



Microwave
Telemetry, Inc.

5g SOLAR PTT FIELD MANUAL





Microwave Telemetry, Inc.

8835 Columbia 100 Parkway
Suites K & L
Columbia, Maryland 21045
USA

Phone: 410.715.5292

Fax: 410.715.5295

Email: support@microwavetelemetry.com

Web: www.microwavetelemetry.com

Cover Pictures courtesy of (from left to right)
Luca Dehelean, Ugo Mellone, Ruben Limiñana



TABLE OF CONTENTS

GENERAL INFORMATION

5g Solar PTT.....	5
Unpacking.....	7

TESTING

Testing.....	9
Attachment.....	13

DATA

Data Formats.....	15
Data Retrieval.....	16
Data Decoding.....	17

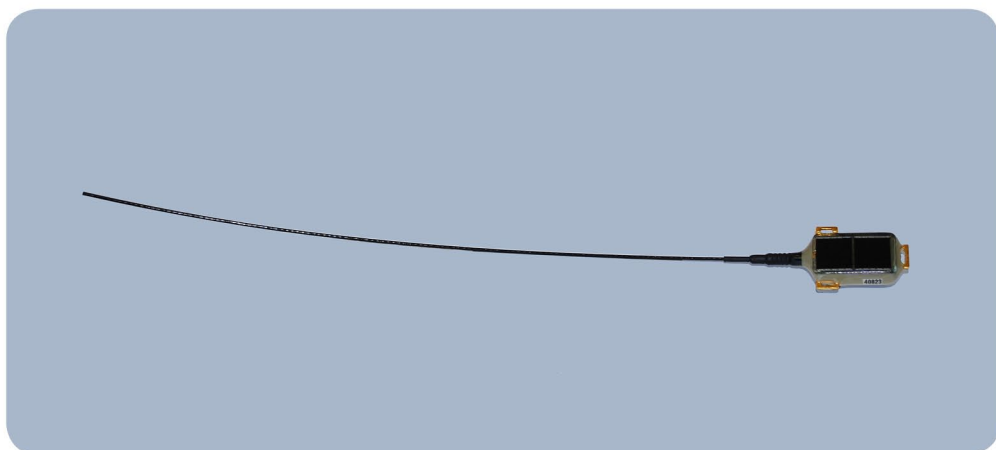
QUESTIONS

Troubleshooting.....	20
Storage.....	22
Returning Your PTT.....	24
Contact Information.....	26
Glossary.....	27
Notes.....	30



Thank You For Your Order!

We are happy to provide you with our state-of-the-art
5g Solar PTT.



5g Solar PTT

Our 9.5g solar PTT was warmly welcomed by biologists interested in tracking birds such as Hen Harriers and Whimbrel but biologists studying shorebirds implored us to find a way to reduce the weight of the PTT so that they too could have a means of tracking these birds' long-range movements. The task was daunting. To reduce a tiny PTT by even a gram or two is a challenge. But to create a PTT small enough to track birds in the 150 to 250 gram range would require nearly halving the weight of the smallest PTT we had built thus far. We needed to further explore the latest developments in solar cells and microelectronics.

It took a year to prepare the first prototype 5g solar PTTs, which were tested on Red Knots in Florida in January 2007. Since then this truly tiny PTT has also been used to track Marbled Murrelets, Kittlitz Murrelets, Amur Falcons and Hobbies. The Amur Falcons have been tracked on their migration from South Africa to N.E. China and back again.

To take the 5g solar PTT from prototype to general production required a tremendous investment of time and money. New machinery was required to handle the smaller components used in this PTT. We had to expand our facility to accommodate the new machinery. We are now offering the 5g solar PTT on a limited production run basis.



5g Solar PTT

Features

Microprocessor controlled battery charging
 Duty Cycle timer
 Sensors: Temperature and Battery Voltage standard
 Mounting loops
 Option- Activity sensor (this will add weight to the PTT)

Physical Specifications

Dimensions: L 0.95" (24) X W 0.55" (14) X H 0.30" (7.5) (mm)*
 Weight: 5 grams
 *Antenna and mounting loops not included in these dimensions
 Antenna: Hard nylon coated flexible stranded marine grade stainless steel, 8.5" (213 mm) long.

Construction

Potted in high grade epoxy resin

General Electrical Specifications

Operating frequency: 401.650 MHz \pm 36 kHz
 Power output: 200 mW output is standard **
 Output impedance: 50 ohms
 Modulation Tri Phase PSK: \pm 1.1 Rad \pm 0.1 Rad
 Quiescent current: $<3 \mu\text{A}$
 Spurious emissions: -45 dB
 Transmission interval: 45 to 120 sec***
 Operating temperature range: -5 to 45 Deg C

Sensors

The 5g solar transmitter comes complete with sensors to measure temperature and its own battery voltage with each parameter relayed by Argos on each transmission. Available with an optional activity sensor.

** Adjustable between 100 - 300 mW

*** This can be optimized for your requirements at time of manufacture



UNPACKING

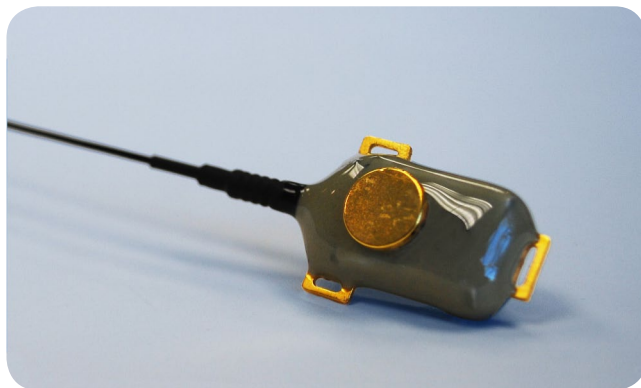
1 Please keep the original box.

Your PTT has been shipped in special antistatic packaging to provide maximum protection during shipment and storage. In the event that you need to return the PTT to us, it will be necessary to ship it in the original box (see Returning your PTT on page 24).



2 Do not remove the magnet until ready to use.

When you remove the PTT from the box, you will notice a magnet taped to the bottom of the unit (see photo). The PTT is activated by removing the magnet from the bottom of the unit. When you remove the magnet PTT begins to transmit.



UNPACKING

3 Always use the button magnet supplied, never use a bar magnet.

Save the button magnet supplied with your PTT. It is the correct magnet to use to operate the PTT's internal switch. The use of any other magnet may not provide the proper magnetic field to shut the PTT off, resulting in battery drain during storage.



Correct magnet



DO NOT USE!

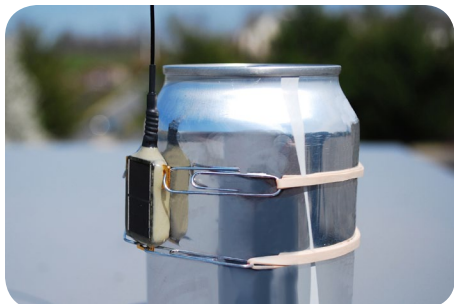
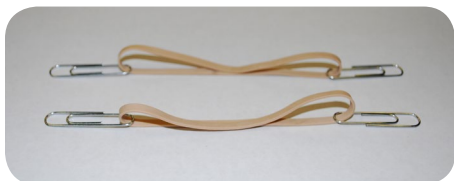


TESTING

Do not deploy your ptt without testing the device and verifying that it is operating correctly.

1 Place the PTT outside in the open for testing.

These tiny PTTs have their antenna tuned to operate optimally when they are attached to the bird. The tiny body of the PTT capacitively couples to the bird, making the bird itself part of the antenna system. To simulate the body of the bird the PTT can be easily attached to a full can of soda or a plastic bottle of saline using 4 paper clips and 2 elastic bands. Make sure that the antenna projects as much as possible above the can or bottle. Place the can or bottle with the PTT attached on a high point with a 360° view of the horizon (remember most of the satellite passes are below 30° above the horizon, so it is imperative that there is an all-around clear view of the horizon from the PTT if you are to get good reception of the PTT at the satellite). Make sure the solar array is facing south (facing north in the Southern Hemisphere).



TESTING

If **multiple PTTs** are placed outside for testing, they should be placed at a relative distance of **at least one meter**.

BEFORE DEPLOYING YOUR PTT, IT MUST BE TESTED THROUGH THE ARGOS SYSTEM.

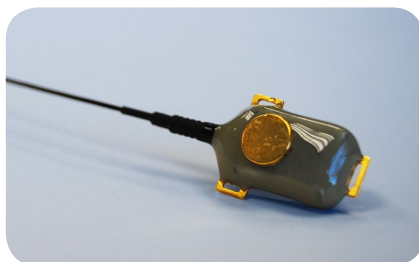
Save the test data for later reference.

2 Be careful not to cover any area of the solar array with tape or any other fastening material.

Covering any part of the array will prevent proper charging of the solar battery.

3 Be sure the magnet has been in the STOP position for at least 70 seconds.

This ensures that when the internal microcomputer “wakes up,” which it does approximately once every minute (the transmission interval), it will sense the timer reset condition and start at the beginning of the test period (the first ON time of your duty cycle) when the magnet is removed.



TESTING

4 Remove the magnet from the STOP position.

Your 5g solar PTT has a standard duty cycle of 10 hours ON and 48 hours OFF. The timer within the PTT commands the PTT ON for the desired period (e.g., 10 hours) and switches it OFF for the desired sleep period. The ON time begins whenever the magnet is removed from the base of the 5g PTT (provided the magnet has been in place for 70 seconds).

Assuming that the PTT is at least partially charged, removing the magnet will initiate transmission. The PTT will then transmit until the charge is depleted. It may then recharge, if it is in the sun, and transmit again until the end of the 10 hour ON period. The recharge time depends on the amount of sunlight the solar array receives.

5 Leave the PTT outside for one complete duty cycle.

If it is not possible to leave the PTT outside for the duration of a complete duty cycle, at a minimum, allow it to remain in the proper test position for the initial 10 hour ON period, to allow time for several satellite passes.



TESTING

A successful test is contingent on adequate battery charge. We recommend you begin your test period in the morning hours of a sunny day so that the unit's solar array can recharge the battery throughout the transmission period.

6 Log into the Argos System to retrieve data.

SEE SECTION ON DATA RETRIEVAL ON PAGE 16

7 Switch off the PTT by replacing the magnet on the bottom of the 5g PTT.

The magnet must be in place for at least 70 seconds to reset the timer before deployment.

Considerations...

If the PTT is going to be deployed at geographical locations far from where it was tested, it should be allowed to transmit for at least one day close to the release site to initialize the Argos system. Initializing the PTT allows Argos to determine its location more quickly. This is also achieved by calling CLS and asking them to initialize the system to the coordinates of the release area (see Contact Information on page 26).



ATTACHMENT

Attachment to the Bird

Take care that the solar array is not even partially covered by the bird's feathers. You may need to trim some feathers from around the transmitter to ensure proper attachment.



Photo by Tomas Aarvak/
Bird Life Norway



ATTACHMENT

If you have never attached a satellite transmitter to a bird before, please contact us and we will be happy to provide you with some resources (see Contact Information on page 26).

It is imperative that you seek training in harnessing the PTT to the bird. We are not responsible for improperly harnessed transmitters.

Do not modify the PTT in any way!

Many researchers choose to custom-make their harnesses from tubular Teflon ribbon. As a courtesy to our customers, we occasionally provide Teflon ribbon at cost. However, you can obtain it directly from the manufacturer:



Photo by Matyas Prommer

Bally Ribbon Mills
23 North 7th Street
Bally, PA 19503-1004
USA
Phone (610) 845-2211
Fax (610) 845-8013
www.ballyribbon.com



DATA RETRIEVAL

Even if you receive your data via Argos ADS, it is useful to know how to log in and check it for yourself. Occasionally, ADS fails; should that happen, you may want to log in directly* and retrieve your data.

1 Log into Argos via the Argos website:
<https://argos-system.clsamerica.com/cwi/Logon.do>

2 Click “Data Access” followed by “Most recent messages”

3 If you have a transmitting PTT click on “Download COM/PRV/DIAG”, then click the arrow to the left of the “PRV/A DS” selection.

4 For “platform” select “all” and then select “ten days”. Download the data and save to a folder on your computer.

5 Repeat this procedure, this time selecting the arrow to the left of the “DIAG” selection.

An Argos user can log in and access the prior ten days of data; after ten days the data is archived and no longer easily accessible. You need to retrieve your data in both DS and DIAG formats.

*See your Argos manual for more details.



DATA RETRIEVAL

Explanation of PTT Sensors

Your 5g PTT is equipped with four sensors for temperature, battery voltage, transmission counter and possibility of the optional activity counter, respectively. Temperature and battery voltage data are integers representing the PTT's internal temperature and battery voltage; these can be converted using calibration formulas. The transmission counter increments every time the PTT transmits, and wraps back to zero when it reaches its maximum value.

The optional activity sensor indicates movement. During a PTT's ON time, it checks every minute for movement. If there is movement, the sensor increments up, then wraps back to zero when the maximum value has been reached. The activity sensor value in itself does not have meaning, it is the change (or lack thereof) that is significant. If the activity sensor value is constant (plus or minus 1) over two or more transmission cycles, it is indicative of bird mortality or PTT detachment.



Photo by Anita Attila



DATA DECODING

Decoding the Sensor Telemetry

The sensor data from a Solar PTT with a 28 bit ID number is transmitted in a 24 bit message as follows:

Sensor CH #1 – 8 bits	(values between 0 - 255)
Sensor CH #2 – 8 bits	(values between 0 - 255)
Sensor CH #3 – 2 bits	(values between 0 - 3)
Sensor CH #4 – 6 bits	(values between 0 - 63)

In order for you to interpret the data easily, you should be sure that Service Argos is passing the data to you with

A1 processing.

The four channels correspond to the following sensors:

- CH #1 The internal temperature of the unit**
- CH #2 The battery voltage**
- CH #3 A counter that increments by one on each transmission**
- CH #4 Activity (if fitted with optional sensor)**

Pages 18 - 19 show examples of the sensor data as transmitted to the user.

On every fourth transmission, the normal sensor frame is replaced by a special information frame. The channels in the information frame provide the following data:

- CH #1 The current hour of present ON time part of duty cycle**
- CH #2 The current cycle of present season**
- CH #3 Spare (normally 0)**
- CH #4 The current season**



DATA DECODING

DS vs. DIAG

To get the full benefit from your PTT, you need to receive your data in both DS and DIAG formats. DS data provides all the PTT's sensor data, whereas the DIAG format gives only a sample. If you are concerned that your bird has died, or that your PTT is having trouble charging, you need to examine your DS format sensor data.

Sample Argos Data

DS Format

```
00123 35222 8 4 D 2 1996-07-12 16:34:55 65.588 251.759 0.000
401652330
```

1996-07-12 16:29:19	1	91	124	01	09	
1996-07-12 16:30:34	1	01	02	00	03	
1996-07-12 16:31:48	1	90	124	03	09	
1996-07-12 16:33:03	1	90	124	00	09	
1996-07-12 16:34:18	1	90	124	01	09	*
1996-07-12 16:35:33	1	01	02	00	03	**
1996-07-12 16:38:02	1	90	124	03	09	

007 msgs 000>-120dB Best: -127 Freq: 652330.3 IQ: 66

Lat1: 65.588N Lon1: 108.241W Lat2: 71.196N Lon2: 140.678W

*Normal information frame

Temp=90 Bat Volts=124 Counter=01 Activity Counter=09

Temperature sensor value can be decoded by applying the following formula where y is deg. C and x is sensor value:

$$y = -28.682 + 0.3609x$$

Battery sensor value can be decoded by applying the following formula where y is voltage and x is sensor value:

$$y = 3.173 + 0.0049x$$



DATA DECODING

****Special information frame**

Hour=01 Cycle=02 Spare=00 Season= 03

DIAG Format

35222 Date: 12.07.96 16:38:02 LC:2 IQ: 66

Lat1:65.588N Lon1: 108.241W Lat2: 71.196N Lon2: 140.678W

Nb mes: 007 Nb mes>-120dB: 000 Best level: -127 dB

Pass duration: 523s NOPC : 2

Calcul freq: 401 652330.3 Hz Altitude: 0m

90 124 03 09

DATA



TROUBLESHOOTING

Problem	Explanation	Action
No results received from CLS when testing your PTTs	CLS may not be sending the results to you by ADS.	Contact Argos, check that the PTT ID is on the ADS list.
	Shielding by metal enclosures interferes with the signal.	Remove the bird and PTT from the metal cage. Elevate above metal roof.
	No satellite overpasses during time of test.	Reset and test again for a longer period or contact us for an optimal test period.
	Solar PTT is not transmitting during the test because the battery voltage is lower than cutoff voltage.	Place the PTT in full sun for several hours with the magnet on, then retest.
	Most satellite passes over any given spot are less than 30° above the horizon. Tall buildings can prevent the satellite from “seeing” your PTT.	Test your PTT in a wide-open space, free of obstructions, with a clear view of the horizon.
	Looking in the wrong place on the Argos web for your data.	Follow the instructions on page 15 to download your data.
	Logging in too soon for data. It can take several hours for data to be received and processed.	Wait a few hours and log in again.



TROUBLESHOOTING

Problem	Explanation	Action
PTT will not switch off	The wrong type of magnet is in use (magnetic field at 90° to switch).	Use only the button magnet supplied.
Activity sensor reading stays the same (+/-1)	PTT is not sensing movement; bird is dead or the PTT has become detached.	Try to locate and retrieve the PTT.
Some of the PTTs seem to be transmitting in storage	PTTs are too close together and their magnets are canceling each other out.	Separate the PTTs. Leave at least 2 inches between each PTT.
Sensor data contains letters as well as numbers (e.g., A7)	Sensor data is being processed in hexadecimal rather than decimal format.	Ask Argos for A1 (decimal) processing of sensor data.

Please do not hesitate to contact us at 410-715-5292 or by email at microwt@aol.com if you are having a problem that is not listed in the troubleshooting guide.



STORAGE

If the PTT is not going to be used...

1 Turn it off.

Place the button magnet over on the bottom of the transmitter and tape it securely in place.

2 Do not store in complete darkness.

A charge should be maintained in the battery; for this reason the solar charged PTT should not be stored in complete darkness. Periodic exposure to direct sunlight (at least 4 hours every two weeks outdoors) will maintain the battery charge.

3 The magnet should remain on the PTT while it charges.

Remember that nothing (e.g., tape) should be allowed to cover the solar array.

The PTT comes equipped with an automatic shunt to prevent overcharge, even if the magnet is in place.



STORAGE

- 4 After storage, the PTT should be allowed to run for one complete cycle before being attached to a bird to verify that it is functioning properly and data are being received and processed correctly by Argos (see section on Testing on page 9).



Photo by Roy Dennis



RETURNING PTTs

- 1 Notify us that you will be returning the PTT.
- 2 Package PTT securely—in its original box.

Remember that the packaging used to ship your PTT to you will also ensure a safe return to us!



- 3 Use FedEx (Federal Express)

FedEx is our preferred carrier*, but we also accept packages shipped via U.S. Priority Mail. Should you ship via a different courier, we cannot guarantee that we will be able to supply the necessary paperwork to clear your package!

*We have an agreement with FedEx that allows them to clear incoming packages without additional charges and added paperwork.



RETURNING PTTs

1 International Customers need to include a “Declaration for Free Entry of Returned American Products Form” with paperwork on the box. Contact us for a form to include with the returned PTTs.

In the past, we have been levied duties and taxes because the paperwork accompanying the PTTs did not state that the goods were manufactured in the United States by us. Dealing with the Customs Clearing department wastes a lot of valuable time. Please be aware of this when shipping the PTTs back to us or the package may be returned to you.

ANY PACKAGE CONTAINING PTTs BEING RETURNED TO US WITHOUT THE PROPER PAPERWORK WILL BE RETURNED TO THE SENDER AT THE SENDER'S EXPENSE!

2 Use Federal Express (FedEx)

When returning a used PTT, please indicate a depreciated value on the “Declaration for Free Entry of Returned American Products Form” and any other Customs documents affecting the shipment.



CONTACT INFORMATION

MICROWAVE TELEMETRY, INC.

8835 Columbia 100 Parkway
Suites K & L
Columbia
Maryland 21045, USA

Phone (410) 715-5292

Fax (410) 715-5295

support@microwavetelemetry.com

www.microwavetelemetry.com

To Reach CLS America:

4300 Forbes Boulevard
Suite 110
Lanham, MD 20706 USA

Phone (301) 925-4411

Fax (301) 925-8995

userservices@clsamerica.com

www.clsamerica.com

To Reach CLS France:

FRANCE
8-10 rue Hermès
Parc Technologique du Canal
31526 Ramonville Cedex
France

Phone +33 (0) 5 61 39 47 20

Fax +33 (0) 5 61 39 47 97

useroffice@cls.fr

www.cls.fr



GLOSSARY

QUESTIONS

A1 processing: A Service Argos term for decimal processing.

A2 processing: A Service Argos term for hexadecimal processing.

ADS: Automatic Distribution Service (Argos).

Argos: The satellite based system which collects, processes and disseminates environmental data from fixed and mobile platforms around the world. For more information visit www.argosinc.com.

attachment: A harness, collar or leg-band used to deploy a PTT on a bird.

CLS: Collecte Localisation Satellites is the operator of the Argos system in Toulouse, France. Its main subsidiary is CLS America in the USA.

COM: One of the on-line commands to an Argos processing center. This data format is antiquated and we do not recommend its use for our transmitters.

DIAG Data: A data format which provides supplemental information on your transmissions, e.g. received signal strength, rejected locations (see Argos manual for details).

DS Data: A data format that provides all the messages (i.e., all sensor data) from each satellite pass. (See Argos manual for details.)

duty cycle: A schedule of transmission times and rest periods used to extend the study interval by budgeting the PTT's battery life.



GLOSSARY

engineering frame: Every fourth message sent to the satellite from the PTT that includes data on the state of the duty cycle times.

fix: The location of the PTT derived from the satellites.

GMT: Greenwich Mean Time (the same as UTC [Coordinated Universal Time]).

harnessing: Attachment of a backpack configured PTT to the bird being tracked.

hexadecimal: A base-16 data format (1 to 9 and A to F, where A is 10 and F is 15) used to represent sensor data. A byte (eight bits) is represented by two characters.

hex-code: The Argos ID encoded in hexadecimal number.

hyperterminal: A Telnet program included with Windows which can be used to download Argos data.

microprocessor: The tiny internal computer which controls the PTT's operation.

Production Form: Our customer information form for the PTT-100 models. The completed production form serves as the work order to initiate production.

PTT: Platform Transmitter Terminal.

season: A period of the schedule of the PTT's ON/OFF times.

sensor data: Part of an Argos message containing data collected by a sensor.



GLOSSARY

sensor decoding: Interpreting the sensor values.

CLS America: A subsidiary of CLS.

solar array: The external portion of the solar PTT that charges the internal battery.

Telnet: An internet protocol used to connect to Argos and view downloaded data.



Photo by Ugo Mellone



QUESTIONS

NOTES



NOTES

QUESTIONS





**Microwave
Telemetry, Inc.**