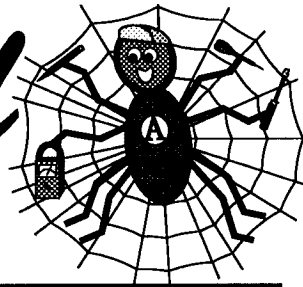


Arachnid Tech. Tips



SPRING 1996

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A Publication Especially for Operators and Technicians who service Arachnid Products

This publication is provided as an aid for field technicians and operators who troubleshoot, repair, and maintain Arachnid games. It is a technical tool designed to keep all the latest updates, service bulletins, suggestions, and ideas together in one neat package.

Your input is welcome. If you have a special idea or tip you would like to share, send it to: It will be reviewed and considered for publication.

Arachnid Inc. Engineering Div.
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Rockford IL 61132-2901

HAVE A TECHNICAL QUESTION OR PROBLEM? Call us at 1-800-435-8319 and ask for Technical Service. We'll be happy to assist you in any way we can.



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#32651 - 25 ft. pre-made 4 cond. silver sheath phone cable, for longer runs or for between games.

(Of course, you can also make your own custom cables to fit your individual needs.)

#38719 - Phone line polarity tester - this handy tester takes the guesswork out of phone line wiring. No more tearing apart wall jacks to determine wire polarity!

#38730 - Arachnet Starter Kit - this kit will help you get started in wiring your own "Arachnet". It includes misc. phone cable, cable connectors, crimper, modular phone jacks, polarity tester, a telephone (for checking dial tone), and modular "T" connectors (for splicing into existing lines).

Modems and Accessories from Arachnid

Need modems? Need external modem adaptor boards or cables? Below is a list of parts and tools available from Arachnid and their respective part numbers.

We now have a new internal modem for the Galaxy and conversion kits. It replaces the old internal and external 2400 baud modems in our stock, so we will not be carrying external 2400 baud modems anymore. You may still purchase them yourself from another source if you like, but check the list at right to be sure the brand you choose is on our "Approved Modem List".

Acceptable 2400 Baud Modems to Use

Why 2400 baud? - At the advent of the Galaxy League Master system, 2400 baud was the most reliable type of commonly available modems. It was slightly more noise tolerant than higher speed baud rates. Since that time, there have been many advances in modem technology, and the 2400 baud modem is not as popular as it once was. But for now, it is what we must use, because the Galaxy was designed around it exclusively.

Below is a list of modems that Arachnid has tested and found to be reliable in darting environments. If you find a modem that is not listed here, please call Arachnid to check on its integrity BEFORE purchasing. Also, you will find a complete listing of acceptable modems, specifications, and even some unacceptable modem brands listed in the Files Menu under the file name MODEMS.LST on the Arachnid BBS.

The BBS phone number is 815-654-7985

#24614 - Internal Modem Kit for Galaxy and Galaxy conversion games

#37150 - Adaptor Board for External Modems, needed with Galaxy main boards prior to Rev. I

#37201 - 3 ft. Cable for External Modems, DB25

#37673 - Special 3ft. Cable for External Modems (DB25) equipped with a right-angle connector for the tighter fit of 6300 to Galaxy conversion games

#36870 - Modem Installation Instruction sheet

#37199 - Service Outlet Rewiring kit - the top receptacle of the service outlet on some older Galaxies and conversions will power down when the side switch is used. This kit rewires the outlet so that it is hot all the time, and an external modem may then be plugged into it.

#38717 - 7 ft. pre-made 4 cond. silver sheath phone cable, ideal for connecting from wall jack to game when the jack is located directly behind the game.

ACCEPTABLE MODEMS:

Cardinal Modem	MVP24E
PC Logic Modem	MB2400EX
Supramodem 2400	50-2400-0
(Supra Corp. , Albany, OR)	
Computer Peripherals	HOOKUP 2400SE
(Computer Peripherals, Newbury, CA)	
Pro Modem Mini	2400 MINI
(Prometheus Prod, Inc., Tualatin, OR)	
Hayes Accura 24	YA13AM
Hayes Accura 2400	5800AM

SPECIAL FEATURE ARTICLE

Inside Wiring Maintenance, Part 1

This article has been reprinted with permission of the author, D.B. Levels, and T & L Publications, publisher of Nuts and Volts Magazine, 430 Princland Court, Corona, CA 91719.

by daniel b. levels

network terminology.

The telephone business is divided into two major segments: Local Exchange Carriers (LECs), and Inter-Exchange Carriers (IXCs). LECs are the local telephone companies (telco) and IXCs are the long distance companies. The U.S. telephone network is divided into geographic zones called Local Access and Transport Areas (LATAs), and telcos switch calls within the LATA. Calls between LATAs are handed off to IXC's and routed to other LATAs (see Figure 1). As the drive for competition

This is part 1 of a 3 part article on phone line wiring and maintenance. It is being provided to you as a learning tool. In today's coin-op world of phone lines, networks, and modems, knowledge of phone installation, service, methods, and applications can be an invaluable tool to technicians in the amusement field. Parts 2 and 3 will be included in future Tech Tips issues,

The Network and CPE components are interconnected at a physical location called a demarcation, or demarc, for short. Several types of devices are used for establishing a demarc for your service. The primary purpose of the demarc is to offer a test point for removing all CPE from the network line. This allows you (or your designate) to determine if CPE is faulty, or if the trouble is in the telco's network. Why provide a test point for network/CPE isolation? To avoid trip charges incurred when telco employees discover trouble in your CPE! Locating your own trouble before calling the telco can save \$45-\$65 per occurrence!

voltage potentials from entering your home. Older protectors have screw/nut terminal design that require nut drivers for disconnection of CPE wiring. In recent years, telcos have been installing a newer type of demarc called a NID (Network Interface Device). The NID offers an arrangement that allows you to "unplug" all CPE by removing a single plug from an RJ11-type jack (see Figure 3). A standard telephone may be plugged into the jack to test for dial tone, etc. from the telco network. All CPE wiring is connected to binding posts that are served via the RJ11 plug. Therefore, when the plug is removed from the

TELEPHONE INSIDE WIRING MAINTENANCE

moves forward, de-regulation will continue to bring new players into the picture. Currently, a number of companies offer specialized services which often overlap those offered by traditional LEC and IXC companies.

The telco is responsible for local service and interconnecting you to your IXC. Telcos provide dial tone (and other services) from switching equipment located in their Central Office (CO). The CO is located in the geographic center of the customers served (thus the term central office).

Modern engineering practices move portions of the CO switching equipment to outlying neighborhoods. These are called remote units. Remote units allow high quality service delivery to customers that are several miles from the nearest CO.

The portion of the telephone network from the serving CO (or remote) to your home/business is called the local loop. Local loops are divided into two components: Network and CPE (see Figure 2).

Network components include all telco equipment, such as switching and transmission equipment, cables, service wires, and lightning/surge protective devices. The term "CPE" (Customer Provided Equipment) denotes all customer-owned components such as station wiring (IWs), jacks, telephones, answering machines, private phone systems, etc.

A majority of telephone troubles are caused by deteriorated and/or improperly installed CPE. When a reported trouble is isolated to CPE, you are presented several repair options. You may authorize the telco technician to complete the repairs for a fixed hourly rate, hire another vendor at a fixed hourly rate, or you may have already purchased an IW maintenance contract from the telco or other vendor that will cover the wire and labor charges. In addition to these choices, you may elect to complete the work yourself. By the end of this article, you will decide which option is right for you!

The demarc for residential service is a device called the station protector. The telco service drop can be aerial or buried wire and will connect to a protector at the side or rear of your home. The drop and protector are usually co-located with the power service entrance to allow easy connection to grounding systems.

Telco and power companies developed a set of standards for proper interconnection of grounding attachments. The purpose of mutual ground connection is to eliminate differences of potential between two independent grounding systems. The power company MGN (Multi Grounded Neutral) is connected to the local ground electrode (rod), and the telco protector will connect to this ground, also. Another option is to connect the protector to a metal water pipe, insuring that the water pipe is connected to the MGN as outlined in the National Electric Code. The ground connection provides a discharge path for hazardous voltages.

WARNING! Use caution when testing telephone lines and equipment. Normal 50 VDC @ 60 mA will

accomplish without the telco office battery connected. This feature provides a quick, easy way to troubleshoot the line.

Let's examine testing methods for several types of troubles. The most common reported trouble is noise and static. Before calling the telco, determine if static is present on all phones or if a single instrument is noisy. If all phones exhibit the same problem, connect a phone directly to the NID. Simply raise the lid, unplug the corded RJ11 plug, and connect a phone into the RJ11-type jack. If noise is present (verify with several different instruments), contact telco repair. However, if a NID connection yields a quiet line,

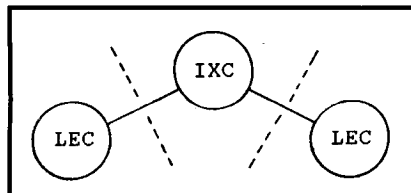


figure 1 Inter-LATA Calls

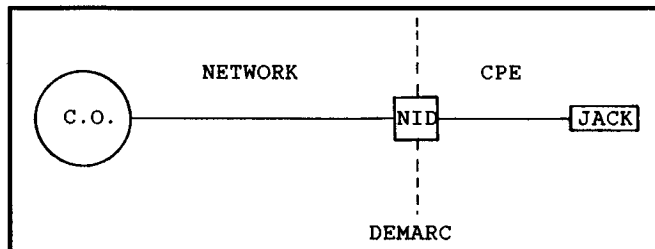


figure 2 Local Loop

jump to 90-130 VAC during ringing cycles. Additionally, longitudinal currents due to power line induction can lead to dangerous voltage levels.

Use insulated equipment and avoid contact with wiring and test points. In addition to test access, the protector provides lightning/surge arrestors that prevent hazardous

use the known good phone as your trouble-shooting "test phone." Reconnect all IWs by restoring the plug/jack in the NID. Move the test phone to each jack and connect as normal, placing a test call to deter-

You never realize how much you appreciate something until it is gone.

Take dial tone, for instance. Every day, millions of telephone calls are completed without a moment's thought about the convenience of this service. However, pick up the receiver to discover a dead line and your world suddenly gets a lot smaller.

In 1984, de-regulation of telephone terminal equipment gave customers the responsibility for maintaining and repairing telephones and "Inside Wires" (IWs). No training classes were held, no TV shows appeared, and we were thrust into a new arena with little information on how to maintain our service.

For some of you, this has been a nightmare. Others have gotten along the best they can, but still have problems they can't solve. Let's build some basic concepts and then learn the best way to identify and isolate telephone line troubles. We begin with a short overview on

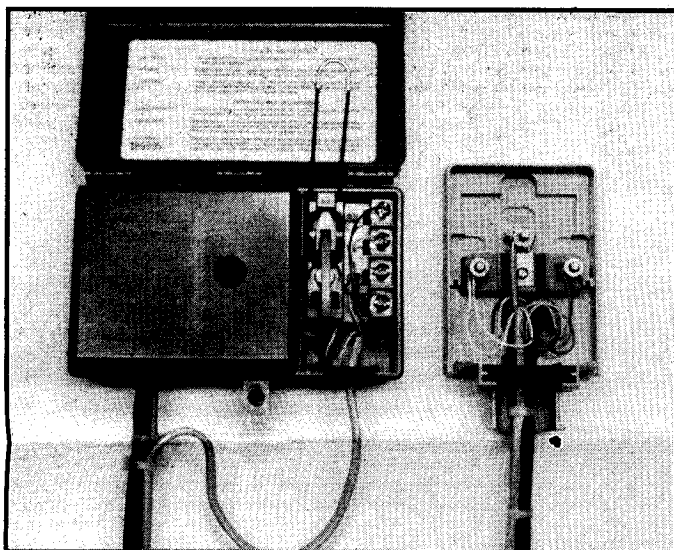
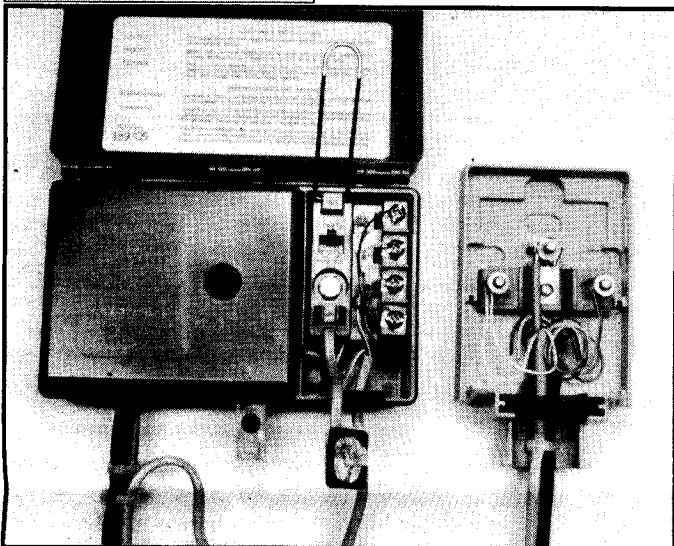


figure 3a
Left — NID
Right — Old Style Protector

figure 3b
NID w/CPE disconnected



mine if noise is present. If the line is quiet, gather each telephone instrument to a central jack location.

Connect each phone one at a time, placing a test call to another line or "reverting" your own line. "Reverting" is a process for calling your own line and may be accomplished by simply dialing your own directory number (DN). After receiving a busy signal or recorded announcement, hang up the phone. The line will ring back and you may answer as if a normal call was received. You may get another recorded announcement, but the line will become quiet. Some telephone switching systems require special codes to revert a line. If dialing your own number does not result in a reverted call, consult your telephone directory for instructions. Reverting on your line provides a balanced line termination to the

telco switching equipment, allowing you to conduct tests for noise, etc.

Once you have reverted the line, wiggle the telephone handset and line cords violently. Really shake them back and forth, and gently tug on strain reliefs at plug/jack combinations. If noise is due to aging cords, this will help locate the offending unit. Be sure to test all phones, including cordless models.

If a phone is noisy, but does not get worse as cords are shaken, lightly rap the handset on a hard surface. If noise clears, you have located a bad transmitter module. Many telephone handsets contain a carbon transmitter module, and the carbon granules become packed together, producing a writhing hiss that changes in loudness. Rapping the handset loosens the granules, and rids the noise. Carbon transmitter elements develop this condition

over a period of years, due to humidity and build-up of human spital (gross, huh?).

Testing all telephone instruments at a single jack location will greatly improve your chances of correcting noise problems. You are dealing with the process of elimination, and you should eliminate noisy phones before proceeding with any IW or jack maintenance.

If the telephone line is clear and quiet at the NID with IWs removed, and you have identified and removed all known defective telephones, suspect faulty wiring and/or jacks. Two conditions will cause noise in telephone wiring/jacks. The IW's and/or jacks are failing from either series faults or shunt faults.

Series-type faults produce noise that will build up to a peak, popping, then sometimes disappear entirely. This is caused by connections that become resistive, then "burn" together by arching currents. Improper splicing methods at wire joints and/or improperly installed jacks cause noise due to series-type resistive connections. This is especially true if wires were "pigtailed" together (see Figure 4). This means they were twisted together at a splice point, rather than via approved connectors or connecting blocks. The red connectors pictured are Scotchlok® Brand, manufactured by 3M. They are available at most electronics stores. While other types are available, these have served the industry for over 25 years.

Series-type troubles are noticeable at the terminating jack and all jacks wired past the trouble point. A simple way to locate the trouble is to connect a test phone ahead of the noise, such as the NID. After reverting on line, have your assistant lift the receiver on each phone in the house, listening for noise. For installations using home runs for each jack, the noise will appear only when the phone is lifted at the defective wire/jack location (see Figure 5). For installations employing "loop feed," the noise will appear at every jack past the trouble.

Shunt-type faults are caused by leakage resistance across conductors due to improper splicing methods, damaged wiring, and combinations of moisture, dust, and cobwebs. Jacks installed in kitchens are subjected to high concentrations of moisture, such as steam. Wiring chewed by pets or rodents will allow moisture to enter the wiring jacket, and water will flow hundreds of feet through the jacketing. "Wet" inside wiring accounts for nearly half of reported noise problems. Shunt-type faults

usually produce constant, scratching noises and will appear at every jack connected to the line. The only way to locate faulty wiring is to disconnect all CPE instruments, such as phones, answering machines, PC modems, FAX machines, etc. Newer electronic phones, answering machines, and modems often contain electronic elements that will measure resistance when tested with a VOM (this is normal). The phone will have a certain "signature" when measured in this manner. Typical readings are 75-100,000 ohms. (If readings are below 30,000 ohms, suspect a faulty unit.) The signature (or characteristic) resistance will interfere with normal IW testing procedures. Therefore, only the wiring and jacks should be connected to the line when testing for IW shunt faults.

Locating the telco demarc, disconnect all CPE wiring. Using a volt/ohm meter, measure resistance between all IW conductors, using the highest multiplier on your meter. For models such as the Tripplett

**Jan-Tech Communications
& Contractor Supply, Inc.**
Attn: Mike
5577 S.E. Hwy 31
Arcadia, FL
813-993-3133

Tel-Part, Inc.
Attn: Menachem
9190 Ulmerton Rd.
Largo, FL 34641
813-581-8003

Safe Communications
Attn: Dave
6619 78th Street, Suite R
Riverview, FL 33569
813-671-4950

Harris/Dracon
809 Calle Joaquin
Camarillo, CA 93012
805-987-9511

Coil Sales & Mfg.
Charles Center
5600 Apollo Dr.
Rolling Meadows, IL 60008
708-806-6231

Tripplett Corp.
One Tripplett Dr.
Bluffton, OH 45817
419-358-5015

Progressive Electronics
325 El Dorado
Mesa, AZ 85202
602-966-2913

630NA, the highest resistance multiplier is "X 100,000." When measuring for resistive faults across all conductors, a good IW will measure infinity. The meter needle may deflect slightly when initially connected, due to the capacitive charging effect of the wiring, but should drop back to infinity very quickly. Any measurable resistance across conductors indicates defective wiring/jacks.

Please do not use a digital meter for this measurement, as the readings may not settle down to a usable figure. Using an analog meter will allow you to observe "swinging" readings, caused by wet station wiring. Again, you should not read any resistance between conductors for a good station wire. If a reading is obtained,

disconnect the jack from the station wire and repeat measure. If a defective station wire is located, replace it to complete repair.

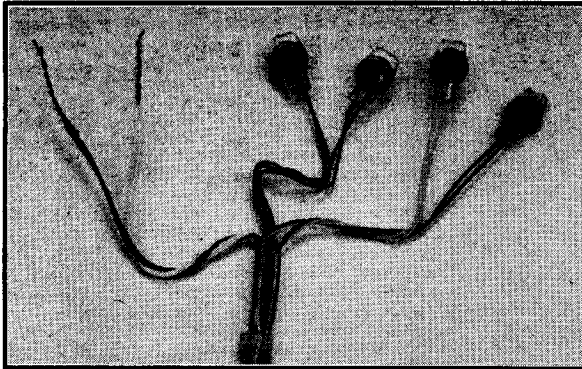


figure 4
Twist vs. Connectors

If you identify a defective IW and need to schedule replacement for another day (attic or crawl space work), you may use this as a short term remedy. For short term repair, change to another pair of wires in the jacket, such as black/yellow or white/orange, etc. These conductors will soon fail, however, so the defective wiring should be replaced as soon as possible.

If you desire to build a toolbox for CPE troubleshooting, let's look at

contains an RJ11 jack for "pass thru" monitoring.

Identifying IWs can be made simple by using a tone generator to send signals from a jack location. Connecting to each IW at NID while listening for tone will let you identify proper wiring for connection. As an option, special induction amplifier probes allow tone reception without physical connection to conductors. Popular units are manufactured by Coil Sales, Progressive Electronics, and Tripplett Corp.

While the tools can be expensive, they greatly simplify testing and troubleshooting procedures. Several vendors can provide these tools from used/surplus stock at great savings. The most widely known surplus tool (telco testing tools) company is Jan-Tech Communications & Contractor Supply, Inc. The manager's name is

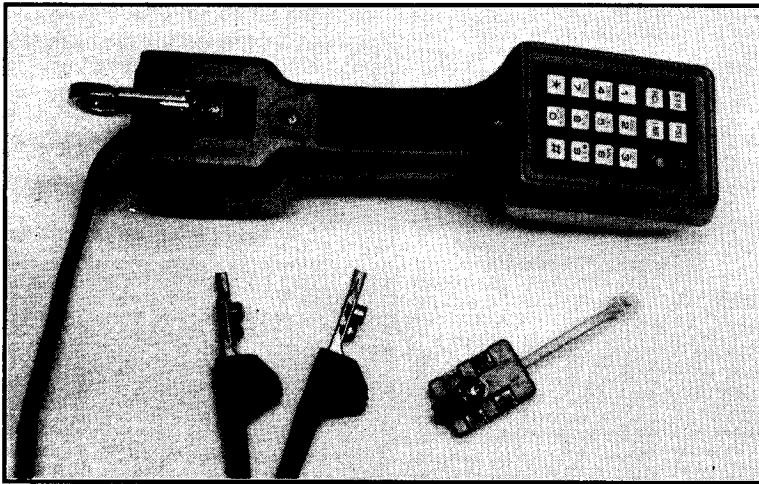


figure 6a
TS22 "Butt-In" Test Set & 10113 Test Adapter

figure 6b
Testing for Dial Tone

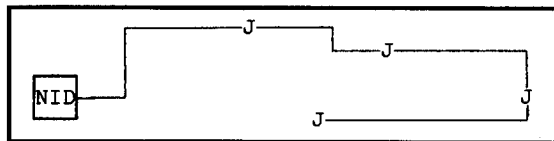
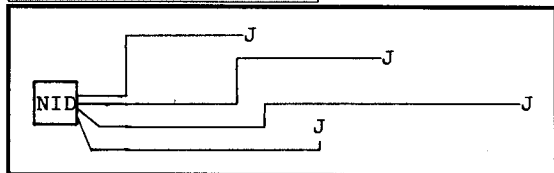


figure 5a
Loop Feed

figure 5b
Home Runs



some equipment you will need. The primary tool for this business is the lineman's test set. Also called a "butt-in" test set, this unit resembles a large handset with built-in touch pad. Equipped with

a three-foot cord, the end is terminated with special alligator clips. This portable test set allows you to monitor the line for conversation before trying to access dial tone. The Talk/Monitor switch allows you to go "off hook" while holding the unit against the ear. Once connected, you can dial and talk as if using a normal telephone instrument. It is much easier than carrying a phone to the NID and/or jack locations. Spiked alligator clips pierce insulation, allowing you to connect directly to IW conductors. Test set runs \$150-\$250, depending on model/options. The most popular units are the TS-2x series made by Harris/Dracon (see Figure 6).

Connecting alligator clips to an RJ11 jack is possible by using a test plug. The test plug is a standard phone plug and cord that terminates on a plastic wafer. The edges of the wafer have metal tabs that terminate to the cord. Again, Harris/Dracon offers a complete line of test plugs with a variety of conductors. One unit

Mike and they are in Arcadia, FL. For any type of used telephone, telephone part, or telephone key system, contact Menachem at Tel-Part, Inc., of Largo, FL. For other miscellaneous telephone gear, call Dave at Safe Communications of Tampa, FL. Tell them you read about them in *Nuts & Volts!*

Next month, we will discuss ways to eliminate other types of noise, such as crosstalk (the ability to hear other conversations on your line), RFI from ham and CB, EMI from noise generators in the home and business, and power line interference. **NV**

Daniel B. Levels has enjoyed a 20 year career with two telephone companies. As Technical Support Engineer, he provides training and assistance to technicians, engineers, and manufacturers. His technical writings are intended to "express, not impress," allowing a wide range of readers to understand difficult subjects. He has published a book entitled, *Tech Notes from a Telephone Engineer*, a 125 page, large-format book covering all aspects of home and office telephone repair, including FAX & PC modem troubles. Enjoyed by thousands, the book contains actual case studies and over 50 illustrations and charts. The book is available for \$18.95 - \$3.50 S&H by check or money order to: **DB Levels, P.O. Box 1125, Tallahassee, FL 32370-1125.** The author may also be reached at **dblevels@prodigy.com.**

The Archives: Service Information, Past and Present... for Galaxies and Older Dart Game Models



SERVICE BULLETIN . . . 6300 to Galaxy lamp heat problem, which may damage shroud decals

6000 or 6300 to Galaxy: Target Lamp Installation Check

WARNING: Disconnect all power to the game and remove all target lamp bulbs before attempting any necessary updates.

NOTE: The target illumination lamps are 40 watts maximum!

Please perform the checks outlined below. If the lamp reflector foil and air slot or holes are not present or properly placed, damage to the shroud decal may result.

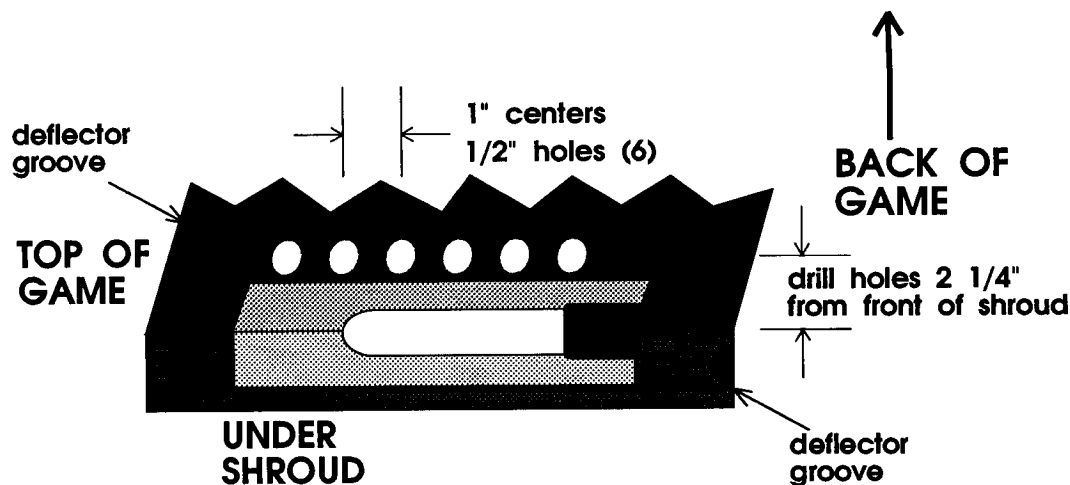
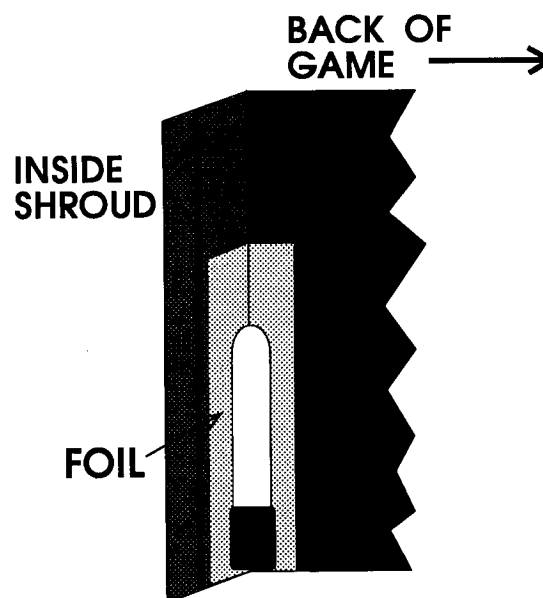
Proceed as follows:

1. Remove the plastic lamp deflectors from the grooves on either side of the (3) lamps. Check to be sure that there is a silver foil piece behind each lamp, and that it is properly positioned in the corner of the shroud. It should look like Figure 1.

2. Look at the lamp on the top of the game. There should be a long cigar-shaped opening cut out of the wood at the top of the game just behind the lamp. This opening is there to provide an escape for heat. If the opening isn't there, then holes should be drilled to take its place.

a. Drill 6 holes as shown in Figure 2. The holes should be 1/2" in diameter, and drilled on 1" centers. They should be drilled 2 1/4" in from the front of the shroud on the top of the game.

b. Make sure that the holes are between the lamp foil and the deflector groove, so that when the deflector is installed, the holes are inside the deflector area.



If there are any questions, call Arachnid, Inc. at 1-800-435-8319, and ask for Technical Service.

New Piezoelectric Missed Dart Detector

Announcing Arachnid's new missed dart detector. Utilizing piezoelectric technology, this device replaces the old "gold contact" type used previously. The new design is less susceptible to dirt and outside influences.

The new "Piezo" missed dart detector consists of a small P.C. board, three wires, and an adjustment pot, along with the piezoelectric switch and mounting hardware. It can replace the existing missed dart detector in older games as follows:

Remove the existing gold contact missed dart detector and install the piezo type missed dart detector in its place per the instructions provided with the Piezo Missed Dart Detector Kit.

The new missed dart detector will be horizontal, with wires exiting at left. It will plug into the Smart Target board at JP10, with the black wire on top. The remaining red wire will be soldered to the leg of R1 that is closest to the edge of the Smart Target board (this is +5V).

The part number for the Piezo Missed Dart Detector Kit is 39168. Please contact your distributor for pricing and availability.

Concerning Galaxy Overhead Bulbs

Since the introduction of the switching power supply in Galaxy games (about 2 years ago), we have gone to a 40 watt bulb for target illumination. We are finding that many operators are replacing these with 60 watt bulbs. The result? Bulbs that burn too brightly, generate too much heat, and burn out too fast.

40 watt bulbs should be plenty bright, even for older games that don't use the switching power supply.

So please, replace your target lamp bulbs with the 40 watt variety. Not only will your bulbs last longer, but the darthead and decals will benefit from the reduced heat.

Hold on to your RAM's!



Since the introduction of the Bermuda Triangle software for the Galaxy game, specifically Versions 5.05 and above (5.07 is the current version), the software performs a check to determine the integrity of the battery backed RAM chip (often referred to as the "Dallas" chip). If it finds a potential problem, specifically in the area of its internal clock, the software will notify you by displaying a message that there is a clock malfunction. (In version 5.05, this message was not visible, and a blank screen would be displayed.)

This message could mean several things:

1. It could mean that the clock is simply set to 00:00.00

Solution: Set the clock to a valid time.

2. It could mean that the RAM battery is low, and loss of stats and spider writer information may occur soon.

Solution: Replace the RAM chip. If stats have already been lost in this game, then discard the RAM chip.

3. It could mean that the RAM has been corrupted from voltage spikes, static, an electrical storm, etc.

Solution: Collect stats if possible, then reset league variables, and reset the entire test mode. (Use a setup card, and check all areas of memory that you can.) Then unplug the game for about 10 minutes, and plug it back in. If the message still appears, then an area of the RAM may be corrupted that you cannot clear with our present software (or the battery is bad as above). The only alternative is to replace the RAM chip.

NOTE: unless you have actually lost stats in a RAM, it may be a good idea to hold onto it. In our next software revision for the Galaxy (due out this summer), you will be able to clear more areas of the RAM chip in the test mode. So in some cases, these RAM chips will be able to be made operable again.

Free binders are available to keep Tech Tips issues together. Write or call us to request one.

IN THE NEXT ISSUE OF ARACHNID TECH TIPS: Darts & Summer Weather // Inside Wiring Maintenance Part 2 // New Software Updates // and Much More !!!


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