RF

ORANGE COUNTY AMATEUR RADIO CLUB, INC.

VOL. LVI NO. 08 **P.O. BOX 3454, TUSTIN, CA 92781-3454** **August 2015**

The Prez Sez.....

By Tim N6TMT

Summer is half over, soon school will start and the pace of life will change again. For the club change is also occurring. No longer focused on Field Day, it will soon be time for our Auction, Elections and end of year Holiday party.

Auction – October General Meeting

We have received some great donations from the estate of SK WA6RUS Ken Torrence, which will be included in the auction.

If you have any equipment you wish to donate or sell now is the time to start setting those items aside. If you have nothing to donate or sell then bring your check book and get ready to bid and win.

Elections – Nov. General Meeting

It takes many great people doing various tasks to keep the club moving. If you want to be active on the board then please let me know. We can always use additional help and with elections on the horizon it is not too soon to consider joining the fun.

Holiday Year End Dinner – Dec.

We will have the dinner on the first Friday in December at the Marie Callenders in Anaheim Hills. This is a great time to gather with club members in a less formal environment and enjoy a nice meal. As a bonus this year we will have a great radio door prize provided by the estate of WA6RUS.

May all your signals be strong, constant and clear!

de N6TMT – Tim

The next General Meeting of the OCARC will be held on: Friday, August 21st, 2015.

The main August program will be…

"Panel of Experts".

Bring your burning questions and see what great answers you receive.

The next General Meeting will be on:

Friday, August 21st, 2015
@ 7:00 PM

As usual, we will be meeting in the east side entrance of the Red Cross Building, Room 208 (2nd Floor).
See you there!

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ORANGE COUNTY
AMATEUR RADIO CLUB
www.W6ZE.org

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Submit Articles:
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Monthly Events:

General Meeting:
Third Friday of the month
at 7:00 PM held at:
American Red Cross
600 Parkcenter Drive
Santa Ana, CA
(Near Tustin Ave. & 4th St.)

Club Breakfast:
First Saturday – Sept 05 at 8:00am
Marie Callender's Restaurant 2525
1821 North Grand Ave
Santa Ana, CA
(North of 17th Street)

Club Nets (Listen for **W6ZE**):
28.375 ± MHz SSB
Wed- 7:30 PM - 8:30 PM
Bob AF6C, Net Control

146.55 MHz Simplex FM
Wed- 8:30 PM - 9:30 PM
Bob, WB6IXN, Net Control

7.086 ± MHz CW **OCWN**
Sun- 9:00 AM – 10 AM
John WA6RND, Net Control

Club Dues:
Regular Members ...$20
Family Members* ...$10
Teenage Members ..$10
Club Badge** $3

Dues run from Jan thru Dec and are prorated for new members.

*Additional members in the family of a regular member pay the family rate up to $30 per family.

**There is a $1.50 charge if you'd like to have your badge mailed to you.

Portable HF Presentation

By Nicholas AF6CF

2015-07-25

Club member Nicholas gave his “Portable HF” presentation to the PAPA System repeater association.

Program Summary

Justification: Why we need portable HF operations?
What is Portable? Portable equipment and human limits are defined.
QRP vs. QRO: The need and justification for low and high power.
Locations: Where we can operate a portable HF transceiver,
Equipment: What type of equipment we use for portable operations and which combination is best. With actual examples of radios, antennas, amplifiers, accessories and power sources.
Operation: Operation modes, power, deployment and tear down are discussed.
RaDAR demo: A brief demonstration of Rapid Deployment of Amateur Radio.

The talk was well received by the PAPA System members in attendance.

There were several questions and comments from the audience, and even emails follow up from members that needed advise on how to choose the best gear for their particular operational needs.

If you have any questions, you can email af6cf@w6ze.org or talk to us personally at one of the OCARC meetings.

73 DE AF6CF

TechTalk120

DigitalATV – Webcams and UDP and DatvExpressServerApp on Windows

by Ken W6HHC

Ever since December of 2014, I have been interested in using a web camera with DATV and the DATV-Express exciter board instead of my trusty-but-old NTSC video camera. And for a very long time, the entire DATV-Express project team has wanted to avoid using Hauppauge video-capture units to perform MPEG encoding. Another "wish list" item asked for by hams using DATV-Express board is to be able to send video stream to the board over ethernet or internet. Finally, many hams who want to use DATV do not want to learn how to use Linux…they like the Windows operating system.

This article describes progress that has been made in all four areas mentioned above.

Testing UDP feature without Express_Server

The current DATV-Express software has been implemented with the desire to choose an UDP IP address for the video source that is sending a stream to the CPU running DATV-Express. See **Figure01** for the HW-Tab setting that is planned for this feature. The first set of tests that I tried sent UDP packets with video and audio stream over WiFi from a Windows PC to ODROID configured for UDP video source. I could **NOT** get this set-up to work. Charles G4GUO encouraged me to abandon this configuration for now and start testing the Express_Server code installed on ODROID U3

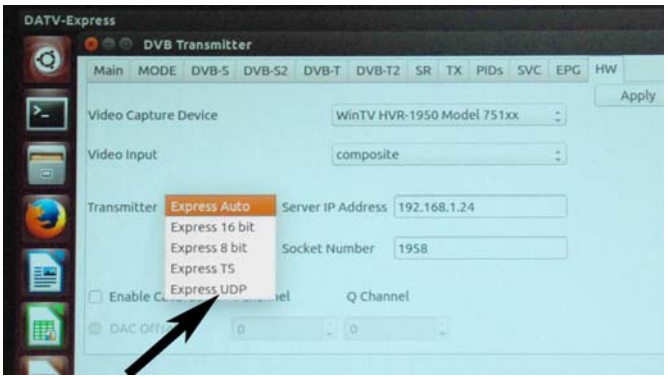


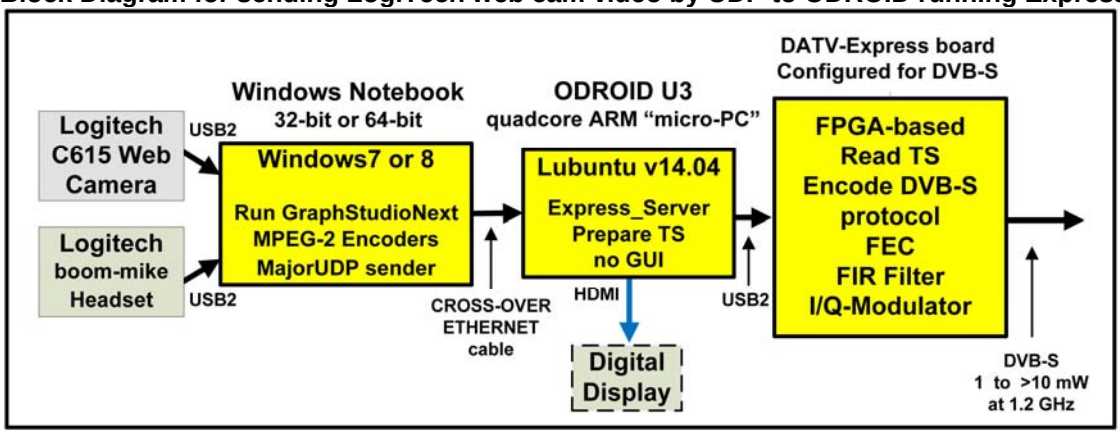
Fig01 – HW Tab in DATV-Express software GUI has setting planned for UDP stream

Testing UDP feature using Express_Server

The Express_Server software was written by Charles G4GUO to better control the receiving of UDP packets by the computer connected to the DATV-Express transmitter board. In this test set-up shown in **Figure02**, A Windows computer has a LogiTech web camera attached and running software called GraphStudioNext to encode the webcam video and use a another piece of software called MajorUDP-Sender to aim the UDP packets to the IP address of the ODROID U3 computer. The ODROID computer is running Lubuntu OS, has the Express_Server software installed and is connected to the DATV-Express transmitter board by USB.

The first testing configuration I tried with the Express_Server software used a LogiTech model C920 webcam, a video-editing software called vMix, encoders configured in a DirectShow Graph called GraphStudioNext installed on a Windows7 notebook computer (see **Figure03**). My initial tests tried to use my home WiFi between the Win7 notebook and the ODROID computer.

Fig02 – Block Diagram for sending LogiTech web cam video by UDP to ODROID running Express_Server



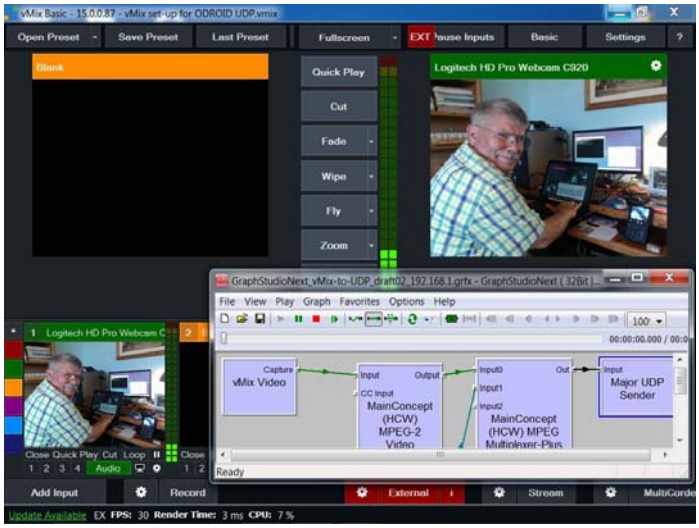


Fig03 - vMix manages the C920 video and GraphStudioNext allows MPEG2 encoding and aims the UDP packets to the Wi-Fi port on ODROID

There were two areas of problems with this first testing configuration that I tried on the Win7 computer:

1. The LogiTech model C920 webcam outputs video that has already encoded using H.264 video compression (aka MPEG-4). Initial tests showed close to 12 seconds of latency delays to receive the video on my receiver. When I reported my C920 results on a DATV internet forum, Jean Pierre F6DZP reminded me that my test set-up was forcing the Win7 computer to first decode the H.264 video stream back to a non-encoded stream and then finally using GraphStudioNext to encode to the MPEG-2 standard. F6DZP recommended that I try using an earlier non-H.264 webcam.
2. The free video editor I was using, vMix BASIC SD (Standard Definition) model, was nice (even allows "green screen" magic) but added a level of complexity that I did not really need. It turns out that Charles had used it in one of his testing set-ups only because it was an easy tool to use to overlay his call letters on top of the video stream…to use during a DATV contest. But vMix added some operational complexity and also prevented me from controlling directly the source-filters settings for the LogiTech equipment.

The next Win7 testing configuration I tried with the Express_Server software was to change the webcam to an older LogiTech model C615 that I owned and to eliminate the vMix video editing software. **Figure04** shows the configuration of "filters" that I now used in GraphStudioNext (I use the latest free version, V0.7.0.430).

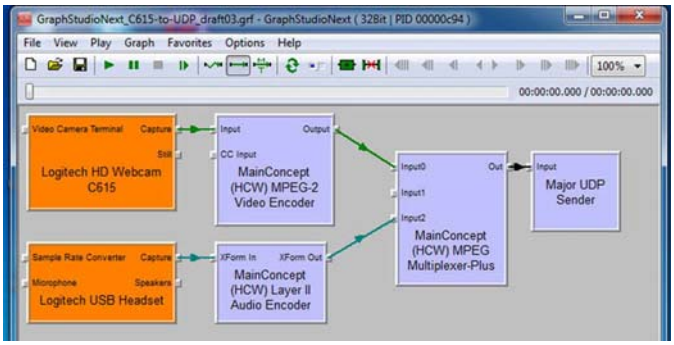


Fig04 - Configuration of DirectShow filters using GraphStudioNext filter for using C615 webcam on Windows. The MajorUDP-Sender software block is aiming packets to ODROID IP address

With the C615 camera, the latency was much improved (perhaps less than using Hauppauge video capture units), but the video would freeze after a minute or two while using a WiFi configuration between the two computers. I suspected perhaps buffer overflow somewhere? G4GUO encouraged me to switch to an ethernet "cable" connection…Charles pointed out he also had poor results with WiFi even though he had "line of sight".

I chose to use a "cross-over ethernet" cable between the two computers. The only tricky part of the "cross-over ethernet" cable installation is that you have to configure both computers for static IP addresses. Setting Windows for a static IP address was straight forward through the Win Control Panel. But setting a static IP address on the ODROID was difficult to sort out …I had to "Google For It" and sort through adding the code below to the INTERFACES system file in the NETWORK folder.

auto eth0
iface eth0 inet static
address 192.168.1.10
netmask 255.255.0.0
gateway 192.168.1.20 (this is the static IP address of the Win7)

Confirm IP addresses are working by pinging from Win7 to ODROID at 192.168.1.10. The static IP addresses cable connection worked perfectly and video was stable in testing lasting more than 8 hours.

One significant difference when using the Express_Server software is that there is **NO** Graphic User Interface (GUI). There is only a command line user interface to show you the server is running (see **Figure05**). The configuration settings that you configure for DATV-Express board DVB-S parameter settings are editable in a text file called, **express.txt**.

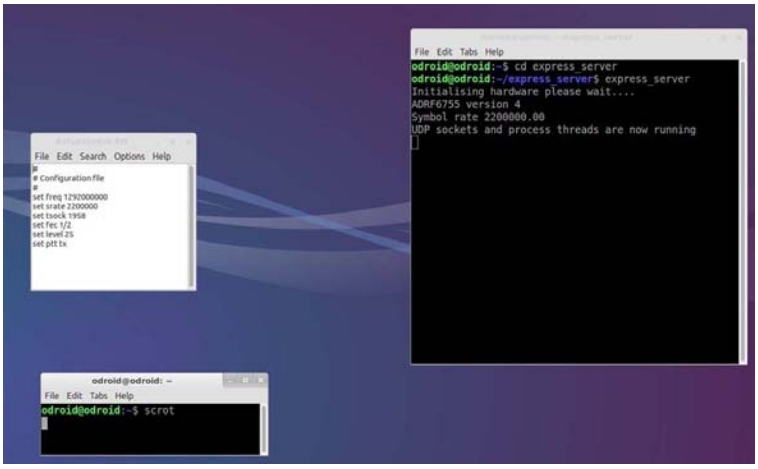


Fig05 – The express_server software is installed and runs (terminal window is on right) on ODROID. It captures incoming internet UDP packets and sends Transport Stream to DATV-Express board. The configuration settings text file is shown on left.

There are two notes about express_server. First, I had to build the express_server software on the ODROID computer from source code that G4GUO makes available on his github (see URL at end of article). G4GUO points out that although I tested the express_server on an ODROID U3 (see **Figure02**), the Express_Server software will run on any linux system.

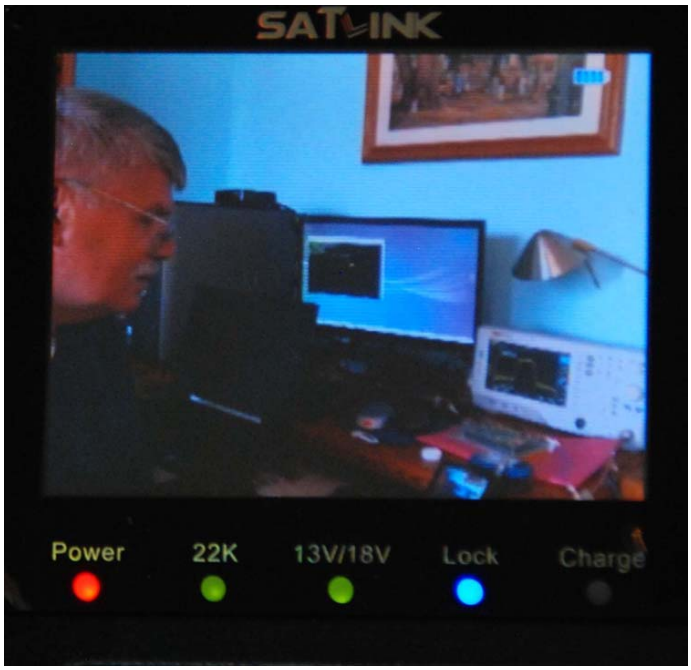
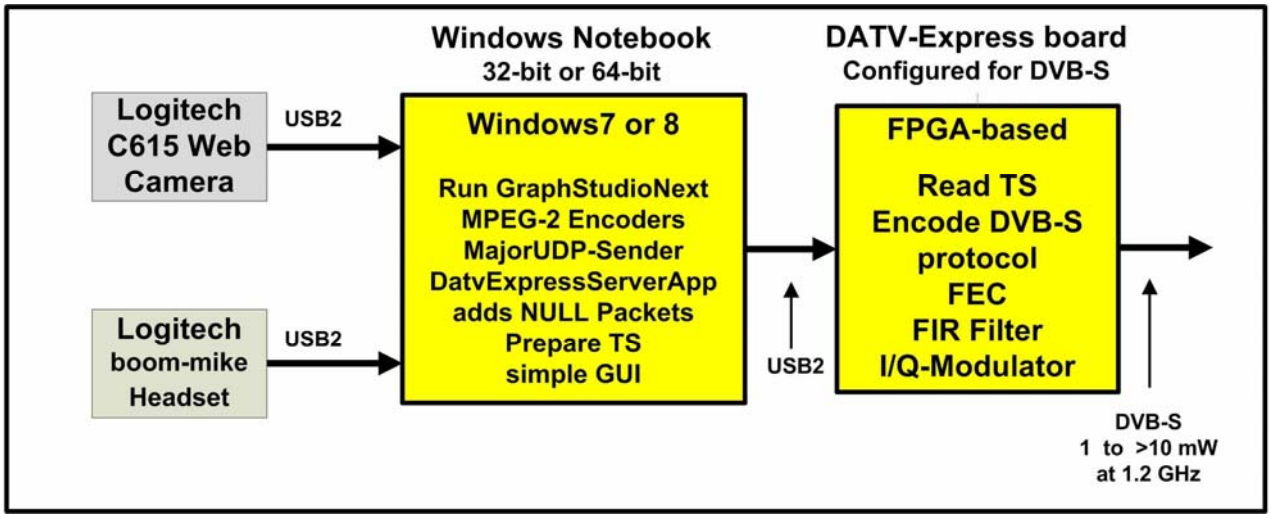


Fig06 - First stable video received using the express_server and cross-over Ethernet cable for UDP packets

Testing DatvExpressServerApp on Windows (no linux used)

A constant request by hams wanting to use the DATV-Express transmitter board was "when will Windows be available?". I then tested the software that Charles G4GUO has written, called the DatvExpressServerApp, that allows the DATV-Express board to be connected directly to a Windows computer running Win7 or Win8. **Figure07** shows the block diagram for my testing set-up.

Fig07 – Block Diagram showing the DatvExpressServerApp software runs completely on a Windows machine and connects to DATV-Express board



This testing configuration uses the same GraphStudioNext set of filters that had been used in **Figure02** and **Figure04**. The only difference is that the Major-UDP-Sender software now aims UDP packets to the internal loopback IP address on the Windows PC, 127.0.0.1.

I did have to sort through installing libusb and driver for the DATV-Express board onto the Windows computer. Libusb(0).dll and the signed Windows driver are publicly available and comes from another Amateur Radio project (HPSDR). Make sure that you use the readme file for DatvExprssServerApp called HELP.txt. **Figure08** shows the simple GUI that DatvExpressServerApp provides on Windows.

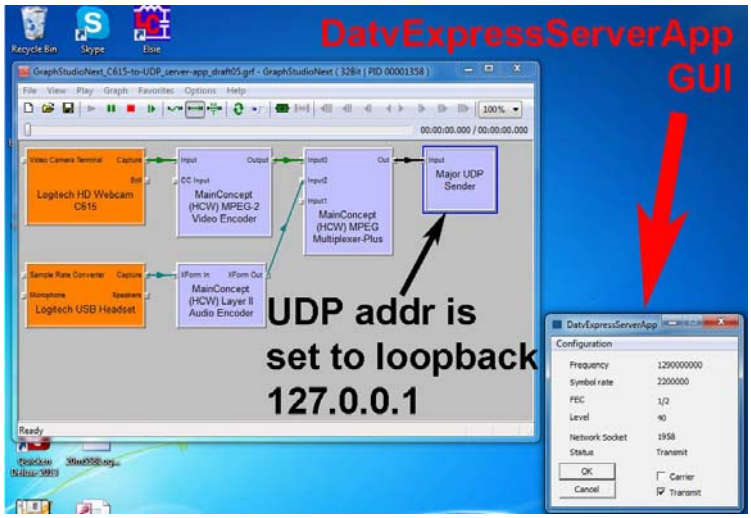


Fig08 - Windows running GraphStudioNext graphs and simple GUI for DatvExpressServerApp

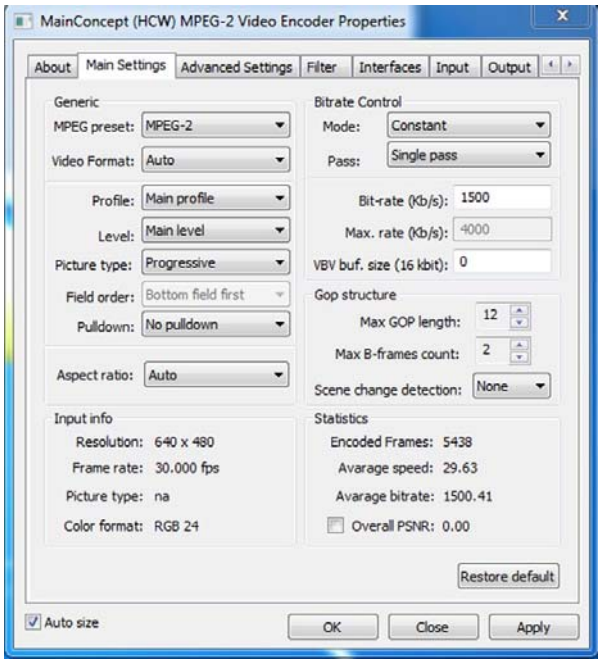


Fig09 – Properties of MainConcept video encoder filter used in my current testing using ConstantBitRate (CBR)

Again notice in **Figure07** that the Hauppauge video-capture board/unit is not used by DatvExpressServerApp. The MPEG-2 audio and video encoder filters in Figure08 are from MainConcept (HCW). I obtained my copy of the three MainConcept filters from the Hauppauge installation CD-ROM that came with my Hauppauge usb-based video-capture unit. The properties display of the MainConcept filter in **Figure09** shows that I have currently set the CBR rate of the desired video bit-rate to 1500 Kbps to not overrun the SymbolRate of 2.20 MSymb/sec that I want to use.

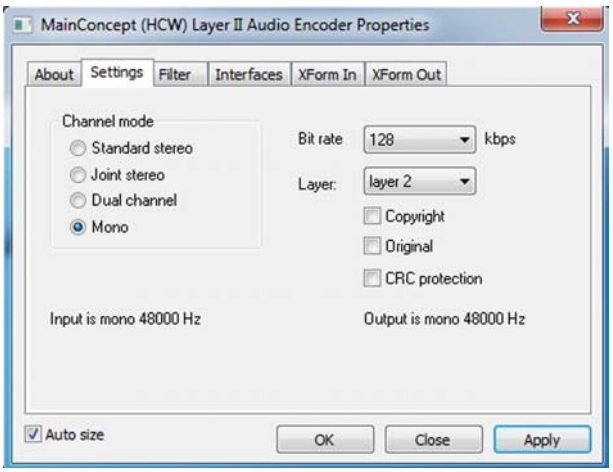


Fig10 – Properties of MainConcept audio encoder filter used in my current testing

One small issue exists with the VideoPID and AudioPID. The MainConcept MPEG MUX filter defaults to values of 1001 and 1002 (as compared to values of VidPID = 256 and AudPID = 257 used for most DVB-S installations). You can change the PIDs to another set of values, but I have not determined how to SAVE those new values as default values.

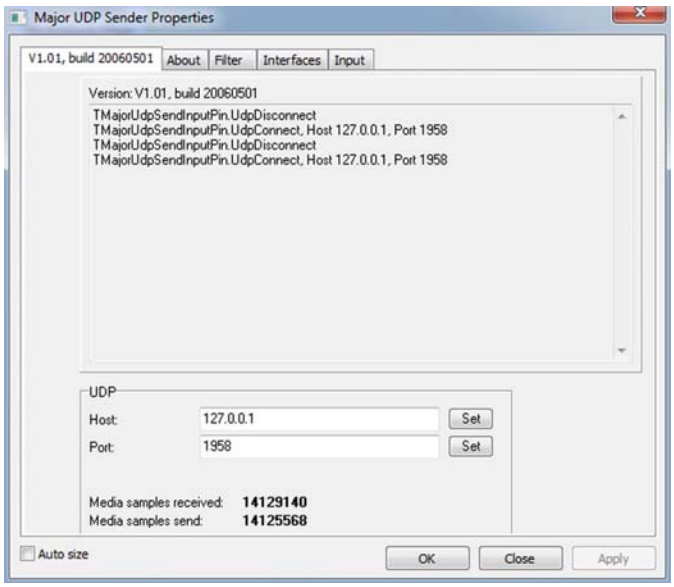


Fig11 – Properties of MajorUDP-Sender software with IP destination address aimed at loopback 127.0.0.1 and socket chosen for an arbitrary 1958

Conclusions

This report is the result of a lot fun trying to break out of the "handcuffs" created by the NTSC/PAL cameras, Hauppauge encoder-boards, and Linux that have somewhat limited the appeal and limited possible applications of the DATV-Express project hardware board.

Using a USB-webcam from Logitech shows that endless cameras can be chosen with many possibilities for other camera interfaces rather than me being restricted to my hand-me-down old (becoming obsolete) home NTSC video camera. I can move to modern cameras now for DATV-Express.

This report also provides a roadmap for using DirectShow filters as software encoders, like the MainConcept ones used in this report. The iron-clad hand-cuffs to Hauppauge video-encoders for many hams has been broken. It does not take too much imagination to see that other encoder filters for MPEG-4/H.264 can be found and substituted for the MPEG-2 encoders in this report to reduce the video-bit-stream-rate and allow smaller RF Bandwidths for DVB-S transmitters in SD (Standard Definition) mode. Or transmit HD video if your application really needs true HD with the corresponding increase in RF Bandwidth over SD.

The ability to send video UDP packet streams over ethernet and even internet to the DATV-Express transmitter board (instead of being tied to the plugged-in-camera) opens up a thousand new possible applications that were not possible before.

Not being able to use Windows operating system and being forced to deal with Linux has been a learning challenge and a "barrier" for many hams. The new DatvExpressServerApp software from Charles G4GUO will eventually allow Windows to be your choice if that is what you want. G4GUO is quick to point out that the DatvExpressServerApp software is still in a highly "experimental stage". But it is a great start. Other hams may be willing to volunteer to make improvements to the source code and add new features to DatvExpressServerApp in an open source spirit.

Finally, if any readers know how to change and save the default PID/PIS values for video and audio in the MainConcept MPEG MUX filter…please send me an e-mail.

Contact Info – the author may be contacted at **W6HHC@ARRL.net**

Useful URLs

- British ATV Club - Digital Forum – see **www.BATC.org.UK/forum/**
- CQ-DATV online (free monthly) e-magazine – see **www.CQ-DATV.mobi**
- DATV-Express Project for Digital-ATV (User Guide and downloads) – see **www.DATV-Express.com**
- G4GUO github for DATV-Express source code – see **https://github.com/G4GUO/datvexpress_gui.git**
- G4GUO github for express_server source code – see **https://github.com/G4GUO/express_server.git**
- HardKernel web site for ODROID U3 – see **www.hardkernel.com/**
- HardKernel USA Sales for faster shipping – see **www.ameridroid.com**
- HardKernel web site for free ODROID Magazine – see **http://Magazine.Odroid.com**
- Chris MWØLLK discussions on vMix and FFMPEG software on Windows to create transport stream – see **http://www.tannet.org.uk/using-ffmpeg-to-generate-a-transport-stream-more-details-and-how-to-add-text-overlays/**
- Orange County ARC entire series of newsletter DATV articles and DATV presentations – see **www.W6ZE.org/DATV/**
- Yahoo Group for Digital ATV - see **groups.yahoo.com/group/DigitalATV/**

Heathkit of the Month #67:
by Bob Eckweiler, AF6C

ELECTRONIC TEST EQUIPMENT
Heathkit IP-32
High Voltage Power Supply

Introduction:
When vacuum tubes were the common active electronic component, a variable high voltage power supply was a standard piece of equipment on the electronic designer's bench. This device normally can supply a B+ voltage in the 100 to 500 volt range, often continuously variable and sometimes adjustable down to zero volts. The device also provides filament voltage (usually 6.3 VAC) at a reasonable current to light-up up to a dozen tubes. Some supplies also provide a negative bias voltage at minimal current to provide tube bias.

Over the years Heathkit manufactured at least seven different bench HV power supplies (See Table I). This article will focus on the IP-32 (Figure 1) as it is the one I used in school for many experiments.

Heathkit PS-1:
Heathkit released their first bench HV power supply, the PS-1, in September 1950 for $29.50. In those days, September was the normal release date for new and upgraded kits. Figure 2 shows the PS-1 advertisement in a 1951 Heathkit flyer.

The PS-1 provides unregulated B+ voltage that is variable between 50 and 300 VDC. I could not find any specification for the maximum B+ current; however the meter is scaled for 200 ma full-scale, so 150 ma would be a good guess. The PS-1 also provides 6.3 VAC for filaments at a hearty 4.5 amperes. There is no bias voltage provision. In 1952 a change was made to the PS-1. Binding posts replaced screw terminals for B+ and filament output on the front panel.

Figure 1: Heathkit IP-32 HV Power Supply

Three tubes are used in the PS-1. A 5Y3GT rectifier tube and two paralleled 1619 series regulator tubes. The 1619 was a common tube that was mass produced during WWII. In 1971 TAB sold surplus 1619 tubes at 5 for a dollar. Heath probably obtained them at even a lower price. They might have been included in the mass surplus component buys Heathkit made in their early days. The 1619 has a 2.5 V filament requiring a separate transformer or isolated winding. Since the filament or cathode in these circuits is at a high voltage this requirement is universal across the various family of kits.


NEW Heathkit LABORATORY
POWER SUPPLY KIT
Features

- Supplies 6.3 V. AC at 4.5 Amps.
- Heavy duty construction.
- Handy for schools, labs., and service shops.
- Supplies variable DC 50-300 Volts.
- Shows voltage or current on 3½" meter.

This new Heathkit Variable Power Supply Kit fills hundreds of needs — use it for experimental circuits — no need to build a separate power supply — use it for a test voltage to determine proper coefficients in unknown circuits — calibrate instruments with its variable voltage, etc. This new Heathkit supplies 50 to 300 Volts continuously variable DC together with an AC filament voltage of 6.3 Volts at 4.5 Amperes. A built-in 1 MA 3½" meter has proper shunts to read 0-500 Volts and 0-200 Milliamperes. The circuit uses a 5Y3 rectifier, two 1619 tubes as electronic control tubes to vary the output voltage with a single potentiometer. Case measures 7⅛" x 13" x 7⅛". Has instruction manual for assembly and use. Model PS-1. Shipping Wt., 18 lbs.

$29.50

Figure 2: PS-1 Ad from 1951 Heathkit Flyer

MODEL	From	To	B+	Filament	Bias	Comments
PS-1	9/1950	9/1952	50 - 300 VDC @ 150 (?) ma	6.3 VAC @4.5A	none	Unregulated; Primary tapped xfmr.
PS-2	9/1952	5/1954	160 - 450 VDC @15 - 150 ma	6.3 VAC @4.0A	none	See Table II
PS-3	5/1954	1957	0 - 500 VDC @ 10 - 130 ma	6.3 VAC @4.0A	none	See Table II
PS-4	1957	1962	0 - 400 VDC @ 100 ma	6.3 VAC @4.0A	Neg. 0 - 100 V @ 1 ma	Dual meters, 125 ma intermittent
IP-32	1962	1967	0 - 400 VDC @ 100 ma	6.3 VAC @4.0A	Neg. 0 - 100 V @ 1 ma	Dual meters, 125 ma intermittent
IP-17	1968	1977	0 - 400 VDC @ 100 ma	6.3 VAC @4.0A	Neg. 0 - 100 V @ 1 ma	Dual meters, 125 ma intermittent
IP-2717	1977	1982	0 - 400 VDC @ 100 ma	6.3 VAC @4.0A	Neg. 0 - 100 V @ 1 ma	Dual meters, 125 ma intermittent

Table I: Power Supply Specifications

An interesting feature of the power transformer in the PS-1 is a primary tap switch built right on the transformer that allows adjustment for varying line voltages around, the then nominal, 117 VAC. This unusual feature might be because Heath acquired a bunch of these transformers in one of their surplus buys.

The PS-1 has four front panel controls, an **OFF - ON** power slide switch, a **STAND-BY** slide switch that removes the B+ but leaves the filament power on, the **VOLTAGE** control potentiometer and a meter switch that selects whether the meter reads the output **VOLTS** or output **MA**. Also on the front panel are a jeweled pilot light, a meter with 0 - 500 volt and 0 - 200 MA scales, and two two-screw output terminals - **6.3 VAC** and **- H.V. +**. (Later units have binding posts).

The PS-1 was produced until late 1952 when it was updated to the PS-2.

Heathkit PS-2:

The PS-2 was released in September of 1952. It originally sold for $29.50, but in the 1954 catalog the price had risen to $33.50. The PS-2 improved on the basic circuit of the PS-1, adding voltage regulation and shifting the output voltage range higher, up to 160 to 450 VDC. Maximum current output varies with the chosen voltage. At 400 VDC the maximum draw is 15 ma increasing to 130 ma at 200 VDC.

A pair of paralleled 1619 tubes remain as the series regulator tubes. The rectifier was upgraded to a 5V4, and a 6SJ7 control amplifier tube and an 0C3 voltage reference tube were


Heathkit LABORATORY

REGULATED POWER SUPPLY KIT

Here is a new Heathkit Laboratory Power Supply with many outstanding features that thoroughly qualify it for laboratory and service shop application. The regulated voltage output is continuously variable and constant under wide load variations. A 4½" Simpson plastic cased panel mounted meter constantly monitors the laboratory power supply output for either voltage or current measurements. Linear, variable DC output voltage with excellent regulation is readily available. Panel terminals provide a separate 6.3 volt AC supply of 4 amperes for necessary filament voltage requirements. The DC voltage output is completely isolated from the chassis and therefore can be conveniently used for AC-DC circuit work. Ripple component is exceptionally low; .03 volt ripple at 250 volts under 50 milliampere load conditions for a percentage of .012%.

These highly desirable features admirably qualify the Heathkit Laboratory Power Supply for experimental high gain audio applications—as a spare source of DC supply for service work—laboratory experimental work—plotting tube characteristics, etc.

MODEL PS-2

$33.50

SHIPPING WEIGHT 20 LBS.

Figure 3: PS-2 Ad from the 1954 Heathkit Catalog

added. These tubes control the regulation by comparing the output voltage to a steady reference voltage provided by the 0C3 reference tube, adjusting the regulator tube grid bias to keep the output voltage nearly constant.

The PS-2 front panel features a similar meter to the PS-1, and the panel nomenclature is identical, with the following exceptions: The two slide switches, are now marked **POWER** above the switch and **OFF - ON** below, and **STAND-BY** above the switch and **OFF - ON** below; the filament output binding posts now also show the maximum current - **6.3 V 4A AC**.

The PS-2 remained in the Heathkit stable until the PS-3 was released in May of 1954.

Heathkit PS-3:
The PS-3, introduced in June of 1954 for $35.50, offers regulated B+ voltage control from zero to 500 VDC. It still uses two 1619 tubes as the series regulators, but the 0C3 was replaced by two 0A2 VR tubes and a second rectifier tube was added to provide negative 150V and 300V to allow the series regulator tubes to operate all the way down to zero volts. The PS-3 uses a transformer that has the same voltages and color codes as the earlier PS-2 and may be identical. I don't have the part numbers to confirm that. Current output is a function of the voltage the supply is set to; this is shown in Table II.

The PS-3 also features a larger meter and changed styling, which uses gray knobs, a dark gray front panel and a flat wrinkled lighter gray cabinet.

The PS-3 appears in the summer catalog for 1956. It remained in production into 1960, according to Chuck Penson's book ***Heathkit Test Equipment Products***. I have no 1959 nor 1960 catalogs to refer to, which is sad since my first ham license arrived in July 1959.

Heathkit PS-4:
The first catalog I have that shows the PS-4 is in 1961, though sources say it appeared as early

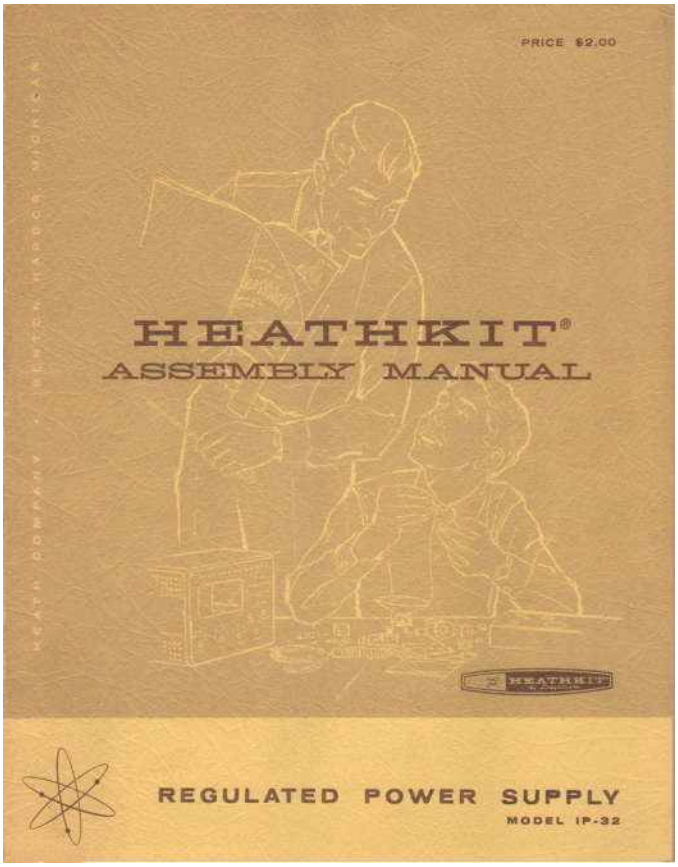


Figure 4: IP-32 Manual Cover

as late 1957 and was sold concurrently with the PS-3. The 1961 catalog has the price at $56.95 as a kit and $82.50 factory assembled. The increase in price is due to the PS-4 being a complete redesign. The PS-4 features separate filament and power transformers, dual meters and a new tube lineup that allows current output independent of the voltage setting. The PS-4 design is the basis for the IP-32, IP-17 and IP-2717 power supplies with only styling and minor circuit changes. The PS-4 is identical to the IP-32 except for styling, so circuit details will be provided in the featured IP-32 section.

Heathkit IP-32 HV Regulated Lab Power Supply:
The IP-32 was introduced in 1962. It is identical to the PS-4 except for new styling, which Chuck Penson refers to as the **Classic II** style. (dark gray front panel with silver nomenclature and trim, lighter gray cabinet and black knobs with silver inserts and white pointers).

IP-32 Physical Specifications:
The IP-32 measures 13"W x 8-1/2"H x 7"D and weights 12 lbs. (Shipping weight is 16 lbs.) The front panel is laid out in rows. Left to right the top row contains the **D.C. OUTPUT VOLTAGE** meter, a pilot light and the **D.C. OUTPUT CURRENT** meter. Directly below the pilot light is a three position rotary power switch marked **OFF**, **STANDBY**, **ON**. Below the voltmeter is the bias supply potentiometer control marked **C– OUTPUT** with a clockwise arrow. Below the power switch is a slide **METER SWITCH** for switching the voltmeter between B+ (0 - 400 V full-scale) and bias (0 to -100 V full-scale). Below the current meter is the **B+ OUTPUT** potentiometer control with a clockwise arrow. Centered horizontally below the meter switch near the bottom of the front panel are seven binding posts marked: **0 TO - 100V AT 1 MA**, **COMMON**, **6.3V AC 4 AMPS** (using two terminals), chassis **GND.**, **COMMON**, **0 - 400V. AT 100 MA 125 MA MAX.**. The rear panel has a fuse holder (3 ampere) and a Heyco type clamp for the AC power cord exit.

IP-32 Circuit Description:
Figure 4 is a block diagram of the IP-32, and figure 7 is the schematic. The circuit may be broken down into seven blocks: filament power; negative/bias power supply; B+ power supply; screen power supply for the regulator tubes; the control circuit; series regulator and the metering circuit. The circuit uses six tubes, six silicon rectifier diodes and two selenium rectifiers. The tubes are two 0A2 150 V regulator tubes, a 6BH6 control amplifier tube, a 6X4 bias rectifier tube and two 6L6 series regulator tubes.

Tube Heater Power:
On most vacuum tubes the spacing is normally very close between the heater and cathode. Hence most tubes have a low maximum voltage rating between these two tube elements. In this circuit, even though all the tube filaments are rated at 6.3 VAC, the cathodes of the tube are at different high voltages. While the cathode of the 6X4 bias rectifier is near zero, the regulator tube cathodes are at whatever the output voltage is set at and the control tube cathode is at negative 150 volts. All heater power is provided by a separate transformer with four isolated and well insulated windings. One winding (2A) powers the two 6L6 tubes, a second (0.6A) powers the 6X4 rectifier, a third (0.15A) powers the 6BH6 and a fourth (4.15A) powers the pilot lamp and the external 6.3 VAC terminals. One side of each heater power winding is also connected directly to its associated cathode.

V out	PS-2	PS-3	PS-4, IP-32, IP-17, IP-2717
500 V	n/a	n.s.	n/a
450 V	n/a	10 ma	n/a
400 V	15 ma	20 ma	100 ma*
350 V	40 ma	40 ma	100 ma*
300 V	70 ma	70 ma	100 ma*
250 V	100 ma	100 ma	100 ma*
200 V	130 ma	130 ma	100 ma*
n.s. = not specified; * 125 ma intermittent max.			

Table II: Power Supply Current Ratings

B+ Power Supply:
Power for three high voltage power supplies is provided by a separate second transformer. The primaries of the two transformers are wired to the three position power switch. In the standby position only the filament transformer receives AC line power, and in the on position both receive AC line power.

The B+ power comes from a 210 volt winding that feeds a full wave voltage doubler. Rectification is provided by two series-pairs of silicon diodes. No load voltage is on the order of 600 volts. This voltage is applied to the plates of the 6L6 regulator tubes and the low side is connected to the common output through a

jumper in one of the 0A2 regulator tube; the jumper will be discussed in the negative/bias power section.

Regulator Screen Power Supply:
A second winding of 175 volts on the power transformer provides power for the screen grid of the 6L6 regulator tubes. The voltage is half-wave rectified by two selenium rectifiers in series and filtered. The supply develops about 230VDC that is fed to the screen grid of the two 6L6 tubes. The common side of this power supply is connected directly to the cathode, so the screen grids remain 230 volts positive with respect to the cathode, independent of the cathode voltage.

Negative Bias Power Supply:
A third winding on the power transformer of 600 VCT is rectified by a 6X4 dual diode rectifier tube in a full-wave configuration. This voltage, approximately 380 volts is filtered and then current limited by R21 and regulated by two 0A2 150 volt regulator tubes. The positive side of this power supply is connected to common through a jumper in one of the 0A2 VR tubes. This supply then produces two voltages regulated at -150 and -300 volts with respect to circuit common.

The voltage regulator (VR) 0A2 tube is constructed with internal jumpers, the anode connected to pins 1 and 6 and the cathode connected to pins 2, 4 and 7. These multiple pin jumpers allow the prevention of unregulated voltage from reaching the circuit should a VR tube be removed. This feature is incorporated in the circuit for both 0A2 tubes.

The -150 V regulated power connects to the cathode of the 6BH6 control tube, allowing the tube to operate even with a plate voltage near zero. The -150 volt supply also is fed through the C– OUTPUT potentiometer and a current limiting resistor and further filtering to the 0 TO -100V AT 1 MA, and associated COMMON binding posts.

The -300 volt supply provides a reference for the control tube as well as a bleeder return for the output of the series regulator. These will be covered in a later paragraph.

Series Regulator Circuit:
A pair of 6L6 tubes, wired in parallel, are used as the series regulator. These tubes drop the +600 volts (at no load) from the B+ power supply to the desired voltage set by the front panel B+ OUTPUT control. The tubes act as active resistors keeping the voltage at their cathodes constant as the current drawn through the tubes fluctuates. Each tube's screen is connected to the screen supply via a 100 ohm parasite suppression resistor. These tubes are controlled by the control amplifier tube discussed next. The control amplifier output is connected to each 6L6 control grid through a 1K ohm suppression resistor. The plates, cathodes and heaters of the 6L6 tubes are directly connected to each other.

This type of series regulator loses control when the current draw drops below a certain value. To prevent this from happening, four 27K ohm 2-watt bleeder resistors are connected in series from the 6L6 cathodes to the -300 volt supply. This assures a minimum current draw about 3 ma even when the B+ OUTPUT control is set to zero.

The Control Circuit:
The heart of the IP-32 is the control circuit. The cathode of the 6BH6 control tube is connected to the regulated -150 volt source, and the plate is connected to the output of the series regulator tubes through a 470k ohm resistor. The plate is also connected to the control grids of the series regulator tubes. Any change in current through the control tube changes the output voltage.

A voltage divider chain, made up of two variable resistors, two fixed resistors and one potentiometer (R10 to R14), is connected between the regulated -300 volt source and the output voltage. The two variable resistors are at

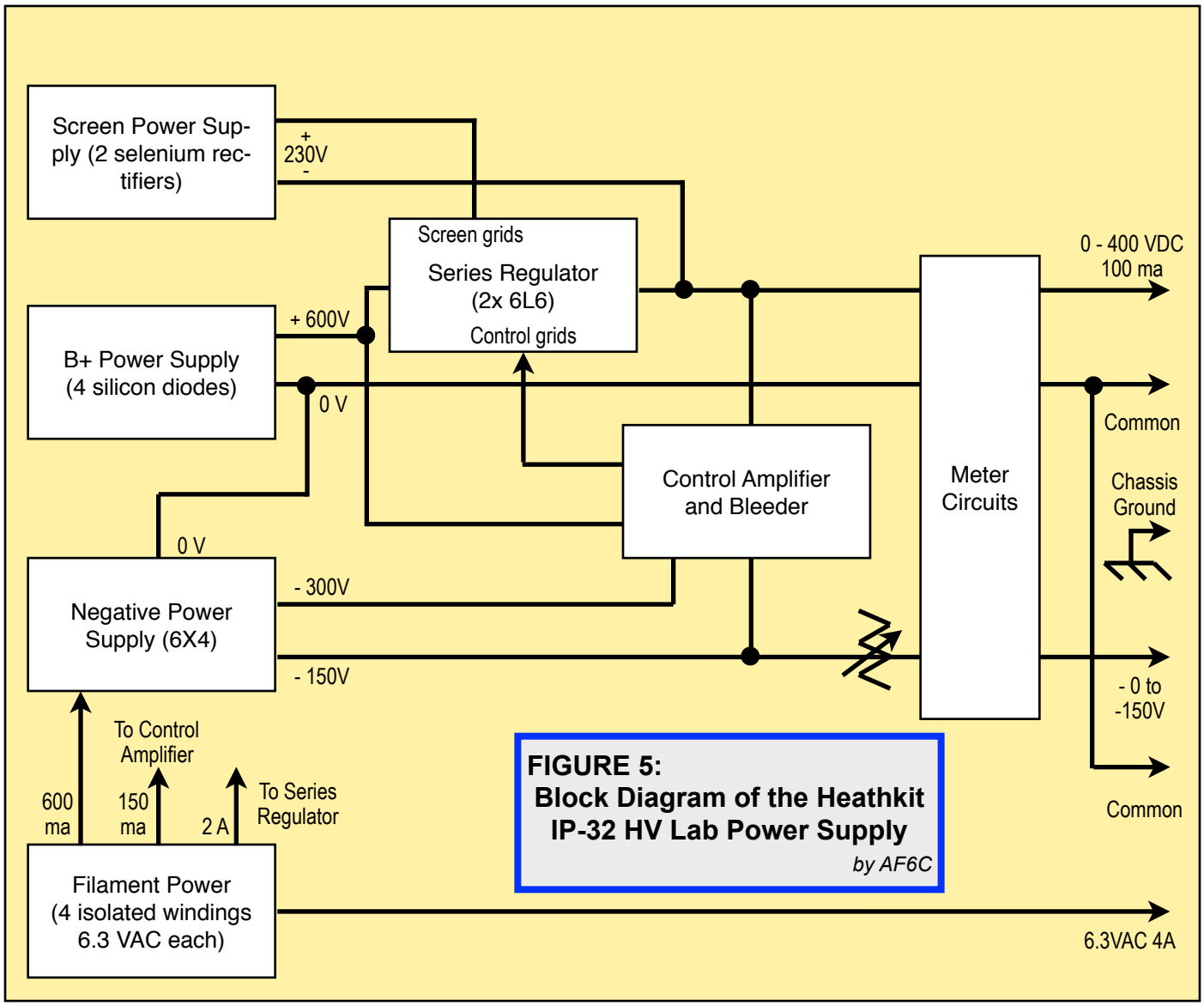


FIGURE 5:
Block Diagram of the Heathkit IP-32 HV Lab Power Supply
by AF6C

each end of the resistor chain and set the zero point and the 400 volt output point. They are internal adjustments. The potentiometer, in the center of the chain, is the B+ OUTPUT control. Its wiper connection is filtered to remove any noise and applied to the grid of the control tube. This potentiometer sets the output voltage. Should the voltage change due to added current draw, the grid of the control tube senses the change and adjusts the series regulator tubes to return the voltage to the set value.

Additionally, the screen grid of the control tube is connected via a voltage divider from the raw B+ voltage to the -150 regulated voltage. Thus any sag in the raw voltage is detected by the control tube. This divider controls the output impedance of the power supply. It is set to make the impedance close to zero. The IP-32 output impedance is specified to be less than 10 ohms from 1 Hz to 1 MHz.

Metering Circuit:
The IP-32 has two meters so the user may monitor the output voltages and the B+ current draw simultaneously. The current meter is a 150 ma full-scale meter with a series resistance of 0.66 ohms and is placed in line with the B+ output. No provision is provided to monitor the C- OUTPUT current since it is very low and current limited internally.

Figure 6: Heathkit IP-17 (top) shown with the IP-27 Low Voltage companion power supply (bottom) from the 810/68 1968 Catalog

The voltage of both the B+ OUTPUT and the C- OUTPUT is monitored on a 1 ma meter with the proper series resistors. A DPDT slide **METER SWITCH** selects the correct resistor and changes the meter polarity to read full-scale 0 to -150 volts on the C- OUTPUT (R25 = 150 KΩ 1%) and 0 to +400 volts on the B+ OUTPUT (R24 = 400 KΩ 1%).

Heathkit IP-17

The IP-17 (Fig. 6) is a totally restyled version of the IP-32. It is now in a low-profile cabinet measuring 13-3/8"W x 11-1/4"D x 5-1/2"H. Electrical changes to the PI-17 are minor. 6.3 or 12.6 VAC is available for external heaters at a total load of 25 VA. The selenium screen rectifiers were replaced by silicon diodes. A third pole has been added to the meter switch and two neon lamps indicate whether the voltmeter is reading C- or B+ volts. Also the primary and transformers have been updated so the IP-17 may be wired for 120 or 240 volt operation. A three wire AC plug has also been incorporated.

The IP-17 came out in 1967, too late for the main catalog. It sold for $59.95 in kit form and $89.95 wired (IPW-17).

Heathkit IP-2717

In 1977 the IP-17 was replaced by the nearly identical IP-2717 which featured only some small styling changes (mainly colors) and a price of $109.95. A factory wired version continued to be available at $210. The IP-2717 continued to appear in catalogs into the mid-eighties when it was phased out and no replacement was released.

Summary:

If you dabble at all in vacuum tube circuits, a HV power supply that can provide filament and B+ voltage for your prototyping is a handy tool to have on the bench.

When Heathkit finally settled on a standard circuit with the PS-4, it and the models that followed have ratings of ±1% load regulation from no load to full load from 100 to 400 VDC and ±1/2 volt change for a 10 volt change in line voltage. Ripple, jitter and noise are less than 10 mV and the output impedance is below 10 ohms.

During my school years the physics department bought some IP-32 power supply kits and a few of us were given the task to each assemble one. By that time I had assembled numerous Heathkits and found the IP-32 not at all challenging, but probably the best homework assignment ever!

I'm busily looking over some Heathkits to find one in the ham category. I'm slowly piecing together information to feature the HW-32 et al. that have been an often requested topic. I also have an IP-27 Low Voltage Power Supply, an IM-4180 FM Deviation meter, an AA-14 Stereo Amplifier and an SK-107 Stereo Synthesizer in the queue.

73, from AF6C

Remember, if you are getting rid of any old Heathkit Manuals or Catalogs, please pass them along to me for my research.

Thanks - AF6C

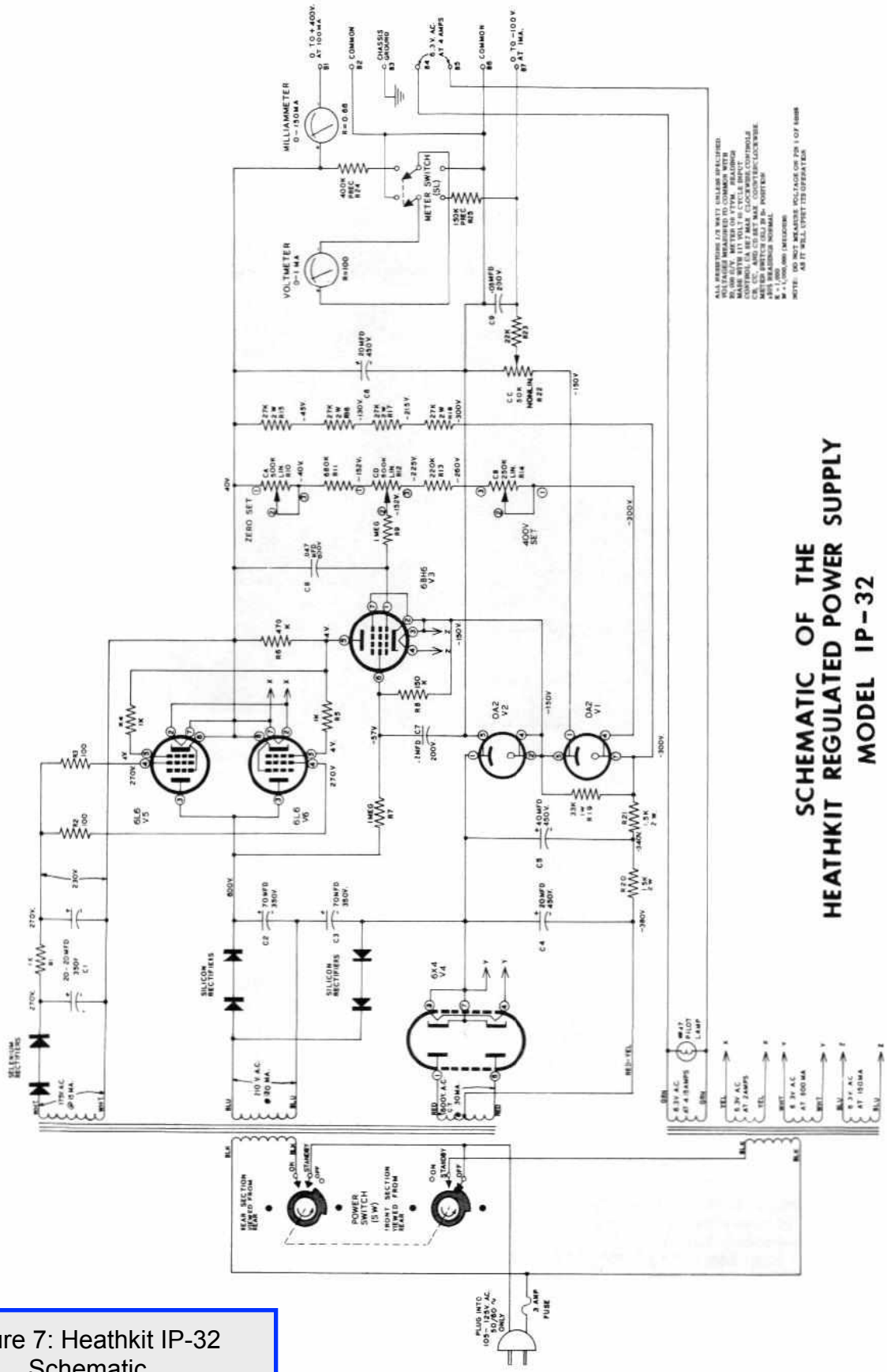


Figure 7: Heathkit IP-32 Schematic

OCARC POE AUGUST 21ST

(Orange County Amateur Radio Club Panel of Experts)

The Orange County Amateur Radio Club membership meeting held on August 21st at the American Red Cross in Santa Ana will be hosting a POE (Panel of Experts) Event offering very interesting, informative and enlightening discussions about various aspects of amateur radio. Do you have a burning question that you've always wanted to ask an experience ham operator, or would like advice from experts in different areas of ham radio? This is your opportunity to learn more about contesting, DX, digital operations, meteor scatter, portable radio, nets, repeaters, ham shack setup, general operations and amateur radio education and instruction.

So plan on being at the next OCARC membership meeting August 21st 7:00PM at the American Red Cross.

by Tom W6ETC

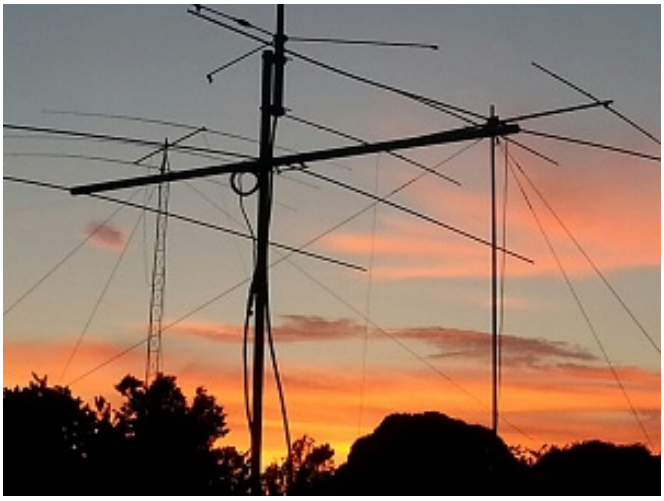
Confirmed Panel Members include:

Tim N6GP will be your moderator ✓ confirmed

Arnie N6HC – Contesting ✓ confirmed

Nicholas AF6CF – Portable Operations ✓ confirmed

Additional members confirming soon!!!



OCARC
GENERAL MEETING MINUTES
2015-07-15

The OCARC General Meeting was held at the Red Cross Complex on July 17th, 2015. The meeting was called to order at 7:00 PM. A quorum of officers was present with Bob AF6C, Don N6XBP, Ken W6HHC and Robbie KB6CJZ absent. There were a total of 21 members and 5 visitors in attendance.

Program for General Meeting:

Our speaker for the evening was Bill Prats K6ACJ about the Raspberry PI ad Arduino applied to HAM radio.

"Arduino, Picaxe and Raspberry Pi "

Bill showed us how these microcontrollers are the latest technology craze with many applications in the field of Amateur Radio with applications and some practical examples.

Bill K6ACJ used a miniature camera to show the very small devices to the audience

Biz:
VP Tom W6ETC – Announced the activities for the next few months.
August: "Panel of Experts", **September:** "Show and Tell" ,**October:** "Auction".
Tom also presented the audience with raspberry pastries as a celebration of the speaker's theme.

FIELD DAY

- Tim N6GP reported that he submitted the logs to the ARRL for this year.
- Just under 9000 Points with 1170 Bonus points.
- FD was declared a success once more.

General Discussion – A discussion was held with the membership about getting a storage place to consolidate the Club's assets in one place instead of depending on the good will of a few members. This would necessitate raising the annual Club dues from $ 20 to $30.
There were many opinions against and in favor of this and the Board promised to research and discuss the matter further before a decision was taken.

Meeting was adjourned at 21:06

Respectfully submitted by:
Nicholas AF6CF – acting as secretary

OCARC BOARD MEETING MINUTES

2015-08-01

The OCARC Board meeting was held at the Marie Callender's Restaurant on Grand Ave in Santa Ana on August 1st, 2015. There were a total of 9 directors and members attending. There was a quorum of Directors present with only Bob AF6C and Doug K6PGH absent.

Director Reports:

- **Treasurer** – Greg W6ATB reported that the OCARC has taken in $1,855 of income and spent $1324, so far during 2015 for a net income of $530. [See club cash flow report on page 21] Not all FD bills are in yet, but currently Greg is showing food-prepays income of $505 and FD expenses of $944 for a net FD expense of $439,
- **Secretary** – Ken W6HHC reported that he has a conflict for the August 21 General meeting. Nicholas AF6CF will act as secretary at that meeting.
- **Membership** – Don N6XBP will send out completed YTD membership roster during the coming week.

OLD BIZ:

- **Newsletter Editors**
  - Aug - Tim N6TMT;
  - Sept - Paul W6GMU;
  - Oct - Corey - KE6YHX;
  - Nov - Greg W6ATB
  - Dec - Bob AF6C
  - Jan - Ken W6HHC
  - Feb - Tom W6ETC
- **Program Speakers for Club Meetings**
  - Aug - Panel-of-Experts
  - Sep - Show-and-Tell
  - Oct - Radio Auction
  - Nov - (pending prgm) & also elections
  - Dec - Club Christmas Party
- **VE Testing Listing**

  OCARC had several people show up for VE Testing at FD because the ARRL web site still showed "VE Testing" available as a club feature. OCARC Secretary will remove **"VE Testing"** from the ARRL web description of OCARC.
- **Storage Unit for Club Equipment**

  Nicholas AF6CF reported a rental site in Placentia for $89/mo. Greg W6ATB reported a rental site in Orange with 9 ft ceilings for $112/mo. Don N6XBP reported that a 5x5 storage unit in Irvine is $79/mo and that a 10x5 unit is $150/mo. The plan is for Greg and Nicholas to visit the Placentia storage site and make sure that the 10 ft aluminum tower sections will stack on end in the unit. If so, they will sign a one-year rental agreement.
- **Training for another Ass't Webmaster**

  Tom W6ETC has offered to try to help out as an Assistant Webmaster. Ken W6HHC reported that he had his first training session with Tom. The next step for Tom is to replicate the web tools at his QTH and have another training session.

NEW BIZ:

- **Christmas Dinner Radio Door Prize**

  As part of handling the estate radio equipment of WA6RUS, one item, an ICOM IC-706-mk2 is in great condition. "El Presidente" Tim N6TMT suggested it might make a great door prize for the December Christmas Dinner. The board members agreed. Greg W6ATB took the unit home to check it out before we offer it as a prize.
- **Disposition of WA6RUS (SK) Estate Radio Gear**

  Tim N6TMT read off the list of equipment that the wife of WA6RUS (SK) had donated to the club. The board agreed - rather than try selling the individual pieces, the club would first offer the gear at October Radio Auction. Tim N6TMT will send the board the list of equipment…that will eventually be used to entice hams to the OCARC October auction.
- **Trying Again for Membership PayPal button**

  The board agreed in discussions that there are many advantages to providing a PayPal button

- **Membership PayPal button – cont'd**

  on the club's online membership form. Ken W6HHC and Nicholas AF6CF described the last two set of PayPal roadblocks that OCRAC ran into back in 2013.

  The board agreed that it would be best to simplify the list of membership items in order to use the free "PayPal Button" (rather than to incur expense to buy a PayPal shopping list in order to give to PayPal a calculated price for the item configuration). New member badges will be included in price of new member $30 membership fee. Otherwise badges will NOT be a PayPal item…new badges will be handled at club meetings. The quarterly rebates for new members also will be dropped in order to simplify the PayPal list. The following committee has been formed to work out the PayPal list details and also create a new PayPal account: Tom-W6ETC, Greg-W6ATB, Ken-W6HHC, and Nicholas-AF6CF.
- **Forming an OCARC VE Team?**

  Tom W6ETC explained that he would like to investigate forming a VE Testing team at OCARC. Gordo WB6NOA is currently planning to "teach the teachers". The intent is to initially be able test for the Technician class license. Several board members thought they might help. Tom will report back with more details.
- **2016 Election Committee**

  An election committee to find nominations for the 2016 Board of Directors has been appointed. The committee consists of Tim N6TMT, Tom W6ETC, Nicholas AF6CF, and Ken W6HHC. The following board members said they were willing to be nominated for the Board in 2016: AF6CF, N6TMT, N6XBP, W6ATB, W6GMU, and W6HHC.

Respectfully submitted by:
Ken W6HHC - secretary

OCARC 'SHOW & TELL' for SEPT 18TH 2015

(Orange County Amateur Radio Club Members Showing Off the 'Good, Bad & the Ugly Amateur Radio ~~Junk~~ Objects')

The County Amateur Radio Club September 18th, 2015 membership meeting will be a 'SHOW-and-TELL' event that you won't want to miss! A show-and-tell event is a teaching method, and when used properly encourages instruction, good information, great conversations, times for Q&A, and in some cases a sense of what could be or should have been? The target audience is both new and old Amateur Radio Operators from within the Orange County, California Amateur Radio community. The public is welcome and its absolutely FREE! It's a great opportunity for its members to bring an object in and share it with the club of what they believe to be interesting, informative, funny, unique, or an item built with great intentions which result in a smoking failure. Some items are just too strange or too weird that needs to be shared. Objects must be related to Amateur Radio operations. It's a time to show off your skills, your abilities or in some instances your inabilities. We can all benefit from both your successes and mistakes. If you built it, designed it, or refined it then come share it! Members are encouraged to bring one (1) item to share… but beware; some items may cause extreme laughter!

Make sure to put this one on your calendar and plan on being at the OCARC membership meeting Friday, September 18th, 2015 held at the American Red Cross in Santa Ana.

by Tom W6ETC

OCARC Cash Flow - Year To Date

1/1/2015 through 7/31/2015

Category	1/1/2015-7/31/2015
INFLOWS	
Badge Income	12.00
Dues, Family	130.00
Dues, Future	20.00
Dues, Membership	1,030.00
Dues, New Member	158.00
Field Day Food Advance	505.00
TOTAL INFLOWS	**1,855.00**
OUTFLOWS	
Bank Svc Chg	35.00
Door Prize	200.00
FD bathroom cleaning	50.00
Field Day - Flowers	49.04
Field Day - Gas	64.71
Field Day Food	780.00
PO Box Rental	56.00
Web Site Hosting	89.94
TOTAL OUTFLOWS	**1,324.69**
OVERALL TOTAL	**530.31**

Bob's TechTalk #39
by Bob Eckweiler, AF6C

Grid Dip Oscillators (Dip Meters)

The Grid Dip Oscillator:
Recent discussions on the ten meter net involved the "Grid Dip Oscillator" (GDO). Of course "Grid" is an old vacuum tube element term, and almost all new meters of this type are solid-state, thus the alternate term "Dip Meter". However the acronym GDO still often used even for the solid-state devices.

For years the GDO has been one of the handiest and most popular pieces of test equipment for hams who build transmitters, amplifiers and antennas. One reason for this is that it is a low cost device that has many practical uses, and is easy to operate.

How it works:
The GDO consists of a variable oscillator that covers a large range of frequencies using plug-in coils and a variable capacitor with a calibrated scale. The coil is external to the chassis and is the sensing device. A meter is connected so that it measures the level at which the oscillator is oscillating. This was accomplished on the original grip dip meters by measuring the grid current drawn by the oscillator tube, hence the name.

When the coil of the GDO is placed next to a tuned circuit to be measured and the GDO capacitor is tuned, the meter will dip when the GDO is tuned to the same frequency as the tuned circuit. If the coupling between the GDO and the tuned circuit is high the dip is quite broad. But once the dip is found the GDO can be moved away until the dip is small and very sharp. At this point the oscillator frequency can be read on the capacitor dial. The GDO capacitor scale doesn't have very good resolution nor accuracy, so one trick is to also listen for the oscillator signal in an accurate receiver. The tuned circuit doesn't have to be a coil and a capacitor, it can be a trap or even an element of an antenna, a length of coax, or a wire antenna.

Remember the meter is measuring the strength that the oscillator is oscillating. When a nearby circuit is resonant at the same frequency as the GDO it absorbs some of the energy from the oscillator by mutual coupling, causing the oscillator to weaken.

Absorption Wave Meter Function:
Most GDOs also have an absorption wave meter function (**AWM**). When in this mode the oscillator is disabled and is replaced by a diode detector. If the GDO's coil is placed near an oscillating circuit and tuned to that frequency, the meter will move upscale. Many GDOs also have a jack for earphones so you can listen to a modulated signal. The wave meter function is good for detecting parasitic oscillations in transmitters and oscillators as well as determining if an oscillator operating or is on frequency.

The GDO can also be used as a crude signal generator for troubleshooting and checking radios. With its external coil and small capacitor scale, it isn't accurate, but again the frequency can be set by using a good communications receiver; that's something most hams have in their shack today, even if it's the receiver part of your transceiver.

What a GDO Can Do:
The GDO or Dip Meter can perform many tasks, here are just a few:

a. Receiver alignment (GDO mode): Preset tuned circuits; use as signal generator for aligning RF and (if in range) IF stages.

b. Transmitter adjustment: (GDO mode): Preset tuned circuits. (AWM mode): determine frequency, peak tuned circuits;

perform final stage neutralization; check for parasitic oscillations.

c. Adjust traps (GDO mode): Adjust series and shunt traps in transmitter and receiver circuits.

d. Measuring Components (GDO mode): Determine unknown values of capacitors, coils, and toroid coils.

e. Measure Q (GDO mode): Determine the relative Q of coils.

f. Field Strength Meter (AWM mode): Use to measure field strength in the shack and around antennas.

g. Feedline Measurements (GDO mode): Use to measure and adjust quarter and half-wavelength stubs and sections. Measure SWR on oven line feeders.

h. Antenna adjustments (GDO mode): Check antenna traps; adjust element resonance; measure bandwidth. Roughly measure antenna front to back and front to side ratios.

There are a lot more uses for this inexpensive piece of test equipment.

For more information on dip meters (GDO's) look in almost any Amateur Radio Handbook going back to the forties!

73, from AF6C

This article is based on the TechTalk article that originally appeared in the August 2008 issue of RF, the newsletter of the Orange County Amateur Radio Club - W6ZE.

HAMCON 2015

HAMCON 2015

The 2015 ARRL Southwestern Division Convention is September 11-13, 2015, at the Torrance Marriott South Bay Hotel, 3635 Fashion Way, Torrance, CA 90503 .

Check our website at:

www.hamconinc.org

HAMCON 2015--also the 2015 ARRL Southwestern Division Convention-- is produced by 13 amateur radio clubs in Los Angeles and Orange Counties committed to providing a positive convention experience for all attendees.

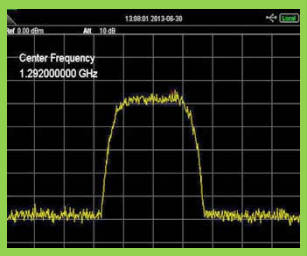
The ARRL's annual Southwestern Division Convention rotates yearly from the Los Angeles-Orange County area to a location in Arizona, then to a site in Santa Barbara or Ventura County, and finally to the San Diego area before repeating this four-year cycle. The ARRL's Southwestern Division includes the Southern California counties of Imperial, Inyo, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura as well as the entire state of Arizona. It is 2nd largest of the ARRL's 15 Divisions in terms of amateur radio licenses issued—only the ARRL's Southeastern Division (all of Alabama, Florida, and Georgia) has slightly more amateur licenses outstanding.

We welcome all amateur operators to HAMCON 2015 during September 11-13, 2015, at the Torrance Marriott South Bay Hotel.

You don't need to be an ARRL member to attend and hams living outside the ARRL's Southwestern Division are also invited. No matter what you're amateur radio experience level we're sure you will find
many topics, products, and people of interest at HAMCON 2015.

Digital Amateur TeleVision Exciter/Transmitter

now available from



DATV-Express

- A more affordable DATV exciter can now be ordered
- Fully assembled and tested PCBA
- DVB-S protocol for DATV (using QPSK modulation)
- Can operate all ham bands from 70 MHz-to-2450 MHz
- RF output level up to 10 dBm (min) all bands (DVB-S)
- Software Defined Radio (SDR) architecture allows many variations of IQ modulations
- “Software-Defined” allows new features to be added over the next few years, without changing the hardware board
- As extra bonus, the team has been able to get the board to transmit DVB-T 2K mode, however we cannot guarantee the performance of that protocol. Caveat Emptor!
- Requires PC or ODROID running Ubuntu Linux (see User Guide)
- Price is US$300 + shipping – order using PayPal

For more details and ordering
www.DATV-Express.com

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