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VHF TRANSMITTING SUBSYSTEM HANDLING GUIDE

Please review this document upon receipt of your transmitters and again prior to deploying them. Not all information concerning handling, deployment, and operation of your units can be included in this short guide. If you have any questions or concerns that are not addressed please contact Telonics before deploying your units.

Telonics is currently using two versions of our VHF electronics in new VHF transmitters, the MK-11 and MK-12, both of which are microprocessor controlled. The MK-11 (-3 versions of model numbers) has the frequency synthesized. The MK-12 (-2 versions of model numbers) has crystal-controlled frequencies.

Programming and other information related to units on a particular order is contained in a ".tpf" programming file/record that is emailed to the customer when the order is shipped. That file indicates the transmitter frequencies, pulse periods, on/off scheduling, and additional specifications. (When older versions of the electronics are refurbished, similar data may be provided on a Transmitter Test Data form.) Please be sure that you understand the programming and correct handling of your transmitters before they are deployed.

Telonics transmitting subsystems are guaranteed against defects in materials and workmanship with specific warranty information available on our website.

We want you to be successful with your telemetry-related project or research. Please call prior to the deployment of the transmitters if you have any questions, or if we can be of additional assistance. We welcome calls and are pleased to be able to help at any time during the course of your project.

TURNING UNITS ON/OFF

Most Telonics transmitting subsystems are provided with the power supplies (batteries) integral to the unit and a magnet is taped to the unit to keep the transmitter turned off during shipping and storage. The correct magnet position is often indicated by a line, blue arrow, or blue dot on the unit; but on some configurations (such as some implants) there is no external indication of the correct position for the shutdown magnet. With transmitters designed for implantation the magnet is taped in place on the bag containing the implant, rather than on the implant itself, to avoid damaging the wax coating. It may be necessary to place the magnet in a few positions to find where the magnet will induce a shutdown. The user should verify shut-down, not just rely on an indicated position of the magnet.

Upon receipt, we suggest the user first verify that the units are not transmitting. All units should be off, but it is possible a magnet could have been moved in shipping or by receiving personnel. We recommend that the user then verify operation of each transmitter, one at a time, to confirm that they can be properly tuned-in on the receiver(s) to be used on the project. To do so, remove the magnet from one transmitter at a time, test that transmitter, then replace the magnet and verify that the transmitter is turned off. Testing of one transmitter at a time is suggested because transmitters operating in very close proximity to the receiver (e.g. in the same room) may "bleed over" onto adjacent frequencies. Such "bleed over", which results in what sounds like a “dull click” rather than a “clear tone”, should not occur in the field because of the greater distance between the transmitters and receiver.

TRANSMITTER STORAGE:

When storing transmitters, each transmitter should be tested with a receiver to verify that the magnet is properly positioned and the unit is shut down for storage. Special care must be taken with units that have been programmed with transmission duty cycles and may have periods of time when the transmitter might not be transmitting. The “off period” could be wrongly interpreted to conclude the unit is actually shut down. If storing transmitters for long periods, the magnet should be removed for one or two days each month to maintain proper battery condition. Be sure that during storage, magnets are not in close proximity (<1 inch) from each other and that the magnet is not placed on metal shelving. This is to avoid the magnetic field being impacted, and the transmitter unknowingly being turned on, thereby consuming battery capacity and reducing operational life. Once the transmitters are in storage, each frequency should again be checked on a receiver to be sure that the transmitters are off. Units are best stored at room temperature.

INITIALIZING TRANSMITTERS FOR OPERATION:

Telonics current VHF transmitters are microprocessor controlled using either the MK-11 or MK-12 electronics. If you are working with older models, including those that may have been refurbished, they may or may not be micro-processor controlled and the start-up/initialization may be different. Generally speaking, all units shut down when the magnet is applied for a few seconds. They all also start up when the magnet is removed; however, the start-up sequence can be slightly different depending on the microprocessor and software contained in the unit. If you are uncertain about the type of transmitter electronics used in your units please contact Telonics for clarification.

INITIALIZING MK-11 AND MK-12 TRANSMITTERS

MK-11/12 devices are shut down and started using a magnet. MK-11/12 devices contain an internal Real Time Clock (RTC) which allows them to duty-cycle on and off at specific dates and times that were specified when the transmitters were ordered. Timing is always indicated in Coordinated Universal Time (UTC) to avoid confusion with regard to local times throughout the world, including issues such as Standard Time versus Daylight Savings Time. This means that the time at which the magnet is removed does not affect the times at which on or off periods begin or end. Refer to the previously mentioned ".tpf" file to determine the frequencies, pulse rates, and on/off cycles for your transmitters.

Note that users can modify the operational parameters of MK-11/12 units by utilizing Telonics' Product Programmer software (TPP-VHF). This includes all timing functions with MK-11/12 units and specific transmission frequency (within a limited band) with the MK-11. Such user-programming requires purchase of the TPP-VHF program, and the appropriate smart cable and adapter (e.g. the TSC-7A and CN008351-001 adapter). This option is not commonly utilized, but it is available. If you have questions about programming your MK-11/12 transmitters, please contact Telonics.

As previously noted, you should test each of your transmitters one at a time or by moving away from other operating transmitters to avoid possible confusion resulting from "bleed-over" from other very nearby transmitters. Tune your telemetry receiver to the correct frequency of the transmitter being tested as indicated on the .tpf record. Remove the magnet from that unit. Approximately 5 seconds later, the unit will transmit 2 rapid pulses to indicate that it is starting operation. This will then be followed by 'normal' single pulses at the pulse period defined by the unit's operational parameters as described in the .tpf programming record.

To make testing easier, units are typically programmed with a Predeployment Season of 1 hour from the time that the magnet is removed. This results in 1 hour of pulses at the "normal" pulse rate, regardless of the rest of the programmed schedule. This is to allow time for testing. After the Predeployment Season, the unit will resume its normal programming, which may include "off-periods" as indicated in the ".tpf" record. The "normal" pulse rate for a transmitter is typically a fixed rate (e.g. 60 beats per minute, bpm), but depending on options selected at the time of purchase, pulse rate may be determined by temperature or activity (movement) of the unit.

Note that the terms pulse rate and pulse period have been mentioned. Pulse rate is the number of pulses in a minute, and is what is most commonly thought about by users. However, what is actually determined electronically is the time between the start of one pulse and the start of the next pulse, which is known as pulse period. Pulse period and pulse rate can be converted by dividing either value into 60,000 (the number of milliseconds in a minute); e.g. a pulse rate of 50 beats per minute, bpm, is equal to a pulse period of 1200 ms.

After proper operation of the unit is verified, continue listening to the transmissions with your receiver and replace the magnet. After approximately 5 seconds, the unit will transmit a single burst of 3 rapid pulses indicating pending shut-down, and then it will shut down.

NOTE: VHF microprocessor-controlled transmitting subsystems have an operating temperature range of -40°C to +65°C. At temperatures less than -40°C, there is a possibility of the microprocessors resetting and interrupting programmed duty cycling or even losing RTC time.

INITIALIZING TRANSMITTERS WITH OLDER ELECTRONICS

In general, any Telonics transmitter that still has adequate battery should start when the magnet is removed.

Transmitting Subsystems with MK-8 electronics:
With MK-8 microprocessor-controlled transmitters there should be an initial rapid series of 4-5 pulses which indicates proper start-up. These pulses should be monitored on your telemetry receiver which is tuned to the correct transmission frequency. If this rapid series of pulses is not heard, replace the magnet and leave it in place at least two seconds before attempting to restart the transmitter. If an MK-8 unit does not transmit the 4-5 pulses at start up the unit should not be deployed.

Special steps are required for units using MK-8 electronics that include a programmed duty cycle. MK-8 units have their timing based on when the magnet is removed, rather than by a “real time clock”. Thus, the magnets must be removed at the right time to assure proper duty cycling. If it is important for your project or monitoring effort (e.g. scheduled field days or times) that particular units be operational at the same time, then the magnets should all be removed at the same time (or removal times should be determined to assure the programmed schedules are coordinated). Note that each time the unit is shut-down and restarted any programmed duty cycle will restart.

COLLAR MOUNTED TRANSMITTERS:

Overall performance of your telemetry system depends on many factors, including the characteristics of both the receiving and transmitting subsystems, the environment in which tracking is conducted, and the specific characteristics and behavior of the animal which is being tracked. The manner in which the transmitting antenna is deployed on collar mounted transmitters is also an important consideration, and a few important technical realities must be carefully considered in such deployments. All materials, even multi-stranded stainless steel cables, fatigue. Any exposed portion of the antenna will eventually break as a result of this metal fatigue. The time frame may vary from weeks, to months, to years, depending on the species, the antenna gauge or thickness, the antenna material, and percentage of antenna exposed. In general, the shorter the antenna, the more limited the range; thus a broken antenna will mean reduced range. In addition, the antenna does not perform very well when it is wrapped back on itself, or brought in close proximity to the metal canister housing the transmitter due to proximity effects. Therefore, in many cases a compromise must be achieved, protecting as much antenna as possible without exposing the remainder of the antenna to the negative effects of proximity to itself or other metal objects. We hope an acceptable compromise has already been established in discussions between you as the principal investigator and our staff. The instructions below should aid you in making last minute adjustments to the antenna structure when deploying your transmitter collars on animals.

ANTENNAS FOR COLLAR MOUNTED TRANSMITTERS:

MONOPOLE WHIP ANTENNAS:

The large majority of Telonics transmitters are supplied with a monopole, whip antenna. Antenna length is determined by both electrical and biological considerations. Electrically, a ¼-wave whip antenna is often the best antenna that can be realistically considered. Such antennas are ~50 cm at 150 MHz. For smaller species, shorter antennas are often required to avoid or reduce impacts of the collar and antenna to the animal.

When mounted on a collar for attachment to an animal, one of two basic antenna designs is typically used. In the first design, the antenna is completely internal, or at least as much of the antenna as possible is internal. When the antenna cable is longer than the collar, an exposed portion extends out the end of the collar material. With the second design, the antenna is exited from the collar material somewhere along the length of the collar. For reference sake, we call the first type of antennas "Internal", and the second type "External". During the process of ordering your transmitters and collars, you were probably asked whether you preferred an internal or external antenna, and the collars where built accordingly. Internal antennas are normally used for large predators and other species known to be particularly hard on collars and antennas, because external portions of the antenna would likely break off within relatively short periods.

When specified as external, antennas are typically exited from the collar prior to the first adjustment hole. This allows for protection of the maximum amount of antenna possible, given the range of neck circumferences and preference for an external antenna as specified at the time of order. External antennas generally require no special modification prior to deployment; however, the researcher should realize that external portion of the antenna is subject to eventual breakage as indicated above. On animals with relatively small necks, or on collars designed for a wide range of neck circumferences, the exposed section of antenna can be quite long. The longer the exposed portion of antenna the more likely it will be that the antenna will break in a shorter period of time after deployment. We typically recommend that no more than about 6 inches of antenna be external to the collar. Loss of the exposed portion of the antenna can result in significant reduction in system range performance.

Internal antennas (i.e. those with the antenna cable enclosed completely within the collar or exiting out the end of collars when collar length is shorter than antenna length) are utilized for many animals, especially those which are predictably likely to break off any external portion of an antenna. With most carnivores, and in a number of other applications, antennas are left completely enclosed within the collar when the collar is deployed on the animal. This provides maximum protection to the antenna. In some other applications, users may order collars with internal antennas, but then exit the antenna from the collar themselves when collaring each animal. Diagram 1 illustrates exiting of the antenna ~75-80% of the distance around the circumference of the neck. Deployment of the antenna in this manner provides the improved power radiation of an external antenna, while allowing most of the antenna to be kept internal (and protected from breakage) as opposed to the external antenna design described above. When exiting the antenna, the user should cut a small hole in the outer collar material and carefully withdraw the antenna from the collar. Care should be taken to be sure not to damage the antenna or its plastic coating when exiting the antenna from the collar.

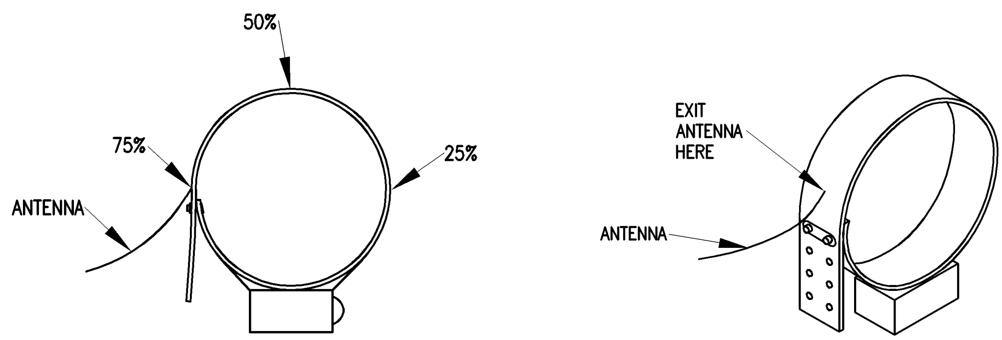

DIAGRAM 1

DIPOLE WHIP ANTENNAS:

On animals with very large neck circumference, it is sometimes possible to use a dipole antenna, in which case the transmitter appears to have two antennas. One antenna is called the "hot antenna" and the other the "cold antenna" as shown in Diagram 2. The most important antenna is the hot antenna, and it is the one most protected by the collar. The second antenna is usually only partially protected in the collar. The exposed portion of the cold antenna will break after a time. The additional range provided by the dipole may be beneficial until the antenna breaks. In order to gain the benefits of the dipole the two antennas must remain as far apart as possible. The ideal case is shown in Diagram 3 to be 180° apart. Little benefit is realized if the tips of the two antennas are brought within ~8"-12". If, as in Diagram 4, the tips of the two antennas are brought closer together than 8"-12", the range of the transmitting subsystem is actually degraded. Thus, this dipole design is seldom used, and only on species with large neck circumferences.

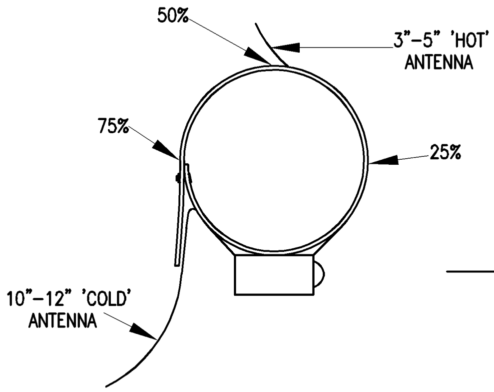

DIAGRAM 2

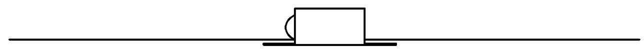

DIAGRAM 3

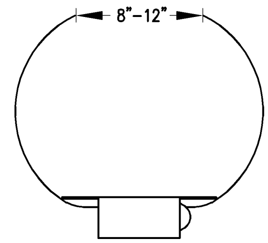

DIAGRAM 4

BREAKAWAY/EXPANSION COLLARS:

Breakaway and expansion collars present special collar design challenges. The time frame for breakaway to occur can vary dramatically depending upon environmental conditions and behavior of individual animals. Actual breakaway times or performance of an expandable collar can only be determined empirically for a given species in a given environment. Telonics is quite willing to offer available technical information or to aid the researcher in establishing estimates of breakaway and expansion times prior to the initiation of a large scale instrumentation effort. However, breakaway times or expansion performance vary with conditions in the field and therefore any estimates provided are gross approximations only, and are not subject to warranty. Users should also realize that collars that are designed to expand may also be more easily “slipped” by the animal than static collars; this is particularly true with dexterous species.

If critical collar release times are required, we suggest use of one of our programmable collar releases. Such units are relatively frequently used with GPS collars. They are less commonly used on VHF collars, but they are available.

IMPLANTABLE TRANSMITTERS:

Telonics transmitters designed for implantation are coated in a physiologically compatible wax which acts as an important part of the moisture barrier. The wax is heated to approximately 100°C for its application and, after cooling, the implants are placed in plastic bags to keep them clean prior to use (but they are not sterilized or disinfected at Telonics).

Implant transmitters coated in physiological wax should never be exposed to temperatures exceeding 45^{o}C, and should be kept at or near physiological temperatures. Excessive heat will melt the wax, and excessive cold can cause the wax to crack - both should be avoided. Care should also be taken not to otherwise damage the wax coating; e.g. if securing an implant within the body, avoid use of any materials that could cut into or damage the wax coating. As previously mentioned, the magnets used to turn implantable transmitters off are attached to the plastic bag enclosing the implant, rather than to the implant itself, so as to avoid damage to the wax coating.

Implants should be sterilized or disinfected prior to use. Consult your veterinarian for advice on this, keeping in mind that heat sterilization is not a good option because it could damage the wax. Soaking the implants in appropriately diluted solution of zephiran chloride or other sterilants/disinfectants has proved successful. Use of alcohol is not recommended because there has been some evidence of alcohol adversely reacting with the polymers used in sealing some implants.

Sterilization of Implantable Transmitters:
(This section was taken from a Telonics Quarterly article by Bill Burger, Telonics; Don DeYoung, DVM, University of Arizona; and Dave Hunter, DVM, Idaho Fish and Game.)

Review of articles published in wildlife journals regarding use of implantable transmitters revealed a number of chemicals which have been used for “sterilization” of implants. These have included ethylene oxide (gas), chlorhexidine diacetate (Nolvasan), povidone-iodine, zephiran and benzalkonium chlorides, ethyl and isopropyl alcohols, glutaraldehydes (Cidex), and Hibitane. According to the articles on sterilization techniques, length of submergence of the implantable transmitters in the chemicals ranged from a dip or rinse to soaking for 24 hours. Several of the articles mentioned a rinse in sterile saline prior to implantation, and one mentioned warming the “sterilant” and rinse to near body temperature. The following information is provided as a starting point for those desiring additional information on this topic, but this information should not be regarded as a complete review of the topic.

Most of the implant preparation procedures mentioned above from the wildlife literature are more accurately referred to as disinfection rather than sterilization. Exact definitions of these terms vary somewhat between sources, as does the categorization of specific techniques or chemical compounds. Sterilization is generally defined as the complete elimination of destruction of microbial life, including all bacteria, mycobacteria, fungi, viruses, and spores. Spores are the most difficult to kill of the life forms just mentioned, thus, methods or substances which killed spores, termed sporicides, were often considered synonymous with sterilants. Some protozoan cysts and metazoan (e.g. pinworm) eggs have now been shown to be more difficult to kill at room temperature than spores. Chemical “cold-sterilants” are ineffective against these materials, thus they should perhaps not be classified as sterilants.

Disinfection is a somewhat looser term, generally describing a process which eliminates many or all pathogenic microorganisms, excepting spores (and now also cysts and metazoan eggs). High-, intermediate-, and low- levels of disinfection are sometimes referenced. Not all disinfectants are effective against all types of microorganisms, and manufacturers labels should be checked to verify whether a specific substance has been tested and proved effective against a wide range of microorganisms.

In hospital settings, sterilization is recommended for items which will enter tissue, the vascular system or blood. High-level disinfection is recommended for items which contact mucous membrane or non-intact skin. Intermediate- and low-level disinfection are typically used for items which only contact intact skin, such as linens, furniture, walls, crutches, etc.

Methods of actual sterilization include wet heat (≈121°C), dry heat (≈160°C), ethylene oxide gas, chemical soaks, and radiation. Disinfection is typically accomplished by an appropriate chemical disinfectant. **Wet and dry heat sterilization techniques are not applicable for use with implantable transmitters as used in wildlife because the temperatures required would melt the outer wax coating.** Radiation sterilization is effective and operates at room temperatures, but it is expensive and not widely available. Gas sterilization is a recommended technique if implantation is being conducted in a controlled hospital setting. With gas sterilization it is also possible to sterilize implants within special packaging, which can then be used to maintain sterility during storage and transport to field sites. Doubly wrapped packages can remain sterile for six months. Care must be taken during storage and transport of the implants to the field because extreme heat, cold, or moisture can be detrimental to the sterile wrapping, and extreme temperatures can also damage the wax coating on the implants.

Gas sterilization with ethylene oxide has proven to be effective against all pathogens when properly carried out. Gas concentrations, temperature, relative humidity, and exposure time interact to determine effectiveness. General ranges used for sterilization of surgical devices and instruments include concentrations between 450-1200 mg/liter, temperatures between 29-77°C, humidity between 30-85%, and exposure times between 2-12 hours. **Again, care should be taken to avoid melting the wax on implantable transmitters; they should not be exposed to temperatures exceeding 45^{o}C**.

Ethylene oxide sterilization leaves toxic residues; therefore, sterilized objects must be aerated prior to use or implantation. Aeration chambers are typically a component of the overall sterilizing equipment. Metal or glass objects should be aerated at 50°C (*too high a temperature for wax coated implants*) for 2 hours, while more absorbent materials such as PVC have recommended aeration times of 12 hours. The wax coated implants should be aerated in the chamber for 12-24 hours *at temperatures less than 45^{o}C*. Storage in a sterile pack on a shelf at room temperature for a week or more is probably also beneficial in providing additional aeration. Ethylene oxide is also considered a carcinogen, and in the U.S. there are regulations regarding its use. In summary, ethylene oxide is a favored sterilant but it does require specialized equipment and care must be taken to use it properly.

Chemical soaks have been the technique most frequently used in a preparation of transmitters for implantation in wildlife. Whether chemical soaks at room temperature should technically be considered sterilization or disinfection is in debate; however, there is general consensus that some chemicals are better than others for such disinfection or sterilization, and that it is important to follow manufacturers' guidelines when using chemical disinfectants or sterilants. Objects to be disinfected or sterilized should first be cleaned and rinsed because excessive organic matter can reduce the effectiveness of many chemical sterilants and disinfectants. Dilutions, if required, should be made in accordance with manufactures' instructions because effectiveness of the chemicals can be reduced at either too high or too low concentrations (hard water may also reduce the effectiveness of some chemicals, so deionized water should be used if recommended). Chemicals should be freshly mixed prior to use as a sterilant or disinfectant for implants because their effectiveness can decrease over time. The pH of solutions is also important in their effectiveness. Buffers within many solutions will maintain the pH over a range of dilutions, but again this is reason for closely following manufacturers' recommendations. Temperature and contact time of the implant (or other object to be sterilized) with the chemical solution are also important, with a minimum of 6-10 hours soaking at room temperature recommended for many solutions. A rinse in sterile, physiological saline after soaking in the disinfectant or sterilant is recommended since some of the chemicals used can be irritating to tissues.

Although specific recommendations and classifications (i.e. sterilant or disinfectant) vary between spores, three groups of chemical compounds are generally recommended as sterilants. These are glutaraldehyde-based formulations (2%) demand-release chlorine dioxide, and stabilized hydrogen peroxide (6%). Other chemicals including most of those referenced above from the wildlife literature are typically classified as disinfectants of various levels.

Table 1 briefly summarizes information on a number of chemicals as compiled primarily from Boatfield & Clifford 1984, Harrison & Malinke 1991, Rutala 1987, and Rutala 1990. Block 1983, Block 1991, and Gardner & Peel 1986 provide more in-depth information (e.g. modes of action, details of use, tests of efficiency, etc.) on chemical sterilants and disinfectants, ethylene oxide gas sterilization and other sterilization techniques.

Table 1 Chemical compounds commonly used as sterilants or disinfectants

COMPOUND	EFFECTIVE AGAINST	COMMENTS
glutaraldehyde-based, 2% (e.g. Cidex)	bacteria, fungi, viruses, spores	Must be activated to alkaline state (pH 7.5 – 8.5) to be sporicidal, generally non-corrosive, can irritate skin & mucous membranes
demand-release chloride dioxide	bacteria, fungi, viruses, spores	Can corrode aluminum, copper, brass, series 400 stainless steel, & chrome w/ prolonged exposure; inactivated by organic matter
hydrogen peroxide, 6%	bacteria, fungi, viruses, spores	Can corrode copper, zinc, & brass
ethyl & isopropyl alcohols, 70-90%	bacteria, fungi, some viruses	Flammable, volatile
iodine (as an iodophor, e.g.	bacteria, fungi, viruses	Proper dilution critical, may

povidone iodine)		irritate mucous membranes and stain; inactivated by UV light, heat, organic load
quaternary ammonium compounds (e.g. benzalkonium and zephiran chlorides)	most bacteria, fungi, some viruses	Not completely effective against gram negative bacteria; hard water, soap, soil, anionic residues decrease effectiveness
chlorhexidine (e.g. Nolvasan)	some bacteria, fungi	Inactivated by soaps and some detergents; non-toxic, non-irritant generally used as skin and mucous membrane disinfectant and antiseptic

Sources:

Block, S.S. (ed). 1983. Disinfection, Sterilization, and Preservation, 3rd ed. Lea & Febiger, Philadelphia. 1053pp.

Block, S.S. (ed). 1991. Disinfection, Sterilization, and Preservation, 4th ed. Lea & Febiger, Philadelphia. 1162pp.

Boatfield, M.P. & D.H. Clifford. 1984. Disinfection in Veterinary Medicine. Veterinary Technician 5(1):31-38.

Gardner, J.F. & M.M. Peel. 1986. Introduction to Sterilization and Disinfection. Churchill Livingstone, Melbourne. 183pp.

Harrison, S.K. & C. Malinke. 1991. Selection and Use of Disinfectants and Sterilants. American Assoc. For Laboratory Animal Science 30(2):10-14.

Rutala, W.A. 1987. Disinfection, Sterilization and Waste Disposal, in Prevention and Control of Nosocomial Infections, R.P. Wenzel (ed). Williams & Wilkins, Baltimore. 641pp.

Rutala, W.A. 1990. APIC Guidelines for Selection and Use of Disinfectants. American J. of Infection Control 18(2):99-117.

CALIBRATING TEMPERATURE SENSITIVE IMPLANTS

If transmitters include temperature sensors, a calibration curve of pulse period relative to temperature should be established prior to use. A circulating water bath should be utilized, and the transmitters should be allowed to stabilize at each calibration temperature. The relationship between pulse period and temperature is not linear, so a sufficient number of calibration points should be utilized to achieve a proper curve over the range of temperatures of interest.

IMPLANTS WITH EXTERNAL ANTENNAS

Most implantable transmitters utilize internal antennas. There are, however, some implants which utilize flexible whip antennas. The ends of these whips have been sealed to prevent fraying. The length of the whips is as decided at the time of order. If, for some reason, the whips need to be shortened please contact Telonics for advice.

AVIAN ATTACHMENTS:

A wide range of attachment methods have been utilized on birds, and a discussion of all these is well beyond the scope of this paper. Even within a generalized attachment method; for example, backpacks, a number of different materials, harness designs, and fitting techniques have been utilized. Your transmitters have been designed for the type of attachment specified at the time of order.

TRANSMITTER MODULES FOR USE WITH USER-SUPPLIED ATTACHMENTS

Telonics offers many customized collar and attachment designs to meet the needs of individual research objectives. However, we can also provide the transmitter electronics, battery, and all interconnects sealed in a metal canister ready to be mounted on a collar, harness etc. as supplied by the researcher. For some applications we can supply the transmitter electronics alone. Under such circumstances, the researcher assumes all responsibility for proper completion of the transmitting subsystem. We will be happy to provide technical advice or review a design upon the request of the researcher. We assume no responsibility for problems resulting from designs which have not received prior approval from Telonics.

GOOD LUCK IN YOUR WORK, AND LET US KNOW IF WE CAN BE OF ASSISTANCE.