DEM 1691
WEFAX Downconverter

Product Description and Specifications:

The DEM1691 down converter is a receive only converter designed to translate the 1691 MHz GOES weather satellite band to a 137.500 MHz IF. If you already have a LEO WEFAX system, the addition of this converter with an suitable antenna will allow the reception of the GOES operation. The converter is a single circuit board contained within a extruded aluminum enclosure (not weatherproof). The circuit has a built in GaAs-FET LNA to provide an excellent noise figure with more than enough gain if it is mounted at the antenna. If it is used indoors, a external preamp is recommended if the feed line is greater than 25 feet. There are options to provide DC biasing to the converter along with different LO frequency combinations for the newer satellites.

Specifications

Frequency range:		1670 to 1720 MHz
Noise Figure:		<1.0 dB
Power requirements:		11-16.5 VDC @ 200 ma.
Min. Gain:		22 dB
Connectors:	1691 MHz: 137 MHz IF: DC Voltage	Type "N" Female BNC Female RCA
Size:		6.25" L x 4.125" W x 1.875" H

DEM 1691 Options

Biasing for external 1691 pre-amplifier	Complete Kit with machined enclosure
Bias thru IF coax for Antenna mounting	Assembled PC board
LO frequencies for new satellite bands	PC board kit available

Assembly Tips: (Read before actual assembly!)

Soldering surface mounted active components (GaAsFET's and MMIC's):

- The DOTS on the MMIC's (U3-U7) and the FET (Q1) determine their orientation and must be ob-served and positioned correctly prior to soldering. Q1 also has a cut lead in the input or gate lead (See fig. 1). Leads on all active surface mounted components should be absolutely flat against the mounting surface so be sure the positioning holes are clear of obstructions before soldering (See Fig. 2).
- Align the component in place based on the diagram.
- While holding the component in place, solder one lead to hold the component in place and observe the alignment of all leads.
- If the alignment is acceptable, solder the remaining leads. You need enough solder to cover the lead and mounting surface for the entire lead length (See Figure 2 shaded areas).

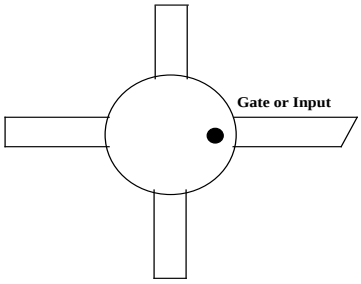


Figure 1A

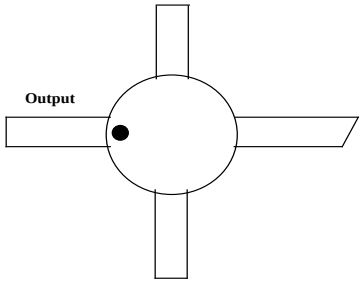


Figure 1B

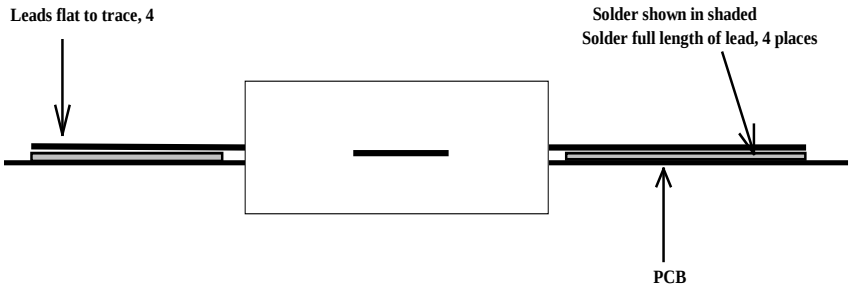


Figure 2 Side view of four leaded active device.

Soldering surface mounted passive components (chip resistors / capacitors):

- Determine the component mounting position based on the assembly diagram.
- Without the component in place, heat one side of the mounting area and flow a small amount of solder on it.
- Place the component in the correct position per the assembly diagram, it should now have one end over the previously melted solder.
- Holding the component in place with tweezers or other soldering aid, heat the end with the previously melted solder and allow it to flow into the solder, once solidified, remove holding tool.
- Now heat and flow the solder to the other side of the component and your done!

Soldering leaded components (resistors, regulators, IC's, etc.):

All leaded resistors are formed and surface mounted. Keep lead lengths as short as possible. U1 is stuffed from the top side and soldered on the top side. Be careful of solder shorts between leads. 4 components are mounted on the back of the PC Board. R8, L6, U8 and the crystal. Refer to special mounting instruction in this manual.

Mechanical assembly:

If a complete kit has been purchased, the interfacing of the RF input connector to the circuit board has been completed. We suggested not to remove the end plate from the PCB at all. The rest of the final assembly is covered in the instruction manual. Please see the detailed instructions and pictorials.

Rework of soldered components if needed:

The easiest method to rework soldered components is to employ a de-soldering braid that is specifically designed for this purpose. It can be purchased at any electronics store. Place the de-soldering braid on the lead that you are removing and apply heat to it. Without excessive pressure the solder will melt and flow into the braid leaving the lead or component ready to be removed. If chip components are to be removed, 2 soldering irons work best by heating both ends of the component at the same time, then lift.

Printed Circuit Assembly Notes:

Your kit is provided with easy to read placement diagrams that show the printed circuit, the component placement, and the reference designators that correspond to the provided component parts list.

Assembly:

The DEM 1691 is fairly easy and fun to assemble even for the first time kit builder and can be completed in any order that is comfortable, however DEM Inc. suggests the following assembly procedure to minimize errors and possible frustration.

1. Pre-form all Resistors and Diodes. Place them on PCB for fit only.
2. Wind and Pre-form all Inductors per parts list.
3. If you have a complete kit, do not remove the end panel from the PCB

Now the following assembly order is only suggested. It is recommended to do the top side first then install the 4 components on the back side that are required to avoid damage to them. Use the component placement diagram and parts list for identification of components. ***Remember to Observed polarity using either the DOTS or lead configuration as explained in the Assembly Tips section.***

1. Install U1-U7 , Q1-Q4, and D1
2. Install all chip capacitors and resistors except C1.
3. Install C1, L2, and L7. See Fig. 3 for detailed installation.
4. Install D2, D3, C28, Wire jumper and all leaded resistors and inductors.
5. Install bottom side components, U8, L6, R8, and the crystal (Fig. 4).

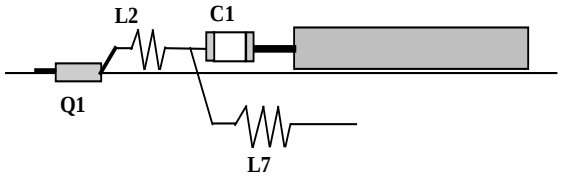


Figure 3 side view

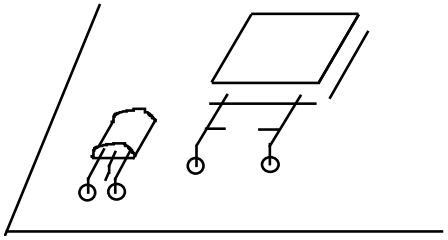


Figure 4

PC Board Electrical testing:

Attach a 8” wire to the pad marked +12V and pass it through the drilled hole to the bottom of the PCB. Then attach a short length of wire to any ground pad available. Connect these wires to a 12 volt supply (11 to 16 volts @ 200 ma) be careful not to reverse polarity. Verify the voltage test points indicated on the table below. All voltages referenced to ground. Some times component tolerances could cause slight difference in readings.

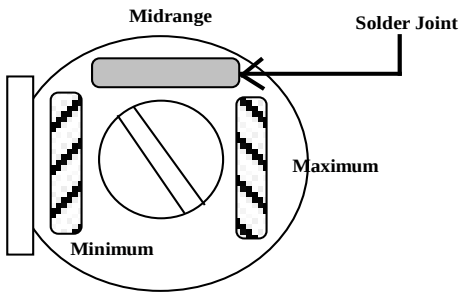
Component Tested	LOCATION	VOLTAGE DC
Q4, U8	Junction of Q4 & R14	5.00 ± 0.3
Q4	Junction of L5 & C28	1.50 ± 0.5
Q3 (oscillator)	Junction of Q3 & R13	< 11.00*
Q3 (oscillator)	Junction of R18 & C31	> 1.00**

* Adjust C28 for minimum voltage
** After C28 is adjusted

If a problem occurs with obtaining specified oscillator voltages, Please follow recommended procedure below. This procedure is also recommended for proper oscillator operation.

Oscillator Alignment:

Connect the positive lead of a Voltmeter to the R18 / C31 junction. Adjust C28 for maximum voltage, note where the capacitor is positioned. A midrange position is preferred (see diagram below). If the capacitor is at the maximum position, spread coil L5, 1 to 2 turns and readjust C28 for maximum voltage, the capacitor should be near midrange, if not repeat. If the capacitor is at minimum position, repeat process but this time compress coil L5. And if necessary, you may need to wind a new coil with an extra turn and replace. The final voltage should be approximately 1.0 - 2.0 volts. If a frequency counter is available probe C20 and tune C28 for 97.093750 MHz. If the voltage or frequency can not be obtained, check all components in the oscillator circuit for proper installation and recheck voltages.



C28 Capacitance Position

U7	Junction of U7 & C31	1.50 ± 0.5
U7	Junction of C20 & U7	5.50 ± 1.0

U6	Input of U6 attached to “U” filter	1.50 ± 0.5
U6	Junction of U6 & C32	3.50 ± 0.7
U5	Junction of U5 & C32	1.5 ± 0.5
U5	Output of U5 attached to “U” filter	3.50 ± 0.7
U4	Input of U4 attached to “U” filter	1.50 ± 0.5
U4	Junction of U4 & R9	3.50 ± 0.7
U3	Junction of U3 & C9	0.75 ± 0.3
U3	Junction of U3 & R20	5.50 ± 0.7
U1, U2, Q1	Junction of R19 & C9	2.0 ± 0.5
U1, U2, Q1	Junction of R1 & L7	- 0.5 ± 0.3

Final Assembly:

If you have a 1691CK, most of the mechanical assembly is completed. You will need to install the shield over the mixer/filter section. Place the shield on the circuit and trial fit it. Push the shield up against the end plate and then check the alignment on the ground pads. If it shorts any active circuitry, turn the shield 180 degrees and fit it again. It only fits one way. When you are certain, tack solder the two sides and inspect before completely soldering. Now solder the ground lug of the BNC connector to the shield. With a short piece of bare wire or resistor lead, attach the center-pin of the BNC to the PCB where it is marked IF.

At this time, you should have a working converter except for maybe a slight frequency adjustment on C28. This can be accomplished with a frequency meter, (97.093750 MHz at the output of U7 or 776.750 MHz. at the output of U4), or with a known signal of 1691.000 input to the converter for 137.500 out of the IF (If you have an optional frequency Xtal installed, do the math!) If your antenna system is in operation, look at the satellite and adjust the frequency to you 137 Mhz. receive system. If all checks OK, finish assembly.

If you wish to mount the converter at the antenna, although is not necessary, you may want to bias the converter through the coax. Follow fig. 5 for recommended assembly. The components are included in the kit.

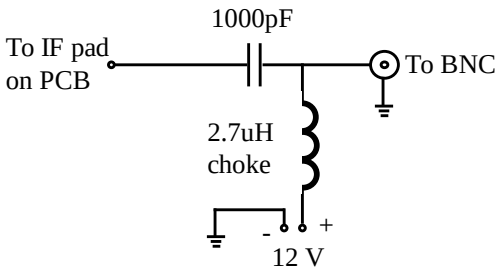
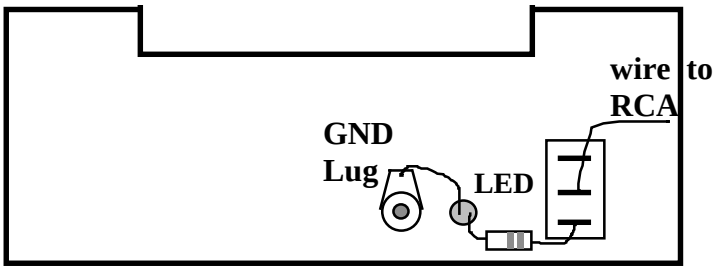


Figure 5

Install switch, ground lug, 1K resistor, and LED on front panel as shown in Fig. 6.



The shortest leg on the LED solders to the GND lug

Figure 6

Connect a 8” piece of wire to the center of the RCA jack on the rear panel. Also install a 100 uF capacitor from the center of the RCA to ground. Slide the PCB assembly into the enclosure and screw on the rear panel. Connect the wire from the RCA connector to the center of the switch. Connect the other wire from the PCB to the same post on the switch that the 1K resistor is connected to. Install the front pannel marking sure that the excess wire goes underneath the PCB before screwing the panel in place.

Label the connectors and front panel as shown in Fig. 7. Enjoy your converter!

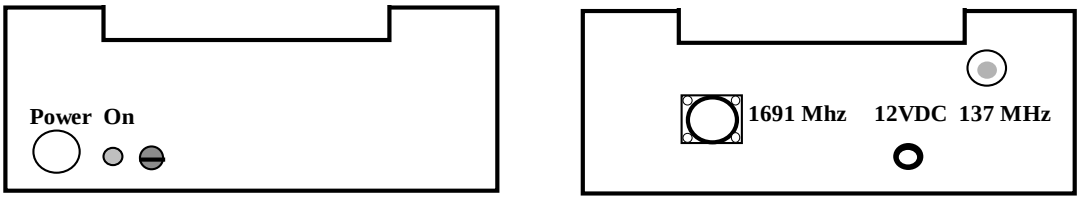


Figure 7

Surface Mount Chip Components on Chip Card

C1 10pf	C15 0.1μF	C30 39 pf	R14 820
C2 2.2μF	C16 0.1μF	C31 1000pf	R15 470
C3 .1μF	C17 1000pf	C32 22pf	R16 100
C4 2.2μF	C18 5 pf	C34 5 pf	R17 51
C5 1.0μF	C19 18pf	C35 5 pf	R18 100
C6 22pf	C20 22pf	R1 51	R19 51
C7 .1μF	C21 0.1μF	R2 24K	R20 100
C8 1.0μF	C22 1.0μF	R3 10K	Q2 MMBT3906
C9 22pf	C23 1000	R4 4.3K	Q3 MMBT5179
C10 1000pf	C24 1.0μF	R5 100	Q4 MMBT5179
C12 10 pf	C25 1000pf	R6 6.2K	D1 HSMS-2822
C13 10 pf	C26 1000pf	R7 10	
C14 1000pf	C29 18 pf	R13 470	

Leaded Components

C28 1.5 - 6.0 pf TRIM SM	R10 270 OHM 1/4W
D2 1N914	R11 270 OHM 1/4W
D3 HP5082-2835	R12 150 OHM 1/2W
L1 4 Turns #28 1/8" ID	R21 680 OHM 1/4W
L2 2 Turns #30 .036" ID., space wound	U1 7660
L3 5 Turns #28 1/8" ID	U2 78LO8
L4 8 Turns #28 1/8" ID	U3 INA10386
L5 10 Turns #28 1/8" ID	U4 MAR-4
L6 0.33μH (orange bands)	U5 MAR-2
L7 7 Turns # 28.036" ID	U6 MAR-2
Q1 ATF10136	U7 MAV-11
R8 150 OHM 1/2W	U8 78LO5
R9 150 OHM 1/2 W	XTAL 97.0980 MHZ.