TELONICS QUARTERLY™

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TAC-7 Electronic Antenna Switch Box

Most airborne radio tracking today entails the use of (and switching between) two or more directional antennas on the aircraft. Because switching radio signals is not always as simple as buying a 99¢ slide switch at the local Radio Shack store, we designed the TAC-2, an RF switch box which provides for switching between (or combining) two antennas. Telonics is now introducing an all new electronic antenna switch box that builds on the TAC-2 capabilities. The newly dubbed TAC-7 is primarily aimed at the airborne researcher, providing options not previously available in a single unit.

Like the TAC-2, the TAC-7 is used to switch a receiver between two antennas (typically mounted on left and right struts of an aircraft). The left and right antennas can also be combined in a ‘both’ mode. In addition to switching between left and right antennas, the TAC-7 adds the capacity to switch a third (auxiliary) antenna, typically used for omnidirectional “signal finding.”

For those who have wished the TAC-2 switch box was small enough to mount on the control yoke of their aircraft, the TAC-7 has the option of plugging in a remote (yoke-mounted) push-to-talk switch to select between the left and right antennas. Just press the switch down for the right antenna, release for the left. So, while the yoke-mounted left/right switch sits right under your thumb, the switch box and all its attendant cabling can be tucked into a more out-of-the-way place, freeing up valuable cockpit space. It just got easier to “fly the plane” and “track the animal” at the same time — no more fumbling around for the switch box that just fell off your lap and under the seat!

The TAC-7 comes in a custom-built aluminum case, which provides RF shielding. In normal operation, three heavy duty toggle switches serve to select between Right, Left, Both , and Auxiliary antennas. For remote operation, the external left/right switch, such as the TPT-1 or TPT-2 push-to-talk switch, plugs into a phone jack on the side panel **Note:** *The case-mounted left/right switch is disabled when the remote switch is plugged in.*

Antenna and receiver connectors are BNC female. The TAC-7 is powered by a standard 9V transistor battery (user replaceable), with a “low battery” warning light that indicates the battery has 8 hours of operational life remaining. You won’t change the battery very often, though. Since a single 9V cell will power the TAC-7 for over 2000 hours, I figure you’ll overhaul your plane’s engine more often than you need to change the TAC-7 battery! *Timo Hansen*

MECHANICAL SPECIFICATIONS

Dimensions
3.0 W X 4.6 L X 2.0 H in.
7.6 W X 11.7 L X 5.1 H cm (excluding switches and connectors)

Connectors
RF Connectors:
BNC Female (four connectors - Left, Right, Auxiliary, Receiver)
Ext L/R Switch Connector
1/4” 2 conductor phone jack.
Compatible with TPT-1 or TPT-2

Weight
approx 360g (including battery)

ELECTRICAL SPECIFICATIONS

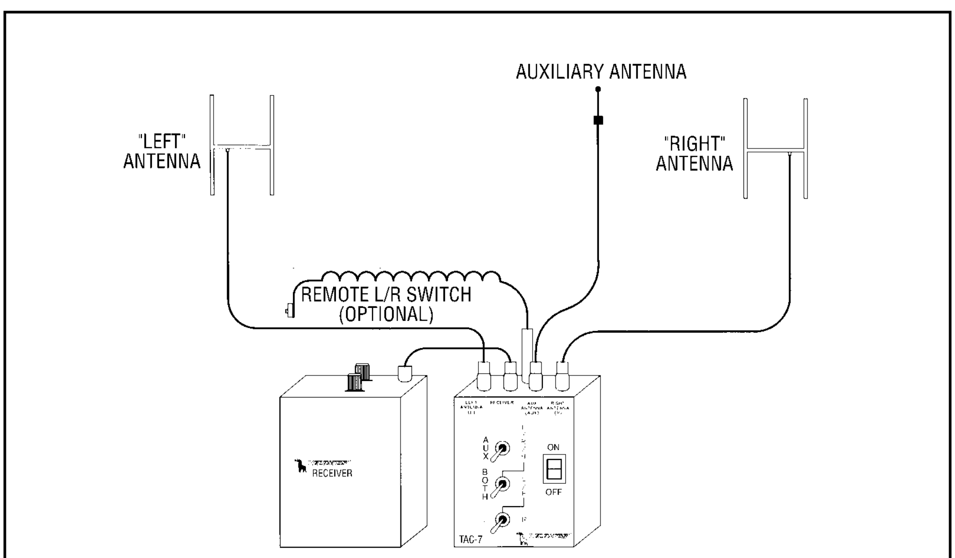
Power Supply
9V transistor battery
(Eveready EN22 or equiv)
Operational life approx 2000 hrs.
Low Battery indication when approx 8 hrs battery capacity remaining.

Frequency Range
50 - 250 MHz

Insertion Loss
Left, Right 1.2dB typ @ 150MHz
Auxiliary 0.6dB typ @ 150MHz
L/R combined 4.4dB typ @ 150MHz
(all inputs terminated in 50 Ω)

Isolation
30dB min, all ports
>40dB typ @ 150MHz

RF Power Handling
20dBm max (all inputs)



Typical TAC-7 application.

Eagle Intrusion Detection System (EIDS)

New products and system improvements.

In the late 1980s, Eagle Security Enterprises recognized a growing requirement for a reliable remote sensor system to operate unattended in harsh environments for long periods of time. One agency with an immediate need for such a system was the U.S. Border Patrol and, in 1989, Telonics introduced a new programmable processor/transmitter in a joint venture with Eagle Security.

The system was designed to detect an intrusion into an area and report back using an RF (radio frequency) link. Our involvement was a natural extension of the type of work already being done at Telonics. Specialized monitoring equipment developed by Telonics for the wildlife community (i.e. battery powered, long life, small size, and a knowledge of designs suitable to hostile environments) laid the groundwork for equipment that meets the needs of this application.

The first processor/transmitter developed for the U.S. Border Patrol, the PT-100, utilized seismic, passive, infrared and magnetic sensors. It relayed the signals received from the sensors via an RF link to either mobile units or a central monitoring point. An immediate success in the field, the PT-100 combined the processor, transmitter and power supply into one compact unit that solved many problems previously associated with other remote sensors designed for surveillance and law enforcement objectives.

The PT-100 also provided the foundation for a highly sophisticated and flexible monitoring system known as the Eagle Intrusion Detection System (EIDS). Developed over a four-year period, each component was designed as a direct response to field requirements for a system suitable for long term deployment. Until recently, the EIDS system included the RM-201 portable monitor/receiver, SID-100 seismic intrusion detector, RP-301 Repeater, and PG-400 handheld programmer. **Note:** *These products have been fully described in the 1992 Spring/Summer issue of the Telonics Quarterly. If you would like a copy or have specific questions on any of the product capabilities or specifications, please contact us.*

Over the past two years, two new second generation processor/transmitters have been developed for EIDS. They are both fully compatible with all other system components (i.e. PT-100, RM-201, RP-301).

The small, sophisticated PT-200.

The PT-200 processor/transmitter was originally designed for the U.S. military. This small, compact unit offers many of the same features as the PT-100 and provides users with a fully programmable tactical unit with a power output of 1.5 watts that is fully compatible with the other EIDS equipment. The unit measures 10.25” X 6.10” X 2.35” (26.0 cm X 15.5 cm X 6.0 cm) and weighs only 3.3 lbs. (1.5 kg) with batteries. The small size makes it easy to transport and conceal while retaining all of the sophisticated processing capabilities of the PT-100.

PT-200 with sensors

The detachable battery pack facilitates battery changes in the field. The power supply consists of eight standard 9v alkaline batteries which will normally operate the unit 3-4 months without changing batteries. Other battery options are available. The PT-200 is micro-processor controlled and allows the user to select a variety of parameters via a handheld programmer in the field or an IBM-compatible computer at the field station. In addition to seismic, passive infrared, and magnetic detectors, the PT-200 can also utilize breakwire, pressure mat, active infrared or any other detector that provides a switch closure. The circuitry is designed to allow the user to program three different message formats: a synthesized voice message for standard VHF radios, modified Manchester for existing Border Patrol units, or SEIWG 005 digital code for military use.

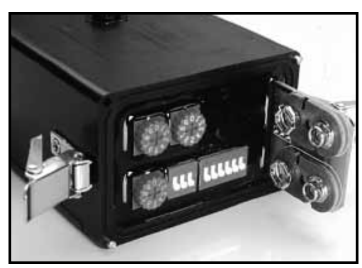
The PT-300 is even smaller.

Concurrently with the development of the PT-200, several agencies asked for an even smaller, simpler processor/transmitter. Users wanted something that could be rapidly deployed, but with the same sophisticated signal processing features of the PT-100 and PT-200. They also wanted a unit that could be completely configured with switches located on the unit. The result is the PT-300, a small rugged processor/transmitter with a power output of 200 milliwatts that is designed for short term covert deployment in harsh environments.

The PT-300 measures only 5.5” X 1.8” X 3.0” (13.8 cm X 4.6 cm X 7.6 cm) and weighs 1lb. (0.5 kg), including batteries. The removable antenna and detachable detector allow multiple units to be carried easily by a single person. The electronic elements are sealed in an injection-molded housing designed for direct burial. The on/off sensitivity selector is external; all other adjustment switches are internal. The unit has a removable battery pack for easy battery replacement and access to the internal switches. The standard power supply consists of two standard 9v alkaline batteries.

Even though miniature in size, the PT-300 contains a footstep counter, selectable ID number, delay transmission setting, two frequency selections and settings for all 37 standard CTCSS subaudible tones. The units can be ordered with either a voice or digital message format (Modified Manchester or

PT-300 with sensors



SEIWG 005). The PT-300 can also be configured either as seismic detectors (PT-300S) or passive infrared/magnetic detectors (PT300M). Like the PT-100 and PT-200, the PT-300 can differentiate between vehicles, pedestrians and four-legged animals in the seismic mode. The processor/transmitters are completely compatible with other EIDS equipment, including receivers and repeaters.

Continued on page 5.

Sterilization of Implantable Transmitters

Implantable transmitters may be used for various reasons. With animals such as snakes and otters, implantation is essentially the only attachment technique which has proven to work reasonably because of the animals' body form. When instrumenting juvenile mammals, neck growth is often a concern. Although expandable collars have been used very successfully on various ungulates; species such as canids, felids, or ursids may be able to easily remove most expandable collars, making implants a favored alternative. For other species or applications, implants may be less obtrusive than a backpack, collar or other external attachment. Implants have also been used when visible transmitters are undesirable because of potential effects on park visitors, hunters, or other animals (e.g. conspecifics or predators); and also in law enforcement applications. Implants with special sensing options are used when study objectives include measurement of body temperature or heart rate. Implantable transmitters have been used on birds, fish, mammals, reptiles, and amphibians.

Implant procedures vary among species, and also with the type of implant used. For example, implants are often inserted through a small incision into the peritoneal cavity, and allowed to stabilize in the cavity on their own. However, if motion sensors are included with the transmitters, if specific site temperature is to be measured, or if leads are routed from the implant package to anther site (e.g. with heart rate transmitters), implants may be sutured in place. Recovery of transmitters may be easier if an implant is sutured in place, although the initial surgery is more complex.

The transmitters Telonics provides which are designed for implantation are coated in a physiologically compatible wax which also 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. Previously, we have recommended the implants be "cold sterilized" prior to implantation, for example, by soaking in zephiran chloride for 24 hours. 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, 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. In general, discussion of the preparation of implantable transmitters for surgery has been limited in both published wildlife literature and Telonics' literature. The following information, and a listing of published sources used in its compilation, is provided for those desiring additional information on this 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 or 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. This is an area currently under debate. 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 membranes 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 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 for these parameters include concentrations between 450-1200 mg/liter, temperatures between 29-77°C, humidities between 30-85%, and exposure times between 2-12 hours. Care should be taken to avoid melting the wax on implantable transmitters if high temperatures are used. 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 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. 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.

To date, chemical soaks have been the technique most frequently used in preparation of transmitters for implantation in wildlife. As previously mentioned, whether chemical soaks at room temperature should technically be considered sterilization or disinfection is in debate. There is general consensus, however, 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 manufacturers 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 sources, 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.

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Don DeYoung, DVM,
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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. povidone iodine)	bacteria, fungi, viruses	Proper dilution critical; may 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. 1162 pp.

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.

Other system improvements.

In conjunction with the development of the two new processor/transmitters, other engineering efforts have improved the overall reliability and capability of the EIDS system. Modifications have been made to the PT-100 and PT-200 programs to allow users to select a special "qualify mode" which greatly reduces the chances for false or nuisance alarms in areas with excessive seismic activity. This setting requires that both a seismic and magnetic or infrared detector be activated before an alarm is transmitted. To further address seismic nuisance alarms caused by four legged animals, Eagle Telonics has developed an animal filter program (AFP) in cooperation with the U.S. Forest Service and Texas A&M University. The user-selectable filter discriminates between ungulates and pedestrians and is now included as standard equipment on all Eagle Telonics processor/transmitters.

Another standard feature on all processor/transmitters and repeaters is a transistor switch closure camera trigger port. This allows users to deploy either still or video cameras which are triggered by the processor/transmitters when they transmit an alarm message.

The combination of new products and overall system improvements have made the EIDS system the most versatile and reliable ground sensor system available on the market today.

For more information on EIDS, call Jim Carter or Scott Jarvis at (602) 892-4444.

Holy Ozone, Batman!

Man has always been creative; always looking for new and innovative ideas, inventing new gadgets and finding easier ways to do things. Conversely, he has not done too well looking ahead at the long term effects of his inventiveness. For example, the industrial revolution led to numerous power plants and factories belching noxious fumes from thousands of tall smokestacks, making the air unfit to breathe. Man is also curious, always attempting to relate cause and effect; when the air smells bad, what is causing it? When hundreds of people become ill and die with the same symptom, what's the reason. He even looks for this cause and effect, not knowing what he is looking for, calling it "basic research."

In the 1970's, some of this "research" indicated that the stratospheric ozone layer which helps shield the earth from potentially harmful ultraviolet radiation was being depleted. It further linked this damage to the release into the atmosphere of certain industrially produced halocarbons (chlorofluro-carbons [CFCs or freons], halons, carbon tetrachloride and methyl chloroform) used widely in refrigeration, industrial cleaning, and many other manufacturing processes. The evidence indicated that these chemicals were moving to the stratosphere where they were able to chemically combine with the ozone, effectively reducing its protective ozone layer. By 1987, this potential threat culminated in a United Nations organized agreement signed by 23 countries, known as the Montreal Protocol. It called for a freeze in production and a reduction in consumption of these chemicals to 50% of their 1986 levels by the year 1998. Currently over 90 nations are parties to the protocol.

In June 1990 the participants met again, this time calling for a complete phaseout of most "CFCs" by the year 2000, followed four years later by a phaseout of the less damaging and more widely used cleaning solvent methylchloroform (1,1,1-trichloro-ethylene). This meeting passed a resolution recommending the elimination of an additional class of refrigerants and solvents known as "HCFCs", developed as replacements for the CFCs but which still have somewhat of an ozone depleting potential.

In November of 1990, the United States decided to proceed ahead of the schedule called for by the Montreal Protocol by passing the Clean Air Act, intended to accelerate the reduction of ozone depleting emissions in the USA. One of the provisions of this Act is a labeling requirement mandating that any product produced with or containing any of the specified ozone depleting substances must either bear a suitable warning label or the purchaser must be otherwise notified, in writing, concerning the use of ozone depleting materials in the production of the product.

Not all the materials being phased out by the Act have the same potential for ozone damage. The assigned potential for damage varies by a factor of more than ten. The main reason methyl-chloroform is not being phased out as soon as the other materials is that it has one of the lowest depleting potentials of all the banned chemicals. There is still a good deal of discussion about just how serious a threat these materials represent. There are those who claim that the combined depletion potential of chemicals that the industrial world can produce in a year doesn't come close to what Mother Nature produces in a single day. Others feel it is very serious, and argue that we shouldn't be releasing known harmful substances, regardless of how small their effect.

Telonics is now caught in this dilemma because, in order to produce products with maximum reliability at a minimum cost to our customers, we need to clean many of the transmitter and receiver parts very thoroughly. In the 60s and 70s, the cleaning solvent recommended by component manufacturers and which we found performed best were CFCs, unfortunately among the most ozone damaging of the lot. When we became aware of the possible environmental threat of the materials we were using, we immediately began searching for cleaning alternatives. Not finding a viable substitute, and finding a good deal of uncertainty within the cleaning industry and equipment community, we took the only approach that we felt in the end was in the best interest of those who buy our products. We found that there are cleaning solvents, based mainly on the more ozone friendly methyl chloroform (1,1,1-trichloroethylene), that could be used in our present cleaning equipment without significant modification. We decided to use this solvent on an interim basis until the dust settles in the cleaning community (pun intended) and it becomes more clear what will provide the best and most cost effective cleaning alternative.

So, for these reasons, you will begin to see in our literature the required notice that reads "WARNING: Manufactured with 1,1,1-trichloroethylene, a substance which harms public health and environment by destroying ozone in the upper atmosphere."

We want you, our customers, to know that we are concerned with this possible threat to our environment and health. We are committed to elimination of ozone depleting materials from our processes and will do so as soon as a clearly effective alternative is available. We are already seeing new cleaning equipment and chemistry being regularly introduced, and the costs involved are coming down, but the changeover is still going to be expensive. Mandated changes like these are costly and ultimately, in one way or another, must be borne by the end user. If we want a clean and safe environment, we all have to be willing to pay for it. *Boyd Hansen*

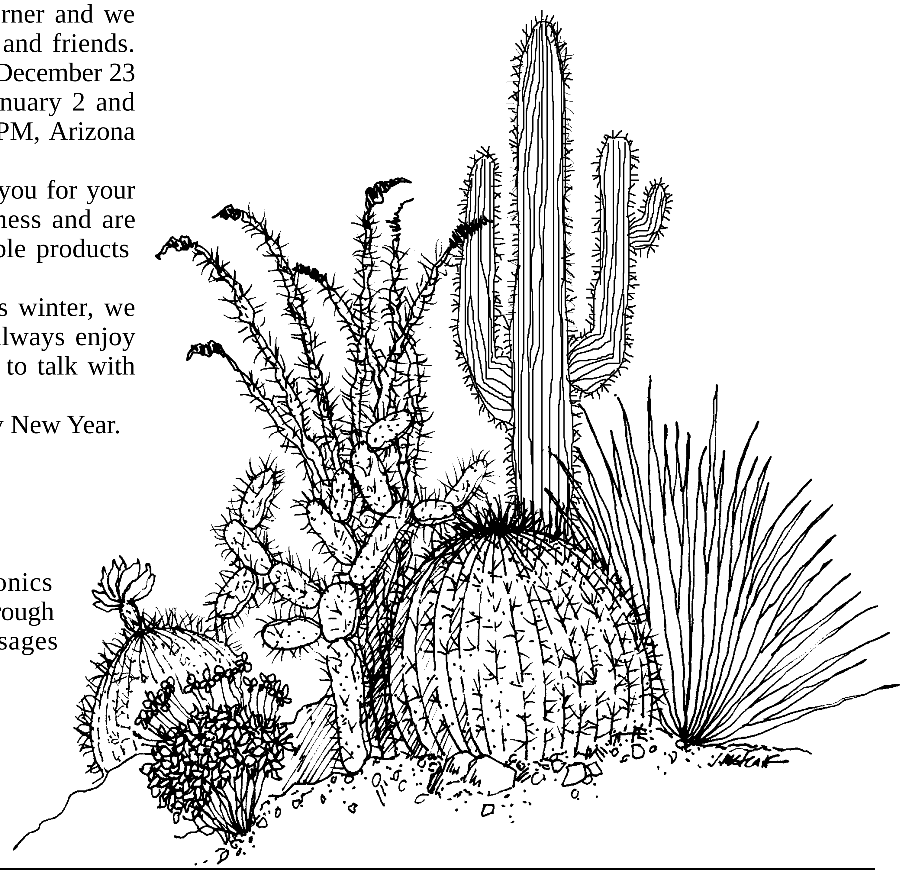
A Holiday Greeting!

Our favorite season is just around the corner and we look forward to sharing it with family and friends. Once again Telonics will be closed from December 23 through January 1. We will reopen January 2 and resume our normal business hours of 7 AM to 4 PM, Arizona time.

We would like to take this opportunity to thank you for your support this past year. We appreciate your business and are committed to providing you with the finest possible products and services in the future.

If you have an opportunity to visit our area this winter, we invite you to stop by Telonics at any time. We always enjoy meeting our customers and having an opportunity to talk with you personally.

Our best wishes for a safe, prosperous and happy New Year.



For all e-mail users...

To better serve our customers worldwide, Telonics now has a general mailbox that can be reached through Internet at 75052.1563@compuserve.com. Messages can be addressed to any individual on the staff.
We hope you find the new service convenient!

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