Digital Frequency Display Applications Notes

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  - **Hammarlund (USE DFD1-HAMM for all models)**
  - The universal signal interface is highly recommended to use with all Hammarlunds using the 6C4 oscillator tube rather than the direct connections listed below.
    - HQ100/110
    - HQ129X
    - HQ-145
    - HQ160
    - HQ170
    - HQ180
    - HQ-200
    - SP400
    - SP600
    - **Hallicrafters SX-28 (Using any DFD1 model set to 455KHz IF)**
    - **Hallicrafters SX-71**
    - **Hallicrafters SX-100**
    - **National HRO type receivers HROM and HRO5T (use DFD1A)**
    - **National NC-183D**
    - **Small Wonders sw30, sw40 and sw80 (uses DFD1A)**
  - Pre-Mix Local Oscillator
    - Ten-Tec Omni
    - Drake R4-A/B/C
    - SPR-4
  - Phase Lock Loop First Local Oscillator dual conversion
    - TS-820
  - Crystal Controlled Converter / Tunable IF (**USE DFD2 custom unit**)
    - FT-101 **(USE DFD2-101)**
    - FR-101 **(Use DFD2-101)**
    - FT-301D **(Use DFD2-FT301)**
    - YAESU FT-101Z / FT-107 / Sommerkamp FT-307 / FT-707 / FT-901,902 (later version) DISPLAY COUNTER UNIT (PB-2086A) Custom Integrated Circuit (MSM9520RS) Replacement Module
    - Collins S-Line **(USE DFD2-S)**
    - KWM-2 **(USE DFD2-S)**

- KWS-1 **(USE DFD2-KWS)**
- TS-520 **(USE DFD3. DFD2 requires tapping signals inside radio)**
- TS-520**S/SE** **(USE DFD2-520)**
- **McKay 3010B and 3010C (USE DFD3)**
- **Heathkit general instructions for SB and HW series.(USE DFD2-Heath)**
  - See also HW-101 **(USE DFD2-Heath)**
  - See also SB-102 **(USE DFD2-Heath)**

- Frequency Translation Phase Lock Loop single Conversion
  - Henry Radio Tempo 2020
- Barlow Wadley
  - FRG-7

Digital Frequency Display Interfaces

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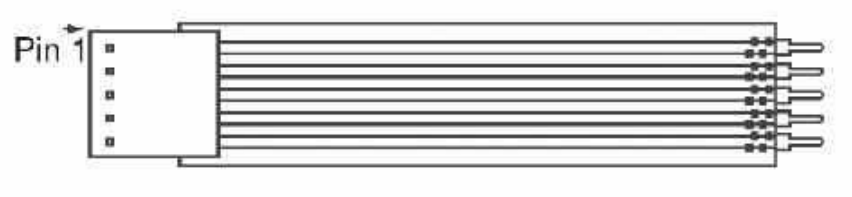
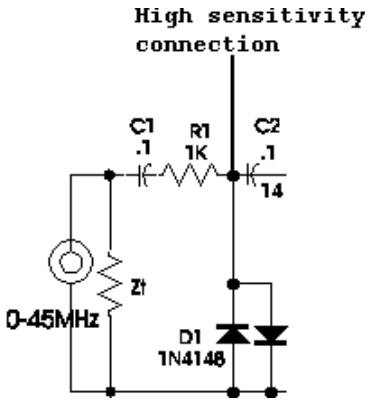
the display can be remotely located using wires or a flat ribbon cable such as

Digi-Key number A9BAG-14xx where xx is the length in inches from 2 to 8.



DFDs will operate to 45 MHz LO with 2V p-p or more drive.
All DFDs now use 100ohms for R1 which doubles the sensitivity.



At 40MHz it normally takes 450mv p-p.
Bypassing the resistor it takes only 225mv p-p.

Zt is to terminate the input coax if necessary, **it rarely is** used.

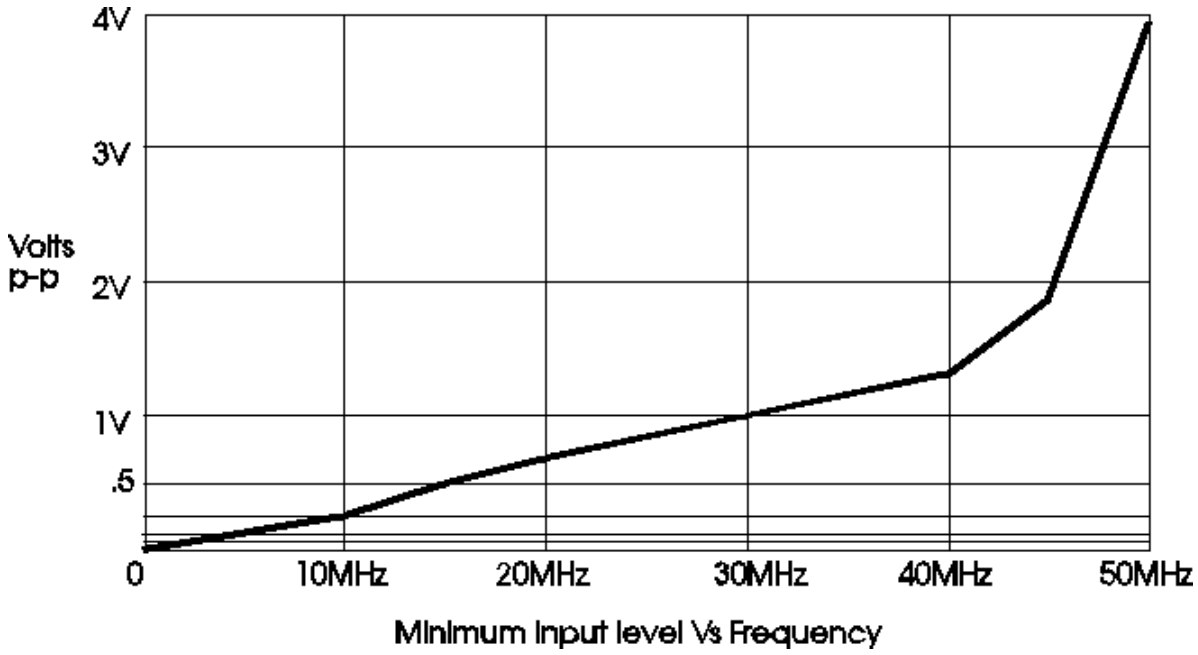
Use an external coupling capacitor as small as possible to minimize capacitive loading of the local oscillator.

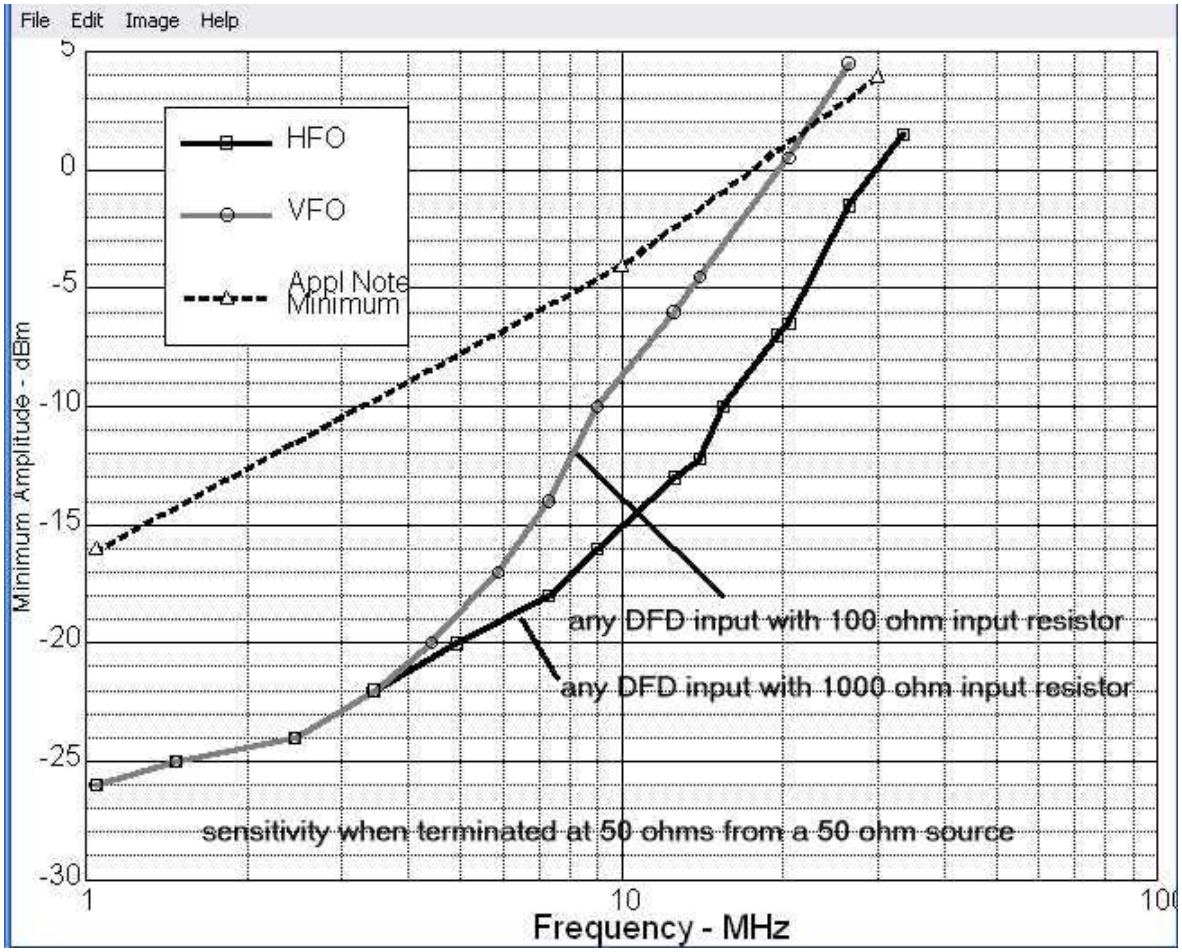
The back to back diodes are there because some radios present high voltage transients when switching bands which will lock up the DFD requiring it to be turned off and back on to unlock.

Several customers have reported success getting local oscillator

signals from tube radios by wrapping a few turn of insulated wire around the tube.

Make sure the insulation can take the heat.



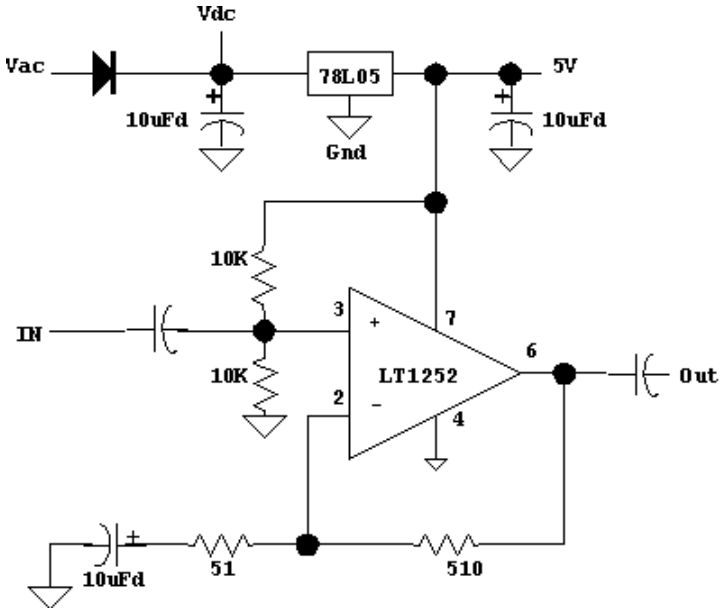


Customer supplied measurements.

He put a 50 ohm termination at the input of the DFDs and used a signal generator with 50 ohm source connected by 50 ohm coax.

Note it shows more sensitivity than the application notes minimum input level curve above.

PREAMPLIFIERS



20db gain 30MHz bandwidth preamplifier.

provides useful gain to 50Mhz.

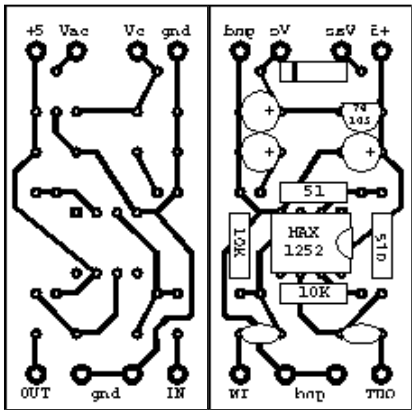
For mounting inside radio.
Can be powered from an

- AC source (labeled **Vac**) such as filiment transformer in radio.
  - If power for the backlit display is to be taken from Vdc when AC is supplied to Vac then the capacitor from Vdc to gnd should be increased to about 100ufd to 250ufd depending on current supplied to backlit.
- DC source (labeled **Vdc**) of 8 to 18 volts or
- DC voltage (labeled **5V**) of 5 to 24 volts. (LM78L05 removed)

IN capacitor would typically be in the order of 5pf to100pf. (As small as possible while providing sufficient coupling)
OUT capacitor would be on the order of 100pf depending on type of cable used to carry signal to counter.

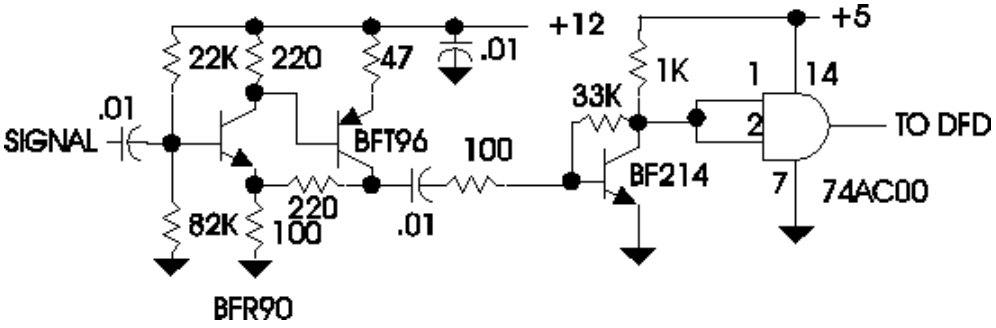
.01 ufd capacitors are supplied with the kit but the input capacitor should be kept as small as possible if connected across the oscillator tank circuit.

.01 is OK if signal is taken from a buffered signal source.



Circuit board and parts layout.
Board is 1" X 2" finished size.

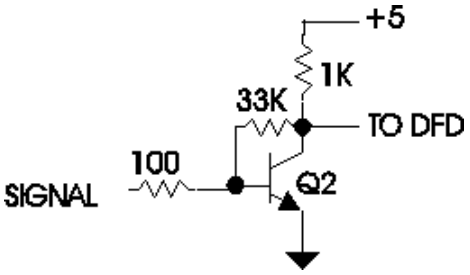
I5TDJ developed the following very sensitive preamplifier which replaces the 74HC4046



This circuit gives 50mv sensitivity to 50MHz. The output of the 74AC00 drives the PIC directly bypassing the 74HC4046.

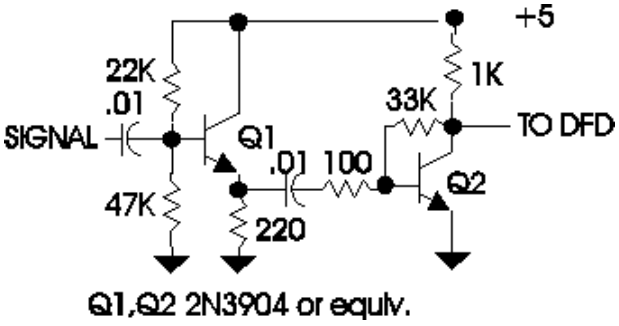
Piero used a DFD with the IC-202S two meter rig. It triples a 15MHz VXO to 45 MHz and then triples it again to 145MHz. Piero took the signal after the first tripler and set DFD to multiply by 3. The signal was taken from the junction of R25, R26 and C39 through a 100pf capacitor and about 12" of RG174U.

For those applications that do not require this much gain I played with just the final stage of I5TDJ's design.



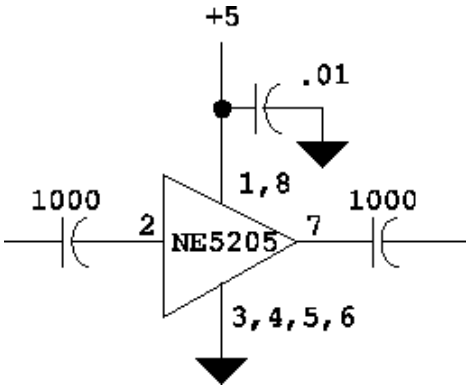
Using a 2N3904 this little amplifier gave a gain of about 15 at 6MHz and dropped to about 3 at 50MHz.

It has a rather low input impedence so for those who need to decrease the load on their VFOs an emitter follower can be added.



It is probably best to put this preamplifier in the radio to buffer the radio from the cable capacitance.

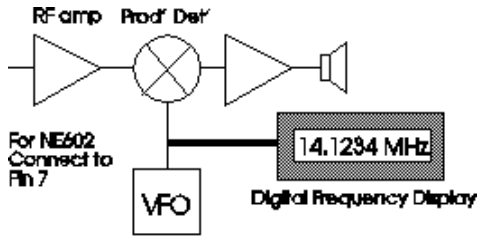
The 5V DC can be borrowed from the DFD at the output of the 78L05.



I purchased your DFD and it works great. Although to get it to work with my Kenwood TS-820. I had to add an amp to the front end to beef up the VCO signal from my radio. I thought you would like to know that I used a Signetics NE5205 wide band 20db amp. I used two 1000pf caps, one on the input and one on the output. Also a .01 bypass cap. I taped into the 5volts on your board and I was in business! I did a bench test and the DFD will convert a 50mvp-p signal up to 47Mhz. Which is well above where my radio VCO tops out at. I thought you would like this info and find it useful, if you didn't already know about this chip. Thanks for bringing my radio up to modern standards.

Regards, Steve KE6WOH

You can also use an NE5204. These devices have a 50 ohm input impedence. An emitter or source follower can be added to the input to increase the input impedence.



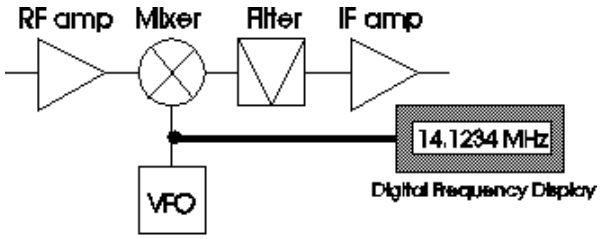
Direct Conversion Type

DFD1

Direct conversion units are simple. Connect to the LO (VFO) output and adjust the IF offset to zero. The NE/SE602 is a popular device in such units. The counter should be connected to pin 7 (the emitter of the oscillator transistor)

circuits suggested on the NE602 data sheet are

NE602.jpg (13719 bytes)



Single Conversion Superhet

Single conversion superhets are common in QRP transceivers and older vacuum tube receivers. When connecting to a vacuum tube unit a resistor attenuator may be required. Put a resistor from the input to ground on the Zt pads provided on the PCB. Connect the unit through a series resistor and capacitor to the oscillator plate or cathode (if unbypassed).

DFD1

- Single-Board QRP SSB Transceiver for 20 or 75 Meters (April 1997 QST) **(Use DFD1A)**
- by Dave Benson
  - Connect to collector of Q13 (VFO buffer)
  - 20 Meters (8 MHz IF, 6.2 MHz VFO
    - Set IF offset to 8 MHz ADD
  - 75 Meters (9.83 Mhz IF, 6.2 MHz VFO)
    - Set IF offset to 9.83 Mhz SUBTRACT

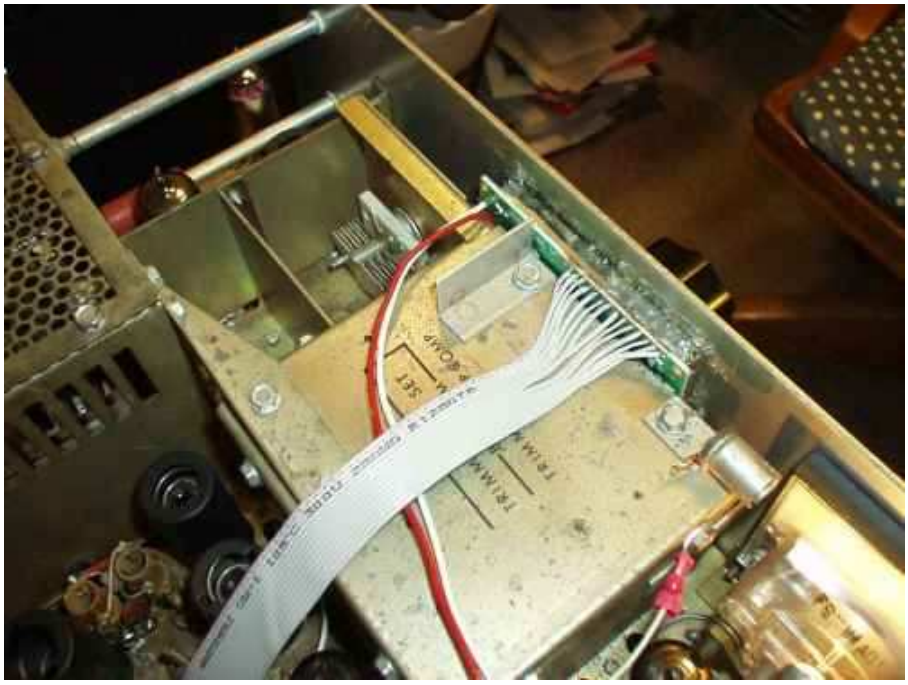
- MFJ-9420 **(Use DFD1A)**
  - Connect across R46 (output of Q1 source follower for VFO)
    - Data I have did not specify VFO frequency range but it makes sense that is in the 4 MHz range
    - Set IF offset to 10 MHz ADD
- MFJ-9040 (and other MFJ-90XX) by **K6ZRL** **(Use DFD1A)**
  - Connect across 'VFO Drive' adjust potentiometer R41 on the top side of the PCB.
    - coax cable should be less than 12"
      - put a 1K resistor in series with the center wire of the coax to reduce loading effects.
    - Set IF to 12MHz.
      - May need to tweek this for each radio.
    - Install +/- Jumper (pin 13 of U2)
- SWAN 700-CX (use DFD1-Swan)
  - Connect to accessory socket pin 8, pin 9 is ground.
  - IF is 5.5MHz
    - On 80 and 40 meters VFO is above th RF frequency and below it on all other bands
      - add/subtract input to DFD should be subtract for 80 and 40, and add for the other bands.
      - This can be accomplished using a little toggle switch mounted with the DFD.
- SWAN 240 three band rig (use DFD1-Swan)
  - For the 240 I suggest off the plate or cathode of the oscillator tube 6AU6.
  - IF offset = 5173.5KHz (**which requires a DFD1A to get 500Hz resolution**)
    on 20MTRS RF=VFO+IF
    on 40MTRS RF=VFO-IF
    on 80MTRS RF=VFO-IF
    so you would have to put a toggle switch on the add/sub jumper of the DFD1A.
- SWAN 250 6 Meter rig (use DFD1-Swan)
  - Connect DFD input to Q2 emitter. (this is the VFO before tripling to 40MHz)
  - Set unit to PRESCALE mode
  - IF is 10.698 MHz. With zero input frequency (input shorted), adjust offset to 3.566 MHz
  - Adjust prescale until display reads 10.698MHz.
  - Set unit to ADD

Here is how Tapio, KF7TY added a DFD1 inside his Swan 250. Use (DFD1-Swan)

"Well I'm finally getting around to finishing up the Swan 250 project, and what a difference that display makes, going to put it on the air in the next few days and start using it alot when band conditions allow. Sending along a few pics to show you how I set it up. I had to separate the display from the board with some 14 conductor ribbon because of room constraints. I was able to also get the display and frame to fit into the existing analog display opening without hacking up the front panel so incase I or someone else wants to return it back to stock they can, I kept all the parts for this. I am having no problems with noise at all and the display is as solid as can be, no wavering on transmit either. Currently still running the display with a 9 volt battery which is also powering the backlight but will build a small regulated circuit run off the rigs filiment power supply. Thanks again.

73's Tapio, KF7TY"

He put the display in the hole that the dial was in using one of my bezels.

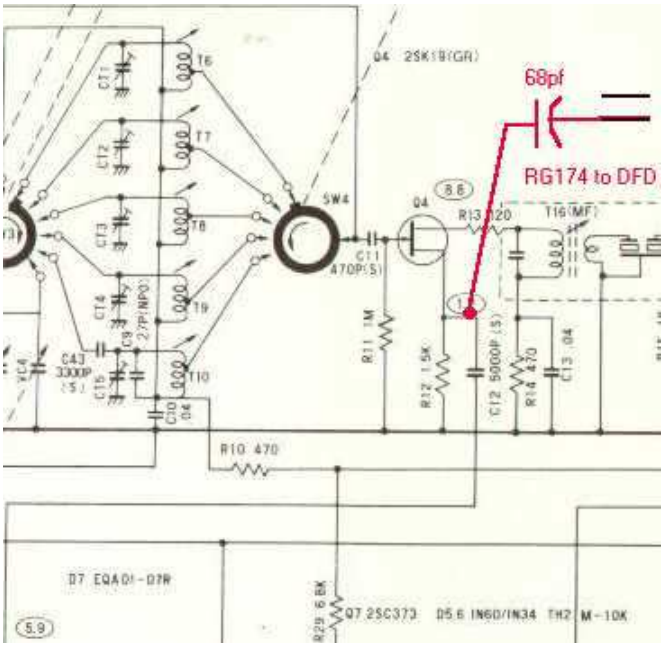


The counter board was mounted in the back of the unit and a flat ribbon cable

was used to remote the display module to the front panel.

- GE SUPERADIO III **(Use DFD1A)**
  - I'm using the DFD with a GE Superadio III. The Superadio is a $49.95 AM/FM battery/ac (with internal power transformer) receiver and is a favorite of AM dx'ers. It has a tuned RF stage for AM, a very large loopstick antenna, a large speaker plus a tweeter, and a wide/narrow IF selectivity switch. What it lacks is frequency calibration; my dial is off by maybe 10%. Looking at a web page for Superadio buffs, I find this is a universal complaint. (Radio Shack sells an Optimus "High Performance" radio that appears to be the same Chinese-made set).
  - I use the DFD only for AM. The only place to get more than about 20 mv of LO signal is at the collector of the LO transistor, Q15 (middle pin). This is right across the tuning varactor but the signal is still only about 1v pk. To minimize the capacitive load I built a dead bug style source follower using a 2N4416 (1.1k source resistor to ground, 100k resistors from the gate to ground and from the gate to Vcc, Drain to Vcc, 10pf capacitor from the gate to the base of Q15). Vcc (4.3V) is from the hot end of R16. Ground is the cold end of R17 (330 Oms). The supply voltage and ground for the DVD (10V) are across C55. (These are convenient places to make connections w/o removing the radio's circuit board).
  - There wasn't room inside the Superadio to mount the DFD so I put a small "D" connector on the back.
  - **Thanks to Jon for supplying this information.**

- **REALISTIC DX-160** **(Use DFD1A)**



From the top inside locate R12, a 1500 ohm resistor, located on the right edge of the printed circuit board. Connect a 68pf capacitor at the end of R12 going to Q4 (other end is grounded). Connect the other end of the capacitor to a length of RG174 coax sufficient to reach your DFD.

- I'm not sure what the IF is for this receiver but I strongly suspect 455KHz. You can use that to start and verify by tuning in an AM broadcast station of known frequency and adjusting the offset and +/- jumper to display the correct frequency.
- for more information see: http://radionut53.tripod.com/id235.html
-

This mod is fairly easy if you can solder, and is real neat to do. If done with the other mods listed here, you will have a neat little radio with features the newer digital portables don't have, for 1/3 the cost. Some would consider it a waste of time to digitize an analog radio, but this little receiver has a tuned front end, a real signal meter, and antenna tuning that the new little digitals don't have. And just try to replace a surface mount transistor in one without a microscope..

As with all the Mods and general projects, we hope you know how to solder small wires with a small 20 watt class iron using rosin solder.

This project works most of the time, the only issue is what you obtain for a counter. If the counter is sensitive enough, with a high enough input impedance, it will not affect the DX-160 operation. Most good lab type counters will work fine. Counters made for coax antenna transmission line use (like CB counters), will not. They will load the DX-160 to where it will not work. These are easily identified since they have Radio transceiver type PL-259 connector(s). Most lab counters have a BNC (push-n-twist) type connector. There are also specialty frequency counter modules made for this use, and are just as easy to install.

1. First, obtain a frequency counter, or a frequency counter module. I like the module you can get from www.aade.com, model DFD1S, because it displays the actual receive frequency. Otherwise, with standard lab type frequency counters, you will need a calculator handy to subtract 455Khz from the reading. Why? The radio signal the counter reads is actually the oscillator that sings along 0.455Mhz higher than the received signal. If you tune to hear the Time Standard at 10Mhz, the oscillator and counter will be at 10.455Mhz. If you want to tune LOWFERS on 180Khz, the lab counter will show 635Khz (455+180=635). Some counters come with the subtraction feature built in. Watch E-bay, lab type 5 and 6 digit frequency counters are bargains, and sell for 1/2 the cost of the custom module. I'm cheap, so I used an old heathkit 5 digit counter, $8 at a yard sale.

   By knowing a station's frequency, you can dial up that frequency, before the station comes on the air. You can spin through a frequency range, hear a interesting signal, and get the frequency withut waiting for a

identification call. Try that with a new digital radio. Sure the new receivers scan, but they lock on to any signal, dead carriers, digital, Navy buzz, television IF's, computer network leakage, any old junk signal. Some don't work at all with SSB signals. You brain discriminates by sound, the new radios just go by signal strength. You forever are pushing buttons to bypass the junk signals.

2. The secret of adding a counter to the DX-160, is knowing where to connect the frequency counter. Our target is resistor R12. You will need about 2 feet (0.6 meter) of RG-174 coax, a 68picofarad disc capacitor, and a connector that matches your counter.

   If your lab counter has a BNC connector (push-and-twist), the small coax can be connected to a standard BNC connector, the coax center wire connects to the center pin, the shield connects to the connecter body or shell. If you are cheap and lazy like me, buy a Radio Shack #278-964 cable, cut it. Now you have 2 cables with BNC ends attached for $6. The cable is the stiffer RG/58, but will work.

   Some other small coaxial cables will work, like thin video cable (some shields are aluminum, unsolderable and useless!!), and real thin magnetic cartridge phonograph shielded line (what's a phonograph?).

   Now unplug the radio before you remove any covers!!

3. Either make a small hole in the radio's rear press board cover,(or metal sheet if you performed the #2 mod listed here on mods.dk) just slightly larger than the coax, or pass the coax through a vent slot.
   If metal, add a small rubber grommet to stop insulation cuts.

4. Remove the radio's top and bottom covers. Looking at the top side of the circuit board, locate Q4, R12, and C12. On the bottom side there is a copper trace that connects all three of these components together. This common connection is the pickup point, and where the 68 picofarad capacitor lead connects to.

5. There are 2 ways to connect the coax and capacitor, either topside, or on the bottom. Topside is easy access but small soldering, bottom side has easy soldering but will require an access hole to run the coax through. If you moved your antenna rod as outlined in Mod #2, use one of the old open screw holes to run the coax through. As long as the coax does not interfere with the tuning strings, run it through a opening in the front.

6. Strip a coax cable end about 1 inch (25mm). Unbraid the shield, gather it into a single line, and twist it into a wire. Take the 68 pico farad capacitor and trim the wires back to 1/4 inch long (6mm). Strip back some of the center wire insulation, and solder the 68 pico farad capacitor to the center lead. The outer coax shield braid will get soldered and connected to ground, so don't cut it away.

   Our 68 picofarad feed capacitor connects to R12 on the end that goes to Q4 and C12. The coax braid connects to the grounded side of R12.

   If you top side connect, polish the wires on R12 with a pencil eraser, soldering will be much easier. Having a stick type eraser around for this purpose is a electronics technician's secret. Typewriter erasers even have a brush!

7. If you have a module, follow it's instructions for connection, mounting, and power. The DX-160's power supply will easily power the module from www.aade.com, just remember the DX-160 runs on 14 volts, the module is less. You might have to cobble a power supply using a LM7805, or get lazy and buy a plug-in wall wart power supply. I used a old wall wart from a discarded portable telephone base. Another 50 cent garage sale item.

8. Put the covers back on, add your BNC connector to the coax, and fire it up! Connect the counter, set it for high impedance and 0-31Mhz operation, and you should see the frequency, always .455Mhz greater than where your ears are. If you have a 455Khz subtracting counter or module, then you see the received frequency.

Now you know what frequency you are listening to, and can look up the frequency of that funny sounding odd language station to see where it is.

- ATLAS 210 **(Use DFD1-Atlas)**

- Pins 2 and 3 of external VFO input connector, gnd on pin 4. An 18pf capacitor couples VFO output to DFD using RG-174.
- **Thanks to W4MCD for this data.**
- **Rudy King, who is willing to provide details,** rudyking@msn.com , really neat internal mounted DFD1A with backlit display option.

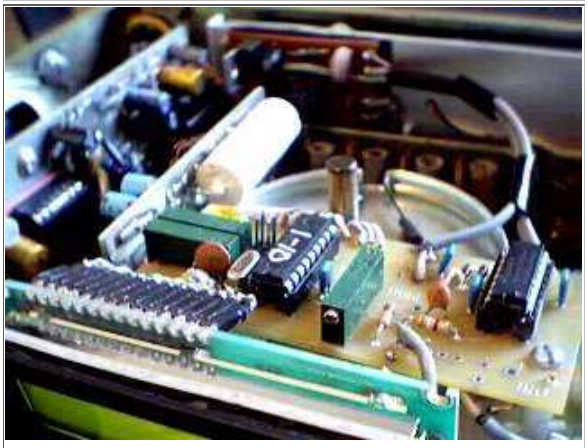
Atlas210 with Digital frequency Display

Atlas210 DFD on 10mtrs

Atlas210 DFD view of installation from rear

Atlas210 Transceiver with DFD

Atlas210 preamp board installation



Atlas210 cover removed showing DFD installation

- **Tentec Triton** **(Use DFD1A)**
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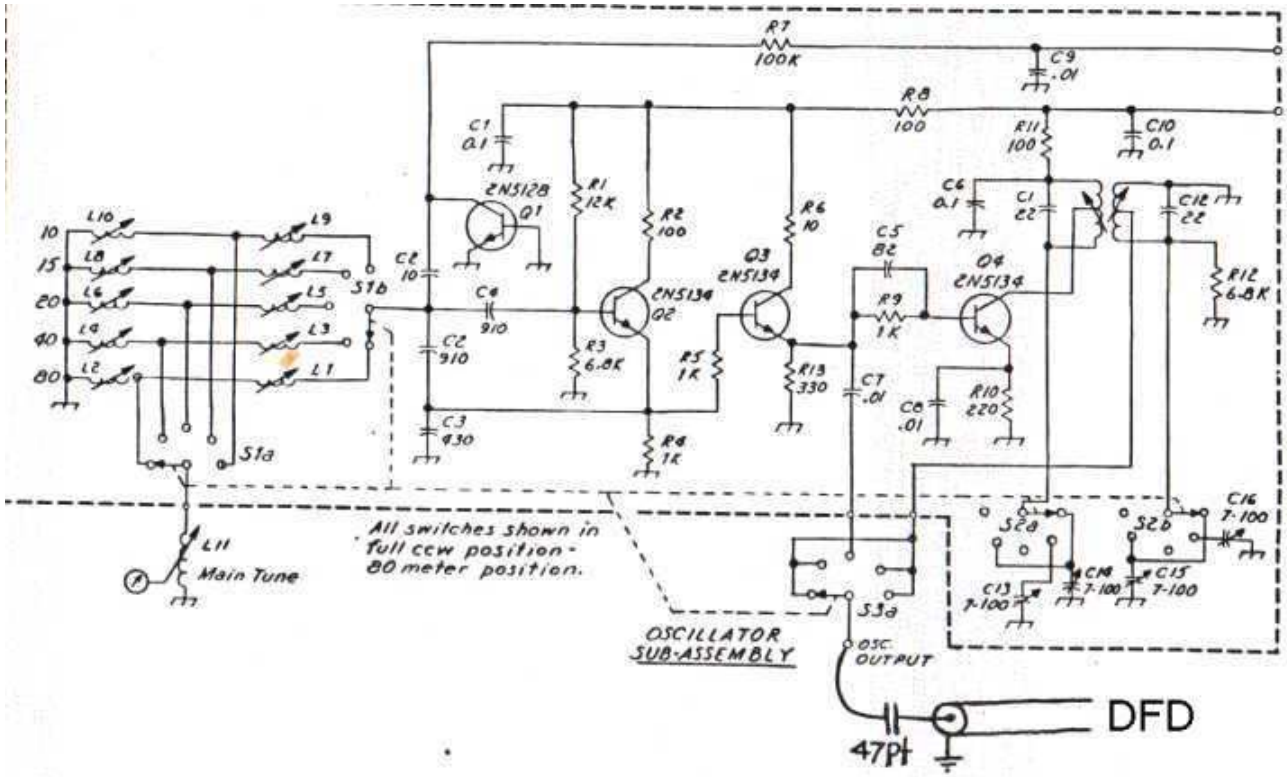
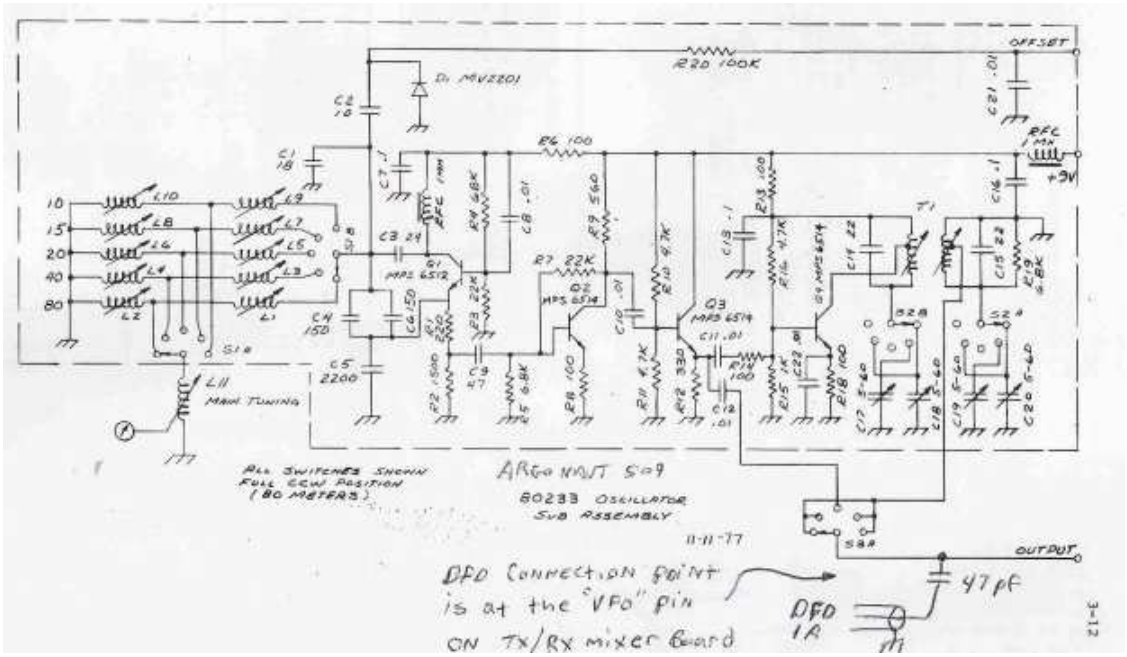


- Connect as shown above and put a SPST switch across the DFD add/subtract jumper pins.
- Triton VFO is:
  - 80 mtrs.....12.5-13MHz (set DFD to subtract)
  - 40 mtrs.....16-16.5MHz (set DFD to subtract)
  - 20 mtrs..... 5-5.5MHz (set DFD to add)
  - 15 mtrs.....12-12.5MHz (set DFD to add)
  - 10 mtrs.....19-21MHz (set DFD to add)
- Set IF offset to 9Mz.

- **TenTec 509** **(Use DFD1A)**



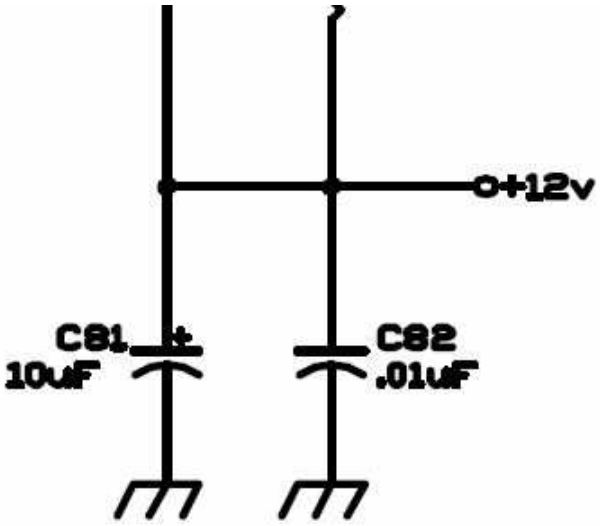
Hi Neil,
I spoke to you a few weeks ago concerning adding the DFD1A to a Ten Tec Argonaut 509. I did purchase a DFD1A from you and installed it in my 509 and it works beautifully. The installation is essentially the same as for the TenTec

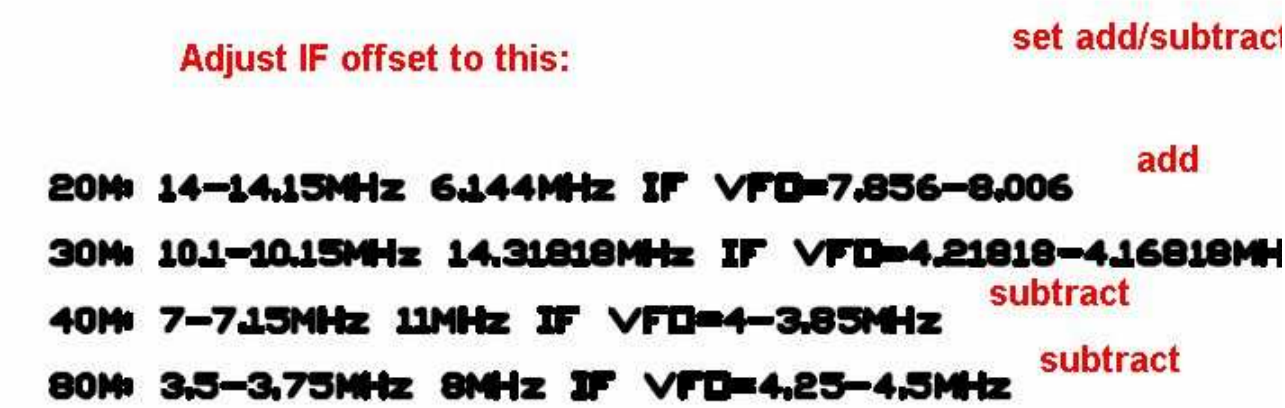
Triton application you have listed.
I have attached a jpeg of the 509 oscillator schematic showing the DFD connection point. You may consider adding this info. to your application notes as I'm sure there are plenty of Argonaut owners out there who would love digital display.

BTW unit went together without a hitch and alignment was a snap. I am also going to post the information on my success with the DFD1A and Argo. on the Ten Tec reflector so others may consider adding one and hopefully you'll get some more business!

Thanks again for a great product,
73
Joe N2OUV

- **TenTec 1300 Series QRP rigs.** **(Use DFD1A)**
  - Connect DFD1A to VFO OUT on radio.
  - Adjust IF offset to listed IF frequency for the band
  - install/remove add/subtract jumper per chart below:





  -

- **SX-28** (Yeah, somebody has an SX-28 with a digital readout now.) **(Use DFD1A)**
  - The DFD-1Hammarlund counter works just great! I must have the only 63 year old SX-28 with a digital readout. I have it tied to the cathode of the 6SA7 osc tube through a 5 pf cap. It works from the BCB right up to 42 MC. I haven't tried it on the GPR-90 yet but I will this next week. KH6U
- **National HRO type receivers HROM and HRO5T** (Using DFD1A)

1. Application as digital frequency read-out for vintage WWII National HRO type receivers HROM and HRO5T. These receivers are virtually identical except the HROM uses glass tubes and the HRO5T uses metal types.

2. The IF of both receivers is 456KHZ

3. With a full coil-set of 9 coils the receivers cover from 50khz to 30mhz. The counter works through the full range. The 1k input resistor is shorted out above 14mhz when using coil-set JA(14.0 - 30.0 mhz) **(1k resistor replaced by 100 ohms in all DFD1 kits which greatly improves sensitivity.)**

4. The HF Oscillator output is taken from V4 underneath the chassis.

5. HROM V4 is 6C6 (glass UX type)
HRO5T V4 is 6J7 (metal octal type)

6. The oscillator output is taken from the anode (pin 3 on the 6J7) or the cathode (pin 5 on the 6J7) through a 5pf capacitor to an RCA type socket on the bottom rear of the receiver. Note the HT voltages present

7. The 5pf series capacitor blocks the DC voltage and feeds the signal to the counter input

8. Set-up:
With coil set JB(7.0 - 14.4mhz) installed in the receiver tune the receiver to WWV on 10mhz (at 206 on my dial drive). The counter +/- link is removed . Adjust the counter to read 10.000.00mhz and tune the receiver up and down to ensure it is reading correctly.
Enjoy ! Pat/EI7CN

- Hi Neil,

  The display is working nicely and I had never thought about how much easier it is to align the dial when you can see where you are tuned!

  Just wanted to let you know that with an HRO-50 R1 or T1, take the signal from pin 7 of the HF Oscillator tube which is a 6C4. We had to use a 12 pf cap but it seems to be ok. The 6.3 volts AC can be taken from many places, as you know. I am writing this to you in case anybody else wants to add a digital display to a radio like mine. It really does work. The HRO-50 is a slightly earlier model so I'm not completely sure the connection is the same but I'm fairly sure it is,

  Thanks a lot.

  Jack
-
- Neil

  Works perfectly on the HRO-60 connected to the cathode of the 6C4 via a 5 pf capacitor..455 offset..

  73 again de Pat/EI7CN
-
- **Clark W0BT's HRO-50T Using (Use DFD2)**

Clarks homebrew case for DFD2, fantastic craftsmanship.

Connections to the HRO-50 shown in the photo below.

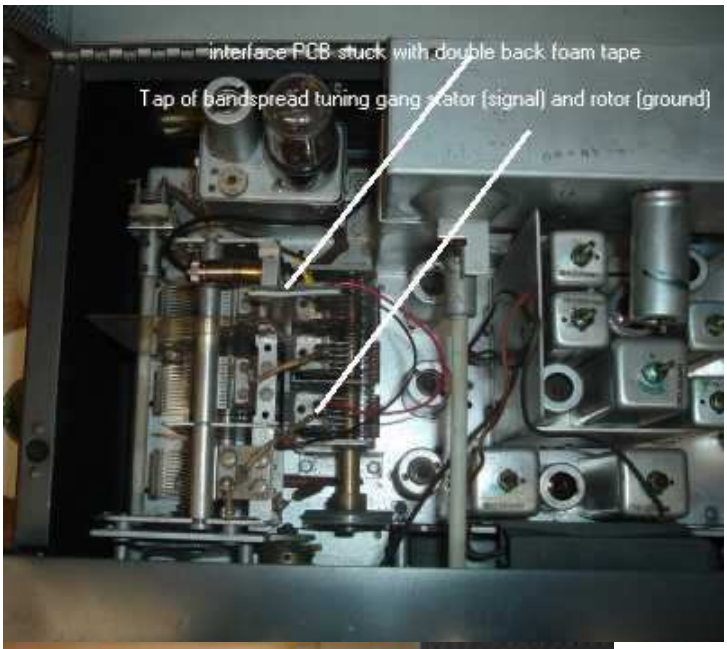
- **Hallicrafters SX-71** **(Use DFD1A)**

  DFD coupled via two one-inch lengths of pvc-covered hookup wire twisted together, at the oscillator tuning gang, connected through 2 ft of RG-58 to the DFD. The twisted wires read about 2pF on my AADE LC meter.
  (I suspect this means right on the main tuning capacitor, section for the local oscillator.)
  SX-71 shows correct on all bands except I can not vouch for its accuracy on 6 meters as my radio has a broken dial string on the bandspread capacitor – this is the cap which tunes 6 meters. Also this radio is not calibrated or aligned on this band. However the DFD showed "believable" readouts, ie, a bit over 50mHz.

- **SX-100** **(Use DFD1A)**

DFD1A (using my plug-n-play model, with optional two line blue display, in this example but applies to DFD1A kit as well) connected to my SX100 (IF frequency = 1650KHz)

using the universal interface connected to the tuning gang. I stuck the interface PCB to the shield plate using double back foam tape. The plug-n-play DFD1A order number is C-DFD1A.
It can be used with most any Hallicrafters except the SX115 or SX117 which are triple conversion. It is also useable with any single conversion radio (crystal controlled second conversions don't count as they do not change the mathmatics of calculating the RF frequency).

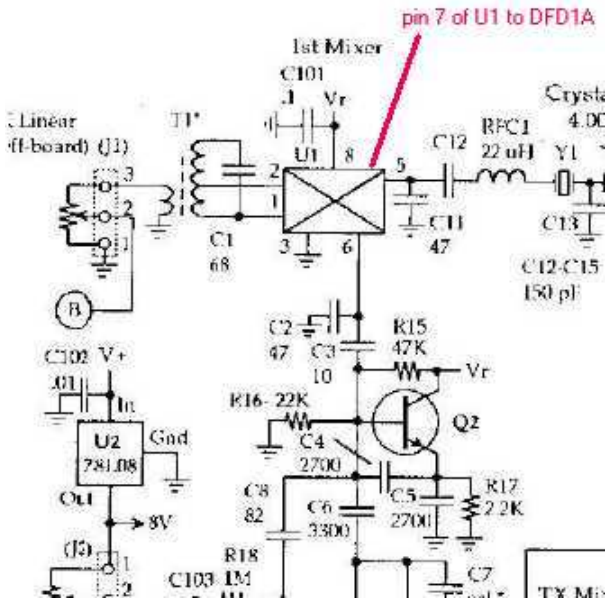


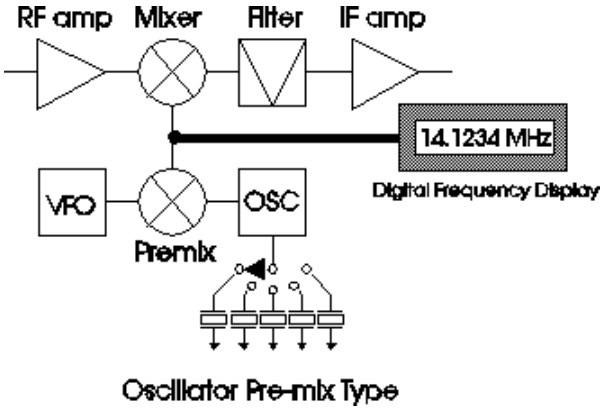
(Use

- **NC-183D** **(Use DFD1A)**
  DFD coupled via two one-inch lengths of pvc-covered hookup wire twisted together, at the oscillator tuning gang, connected through 2 ft of RG-58 to the DFD. The twisted wires read about 2pF on my AADE LC meter.
  (I suspect this means right on the main tuning capacitor, section for the local oscillator.)
  NC-183D shows correct on all bands except 6 meters. On 6 meters it shows a bit over 40mHz, but this does not vary when I tune the radio.

- **Small Wonders sw30, sw40 and sw80 suggested connection.** **(Use DFD1A)**

  Pin 7 of U1 is the emitter of the emitter follower inside U1. The base, pin 6, is driven by the local oscillator so pin 7 is a buffered LO signal





Oscillator Pre-mix Type

The oscillator pre-mix type unit mixes a VFO with a crystal oscillator. Either the sum or difference frequency of that is filtered and sent to the RF mixer. The pre-mix output frequency is the main LO frequency. The IF offset should be set to the units IF frequency. ADD/SUBTRACT depends on if the main LO is above the RF frequency (SUBTRACT) or below (ADD). In some units it may be a function of which band it is set on. In that case it is necessary to have a switched input to the ADD/SUBTRACT input of the DFD.

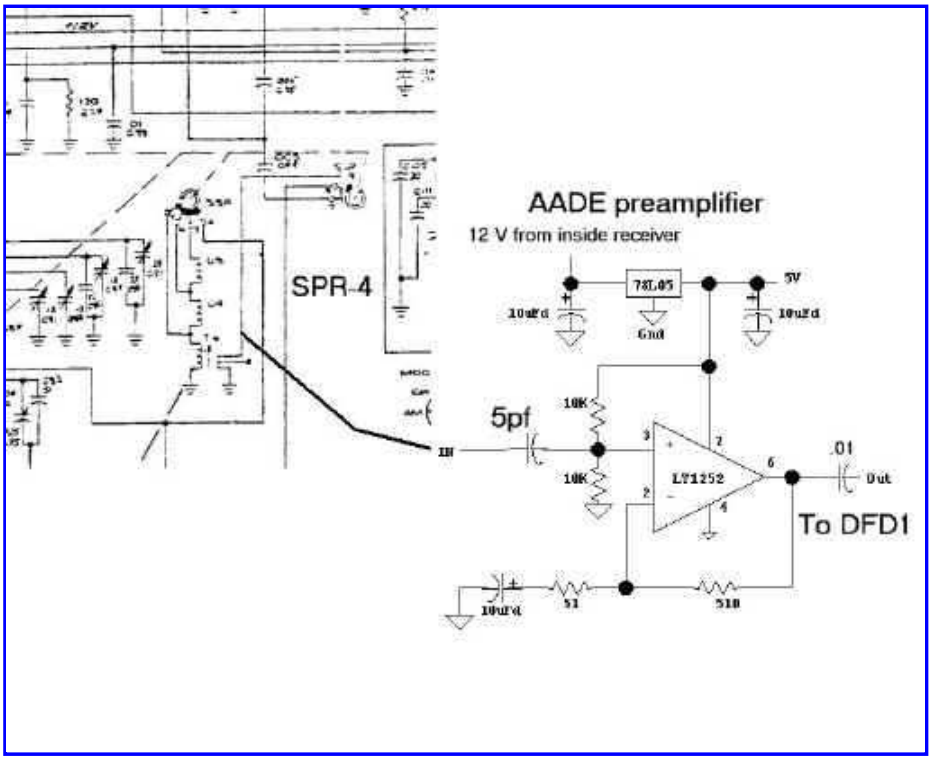
- Ten-Tec Omni DFD1
  - Set IF offset to 9 Mhz
  - The main LO frequencies and ADD/SUBTRACT modes are
    - 160 Meters 10.8-11.3 MHz (SUBTRACT)
    - 80 Meters 12.5-13 MHz (SUBTRACT)
    - 40 Meters 1.0-16.5 MHz (SUBTRACT)
    - 10MHz band 19.0-19.5 MHz (SUBTRACT)
    - 20 Meters 5.0-5.5 MHz (ADD)
    - 15 Meters 12.0-12.5 MHz (ADD)
    - 10 Meters A 19.0-19.5 MHz (ADD)
    - 10 Meters B 19.5-20.0 MHz (ADD)
    - 10 Meters C 20.0-20.5 MHz (ADD)
    - 10 Meters D 20.5-21.0 MHz (ADD)
  - There is a 9 pin Molex connector on the back.
    - Connect the DFD input to pin 5 (VFO output) and pin 8 (ground).
    - 8VDC power for the DFD is available on pin 2.
  - There is a 12 pin Molex connector on the back which has connections to an uncommitted wafer on the band

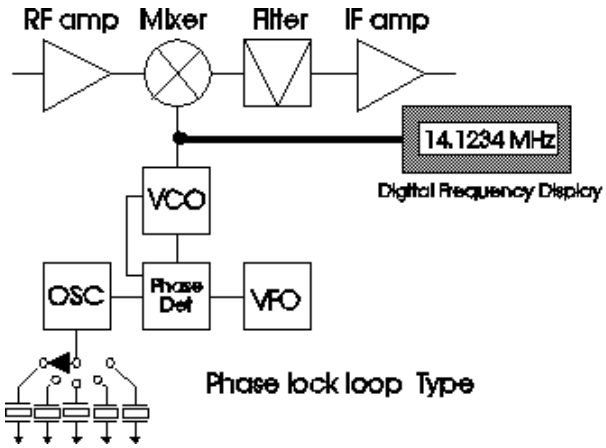
switch.
  - Connect pins 5, 6, 7 and 8 togather and connect to the ADD/SUBTRACT input of the DFD.
  - Connect pin 1 (ground) to pin 4 (switch common)

- Drake R-4A/B/C DFD1-Drake or DFD1A Set IF offset to 5.645 Mhz
  - High side injection is always used (set DFD to SUBTRACT)
  - Connect DFD input to the connector on back of the unit intended to drive a T-4 or T-4X transmitter. (**INJ** jack)
  - NOTE there is a bandpass filter tuned by the PRESELECT knob on the output of the LO mixer. DFD may not read right unless the PRESELECT is set at least close to correct for the frequency of operation.
  - K5DKZ's R-4A with DFD1 built in.
  - 


  - Click to visit Frank's web site for more Drake mods
  - and click here for details of how he installed DFD1 in his R4

- **Suggested connection to SPR-4**



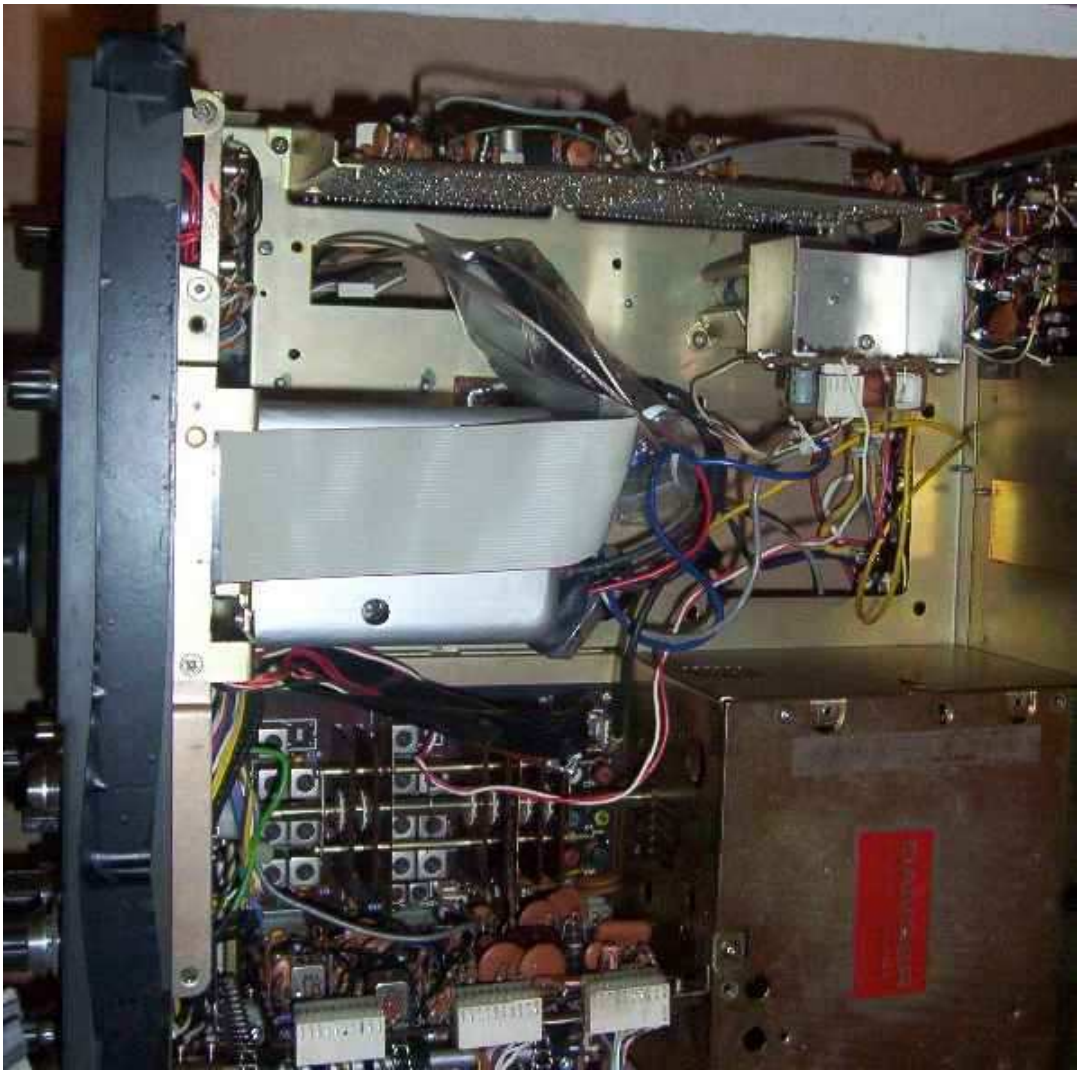


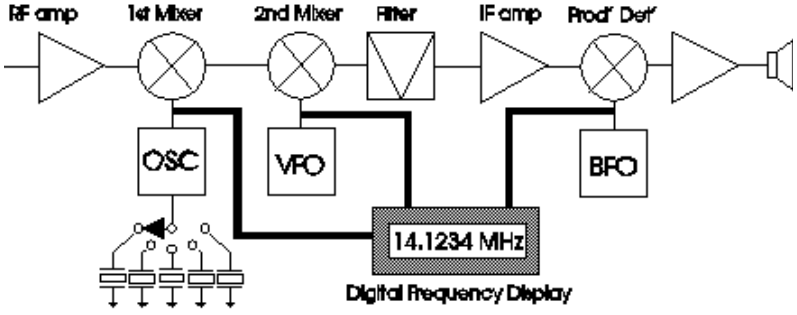
This type uses a frequency translation phase lock loop to add the VFO to the crystal oscillator. This is better than the pre-mix approach because it lacks the spurious frequencies generated by the LO mixer.

- TS-820 DFD1
  - Set IF offset to 8.83 Mhz
  - The LO is always high-side (above the RF frequency). This makes the maximum LO frequency 38.83 MHz. With 2V p-p or more the DFD can be connected to the LO output at pin 4 of the RF unit (X44-1150-001). This signal will have to be routed out of the unit. I suggest using high impedence shielded cable such as used for RCA type video cables between VCR and TV.
  - A preamp may be required as shown in this application note.
- **Here is how one customer built it into the radio.** using a DFD2 with modifed software. (I can make this version available for same price as DFD2)

  A standard DFD2 can be used if externally mounted.

the second of 2 pictures is from the top down with left side at the top. at the center you can see ribbon cable running back over the vfo. to the left, top of picture was filled by the counter assembly now removed and the rectangular hole is the location of the connector for same. the only 2 coax leads were removed from the connector and spliced to the input leads. the vco input labeled (cvc) pin 1 and ground pin 3. the bfo input labeled (ccr) pin7 and ground pin 6. looking to the right of the rectangular hole in chassis you see a very shiny aluminum heat sink (avr unit) a 5v supply a convenient point for power. the 5 pin white connector is power in and out. pin 1 is +5, pin 2 is ground and pin 4 is +12. at present the backlit is tied to pin 4 through a 180 resistor. that will be the same place for dfd power. .....Ron





Tunable IF Type

This type is a crystal controlled band switching converter in front of a tunable IF.

I have developed a special version of the DFD (DFD2)which will measure three different frequency simultaneously, the crystal OSC, the VFO and the BFO. It will then compute the carrier frequency of the RF for LSB, USB, AM and the zero beat carrier frequency of CW. It will automatically determine the operation mode as a function of BFO frequency and display LSB, USB, CW or AM.

There are custom chips for the following which offer jumper selectable 10/100Hz resolution and display using either "MHz" or dummy zeros to fill out 8 digits. ie: 14.234.56MHz or 14.234.560 (10Hz resolution) or 14.234.5 MHz or 14.234.500 (100Hz resolution).

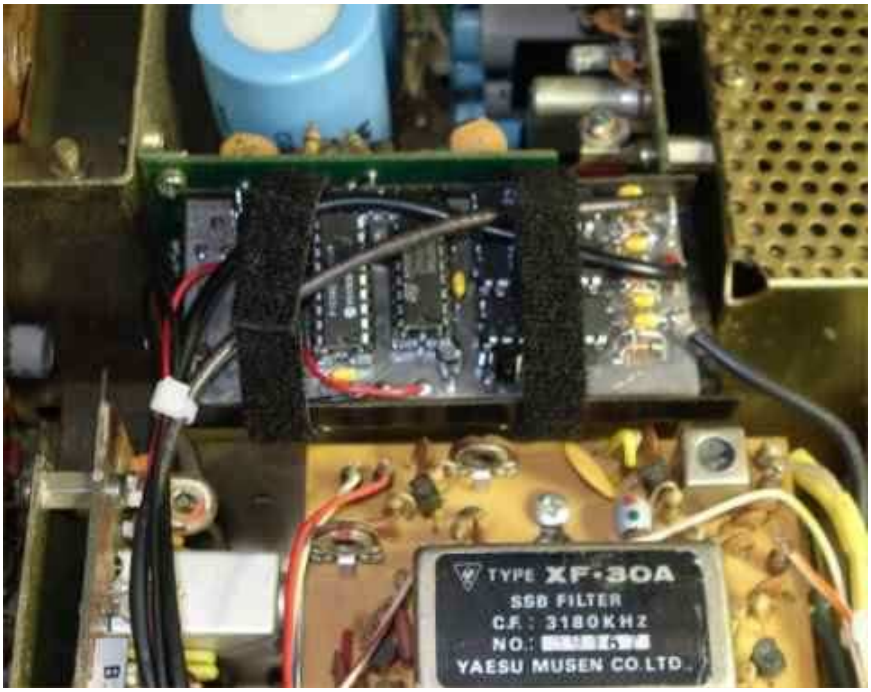
FT-101 (using DFD2-101)

- CONNECTING TO THE FT-101 TRANSCEIVER
- Cabling options:
- 1) You may use the remote VFO plug (octal) if: a. You are sure that you, or anyone else that you may sell the rig to in the future, will never want to install a Yaesu remote VFO; b. You have a spare octal, male plug; c. You are willing to work in a very restricted space. 2) You may bring cables out of the rear of the rig and terminate them with RCA or BNC connectors at the Digital Frequency Display unit if: a. You are not concerned with affecting the resale value of the FT-101 by drilling holes in the rear panel; b. You want to avoid soldering to an octal plug in a very congested location. 3) You may install RCA or BNC chassis mount jacks on the rear panel if: a. You want the modification to appear as inconspicuous as possible; b. You don't want cables that cannot be disconnected at the rear panel; c. You are willing to very accurately measure and drill mounting holes in a very small space.
- Yaesu FT-101 signals
- The BFO signal (3.1793 mhz) is approximately a 3 volt (peak-to-peak) signal that may be tapped in either of two different places. It appears on pin 6 of board 1184A and is carried by a short piece of coaxial cable to pin 5 of board 1183A. Each board has a convenient grounded pin for shield connection, but board 1183A is easier to reach with a small soldering iron.
- After routing the new cable (or mini-coax, which ever you have chosen) from the rear panel to the area of the board chosen, solder a .01 disk ceramic capacitor to the center conductor of the cable. Then solder the free lead of the capacitor to the chosen pin of the board edge connector and the shield to the nearest grounded pin on the edge connector.
- The Local Oscillator signal (approximately 6 mhz above the displayed signal, or 8 to 36 mhz) is approximately a 3 volt (peak-to-peak) signal that is available at the test point near the top edge of board 1181A.
- You have 2 cabling options here. The first option is to route the cable from the rear panel toward the front of the transceiver, and the openings around the tuning dial. Use these openings to pass the cable to the top of the chassis. While viewing the FT-101 from the normal operating position in front of the rig, route this cable up over the tuning shaft and to the right of the chassis. Solder a .01 disk ceramic capacitor to the center conductor and a small ground lug to the shield. Solder the free lead of the capacitor to the test point at the top of board 1181A, and attach the ground lug under the adjacent control's mounting nut and lock-washer.
- CAUTION. This method of installation means that you must disconnect the ground lug in order to remove the board from its edge connector.
- AN ALTERNATIVE installation method is to install the blocking capacitor (.01 disk ceramic) on the board between the test point and unused pin 15. This will allow easy removal of board 1181A. However, it requires soldering the coax to the edge connector for board 1181A in a very congested area. In this alternative installation the cable stays on the underside of the chassis and is soldered to pin 15, with the shield is soldered to pin 18 of the edge connector for board 1181A.
- The VFO signal (approximately 9 mhz) is about a 1 volt (peak-to-peak) signal available at pin 11 of board 1180A. After routing the cable from the rear of the chassis, solder a .01 disk ceramic capacitor to the center conductor. Solder the free capacitor lead to pin 11 and the shield to pin 10 of board 1180A.
- (The VFO signal also appears on the remote VFO adapter (octal) plug. In some versions of FT-101's, this signal does not have enough amplitude to operate the DFD reliably. Your mileage may vary.)
- **Thanks to Stan for supplying this information.**

- **Nick, W2NER,built in a DFD2-101 into his FT-101, nice job, very professional.**

Here is the finished product. He has not powered the backlite yet so it will be more readble when he does.

Picture just before final testing.

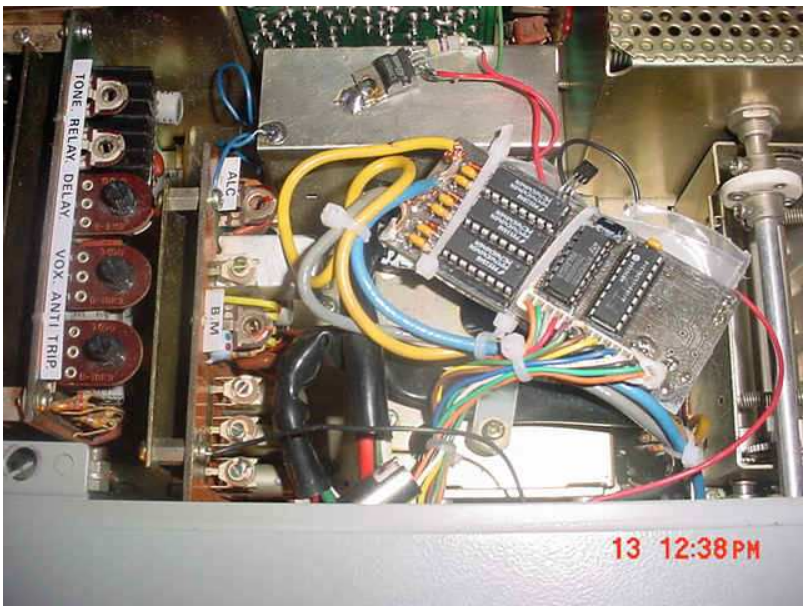


The counter board is remotely located from the display module using a flat ribbon cable from digikey

goto www.digikey.com and plug A9BAG-140 into the search window

Power was taken from pin 12 of PCB-1547 (regulator PCB) 14 volts DC.

Howard, N4DXX, made a nice internal installation and a second one using the blue display.



Bill, WA0VGD added a (DFD2-101) to his FR-101 to replace the existing readout.

- **SB-102**(using DFD2-Heath)
  - Hello Neil! I received the DFD2 kit, programmed for a Heath SB-301,
  - in the mail yesterday to be used on my Heath SB-102. Foresaking all
  - other household chores, I assembled the kit. It works like a champ.
  - For other person's info, these are the connections I made to the Heath
  - SB-102. For the BFO connection, I used Pin 9 on Tube V-13C which is the
  - product Detector. For the VFO, I used Pin 7 on Tube V-12A which is the
  - Second Receiver Mixer. These can easily be accessed fron the bottom of
  - the Circuit board. The HFO is a little harder to access. I used Pin 7
  - on Tube V-11 which is the First Receiver Mixer. It is almost impossible
  - to access from the bottom, but the way the tube sockets are constructed,
  - it is easy to solder the lead from the top on the tube socket. These
  - are all Cathode connections, which you recommended. Naturally I used
  - shielded cable for all connections.
  - I used the Phono connectors on the back of the Chassis. There is Spare
  - A and Spare B already, I unhooked the wire from the ALC connecter (Since
  - I don't plan to use an Amplifier) and used that one for the third
  - connection.
  - Bucky
  - KB5DRZ
- **Unique SB102** on Youtube by KS1U. example of DFD2-Heath built in.
- 

- **HW-101** (using DFD2-Heath)

  - I used this with a HW-101. Here are the particulars:
  - All connections are made at the cathodes of the various oscillator tubes.
  - All connections are made through a 27pF cap and RG-174 coax. 27 pf was
  - found to provide adequate coupling without loading any stage.
  - HFO connection at pin 7 of V11
  - VFO connection at pin 7 of V12
  - BFO connection at pin 9 of V13
  - Bypass (Jumper out) the input .01 and the 1 K res on the HFO input ckt of
  - the counter if it will not count above 15 meters.
  - Keep cables as short as possible.

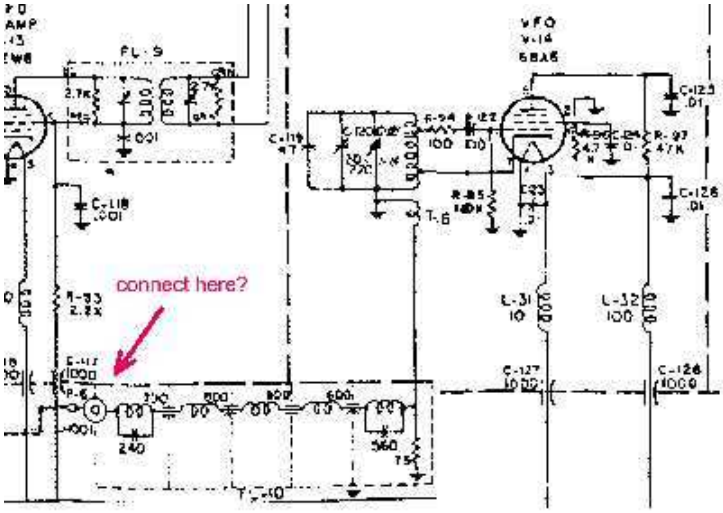
    Rodger

  - I received the kit and burned the midnight oil to get the thing working. Which it does.
    I would like to add a possible aid for anyone else doing this 301 into HW-101 conversion. The BFO connection suggestion on your site did not work for me. Instead I used the junction of R17 and CR2 before the resistance of R17 effects the line level. Instead of using the cathode of the tube at the end of that line. It now works perfectly

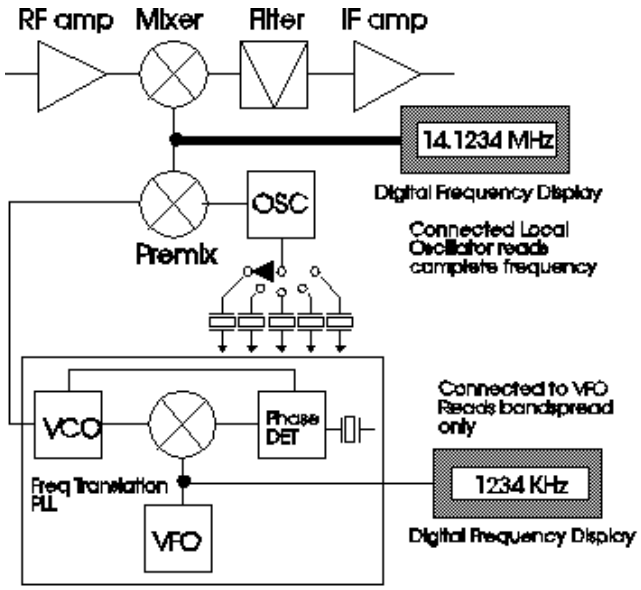
as you can see.

Jake

- **McKay 3010B and 3010C**



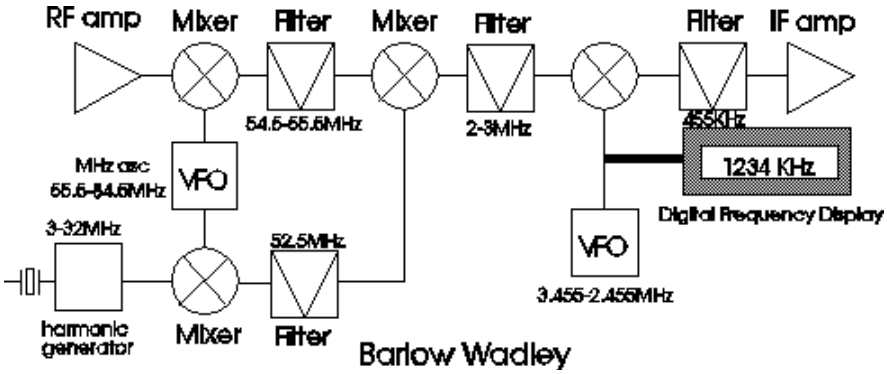
Suggest connecting DFD3 to the 3-5MHz VFO at the jack leading to HF LO mixer as shown above. **(Use DFD3)**



Frequency Translation Phase Lock Local Oscillator

This type uses a frequency translation phase lock loop to generate the local oscillator. The VCO is locked onto the sum or difference of the VFO and a harmonic of the reference crystal.

- Henry Radio Tempo 2020 (**(Use DFD1A)**)
  - Unit already contains MHz and 100KHz digital display.
  - By connecting the DFD1 to the VFO (J701 pins 5 and 4) the bandspread (0-100KHz) is displayed.
    - VFO range is 9.038 MHz to 9.138 MHz.. Not sure which way it tunes. Either:
      - Set the IF offset to 9.038 MHz SUBTRACT
      - or 9.138 MHz SUBTRACT whichever works.
  - By connecting DFD to the LO (J103) the DFD will display the total RF frequency.
    - Set IF offset to 6.187 MHz SUBTRACT
    - Not sure what signal level is but if it is 2 Vp-p or more it will work.



This is a novel design approach intended to provide a stable MHz per band approach without using phase lock loops. A 1MHz xtal oscillator is run through a diode harmonic generator to generate harmonics from 3 to 32 MHz. The "MHz oscillator" tunes continuously from 55.5 to 84.5 MHz. Whenever it is close to one of the harmonics from the harmonic generator one of the many frequencies will be 52.5 MHz. This is selected out by a bandpass filter. A level detector on the output of the filter usually drives some sort of front panel "lock" indicator.

The "MHz oscillator" also mixes with the incoming RF frequency and is passed through a 1 MHz wide bandpass filter centered around 55 MHz. The output of that filter is mixed with the 52.5 MHz filter output causing a 1MHz band of frequencies centered at 2.5 MHz at the output of the 2-3 MHz filter.Any positive drift in the MHz oscillator causes a negative drift in the 52.5 MHz frequency effectively canceling out the drift so far as the 2-3 MHz band is concerned.

A 3.455 to 2.455 MHz VFO tunes the 2-3 MHz into a 455 KHz IF section.

At present the DFD1A must connected to the 3.455-2.455MHz VFO and only the bandspread frequency (0-.9999MHz) will be displayed. The MHz portion must be read off the front panel when the lock indication is on.

You can also connect DFD3 in the same way and obtain complete frequency display using the band selector function of DFD3.

- Yaesu FRG-7
  - Take signal from TP404 of the IF-AF UNIT
  - I'm not sure which way it tunes but either:
    - Set IF offset to 3.455 MHz SUBTRACT
    - or Set IF offset to 2.455 MHz SUBTRACT
    - one of these will provide correct display.

Back to DFD spec page

Back to homepage