

285 TechConnect Radio Club

Meeting for 4 June 2011

<http://www.na0tc.org/>

Agenda

- **Any First-time Visitors/Guests?**
- **Club Business**
- **Questions & Answers**
- **Solve the Problem**
 - **DC to AC Power Inverters** ('till death do us part!)
- **Propagation Update**
- **Info of General Interest**
- **Presentation by Pete (NE0T)**
 - **Proposed Club Project:**
 - **The Ensemble II Software-Defined Receiver (SDR) Kit**

Club Business

- **Member Info**
- **Field Day 2011**
- **New Location for Meetings**
- **PPRAA MegaFest**
- **TechFest**
- **Future Topics/Projects for Meetings (see list)**
- **Suggestions? (send to NOCU@arrl.net)**

Club Business - Member Info

- Check Attendance box on Attendance/Info Sheet
- Verify Member Info is correct
- **When/How/To Whom should we make member email addresses available?**
 - **Jan WY0T offers:**
 - The IRG has spaces on the Membership Form for e-mail, phone , address, etc.asks if you want to share any of that info
 - Then after your dues are paid, they send out the rooster via 1st class mail (pardon the pun)
 - Most hams include an e-mail but some don't want the phone numbers shown

Club Business - Field Day

- **Field Day 2011 - June 25-26!**
 - **POCs for clubs that will be participating:**
 - **Denver Radio Club:?**
 - **QRP Club: Frank Ivan (K0FEI)**
 - **Multiple sites**

Club Business – New Location for Meetings

- ?

Club Business – TechFest

- **Date: 5 November**
- **Theme: ?**
 - No theme
 - Common theme:
 - Antennas
 - Operating
 - Mix during day
 - Antennas in a.m. and Operating in p.m.
 - Split theme:
 - Antennas/Operating
 - ?
- **Format:**
 - Welcome at 8:45 a.m. => 9:00 a.m.
 - Four, five or six presentations?
 - Start at 9:00 a.m.
 - No “hard” start times for presentations
 - End at 4:00 p.m.=> 3:00 p.m.
 - 45 minute each=> 1 hr+ each
 - 10+ minute Q&A
 - 5 minute break
 - Topics/Presenters: ?
 - Fox Hunt, Digital tv?, Haming in other countries???

Club Business – TechFest

- **Location: ?**
 - Fire station #1
 - Limit to **xx** participants
 - ~~Red Rocks?~~
 - ~~Need to move to Sunday?~~
 - Other?

Future Topics/Projects

285 TechConnect Radio Club Meeting Topics (3/28/2011)

When	Topic	Presenter		Length
		Name	Call	Hr
April	"Ham Radio with Rooster & Peanut"	Steve	wGOAT	1
	S Meters: The Good, the Bad, and the Erroneous	Bill	NOCU	1/2
May	Remoting an HF station	Jim	KCORPS	1/2
	?	?	?	?
June	?	?	?	?
	?	?	?	?
TBA	Cheap rotator thrust bearing	Bill	NOCU	1/4
TBA	How real components perform at HF	Bill	NOCU	2
TBA	Surface mount	Pete	NEOT	?
TBA	Show & tell day			
	-New equipment			
	-Old equipment			
	-Completed projects day			
	-?			
TBA	Network analyzer- what does it do & how does it do it	Bill	NOCU	1
TBA	Reflections: Where does all that power go?	Bill	NOCU	1
TBA	Transmission lines			

Please Comment

(Again)

Questions & Answers

- **New Questions?**

Solve the Problem

- **DC to AC Power Inverters** ('till death do us part!)

Typical DC to AC Power Inverter

- **Targus Model APV10US**
 - “Modified Sinewave” design
 - Features over-current, over-temperature and surge protection
- **Cost:** ~\$70
- **Input:** 10.8-15.8V DC (Plugs into cigarette lighter socket)
- **Outputs:** 120 VAC and a USB Port
 - Output power 100 watts continuous (150 max)
- **Targus claim: “Popular devices that can be charged or powered”**
 - Laptops
 - Cell phones
 - TVs
 - Gaming consoles
 - DVD players
 - Camping lights
 - GPS devices

Problems Encountered with Targus Model APV10US

- Plugged Dell laptop AC power supply into inverter (running on a car battery) and the AC power supply immediately **died**
- Plugged a Heathkit IG-1271 Function Generator into the inverter and the -1271's **fuse blew immediately**
- Plugged a second Heathkit IG-1271 Function Generator into the inverter and the -1271's **fuse blew immediately**
- Installed a larger fuse in the -1271 (*not a recommended approach!*)
 - Unit worked, but I smelled something burning after a couple of minutes
 - **Power transformer in the -1271 was too hot to touch**
- Both -1271s worked normally on commercial 120 VAC with new fuses
- Numerous frequency regions across HF spectrum with **>S9 noise level**
 - Background noise level was S0
- Output voltage readings:
 - Fluke DVM: **93 VAC** (no load)
 - Velleman DVM: **89 VAC** (no load)
 - Scope: **170 Vpeak** (expected value with no load)

So What is the Problem?

Three Types of DC to AC Inverters

- **Electro-mechanical multivibrator**

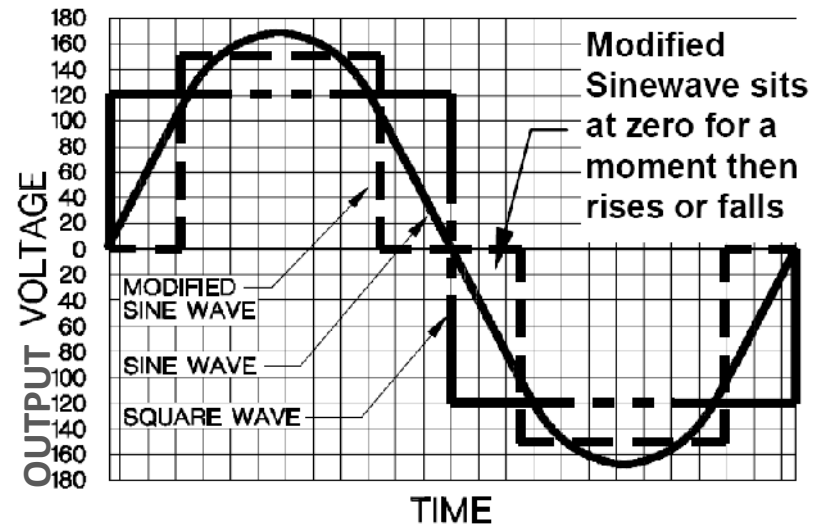
- True square wave
- Popular in the '60s for mobile ops
- No longer used

- **Modified Sinewave (MSW)**

- Really a modified *square* wave
- Can't be used with some electronics
- Output has:
 - Fast/fall risetimes
 - High (up to 25%) total harmonic distortion (THD)
- Relatively inexpensive (~\$0.3 - \$0.7 per watt)

- **Pure Sinewave**

- Same characteristics as power company AC
 - No compatibility problems
- Prices becoming very competitive with modified sinewave inverters

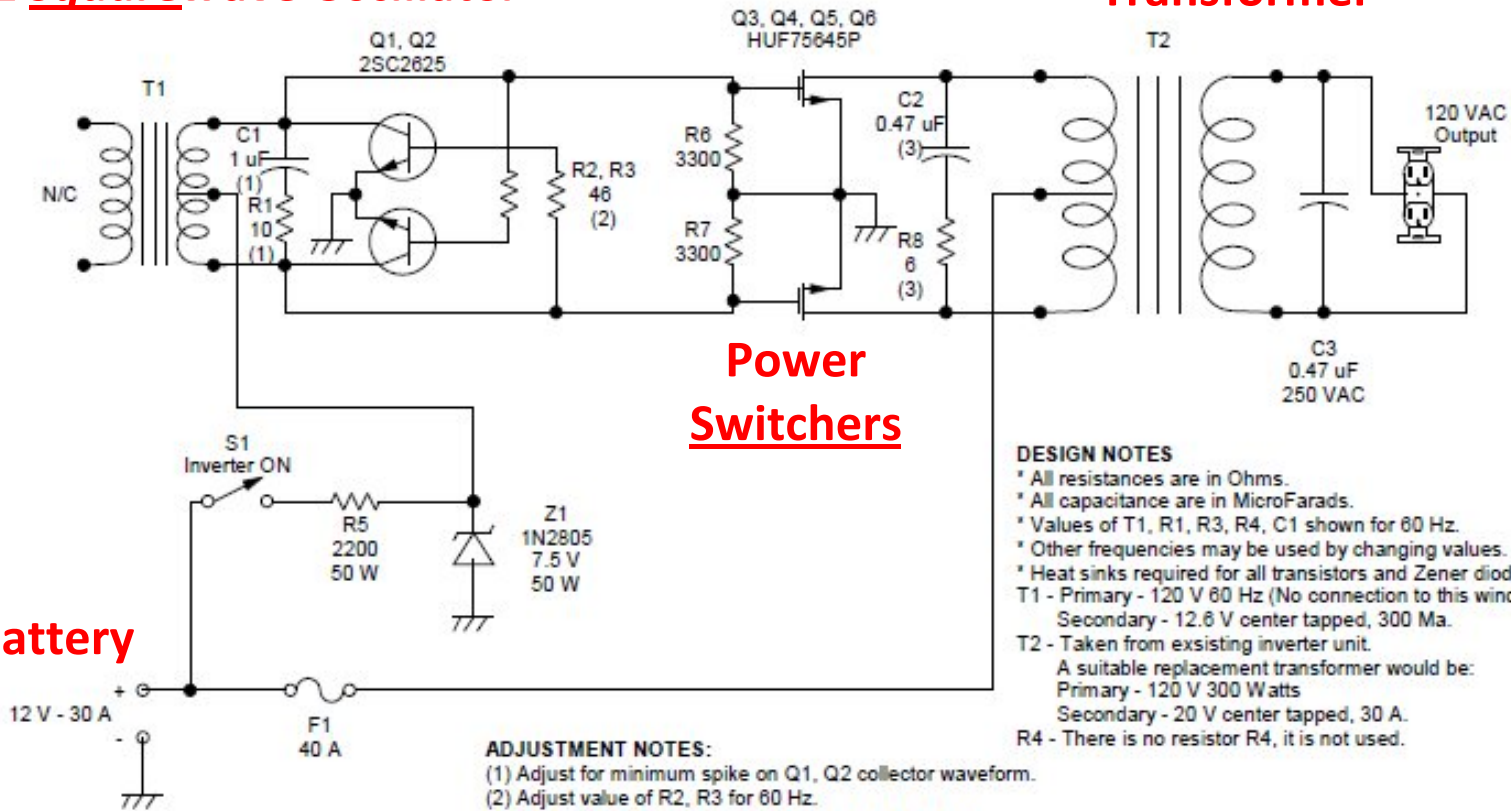


Modified Sinewave Inverter

12 Volt DC to 120 Volt AC Inverter
 By Ralph Hartwell W5JGV
 August 12, 2005
 Design Notes corrected July 10, 2008

60 Hz Squarewave Oscillator

Voltage Step-up
 Transformer



Car Battery

Power
 Switchers

DESIGN NOTES

- * All resistances are in Ohms.
- * All capacitance are in MicroFarads.
- * Values of T1, R1, R3, R4, C1 shown for 60 Hz.
- * Other frequencies may be used by changing values.
- * Heat sinks required for all transistors and Zener diode.
- T1 - Primary - 120 V 60 Hz (No connection to this winding.)
 Secondary - 12.6 V center tapped, 300 Ma.
- T2 - Taken from existing inverter unit.
 A suitable replacement transformer would be:
 Primary - 120 V 300 Watts
 Secondary - 20 V center tapped, 30 A.
- R4 - There is no resistor R4, it is not used.

ADJUSTMENT NOTES:

- (1) Adjust for minimum spike on Q1, Q2 collector waveform.
- (2) Adjust value of R2, R3 for 60 Hz.
- (3) C2, R8 for minimum T2 switching spike at full load and minimum waveform ringing at no load.

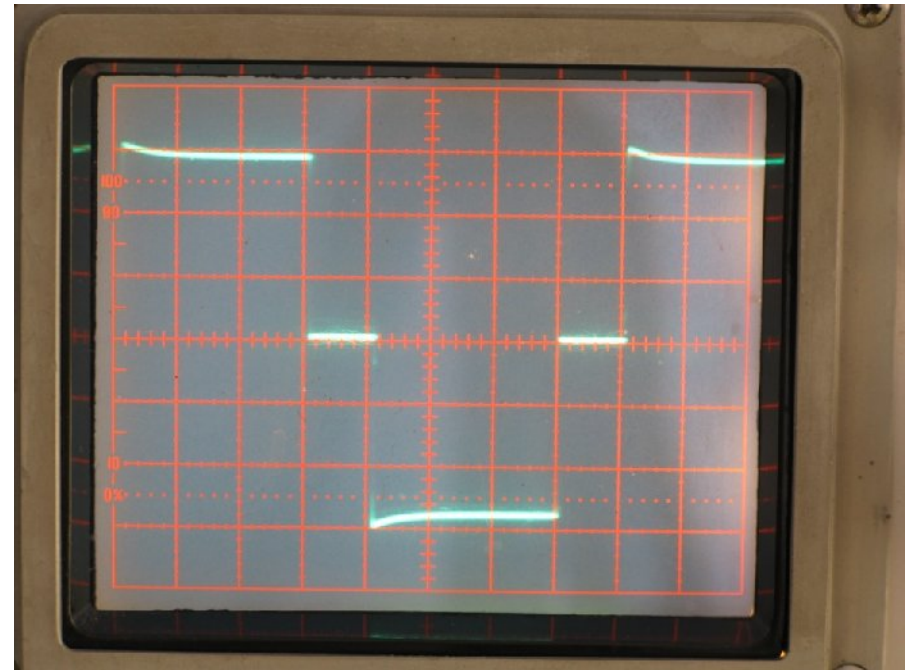
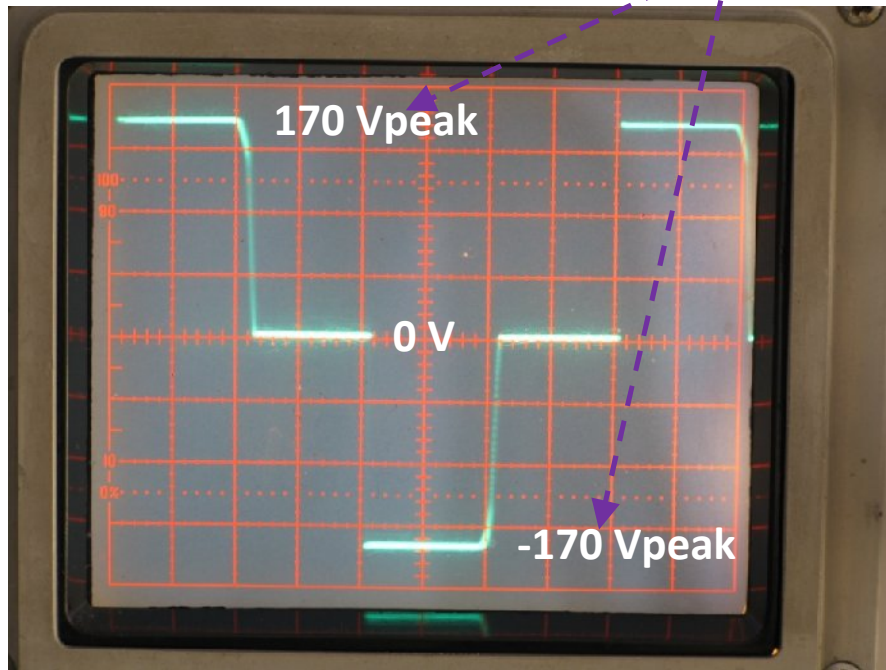
Information Found on the Internet

- “Do Not Use Modified Sinewave Inverters With”:
 - Laser printers, photocopiers, magneto-optical hard drives
 - *Some laptop computers*
 - *Be especially careful when the load (AC pwr supply) is a “switcher”!*
 - Some fluorescent lights with electronic ballasts
 - Power tools employing "solid state" power or variable speed control
 - Some battery chargers for cordless tools
 - Some new furnaces and pellet stoves with microprocessor control
 - Digital clocks with radios
 - Sewing machines with speed/microprocessor control
 - X-10 home automation system
 - Medical equipment such as oxygen concentrators
 - ?
- The [Targus](#) website gives no information on what equipment is compatible with their inverters
- The [Dell](#) website gives no information on what inverters are compatible with their computers
 - They sell DC-DC converters for their laptops

Targus Inverter Output Voltage Waveform

No Load

½ Amp Load

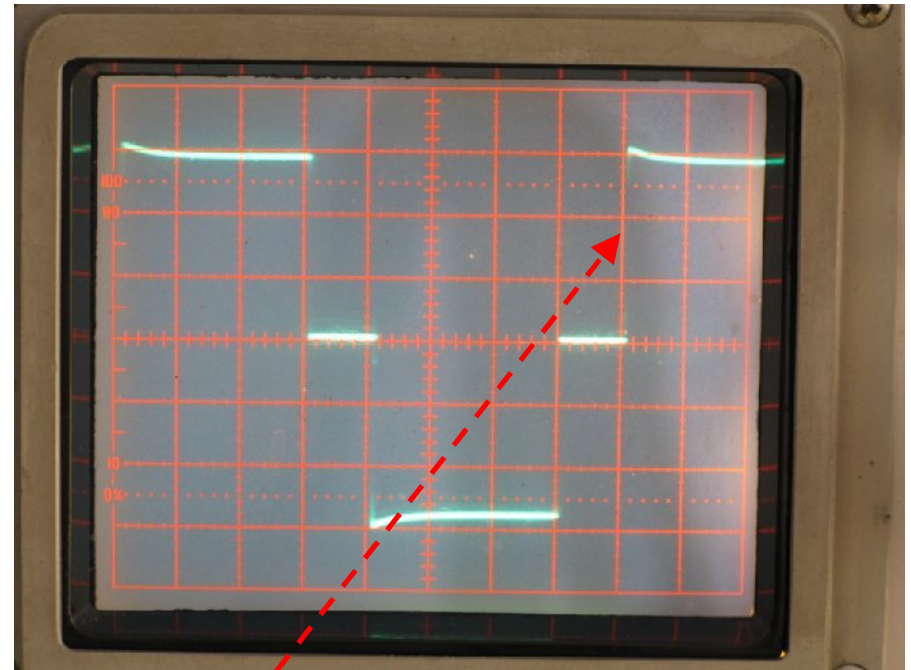
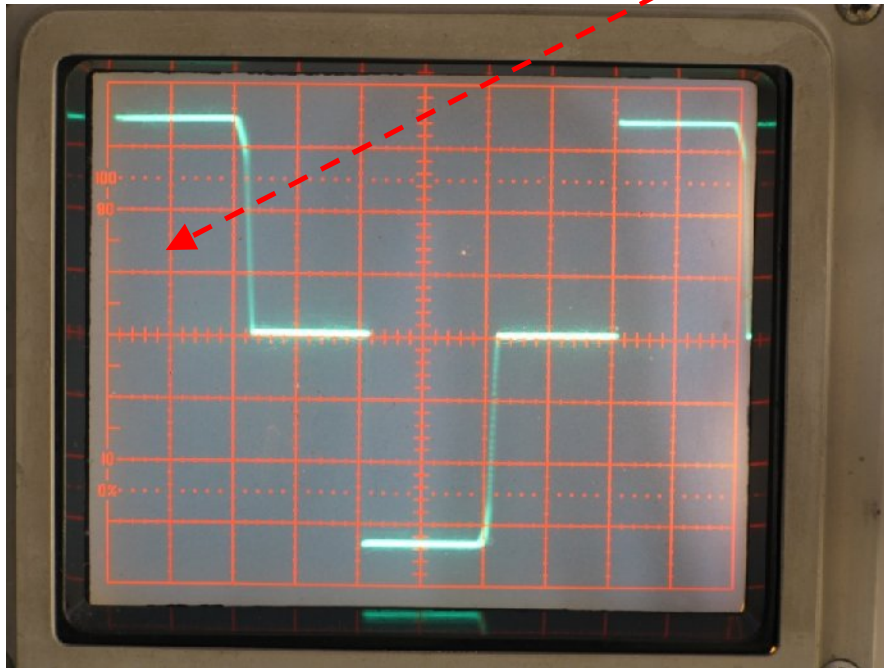


Targus Inverter Output Waveform

No Load

Modified
Square waves

½ Amp Load



Fast Risetime (<10 usec)

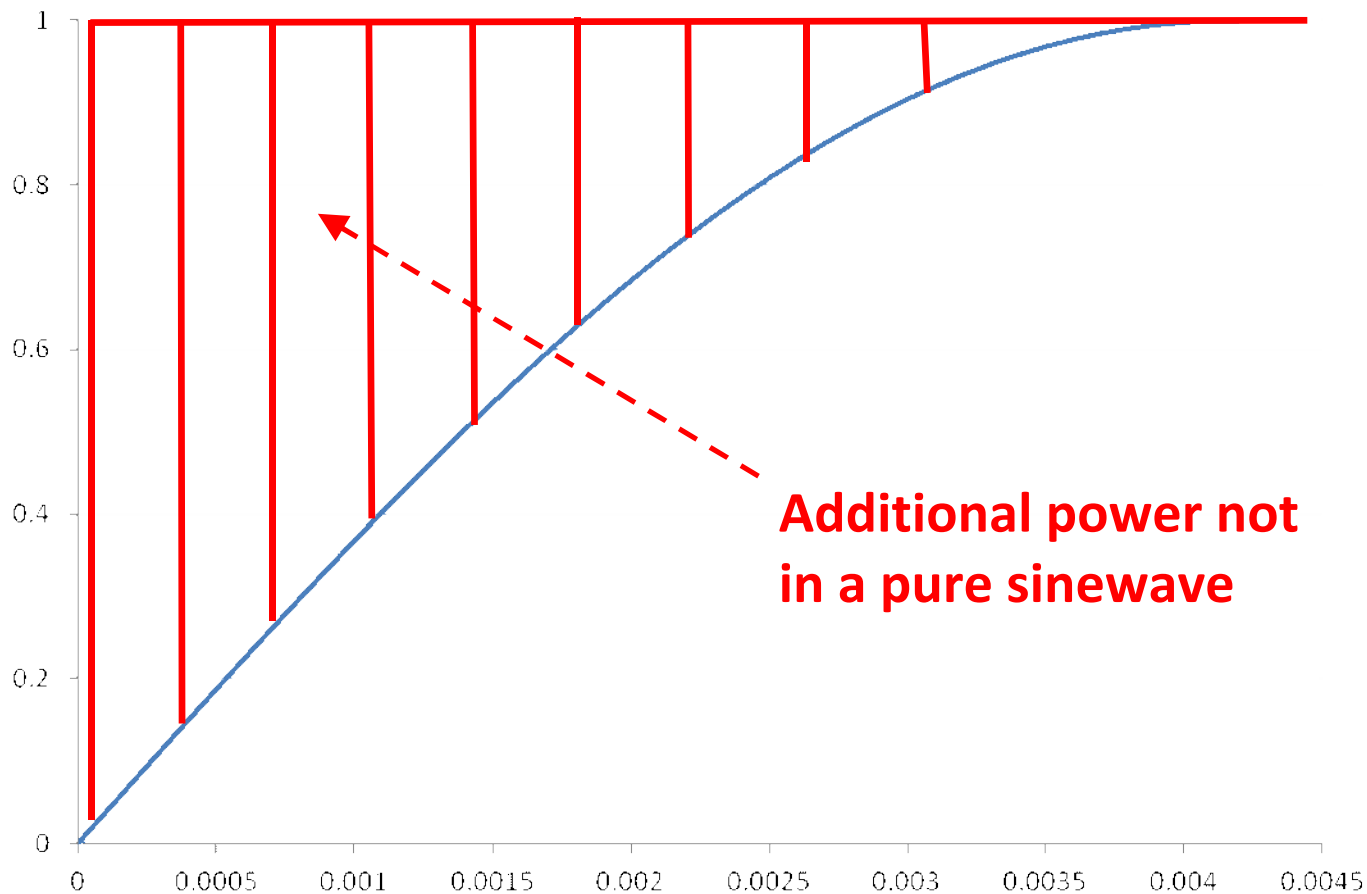
So What is the Problem?

- **The Waveform Creates Two Issues That Can Cause Problems**

- 1) Square Wave Shape
- 2) Fast risetime

1) Square Wave Shape:

- High THD increases power dissipation in the Load (up to 25%)
 - Mostly in the load's power supply filter components
 - Probably not the cause of my transformer over-heating problem



2) Fast risetime:

- **The likely cause for all three problems**
- High voltage spikes feeding thru to downstream circuits
 - Probably what killed the laptop battery charger
- High harmonic content
 - Caused the high noise levels across the HF spectrum
- Probably caused transformer core saturation in the 1271s
 - When a transformer core saturates, it can start to look like a short circuit
 - Current through transformer increases significantly
 - Probably what caused transformer over-heating and the fuses to blow

AIMS 180 Watt Pure Sinewave Inverter

•Features:

- Pure sinewave design
- 180 Watt continuous output power
- “New exclusive NEPT (New Equipment Protection Technology) design prevents excessive spikes from damaging your equipment”
 - “Soft” or “Easy” start
- **\$80** (on Internet)

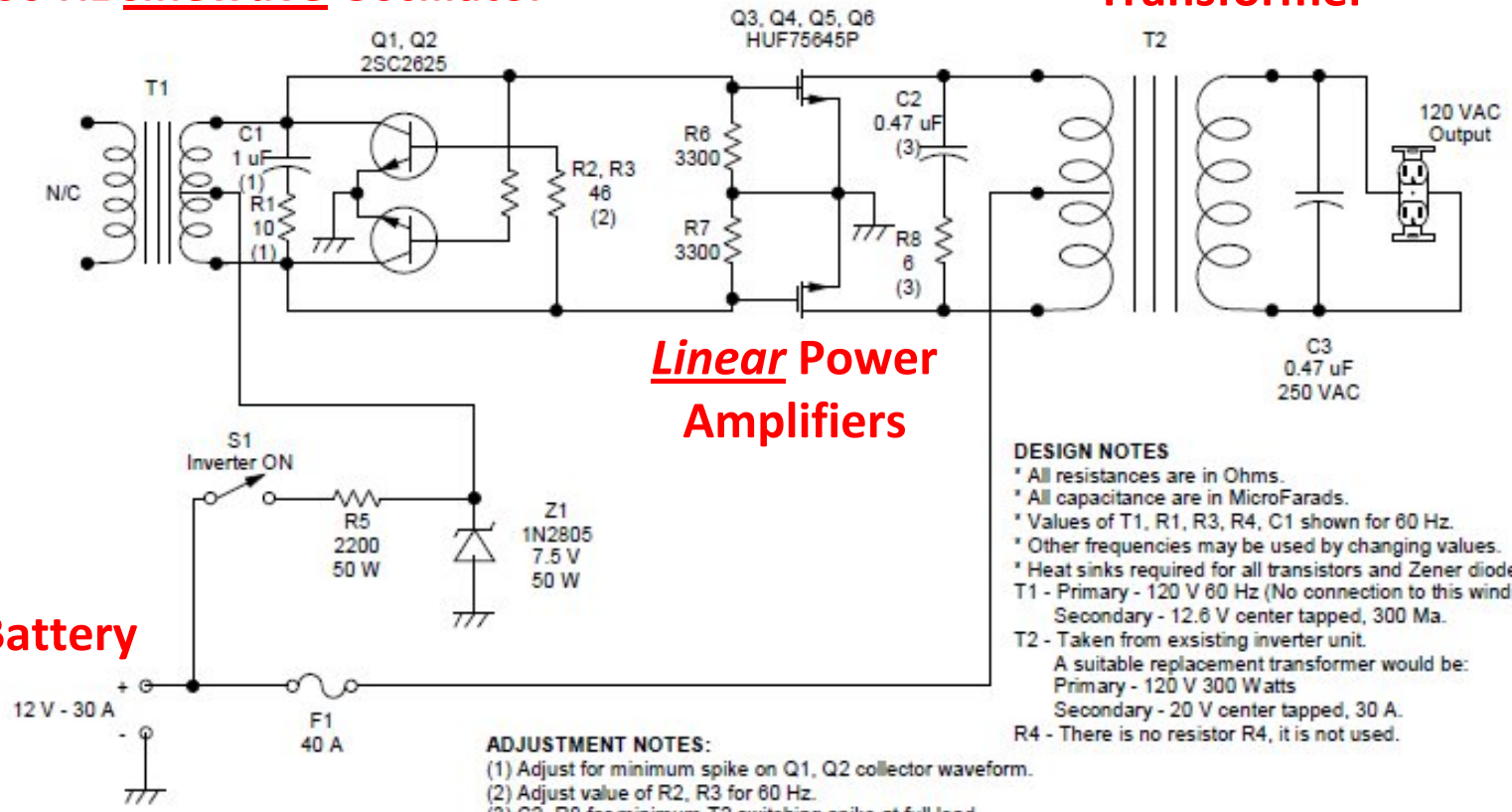


How Does a Pure Sinewave Inverter Work?

12 Volt DC to 120 Volt AC Inverter
 By Ralph Hartwell W5JGV
 August 12, 2005
 Design Notes corrected July 10, 2008

60 Hz sinewave Oscillator

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Linear Power
 Amplifiers

Car Battery

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 and minimum waveform ringing at no load.

AC Voltage & Current Measurements

- **RMS is intended to represent the DC equivalent of a time varying signal**
- **Most multimeters do not really measure RMS voltage or current**
 - They measure the PEAK value and multiply by 0.707
 - This approach is accurate only for pure sinewaves
- **“True RMS” meters do actually measure RMS values**
 - Use integrated circuits to compute the true root-mean-square value of complex signals
 - More expensive



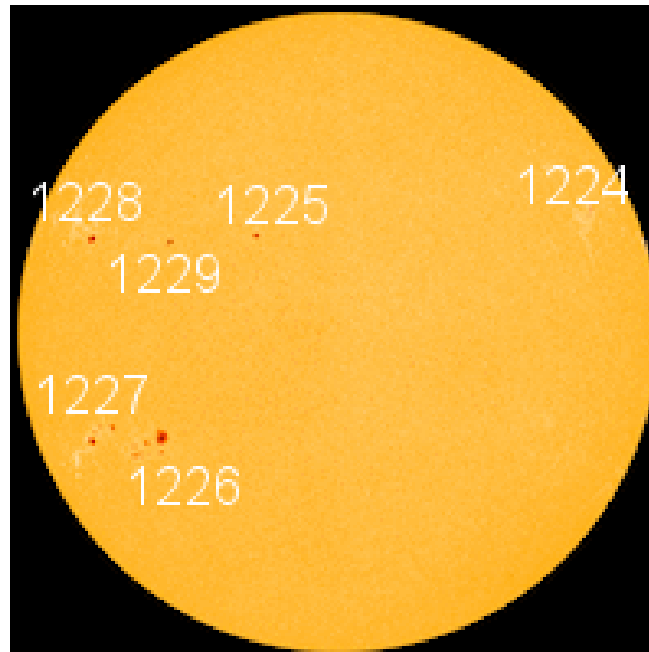
Fluke 8920A True RMS Voltmeter
\$475.00

Summary

- **Pure sinewave inverters:**
 - **Are becoming cost competitive with MSW inverters**
 - **Do not have the potential compatibility issues that MSW inverters have**
- **When using MSW inverters to power certain electronic hardware, you can encounter:**
 - **Improper operation of the electronic hardware**
 - **Damage to the electronic hardware**
 - **RFI**
- **Most AC meters give correct current/voltage readings only when used to measure pure sinewave signals**

Propagation Update:

- The Sun was less active this past month
 - Nevertheless, conditions for DX still remain good overall
 - 20M good into the early evening
 - 18M very good during the late morning to early afternoon
 - 15M – 6M open well sporadically
 - Still seeing periods of no activity when the bands are open
- Starting to see southern hemisphere spots
- Beginning September 6, WWV will stop making announcements of solar flux, K and A index



Info of General Interest

- Did anyone go to Dayton?

Info of General Interest

- **Steve (AI0W) donatation to the club:**

- Mosley TA-36: 6 ele yagi for 10, 15, & 20 M \$450/obo
- RF Signal Generator: HP 608E, 10-480 MHz \$150/obo
- RF Signal Generator: HP 606B, 50 kHz to 65 MHz \$125/obo

HP-606B



HP-608E



TA-36



Info of General Interest (continued)

- **Four club members signed up for presentations at the MegaFest**
 - Bill NOCU (2)
 - Larry KONA
 - Frank KOFEI
 - Jim KCORPS
- **Virtual Antenna Tuner**
 - <http://fermi.la.asu.edu/w9cf/tuner/tuner.html>
 - Standard T-Network
 - Shows component values & loss
 - Has “Auto-tune” feature

Upcoming Events

- Next Club meeting: **6 August** (**no July meeting**)
- **Remaining Club Meetings for 2011:**
 - **July -no meeting** (due to Field Day)
 - August 6
 - **September 10** (2nd Saturday due to Labor Day)
 - October 1
 - November 5 (TechFest)
 - **Location: Fire station #1**
 - December 3 (Holiday lunch)
- Swapfests:
 - PPRAA Megafest (July 16)
 - DRC Hamfest (August 21)
 - BARCfest (Sept 25)
 - ?

Upcoming Events - continued

- Edge of Space Sciences (EOSS) Balloon Launches:
 - 11-Jun-2011
- CQ Colorado (<http://cqcolorado.org/Events.aspx>):
 - 2011 ARRL Rocky Mountain Division Convention (August 5-7)
 - New Mexico
 - Colorado QSO Party 2011 (Sept 3-4)
- Other events to list?

Presentation

<http://www.naotc.org/>