W6OTX W6ARA PAARA NEWSLETTER K6OTA K6YQT
VOLUME 63, NUMBER 2, February 2013

PAARAgraphs

The Official Newsletter of the
Palo Alto Amateur Radio Association, Inc.
Celebrating 76 years as an *active* amateur radio club—*Since 1937*
http://www.paara.org/

PAVE PAWS's Mission
Beale AFB, Merced CA.
Capt. Stewart Smith and Others

PAVE PAWS is an Air Force Space Command radar system operated by three 21st Space Wing squadrons for missile warning and space surveillance. PAVE PAWS radars are located at Cape Cod Air Force Station, Mass., and Beale Air Force Base, Calif.

PAVE is an Air Force program name, while PAWS stands for Phased Array Warning System. The radar is used primarily to detect and track sea-launched, intercontinental ballistic missiles and supports space situational awareness.

The Beale AFB PAVE PAWS Radar was recently upgraded to an Upgraded Early Warning Radar (UEWR) to support the co-primary Missile Defense mission. Cape Cod radar is being planned for an upgrade to start in FY12.

The system also has a secondary mission of earth-orbiting satellite detection and tracking.

Information received from the PAVE PAWS radar systems pertaining to SLBM/ICBM and satellite detection is forwarded to the U.S. Strategic Command's Missile Warning and Space Control Centers at Cheyenne Mountain Air Station, Colo. Data is also sent to the National Military Command Center and U.S. Strategic Command. Missile Defense data is sent to the GMD Fire Control Center (GFC/C).

February 1, 2013
7:00 pm
Cubberley Community Center
Room H-6
4000 Middlefield Road
Palo Alto, CA 94303

President's Corner

Let me formally welcome you to 2013 after the quick missive from January, and also thank everyone who came to the Winter Banquet. We also had a great Homebrew Night at the January PAARA meeting, and a big winner at the December PAARA meeting.

The PAARA / FARS FARS / PAARA Winter Banquet just concluded at the time of this writing, featuring Steve Kushman from the California Historical Radio Society and Bart Lee, K6VK. We learned of the wonderful history of both the KRE building and radio station, and of the col-

Steve Kushman

Bart Lee

Photos courtesy of Dave K6WA

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lection of radios that are now housed in the building. I have had the privilege of visiting KRE and also speaking there for the East Bay Section Convention in 2011. I don't think I've seen so many radios in one place before. We are hoping that we can organize a PAARA field trip to the CHRS and KRE in the near future, so stay tuned. Beyond the talk, the Banquet was a wonderful chance to meet and talk to all of my friends. I hope that you too got a chance to spend some time with other ham friends. To me, that's what makes our hobby so special.

Homebrew Night at PAARA was a really amazing display of creativity and ingenuity this year with projects ranging from NVIS antennas to PVC pipe cable spools to homemade versions of Tom Schiller, N6BT, antennas, to a 10GHz rover setup, to the very special WWII replica radios made by Hiro, AH6CY (featured in PAARAgraphs). There was also a homemade HF receiver, a station-in-a-box, and a shock cord j-pole. Also of particular note were some sample chapters from the upcoming ARRL Arduino projects book edited by our very own Leigh, WA5ZNU. I always marvel at how much our club members do to make things on our own. That is the very essence of ham radio. From the small things to the large, ham radio is about building, as much as it's about communicating. Thank you all for sharing your contributions to our hobby with the membership. I'm really looking forward to what you'll come up with next year.

Our December meeting was our big Dream to Reality Raffle IX, and it was also a great success! We had an informative visit with Eric Swartz, WA6HHQ, who told us all about the K-line transceivers and accessories, as well as the KX3. Finally we had the drawing for the big winner. As I'm sure you saw in the last issue, Tony, W6AWK, is just the latest in a long line of PAARA K3 winners. Congratulations Tony, and I'm looking forward to hearing you on HF with that great new radio. Thank you also to Jim, K6AK, for all the work he does to make the PAARA Raffle a success year after year. There is nobody in the business who is as good at this as Jim. Next time you see him at a meeting, thank him.

I hope you've had a chance to get on the air a bit over the last few weeks. I've not had much time myself, but I did make it on the air for my favorite operating event, ARRL Straight Key Night. This happens at 0000Z on the first of the New Year, which is New Years Eve local time. It's a great time to break out the boat anchors and the straight keys, and spend some quality time having a real CW QSO, instead of the usual 599 TU of a contest. The best band seems to be 40 meters, and this year was no exception. I usually take some time for just a couple of QSOs operating portable at around 8 or 9 in the evening with my Kent Hand Key, and this year with my K3. I had a wonderful time talking with a ham right in Fremont! It was a great LX contact that made my day.

Don't forget that even though we're not into the Spring contest season yet, there are still some contests on the air. Check out the WA7BNM contest calendar to see what's on. It's a great way to get on the air if you haven't done it before. You can also just call CQ and see what's out there.

CU AT PAARA IN FEB DE K6WX

February Raffle Prizes

1st PRIZE: **SignaLink™ USB Sound Card - Radio Interface**

2nd PRIZE: **Super Antennas MP1 Portable HF 7- 450 MHz Antenna**

3rd PRIZE: **Arrow 3EL VHF, 7EL UHF Yagi**

4th PRIZE: **DBJ-1 J Pole Antenna**

5th PRIZE: **Kill-A-Watt / AC Electricity Usage Monitor**

6th PRIZE: **ARRL Repeater Directory 2012-2013**

7th PRIZE: **Bongo Ties**

Ham Radio Power Supply Testing

By: Gary Barnes

The first thing most people want to do when the get a new item is to use it, but the first thing should be to read the manual. Although the power supply manufacturer has a warranty, if the power supply causes a problem with the radio, this is your problem. I would recommend that the new power supply operation be checked before it is place into service.

Power Supply Operation:

Most Amateur Radio high frequency radios, of the 100-watt category, require an external power supply at 13.8 Volts DC that can supply at least 23 Amperes of current. The two types of power supplies are linear and switching. Linear power supplies are heavy and large compared to the switching type which are lighter, smaller and cheaper. Switching power supplies have more parts than linear but the mean time between failure rate is about the same for both types of power supplies. The only problem with switching power supplies is the RF noise that they generate. I will use a Samlex America Inc. model SEC 1223 switching power supply as an example for this paper. This is a 13.8-volt, 23-Ampere power supply. The data worksheet lists the power supply's specifications[1].

The first test for any power supply is the output voltage check. This check is done at nominal line voltage of 120 volts, 60 Hertz. With the power supply turned-on, the voltage at the power supply's output terminals is measured. Next, a load is connected to the output terminals, and the output voltage is recorded again. The smaller the change between no load voltage and full load voltage, the better the regulation. Finally the peak-to-peak ripple and noise voltage are measured with full load. The smaller the power supply's ripple voltage the better.

The next check is line voltage regulation using the same setup as above. With full load and the voltmeter connected to the output terminals, the line voltage is adjusted over it's normal range for voltage. The change in output voltage is recorded on data worksheet. The smaller the change in output voltage the better regulation.

Power supplies have a current limit circuit for protection of the power supply. There are two types of over current protection circuits. The first type will have the same output current after the maximum load is reached. The second type has a fold back type of circuit. After the maximum load current is reached the output current and voltage will decrease with an increase in load (less resistance). The output current with a short circuit will be the least amount.

Another protection circuit for power supplies may have is an over voltage circuit. If a problem occurs and the output voltage increases above a preset level, the circuit will reduce the output voltage to zero. One type of circuit for over voltage protection is called a crowbar. When the Silicon Controlled Rectifier or SCR fires, it will short the output terminals of the power supply protecting the radio. Turning off the output will reset the SCR if no problems exist. The model SEC 1223 does not have a crowbar type of over voltage protection. The over voltage protection is part of the Pulse-Width-Modulated (PWM) controller. The model SEC 1223 does not have a procedure to check the over voltage protection function.

Another test is the time the power supply requires when the load changes from one level to a differ-

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1. Specifications: Output is 13.8 volts at 23 Amperes with ripple and noise less than 150 mV_{p-p}. Output voltage is within 1% of setting and current limit is 25 Amperes.

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ent level. Power supplies used with computers are checked with level change from 40% to 100% of rated output current. The shorter the time to recover the output voltage, the better the power supply's dynamic voltage regulation. For amateur radio transceivers the change should be between 2 Amperes and 100% of the current rating. An electronic dynamic load is required to perform this type of testing.

Equipment Required for Testing:

The first piece of test equipment required for testing power supplies is a 4.5-digit or better digital multimeter (DMM). This meter should be able to display 15 volts DC with 0.001-volt resolution with an accuracy of 0.05% of reading or indication. A second voltmeter is required to measure AC voltage to 150 volts, 60 Hertz, with an accuracy of 1% of reading. An ammeter should be able to display DC test current up to 50 Amperes, with an accuracy of 1% of reading. A 50-Ampere, 50-millivolt current shunt can be used with a DMM to measure test current. The DMM will display the power supply's output current with each millivolt equaling one Ampere.

A load is required for power supply testing. This load can be fixed resistor(s), adjustable resistor or an electronic load. In the case of a 23-Ampere power supply a fixed resistor would be a 0.60-ohm resistor in series with an on-off switch and a DC Ammeter. A 0.60-ohm load can be replaced with an electronic load such as ACDC Electronics EL 750.

To supply a short circuit to the output terminals of the power supply and a way to measure the output current, a 50 Ampere relay is used with a current shunt in series. The current shunt should have at least a 50-Ampere current rating. When power is supplied to the relay, current will flow though the current shunt. A DC voltmeter is used to measure the shunt voltage and the short circuit current will be known.

An oscilloscope can be used to display the Peak-to-Peak output ripple voltage and noise. This oscilloscope should have a bandwidth of 20 Megahertz. If an oscilloscope is not available, then an RMS indicating DMM can be used to measure the RMS output voltage ripple. A DMM will not work as well as an oscilloscope because of bandwidth and frequency response. The DMM indication should be multiplied by 3 for a Peak-to-Peak voltage. The lowest measured power supply noise I have ever seen was 250 microvolts Peak-to-Peak without any ripple. This was on a 25-Ampere power supply.

The last item needed is a variable auto-transformer to adjust input line voltage to the power supply. The output of the variable auto-transformer should be monitored with an AC voltmeter. The variable auto-transformer should have brush current rating of at least 7 Amperes.

Testing Procedure:

The power supply operation should be checked when new and anytime a problem has occurred. The following are the steps for testing the power supply. Connect the equipment as per Figure 1 if you are using a fixed load, or Figure 2 if you are using a dynamic load. Connect the power supply's line cord to the variable auto-transformer. Connect the load to the output of the power supply. Also connect the DC voltmeter and oscilloscope to the output terminals of the power supply. Set the oscilloscope for a bandpass limit of 20 Megahertz, the input to AC coupling and the trigger source to line. Use short #10 AWG or larger leads to connect the power supply to the load and 50 Ampere current shunt. Note: The setup drawings show the test equipment that I have and use. This is only

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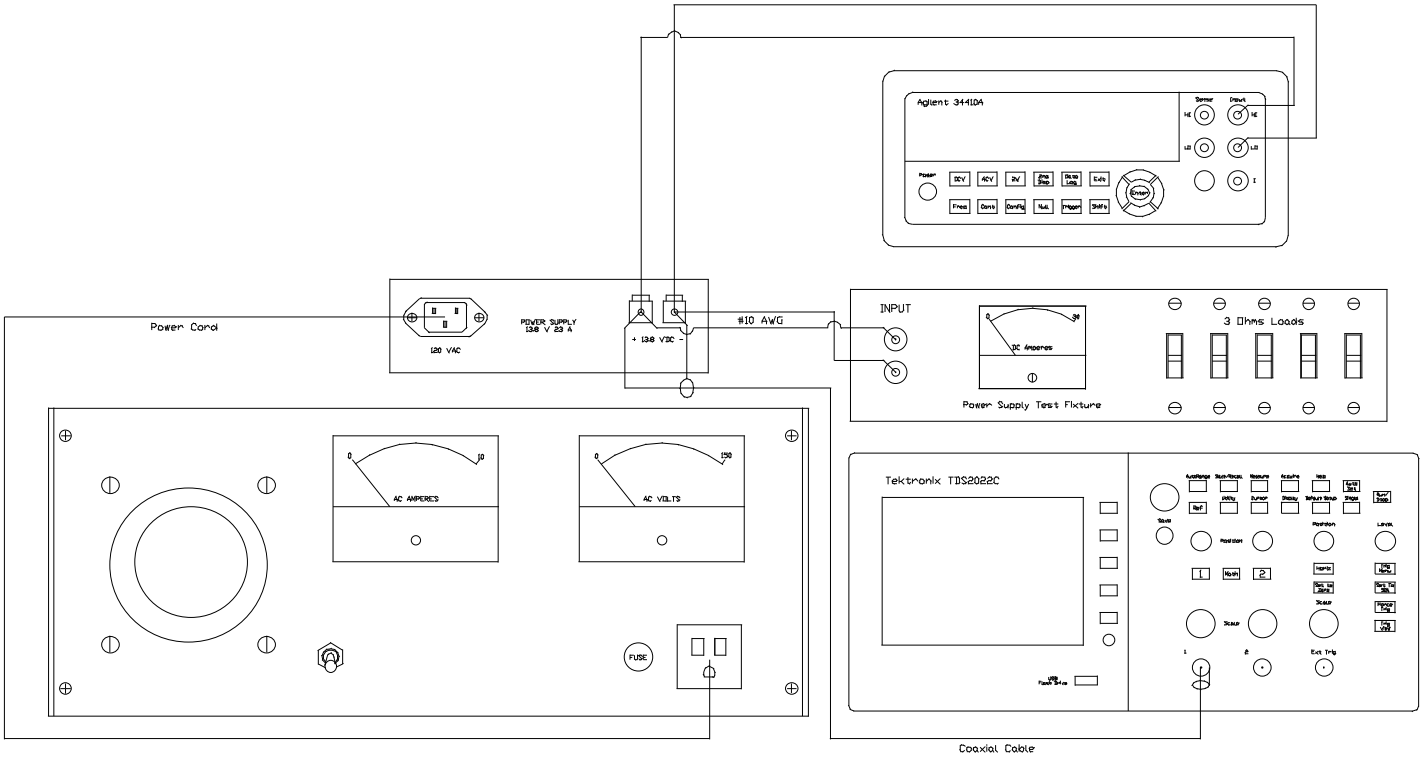

Figure 1—DC Power Supply Test Setup with Fixed Load

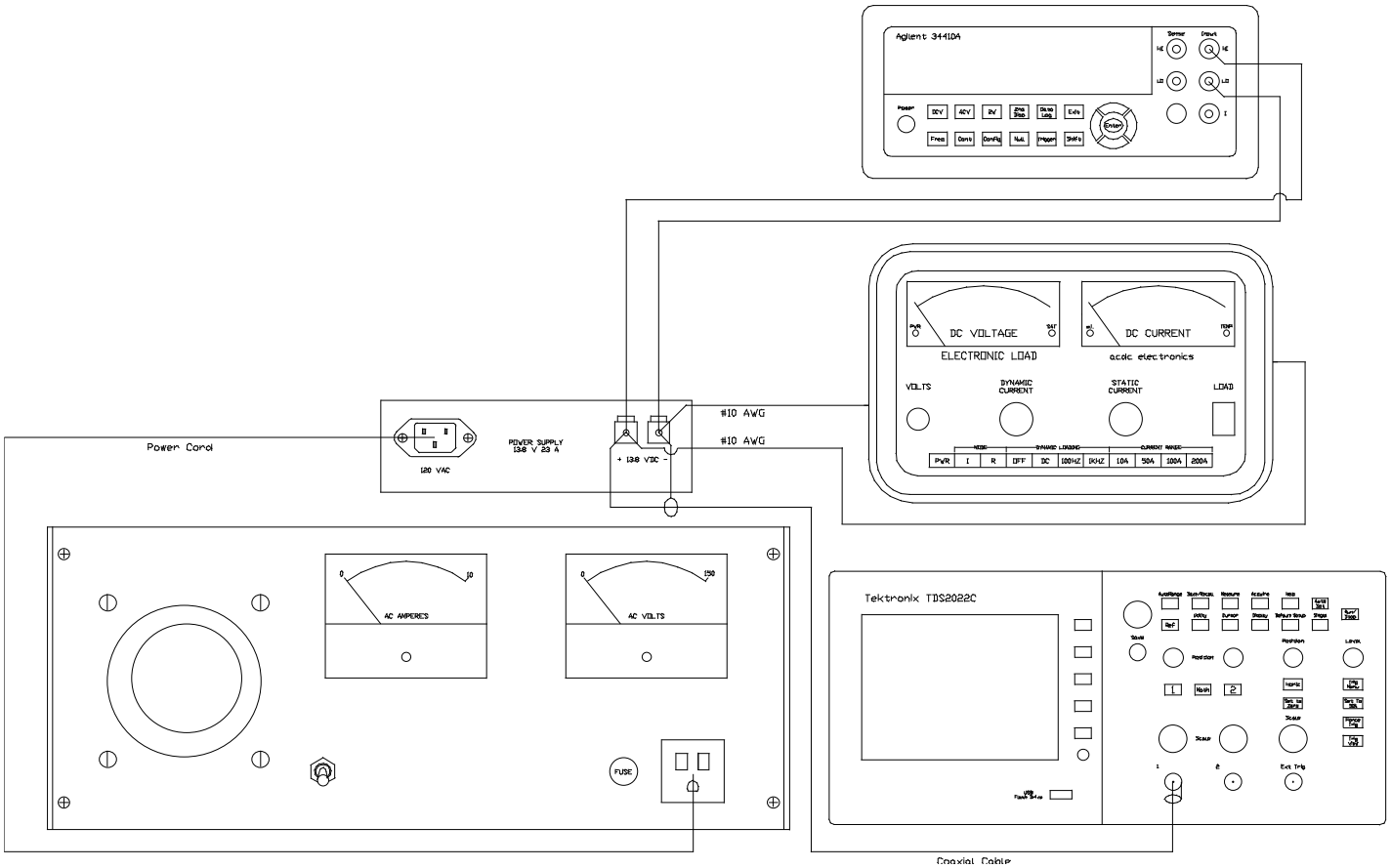

Figure 2 — DC Power Supply Test Setup with Dynamic Load

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a guide.

Adjust the variable auto-transformer to 120 volts with the power supply turned on. With the load off, record the DC output voltage. Turn on the load and record the DC output voltage and the ripple voltage. Record the no load to full load output voltage difference to the data worksheet. This completes the load regulation and ripple checks.

With the load connected, adjust the variable auto-transformer to 108 volts and record the output voltage. Change the line voltage to 120 volts and record the output voltage of the power supply. Then repeat for the 132 volt test point. Record the difference between highest voltage and the lowest voltage. This completes the line regulation check.

With the load connected, reduce the line voltage until the output ripple just starts to increase and the output voltage just starts to decrease. Record the line voltage, as this is the low line voltage point.

Change to the setup to Figure 3 and return the line voltage to 120 volts. With the load turned off, short circuit output current is measured using a high current relay, current shunt and DC voltmeter. The relay and current shunt are connected to the power supply's output terminals. The DC voltmeter is connected to shunt's potential terminals. The relay is activated, and the shunt voltage is noted. One millivolt equals 1 Ampere. Record the short circuit current on the data worksheet.

If you have an electronic load with dynamic load testing provision and an oscilloscope, the Transient Recovery time can be checked. Set the low current point to 2 Amperes and the high current point to 20 Amperes. Change the oscilloscope's trigger source from line to internal. Set the oscilloscope to display the change in amplitude between low load and high load. Record the time in microseconds on the data worksheet. The shorter the recovery time, the better the power supply's dynamic performance. The test leads between the power supply and dynamic load tester should be as large as possible to lower inductive kick. Large bus bars would have the least amount of inductance.

After you finish testing and recording the power supply's performance, save the data in a safe place, then you can compare this with future checks of the power supply. A good place would be with the manual.

Power Supply Load Side Bar:

The ideal power supply current load should be infinitely adjustable from 0 Amperes to current limit and the resistance should be adjustable to zero ohms. A rheostat can be used to perform some of these functions. Although a rheostat will not have the zero current position, a switch in series will provide this function. The problems are cost, size and weight. The best rheostat for testing a 13.8-volt, 23-Ampere power supply is an Ohmite 1000-watt, 1.5-ohm model RUS1R5. This rheostat's current rating is 25.8 Amperes and costs about $580. An enclosure, input terminals and knob must be obtained to complete the test fixture. I have used rheostats to test low current power supplies.

Fixed resistors can be used, but they lack adjustably. The resistance required for the 13.8 volts and 23 Amperes is 0.60 ohms at 317.4 watts. I used five 3-ohm resistors; each resistor has an on/off switch to vary the load current in 4.6-Ampere steps. I used light switches because of the low cost and replacements are available at the hardware store. An enclosure and input terminals must be

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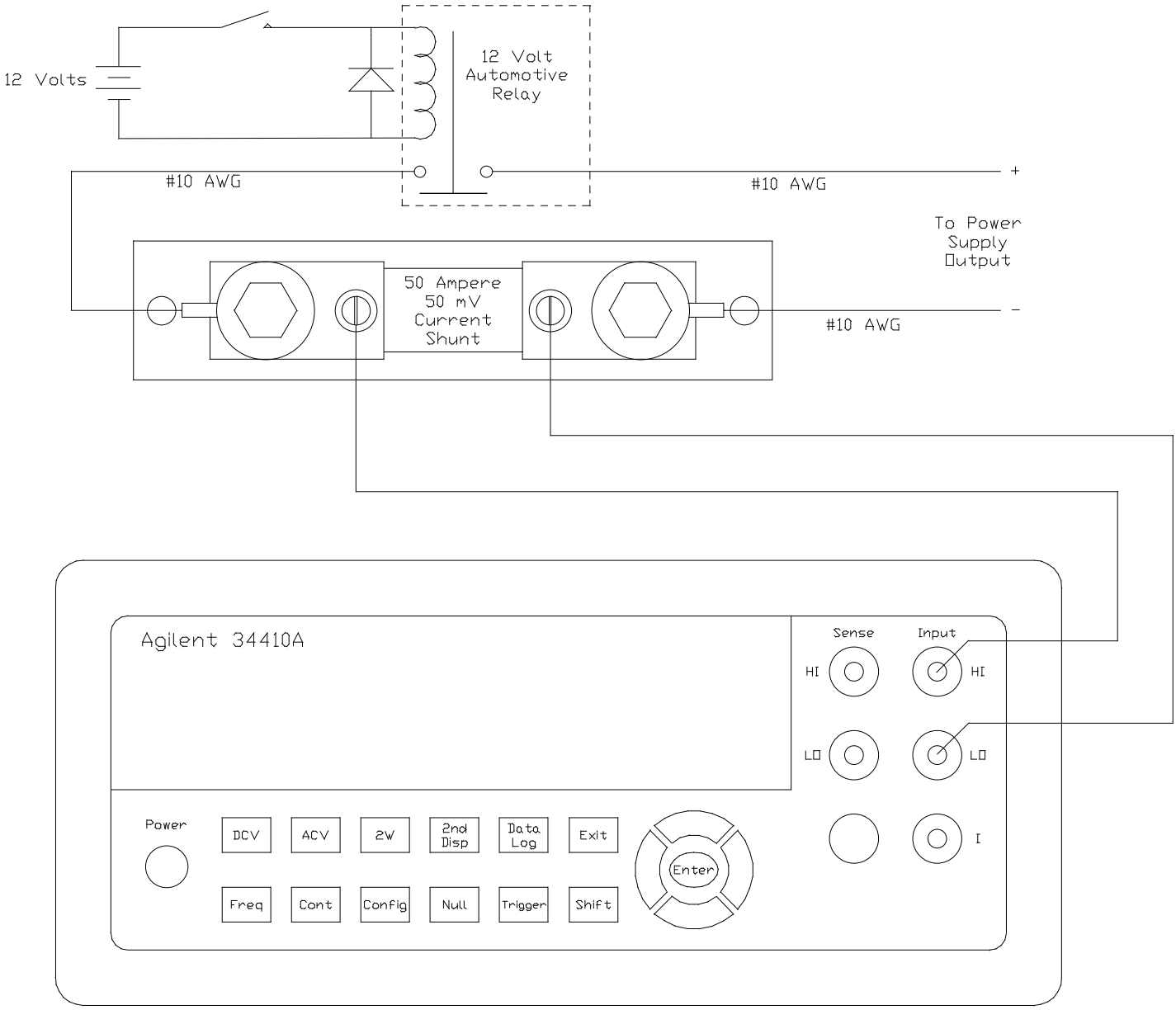

Figure 3 — Short Circuit Setup

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obtained, and I included an ammeter in my load test fixture. Each 3-ohm power resistor dissipates 63.5 watts. If each resistor is rated at 63.5 watts, the resistor temperature would rise to about 200° C after 20 minutes. If each resistor is rated at 127 watts, the resistor temperature would rise 100°C after 20 minutes. In either case the resistor will burn you, if you touch it. I used 225-watt load resistors to reduce temperature rise. An additional switch or relay and current shunt will be required to the test short circuit current.

An active load using transistors can be used. The load current can be set to any value within the transistor's ratings except zero current and short circuit. The test current will stay the same as the voltage is changed. Many transistors will need to be connected in parallel to get to the required current capacity. I would connect 25 2N3773 transistors in parallel for an active load. The transistors will need a large finned heat sink. Controlling the base current will control the test current. A resis-

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tor would need to be connected to each transistor's emitter lead and another resistor connected to each transistor's base lead. The resistors are needed so the current though each transistor will be about the same. I have made active loads for test current from 1 Ampere to 50 Amperes.

A manufactured active load has the advantage of dynamic load testing. This is where the load current is changed between two different levels at a rapid rate. A new dynamic power supply tester will cost at least $2000 to test a 13.8-volt, 23-Ampere power supply. A used ACDC Electronics EL 750 tester will cost about $550, but ACDC Electronics is out of business. This may cause may a problem in obtaining repair parts, if required. An additional switch or relay and current shunt will be required to the test short circuit current.

A carbon-pile load can be used to check power supply operation. Carbon-piles are designed the test batteries and their charging systems. Carbon-pile testers are produced in different current ratings from as little as 50 Amperes to greater than 1000 Amperes. An additional switch or relay and current shunt will be required to the test short circuit current.

I was an electronics technician while I was in the Navy after high school. After the Navy, I worked at Lenkurt Electric Company in San Carlos. I also went to College of San Mateo to study electronics, and Canada College to study computer programming. I worked for a power supply company in the Research and Development Department building and testing new power supplies and test fixtures. I spent the last 37 years calibrating electronics test equipment where I wrote data worksheets, calibration procedures and made calibration test fixtures until my retirement.

January Raffle Prize Winners

1st Prize:	Kristen McIntyre / K6WX / MFJ 4230 MV / 30 Amp Switching Power Supply
2nd Prize:	Pat Sullivan / W6ABA / Diamond NR770HA Dual Band Mobile Antenna with MFJ Magnet Mount
3rd Prize:	Kristen McIntyre / K6WX / Powerwerx DC Power Analyzer
4th Prize:	Daniel Rahamim / KJ6SEE / Battery Tender Junior
5th Prize:	Joel Wilhite / KD6W / ClearTone Speaker
6th Prize:	Kristen McIntyre / K6WX / Pocket Reference / Thomas Glover
7th Prize:	Rebar / N6DB / Bongo Ties

A Few of the Banquet Raffle Prizes

- Grand Prize Elecraft KX-3 — Joanna K6YL
- CC WiFi Internet Radio — Mike W6WZ
- Super Antenna MP1B — Wilco AG6DK
- Tigertronics SignaLink USB — John KF6YXN
- MFJ 2m/70cm Mobile Antenna w/ Mag Mount — Kristen K6WX

Palo Alto Amateur Radio Association, Inc.

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Future PARRA Meeting Dates

Mar 1st, Apr 5th, May 3rd

VE Exams

3rd Saturday each month, 10:30AM, 145.23− PL=100Hz
Redwood City Main Library, Community Conference Room
1044 Middlefield Road, Redwood City, CA
Contact: http://amateur-radio.org or Al, WB6IMX@att.net

Electronics Flea Market

Sponsorship by **A.S.V.A.R.O. — A**ssociation of **S**ilicon **V**alley **A**mateur **R**adio **O**rganizations
Second Saturday of month, March-October, 6am–2pm
Howard M. Krawetz, N6HM 650-856-9761
Contact: http://www.electronicsfleamarket.com/

PAARA — Palo Alto Amateur Radio Association

Meets 1st Friday 7:00pm each month at Menlo Park Rec. Center; Net 145.230 - PL 100Hz
Mondays at 8:30. See our website at http://www.paara.org for more information or contact:
Joel Wilhite KD6W, KD6W@ARRL.NET, 650-325-8239

FARS — Foothills Amateur Radio Society

Meets 4th Friday each month at 7:30pm
Contact: http://www.fars.k6ya.org

NCDXC — Northern California DX Club

Meets 3rd Thursday 7:30pm each month,
Repeater for member info 147.360, Thursday 8:00PM
Contact: http://ncdxc.org or Mike Gavin W6WZ, (650) 851 8699

QCWA Chapter 11

Northern California Quarter Century Wireless Association

Meets third Wednesday monthly at Harry's Hofbrau in Redwood City @ 11:30 AM.
Guests are welcome. Saturday morning net on 146.850 MHz, PL 114.8

NorCalQRP — Northern California QRP Club

Meets 1st Sunday each month
Contact: http://www.norcalqrp.org

SPECS

Southern Peninsula Emergency Communication System

Meets each Monday 8:00pm on Net 145.27, 440.80 MHz
Contact: http://specsnet.org or Tom Cascone, KF6LWZ, 650-688-0441

SCARES

South County Amateur Radio Emergency Service

Meets 3rd Thursday 7:30pm each month, San Carlos City Hall.
Net is on 146.445 [PL 114.8] & 444.50 (PL-100) 7:30 Monday evenings.
Contact: President Gary D. Aden, K6GDA 650-743-1265 (D), 650- 595-5590 (N)
Web: http://k6mpn.org E-mail: pres@k6mpn.org

SCCARA

Santa Clara County Amateur Radio Association

Operates W6UU & W6UU/R, repeater 146.985-pl
Nets: 2m, 7:30pm Mon; 70cm, 442.425+ (pl 107.2) Thur.
Meets 2nd Mon each month @ 7:30 PM.
Contact: http://www.qsl.net/sccara or Clark Murphy KE6KXO 408-262-9334
ARRL/VEC license testing contact 408-507-4698

SVECS — Silicon Valley Emergency Communications

Operates AA6BT repeater (146.115 MHz+)
contact: http://www.svecs.net or Lou Stierer WA6QYS 408 241 7999

TEARS — The Elmer Amateur Radio Society

Dedicated to operational training, knowledge building & FCC exam testing.
KV6R repeater under construction.
Contact: AA6T@ARRL.NET
Most members are Extra Class or VE's. See QRZ dot com/kv6r for class info

WVARA — West Valley Amateur Radio Association

W6PIY six-meter repeater on 52.58mHz. Normally, six-meters is linked with 147 and 223, while 441 and 1286 repeaters are linked.

VHF:			UHF:		
52.58	(-500)	151.4 ctcss			
147.39	(+600)	151.4 ctcss	441.35	(+5.0)	88.5 ctcss
223.96	(+1.6)	156.7 ctcss	1286.20	(-12m)	100.0 ctcss

Meetings are 3rd Wednesday of every month.
Contact: http://wvara.org, Bill Ashby N6FFC, 408-267-3118, N6FFC@Juno.com, or N6FFC@ARRL.NET

American Red Cross,

Santa Clara Valley Chapter

Contact: http://santaclaravalley.redcross.org or Scott Hensley KB6UOO, (408) 967 7924
fshensley@Novell.com

(**Please** send changes to PAARA*graphs* editor)

Badges are ready for pickup.

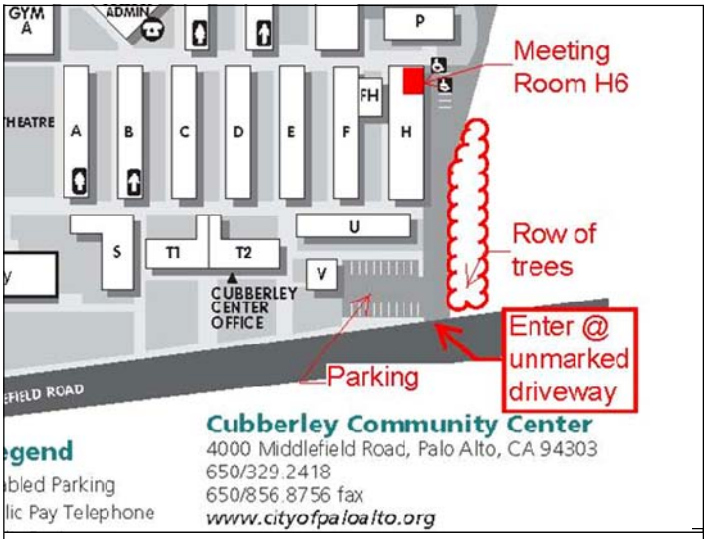
If you would like to order a badge, see **Doug Teter, KG6LWE**.

PAARA Weekly Radio Net

Info and Swap Session
every Monday evening at 8:30pm
on the N6NFI 145.230 MHz repeater

Week	Control Operator
1st	Open
2nd	Doug - KG6LWE
3rd	Jack - N1VSL
4th	Marty - W6NEV
5th	Up for Grabs!

If you're interested in trying out at Net Control, Contact Doug, KG6LWE. It's good practice, and lots o' fun! Give it a try.



Meeting Location — Middlefield Road between San Antonio and Charleston in Palo Alto. 4000 Middlefield Road

Join us for pre-meeting eyeball

Eye Ball QSO
gab & gobble

*Food will be served at **6:00** sharp, so guests will be on time for the PAARA meeting. Those arriving late will be responsible for their own food order.*

5:30 pm—at Su Hong Restaurant
1039 El Camino Real
Menlo Park

across from Kepler's Book Store
on El Camino Real
Walking distance from Caltrain!

Palo Alto Amateur Radio Association
P.O. Box 911, Menlo Park, California 94026-0911
Club meetings are on the first Friday of each month, 7:00pm at the Menlo Park Rec Center, 700 Alma Street, Menlo Park, CA.

Radio NET & Swap Session every Monday evening, at 8:30pm, on the 145.230 −600 MHz repeater, PL 100Hz.

Membership in PAARA is $20.00 per calendar year, which includes one subscription to PAARAgraphs
$6 for each additional family member (no newsletter).
Make payment to the Palo Alto Amateur Radio Association, P.O. Box 911, Menlo Park, CA 94026-0911

Submit items to **PAARA*graphs*** by the 3rd Wed to: rrvt@swde.com
Text: .doc, .rtf, or .txt
Photos: jpg, png or tiff

Subscription Problems? Contact Database Manager: Rick Melrose K6RDM, 888 725-1895, k6rdm@arrl.net

PAARA*graphs* Ad Rates

PAARA*graphs* accepts paid advertisements from non-members. (short personal ads remain free for members in good standing). **All ad rates listed are per issue**.

1. Not-for-profit ads by association members for ham-related items and wants. No cost for business card–size ads (additional space at $2.50 per business card size per issue).
2. For Profit organizations and/or individuals: $5-business card size, $25-half page, $50 full page or back cover per issue.

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