where $1 \leq n \leq 14$
$RR[*k*]m	"Read Repetition" period – the response is $RR=n*k*<*CR*><*LF*> where $30 \leq n \leq 300$

5 Using the Hammerhead to Send a Data Message

In order to make using the Hammerhead both simple and backwards compatible with older Argos formats, there are 4 different commands that send Data. This section describes how to use the 4 commands by giving examples, as well as what legacy product the command emulates.

You must first configure the Hammerhead for "User Data PTT mode"
Connect the Hammerhead to a computer and run a serial emulator like "HyperTerminal"

Type "$et" to enter ASCII terminal mode
Type "$m1" to enter "User Data PTT mode"
Type "$en" to exit ASCII terminal mode and go back to normal operating mode

You will not have to do this again; these settings are saved in EEPROM and will be retained in the unit even if it is powered off. Once you have connected the microcontroller that is going to send the data, you are now ready to give the Hammerhead the commands to send data

5.1 The $TK Command

To send the data message "0xAA 0xBB 0xCC "using the $tk Command, the binary message will look like this:

24 74 6b 03 aa bb cc 0a
$Tk(3 byte message) (message aa bb cc) (LF)

NOTE: This command enables transmissions, sends the data once, and then disables transmissions. If you want to send data again, you have to use one of the "send data" commands again.

NOTE: You will not be able to override the Repetition rate already programmed into the Hammerhead with this command. ie: if the rep rate is 90 seconds, the Hammerhead will hold the message until 90 seconds has passed since the last message was sent.

5.2 The $TN Command

This command is exactly the same format as the $TK command. The only difference is that if this command is used, the Hammerhead will send $TC on its serial TX line, once the message has been sent to the satellites.

5.3 The $SD command (X-Cat)

This command emulates the X-Cat command for sending data

First you must enable transmissions: send "$TOk(k)" to enable transmissions

To send the data message "0xAA 0xBB 0xCC" using the $SD command, the binary message will look like this:

24 53 44 03 aa bb cc cb 0a

$SD(3 byte message)(message aa bb cc)(53+44+03+aa+bb+cc=2CB checksum=CB)(LF)

NOTE: Once this command is sent, the Hammerhead will continue to send the same data over again at the programmed repetition rate, until transmissions are disabled, or until a new command with different data is sent to the Hammerhead.

NOTE: This command does not require a checksum, however to make it compatible with the X-Cat command, you may add one to ensure the data being sent is correct.

5.4 The * command (Wild Cat, Smart Cat)

This command emulates both the Wild Cat and Smart Cat commands.

To send the data message "0xAA 0xBB 0xCC" using the"*" command, the binary message will look like this:

2a 00 03 aa bb cc 31 0a

*(3 data bytes)(data aa bb cc)(aa+bb+cc=231 checksum=31)(LF)

NOTE: A checksum is required for this command. However, you only add the "Data" values to calculate the checksum, do not include the start character or the value stating how many data bytes there are.

NOTE: If you are only using a 20 bit ID you are able to send 32 bytes of data instead of only 31.

6 Bootloading New Firmware

A bootloader is normally installed in the Hammerhead to allow programming of new firmware. The bootloader runs at power-up and whenever the CPU is reset. It issues a “>” prompt character. If it does not receive any bootloading commands, the bootloader program times out after about 10 seconds and then executes the main code.

To load new main code using the bootloader, connect the device to a computer using the USB adapter as described in the previous section. If the device is powered from the USB adapter, unplug the Hammerhead from the adapter (but leave the USB plugged into the computer).

Shut down any terminal program on the computer that is using the USB adapter port.

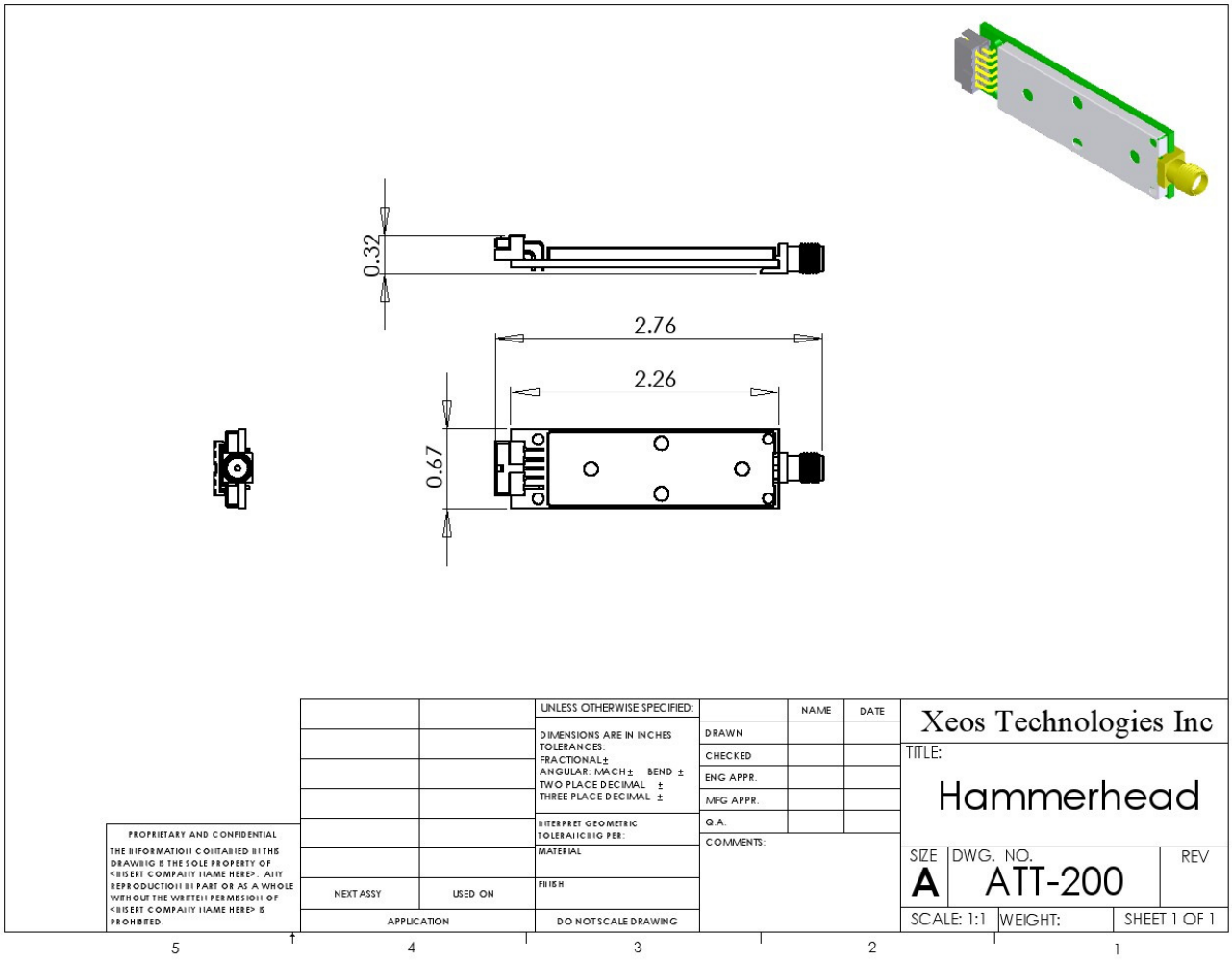
Run a bootloader application such as MegaLoad .NET V7.0. Select the COM Port for the corresponding USB port, set the baud rate to 57.6 kbaud (which is the normal baud rate for the bootloader.

Select the hex file for the new firmware and then plug Hammerhead into the USB adapter. The bootloader should start automatically and begin loading in the new code. (It should print messages “Sending Page #1, Sending Page #2 … in the messages window.) When it is complete exit the bootloader application on the computer (or it will reload the code each time you cycle power on the Hammerhead.)

Appendix A - Technical Specification

Mechanical:

Dimensions: 2.76” x 0.67” x 0.32”



Electrical:

Electronics

Supply Voltage:	7V – 24V
Digital Controller:	Xeos Hammerhead
Antenna Output Impedance:	50 ohms nominal
Sleep Current:	<30µA
Transmit Current:	325mA @ 800mW Output
Output Power:	From 500mW to 1 watt (voltage dependant)
Channels:	14 Frequency synthesized from 401.63MHz to401.656MHz
Serial Interface:	TTL level 9,600 baud (Firmware bootloader standard)

Environmental

Operating Temperature:	-40° C to +60° C (-40° F to +140° F)
Storage Temperature:	-50° C to +80° C (-58° F to +176° F)

Warranty, Support and Limited Liability

Xeos Technologies Inc. warranties the Hammerhead to be free of defects in material or manufacturing for a period of one year following delivery. Liability is limited to repair or replacement of the defective part and will be done free of charge.

LIMITED WARRANTY: Xeos Technologies Inc. warrants that the product will perform substantially in accordance with the accompanying written materials for a period of one year from the date of receipt.

CUSTOMER REMEDIES: Xeos Technologies Inc. entire liability and your exclusive remedy shall be at Xeos Technologies Inc. option, either (a) return of the price paid or (b) repair or replacement of the product that does not meet Xeos Technologies Inc. Limited Warranty and that is returned to Xeos Technologies Inc. with a copy of your receipt. This Limited Warranty is void if failure of the product has resulted from accident, abuse, or misapplication. Any replacement product will be warranted for the remainder of the original warranty period or ninety (90) days, whichever is longer.

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