TECHNICAL MANUAL
888-2572-001

OSCILLATOR
992-8069-004

T.M. No. 888-2572-001

Printed: December 2004
Rev B. : 01-06-2005

Returns And Exchanges

Damaged or undamaged equipment should not be returned unless written approval and a Return Authorization is received from HARRIS CORPORATION, Broadcast Systems Division. Special shipping instructions and coding will be provided to assure proper handling. Complete details regarding circumstances and reasons for return are to be included in the request for return. Custom equipment or special order equipment is not returnable. In those instances where return or exchange of equipment is at the request of the customer, or convenience of the customer, a restocking fee will be charged. All returns will be sent freight prepaid and properly insured by the customer. When communicating with HARRIS CORPORATION, Broadcast Systems Division, specify the HARRIS Order Number or Invoice Number.

Unpacking

Carefully unpack the equipment and preform a visual inspection to determine that no apparent damage was incurred during shipment. Retain the shipping materials until it has been determined that all received equipment is not damaged. Locate and retain all PACKING CHECK LISTs. Use the PACKING CHECK LIST to help locate and identify any components or assemblies which are removed for shipping and must be reinstalled. Also remove any shipping supports, straps, and packing materials prior to initial turn on.

Technical Assistance

HARRIS Technical and Troubleshooting assistance is available from HARRIS Field Service during normal business hours (8:00 AM - 5:00 PM Central Time). Emergency service is available 24 hours a day. Telephone 217/222-8200 to contact the Field Service Department or address correspondence to Field Service Department, HARRIS CORPORATION, Broadcast Systems Division, P.O. Box 4290, Quincy, Illinois 62305-4290, USA. Technical Support by e-mail: *tsupport@harris.com*. The HARRIS factory may also be contacted through a FAX facility (217/221-7096).

Replaceable Parts Service

Replacement parts are available 24 hours a day, seven days a week from the HARRIS Service Parts Department. Telephone 217/222-8200 to contact the service parts department or address correspondence to Service Parts Department, HARRIS CORPORATION, Broadcast Systems Division, P.O. Box 4290, Quincy, Illinois 62305-4290, USA. The HARRIS factory may also be contacted through a FAX facility (217/221-7096).

NOTE

The # symbol used in the parts list means used with (e.g. #C001 = used with C001).

MANUAL REVSION HISTORY PAGE Oscillator 888-2572-001			
Rev.	Date	ECN	Pages Affected
001-A	Dec. 2004		Book Created
001-B	01-06-05	50713	Title Pages, added MRH1-MRH-2, Section A.

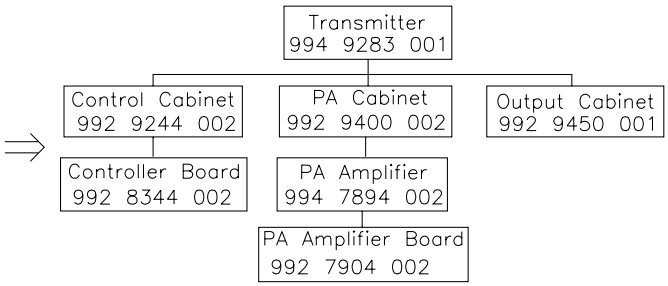
Guide to Using Harris Parts List Information

The Harris Replaceable Parts List Index portrays a tree structure with the major items being leftmost in the index. The example below shows the Transmitter as the highest item in the tree structure. If you were to look at the bill of materials table for the Transmitter you would find the Control Cabinet, the PA Cabinet, and the Output Cabinet. In the Replaceable Parts List Index the Control Cabinet, PA Cabinet, and Output Cabinet show up one indentation level below the Transmitter and implies that they are used in the Transmitter. The Controller Board is indented one level below the Control Cabinet so it will show up in the bill of material for the Control Cabinet. The tree structure of this same index is shown to the right of the table and shows indentation level versus tree structure level.

Example of Replaceable Parts List Index and equivalent tree structure:

Replaceable Parts List Index

Table 7–1.	Transmitter	994 9283 001	7–2
Table 7–2.	Control Cabinet	992 9244 002	7–3
Table 7–3.	Controller Board	992 8344 002	7–6
Table 7–4.	PA Cabinet	992 9400 002	7–7
Table 7–5.	PA Amplifier	994 7894 002	7–9
Table 7–6.	PA Amplifier Board	992 7904 002	7–10
Table 7–7.	Output Cabinet	992 9450 001	7–12



The part number of the item is shown to the right of the description as is the page in the manual where the bill for that part number starts.

Inside the actual tables, four main headings are used:

Table #-#. ITEM NAME - HARRIS PART NUMBER - this line gives the information that corresponds to the Replaceable Parts List Index entry;

HARRIS P/N column gives the ten digit Harris part number (usually in ascending order);

DESCRIPTION column gives a 25 character or less description of the part number;

REF. SYMBOLS/EXPLANATIONS column 1) gives the reference designators for the item (i.e., C001, R102, etc.) that corresponds to the number found in the schematics (C001 in a bill of material is equivalent to C1 on the schematic) or 2) gives added information or further explanation (i.e., “Used for 208V operation only,” or “Used for HT 10LS only,” etc.).

Inside the individual tables some standard conventions are used:

A # symbol in front of a component such as #C001 under the REF. SYMBOLS/EXPLANATIONS column means that this item is used on or with C001 and is not the actual part number for C001.

In the ten digit part numbers, if the last three numbers are 000, the item is a part that Harris has purchased and has not manufactured or modified. If the last three numbers are other than 000, the item is either manufactured by Harris or is purchased from a vendor and modified for use in the Harris product.

The first three digits of the ten digit part number tell which family the part number belongs to - for example, all electrolytic (can) capacitors will be in the same family (524 xxxx 000). If an electrolytic (can) capacitor is found to have a 9xx xxxx xxx part number (a number outside of the normal family of numbers), it has probably been modified in some manner at the Harris factory and will therefore show up farther down into the individual parts list (because each table is normally sorted in ascending order). Most Harris made or modified assemblies will have 9xx xxxx xxx numbers associated with them.

The term “SEE HIGHER LEVEL BILL” in the description column implies that the reference designated part number will show up in a bill that is higher in the tree structure. This is often the case for components that may be frequency determinant or voltage determinant and are called out in a higher level bill structure that is more customer dependent than the bill at a lower level.

HARRIS Broadcast Systems Division
P.O. Box 4290, QUINCY, IL 62305

PARTS ORDER FORM

HARRIS PHONE: 217-222-8200
HARRIS FAX: 217-221-7096

BILLING INFORMATION

CUSTOMER NAME: _____

ADDRESS: _____

_____

_____

_____

TELEPHONE NUMBER: _____

FAX NUMBER: _____

PREFERRED PAYMENT METHOD: _____

SHIPPING INFORMATION

SHIP TO: _____
(if different from billing information)

ADDRESS: _____

_____

_____

_____

TELEPHONE NUMBER: _____

FAX NUMBER: _____

SHIPPING METHOD PREFERRED: _____

FREQUENCY (If required): _____

EQUIPMENT NAME: _____

EQUIPMENT PART NUMBER: _____

EQUIPMENT SERIAL NUMBER: _____

GUIDE FOR ORDERING PARTS

Please use the following parts order form, filling is as much information as possible. The complete informaiton will allow double checking the part number for correctness or locating a substitude if the part is not available.
The equipment name, part number, and serial number will be found on the metal ID plate on the back of the unit. The serial number MUST be included for any parts ordered under warranty.
Describe the part using the description in the parts list if possible. Include the schematic information, schematic number, or number of next higher assembly. The next higher assembly is usually a 992-xxxx-00x type.

ITEM #	QTY ORD	HARRIS PART NUMBER	DESCRIPTION OF PART (PART'S NAME, DESCRIPTION, SPECIFICATION FROM PARTS LIST IF AVAILABLE)	SCHEMATIC REFERENCE REFERENCE NAME (e.g. C001, R100, etc)	ITEM USED ON (NEXT HIGHER ASSEMBLY IF KNOWN) (e.g. C001 used on 992 8025 001, SCHEMATIC 839 8099 991)	COMMENTS

WARNING

THE CURRENTS AND VOLTAGES IN THIS EQUIPMENT ARE DANGEROUS. PERSONNEL MUST AT ALL TIMES OBSERVE SAFETY WARNINGS, INSTRUCTIONS AND REGULATIONS.

This manual is intended as a general guide for trained and qualified personnel who are aware of the dangers inherent in handling potentially hazardous electrical/electronic circuits. It is not intended to contain a complete statement of all safety precautions which should be observed by personnel in using this or other electronic equipment.

The installation, operation, maintenance and service of this equipment involves risks both to personnel and equipment, and must be performed only by qualified personnel exercising due care. HARRIS CORPORATION shall not be responsible for injury or damage resulting from improper procedures or from the use of improperly trained or inexperienced personnel performing such tasks.

During installation and operation of this equipment, local building codes and fire protection standards must be observed. The following National Fire Protection Association (NFPA) standards are recommended as reference:

- Automatic Fire Detectors, No. 72E
- Installation, Maintenance, and Use of Portable Fire Extinguishers, No. 10
- Halogenated Fire Extinguishing Agent Systems, No. 12A

WARNING

ALWAYS DISCONNECT POWER BEFORE OPENING COVERS, DOORS, ENCLOSURES, GATES, PANELS OR SHIELDS. ALWAYS USE GROUNDING STICKS AND SHORT OUT HIGH VOLTAGE POINTS BEFORE SERVICING. NEVER MAKE INTERNAL ADJUSTMENTS, PERFORM MAINTENANCE OR SERVICE WHEN ALONE OR WHEN FATIGUED.

Do not remove, short-circuit or tamper with interlock switches on access covers, doors, enclosures, gates, panels or shields. Keep away from live circuits, know your equipment and don’t take chances.

WARNING

IN CASE OF EMERGENCY ENSURE THAT POWER HAS BEEN DISCONNECTED.

WARNING

IF OIL FILLED OR ELECTROLYTIC CAPACITORS ARE UTILIZED IN YOUR EQUIPMENT, AND IF A LEAK OR BULGE IS APPARENT ON THE CAPACITOR CASE WHEN THE UNIT IS OPENED FOR SERVICE OR MAINTENANCE, ALLOW THE UNIT TO COOL DOWN BEFORE ATTEMPTING TO REMOVE THE DEFECTIVE CAPACITOR. DO NOT ATTEMPT TO SERVICE A DEFECTIVE CAPACITOR WHILE IT IS HOT DUE TO THE POSSIBILITY OF A CASE RUPTURE AND SUBSEQUENT INJURY.

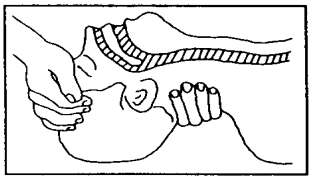
TREATMENT OF ELECTRICAL SHOCK

1. IF VICTIM IS NOT RESPONSIVE FOLLOW THE A-B-CS OF BASIC LIFE SUPPORT.

PLACE VICTIM FLAT ON HIS BACK ON A HARD SURFACE

(A) AIRWAY

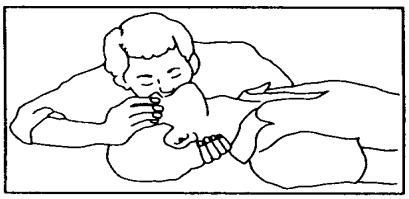
IF UNCONSCIOUS,
OPEN AIRWAY



LIFT UP NECK
PUSH FOREHEAD BACK
CLEAR OUT MOUTH IF NECESSARY
OBSERVE FOR BREATHING

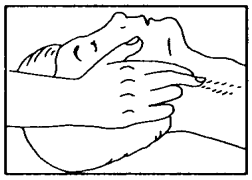
(B) BREATHING

IF NOT BREATHING,
BEGIN ARTIFICIAL BREATHING



TILT HEAD
PINCH NOSTRILS
MAKE AIRTIGHT SEAL
4 QUICK FULL BREATHS
REMEMBER MOUTH TO MOUTH
RESUSCITATION MUST BE
COMMENCED AS SOON AS POSSIBLE

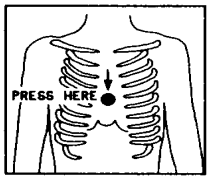
CHECK
CAROTID PULSE



IF PULSE ABSENT,
BEGIN ARTIFICIAL
CIRCULATION

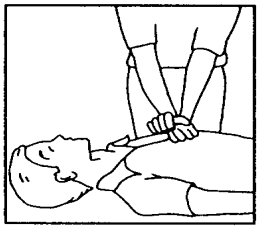
(C) CIRCULATION

DEPRESS STERNUM 1 1/2 TO 2 INCHES



APPROX. RATE OF COMPRESSIONS --80 PER MINUTE
- ONE RESCUER
- 15 COMPRESSIONS
- 2 QUICK BREATHS

APPROX. RATE OF COMPRESSIONS --60 PER MINUTE
- TWO RESCUERS
- 5 COMPRESSIONS
- 1 BREATH



NOTE: DO NOT INTERRUPT RHYTHM OF COMPRESSIONS
WHEN SECOND PERSON IS GIVING BREATH

CALL FOR MEDICAL ASSISTANCE AS SOON AS POSSIBLE.

2. IF VICTIM IS RESPONSIVE.

A. KEEP THEM WARM
B. KEEP THEM AS QUIET AS POSSIBLE
C. LOOSEN THEIR CLOTHING
D. A RECLINING POSITION IS RECOMMENDED

FIRST-AID

Personnel engaged in the installation, operation, maintenance or servicing of this equipment are urged to become familiar with first-aid theory and practices. The following information is not intended to be complete first-aid procedures, it is a brief and is only to be used as a reference. It is the duty of all personnel using the equipment to be prepared to give adequate Emergency First Aid and thereby prevent avoidable loss of life.

Treatment of Electrical Burns

1. Extensive burned and broken skin
   a. Cover area with clean sheet or cloth. (Cleanest available cloth article.)
   b. Do not break blisters, remove tissue, remove adhered particles of clothing, or apply any salve or ointment.
   c. Treat victim for shock as required.
   d. Arrange transportation to a hospital as quickly as possible.
   e. If arms or legs are affected keep them elevated.

NOTE

If medical help will not be available within an hour and the victim is conscious and not vomiting, give him a weak solution of salt and soda: 1 level teaspoonful of salt and 1/2 level teaspoonful of baking soda to each quart of water (neither hot or cold). Allow victim to sip slowly about 4 ounces (a half of glass) over a period of 15 minutes. Discontinue fluid if vomiting occurs. (Do not give alcohol.)

2. Less severe burns - (1st & 2nd degree)
   a. Apply cool (not ice cold) compresses using the cleanest available cloth article.
   b. Do not break blisters, remove tissue, remove adhered particles of clothing, or apply salve or ointment.
   c. Apply clean dry dressing if necessary.
   d. Treat victim for shock as required.
   e. Arrange transportation to a hospital as quickly as possible.
   f. If arms or legs are affected keep them elevated.

REFERENCE:

ILLINOIS HEART ASSOCIATION

AMERICAN RED CROSS STANDARD FIRST AID AND PERSONAL SAFETY MANUAL (SECOND EDITION)

A.1 Introduction

This section covers the Oscillator board(s). Topics include function, location, block diagram description, detailed diagram description, and troubleshooting.

Assembly #	992-8069-004
PWB #	843-5155-853
Schematic #	843-5155-851

A.2 Function

The Oscillator board includes a crystal oscillator stage, frequency dividers, and amplifier/driver stages. The Oscillator board provides an RF signal at the transmitter operating frequency to be amplified by the Buffer Amplifier. The oscillator board provides a auto/man switch of the Ext rf to the Internal crystal. The oscillator board provides a duty cycle adjustment. Normally Oscillator A is selected by the Oscillator Interface. If optional Oscillator B is installed it can also be selected for operation.

A.3 OscilloscopeWaveform Plots

Actual oscilloscope waveform plots of key troubleshooting points are located at the end of this section. All plots were taken at 100kW with no modulation at 1575kHz + 882kHz carrier frequency.

NOTE:

Some signal magnitudes vary with carrier frequency, therefore expect some differences in magnitude for some frequencies other than 1575 kHz

A.4 Block Diagram Description

A.4.1 RF Flow

Two crystals, with manual switch-over, are used to generate a sinewave RF signal that is either four or eight times the transmitter frequency. A buffer/squaring amplifier converts the sinewave into a squarewave which is then divided down to the transmitter frequency by the Frequency Divider. Jumper plugs and buffer/driver amplifiers allow the use of an external oscillator source, and there are also provisions for combined transmitter operation. The Oscillator output, at the carrier frequency, is sent to the Buffer Amplifier via the Oscillator Interface board. The Oscillator board also has an output signal to operate a frequency monitor or counter. RF presence signals are sent to the Oscillator Interface board for fault sensing.

A.4.2 A.4.2 AUTO Switching

When the loss of the External RF signal is detected the Oscillator board when in Auto mode will switch to the Internal Crystal.

A.4.3 VSWR Switching

A VSWR-H input signal operates an analog switch when a VSWR fault occurs. During this time, the Oscillator output will be switched from the crystal or External oscillator output, to an RF current sample taken from the output network.

A.4.3.1 Duty Cycle Adjust

In combined type systems this circuit is used to help NULL out harmonics in the output spectrum.

A.4.3.2 Power Supplies

+22Vdc is regulated down to +15Vdc, +9Vdc, and +5Vdc for on board circuits, while -22Vdc is regulated down to -15Vdc to power the crystal ovens.

A.5 Detailed Circuit Description

Refer to the schematic diagram for the Oscillator board (843-5155-851) for all descriptions in this section.

A.5.1 Oscillator Stage

The crystal oscillator stage, Q1, is a standard Pierce circuit, operating at 4 or 8 times the carrier frequency. The crystal operates in its parallel resonant mode. Jumper plug, P1, allows selecting either one of two crystals. If one crystal should fail, this jumper allows quick selection of the backup crystal (the oven jumper must also be changed).

For each crystal, small frequency adjustments can be made with C1 (for crystalY1) or C3 (for Y2).

For carrier frequencies of 1250 kHz and below, the crystal frequency is eight times the carrier frequency, and for carrier frequencies above 1250 kHz, the crystal operates at four times the carrier frequency.

Each crystal is contained in a sleeve type oven, which maintains temperature at 70°C (+/-3°C, approximately). Oven jumper plug P6 supplies -15Vdc to either oven. Note that crystal jumper plug P1 and oven jumper plug P6 must both be in the same position, otherwise the crystal in use will not be at the correct temperature and may be off frequency (P1 and P6 must both be in the upper position, or both in the lower position).

A.5.2 Buffer/Squaring Amplifier

Buffer amplifier Q2 is coupled to the oscillator output, and operates as an overdriven amplifier, with a +5 volt supply voltage. The output of Q2 is a TTL-level square wave which drives the frequency divider. Diodes CR2 and CR3 protect Q2 against reverse voltages.

WARNING: Disconnect primary power prior to servicing.

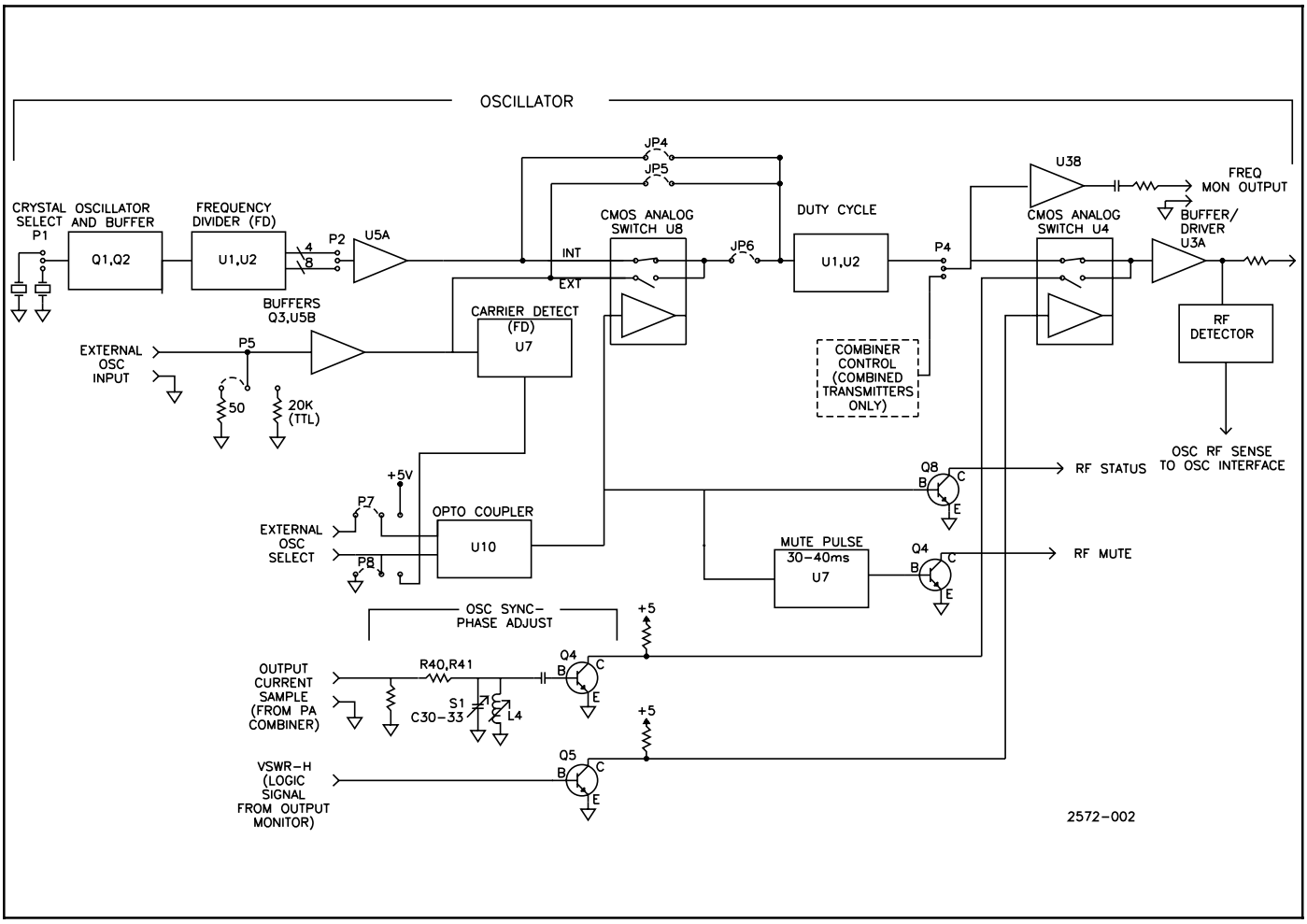


Figure A-1. Oscillator, Simplified Block Diagram

A.5.3 Frequency Divider

Integrated circuits U1 and U2 are dual J-K flip-flops, used as frequency dividers. Each IC section is connected as a divide-by two circuit. The signal at U2-11 and P2-2, is one-fourth of the crystal frequency. Half of U1 divides this frequency by two, so the signal at U1-15 output, and P2-3, is at 1/8 of the crystal frequency. Jumper plug P2 is then installed to route either the divide-by-four or the divide-by-eight output to buffer-driver U5A, pin 2. The output ofU5A-7, at Test Point 14, is a TTL-level square wave at the transmitter operating frequency.

A.5.4 External Input

An HD Radio Exciter, AM stereo generator or high-stability external oscillator can be connected to BNC jack J2, which is located on the Oscillator board. The external input impedance is either 50 ohms or approximately 20k ohms, depending on the position of jumper plug P5. The high impedance input is for use with TTL level (4 to 4.5 volt peak-to-peak square wave).With a 50 ohminput impedance, RF input levels from 0 to +25 dBm can be accommodated. (At 50 ohms, 0 to +25 dBm is 1 mW to 316 mW, or 0.22 V rms to 4 V rms).

Amplifier Q3 and buffer/driver U5B provide a logic-level signal to Test Point 8. Diodes CR8 and CR9 at Q3 input provide protection against excessive input voltages.

A.5.5 Internal/External Oscillator and Combined Transmitter Operation

Jumper plugs JP4, JP5, JP6 are used to select either an external oscillator, the internal oscillator or Automatic, respectively. The signals at this point are 4 to 4.5 volt peak-to-peak square wave signals (logic level signals) at the transmitter's operating frequency. JP4 selects the external crystal oscillator, JP5 selects the internal oscillator source and JP6 puts the board in Automatic mode.

JP1 is used to invert the signal, used only in combine mode when needed.

When JP6 is installed then the Oscillator Board is in the AUTO Mode. When an Ext RF Signal is applied at J2 and a signal is present at TP8 this causes a retriggerable monostable vibrator to have a Logic "1" on the Q output. This output turns "ON" Q10 which then applies a Logic Low to the U10 Pin 2 when P8 is in Position 1-2. When U10 is enabled this provides a low to U9 pin

WARNING: Disconnect primary power prior to servicing.

10 and 13. Pin 8 of U9 will be low and Enable DS1 And the CMOS switch (U8) which switches to the External RF signal.

A.5.5.1 DUTY CYCLE

The output of U8 drives the duty cycle adjustment circuit. In combined type systems this circuit is used to help NULL out harmonics in the output spectrum.

A.5.5.2 AUTO/MANUAL

P7 and P8 provide active High or Active Low logic for manual switching of the Ext RF to internal Crystals.

A.5.5.3 Switch Delay

There is an RC time Constant on the Input of U8 (CMOS switch) this is set to 6-10ms.

A.5.5.4 MUTE

Anytime a switch takes place a 35-40ms pulse is generated. Connect this line J8-2 to your transmitter Ext RF Mute connection. The RF mute occurs before the RF switch takes place to insure that when the Ext RF signal is reapplied and it is out of phase with the Internal crystal that damage is not done to the transmitter.

A.5.5.5 EXT STATUS

When U8 (CMOS switch) is switched to the External RF Signal J8-1 will be Low. This is an Open Collector Transistor.

A.5.5.6 Single Combined Mode

Jumper plug P4 is used to select either normal or combined transmitter operation. For normal operation, P4-1 and P4-3 are jumpered, and the RF signal from buffer/driver U5A or U5B is fed to U4 pin 4. For combined operation, P4-1 and P4-2 are connected.

A.5.6 Frequency Monitor Output

Buffer/driver U3B provides an output signal to a frequency monitor or counter. Resistor R17 sets the driver output impedance at 50 ohms. The frequency monitor output signal, at BNC connector J5, will be a 4-4.5 volt peak-to-peak square wave at the transmitter operating frequency when the load impedance is 50 ohms.

A.5.7 VSWR Switching

The combiner output current sample from T4, is brought to the Oscillator board at J3. R37 provides a 50-ohm input impedance, and zener diodes CR11 and CR12 protect Q4 from transient voltages. R40, R41, L4, and DIP-switch selected capacitors C30 through C33 form a phase shift network. Q4 amplifies this phase-shifted RF sample and feeds it to pin 11 of CMOS analog switch U4.

Integrated Circuit U4 is a CMOS analog switch, which selects one of two RF signals. During normal operation, the signal from P4-3 is routed through U4 to buffer-driver U3 and the transmitter RF drive section. During a VSWR fault, U4 pin 6 goes low, and U4 switches so that the output current sample is used as the transmitter's RF drive.

A.5.8 Output Buffer/Driver

Integrated circuit U3A is a logic buffer-driver. Its input, at U3-2, is a TTL level logic signal, and its output, at U3-7, is a square wave (8-9v p-p). The output impedance of U3A is very low, and resistor R31 sets the 50-ohm output impedance of the Oscillator board. Resistor, R31, is one half of a voltage divider with the other half being R16 (to ground) on the input of the Buffer Amplifer. The output signal at J4-8 is a 4-4.5 vp-p square wave and goes to the Oscillator Interface.

A.5.9 RF Present Output

The RF output from buffer/driver U3A is converted to positive and negative dc voltages by peak detectors CR7-C18 and CR6-C17. These dc voltages go to a fault circuits on Oscillator Interface, through resistors R19 and R21.

If the RF output from the Oscillator board is lost, there will be no "RF Present" voltages.

A.5.10 Power Supplies

Input voltages for the Oscillator board, from the transmitter low-voltage power supply, are +22 volts and -22 volts, unregulated, at J1-1 and J1-4; J1-2 is "ground." Voltage regulator U6 provides -15 volts for the crystal ovens. All positive voltages used on the Oscillator board are shunt regulated by zener diodes, and include +15 volts (from CR1), +9 volts (from CR13), and +5 volts (from CR4).

A.6 A.6 Troubleshooting

The following information contains general troubleshooting tips and any precautions if applicable.

Failure of an oscillator will result in an OSC FAULT and possibly a LOWDRIVE FAULT

A.6.1 Measure The Power Supplies

a. Check the dc voltage at each side of F1 and F2. Both +22 volts and -22 volts should be present any time low voltage ac power is on provided the Low Voltage Power Supply is in the "TEST"mode. The Control multimeter will indicate whether transmitter low voltage power supply voltages, including +22 V and -22 V are present.

b. Check the voltages at TP1 +15Vdc, TP2 +5Vdc, TP3 +9Vdc, and P6-1 -15Vdc. If one voltage is missing, a zener diode may be shorted or there may be a short in a circuit supplied by that voltage.

A.6.2 Measure the VSWR-H Input

Observe the voltage at J7-5, if this voltage is more than about +1 volts when the transmitter if off, there is probably a fault on the Output Monitor board. (When VSWR faults are detected, logic high pulses will appear at J7-5.)

A.6.3 Measure the RF Output

Using an oscilloscope, check for RF output at J4-8 (a convenient place to check this is at the end of R31 which is furthest from the BNC connector J5, on the left side of the board). A square wave of 4-4.5 volts peak-to-peak at the transmitter carrier frequency should be present.

A.6.4 A.6.4 No Signal Present

If no RF signal is present, sequentially check the following test points until RF is found.

a. Check TP5 and the frequency divider outputs at P2-1. A 4-4.5 V p-p square wave should be present at the transmitter frequency
b. Check the signals at Q1 and Q2 collectors. Typically 8 volts of sinewave RF should appear at Q1 output. The Q2 output should be a slightly distroted squarewave of approximately 5-6 volts p-p. RF frequency at these points should be at the crystal frequency.
c. If no RF signal is present, try moving P1 to the other crystal position.
d. If RF output returns, one crystal is defective. (If you are going to operate with the alternate crystal, don't forget to change the crystal oven plug P6 as well).

A.7 A.7 Oscillator Alignment

A.7.1 Carrier Detect Adjustments

Depending on your Transmitters Freq R64 must be adjusted for proper Carrier loss Detection. Refer to Table A-1.

NOTE

R64 must be adjusted with Power off. Place a Multimeter on TP13 and R70. Make sure you are on the junction of R70 and R64. To achieve this place your meter on either side of R70. The side with 5k Ohm less is the side you want.

This adjustment is used to detect the loss of the External RF signal.When RF is lost for 5-8 cycles U7 will be set causing the "Q" output to go low. This in turn causes the CMOS switch to switch to the Internal Crystal.

A.7.2 Oscillator Frequency Fine Adjustment

a. Connect a frequency counter or frequency monitor to the Oscillator to the Oscillator board Frequency Monitor Output (BNC Jack J5).
b. Select the crystal to be adjusted, make sure its oven is operating and warmed up.
c. Adjust C1 (for crystal Y1) or C3 (for crystal Y2) for the desired frequency. Only a small range of adjustment of frequency is possible.

NOTE:

Crystal jumper plug P1 and Oven jumper J6 must both be in the same position during adjustment or operation. Do not adjust frequency for either crystal until its oven has had sufficient time to warm up, allowing at least 15 minutes.

A.7.3 Oscillator Sync Adjustment

Using a dual trace scope:

a. Connect channel 1 to TP5.
b. Connect channel 2 to TP4.
c. Sync the scope to channel 1.
d. Set the sweep speed on the scope to display one or two cycles of RF.

Table A-1

Freq (kHz)	500	540	640	740	840	940	1040	1140	1240	1340	1440	1540	1640	1740
Ohms (k)	23	21	17	14	11	9	8	7	6	5	4	4	3	3

Table A-2 Oscillator Jumper Positions

Oscillator Board Jumper #	Jumper Position Description	
	Pins 1-2	Pins 1-3
P1	Activates Crystal Y1	Activates Crystal Y2
P2	For 1251kHz & Above, selects divide by 4	For 1250kHz and below, selects divide by 8
P4	Can be used for Combined Transmitter Operation	Selects Normal Single Transmitter Operation
P5	Sets Input Impedance for External Oscillator. Input at 20k Ohms for TTL Levels	Sets input Z for External Oscillator Input at 50 Ohms for 0-25dBm Input
P6	Activates Oven for Crystal Y1	Activates Oven for Crystal Y2
P7	+5V External Failsafe Disabled	+5V External Failsafe Enabled
P8	External Carrier Detect ON	External Carrier Detect OFF
JP4 (see note at right)	Selects External Oscillator Inputs from J2	**NOTE:** ONLY one of these three jumpers can be installed at a time
JP5 (see note at right)	Selects Internal Crystal	
JP6 (see note at right)	Uses CMOS switch of RF Signals	

WARNING: Disconnect primary power prior to servicing.

e. Operate the transmitter at maximum TPO, and note that at this time, channel 2 will also have a 5Vp-p squarewave displayed.

f. If the positive going edges of the two waveforms are lined up, no further adjustments are required.

1. If the trace on channel 2 is not aligned in phase, adjust L4 to bring them into phase with each other.
2. If by adjusting L4 the two waveforms will not line up, then different combinations of capacitance as selected by S1 can be switched in to provide various amounts of phase shift.
3. If it appears that the two signals are 180 degrees apart then the plug P3 can be reversed at J3. This should not be the case if the board is simply being replaced assuming the plug position was noted before removal.

NOTE:

When switching in different values of capacitance, try to use the least amount of capacitance (S1-1, 2, and 3) to achieve phase alignment of the two signals. If too much capacitance is used there may not be enough signal input to produce a signal at TP4.

A.8 Oscillator Replacement

A.8.1 Installation

For Replacement install new Oscillator board and note switch and cable connections.

Set Dip switches the same. Note they will be checked after turn "ON."

Remove Crystals and reinstall crystal in new Oscillator board.

Refer to Table A-2 for Jumper configuration.

A.8.1.1 Additional Installation Steps for HD Radio ONLY

Refer to Fig.1 in Application Note following parts list for HD Radio setup.

a. Connect Ext RF Mute from A17J8-2 Oscillator board to the following:

Model	Location	Connection	Notes
DX10/15/25/50	TB1	TB1-23	Connect TB1-21 to TB1-11 for +15V Common

b. Connect External Failsafe as follows

1. HD Rack TB1-23 to DX Oscillator Board J6-1
2. HD Rack TB1-24 to DX Oscillator Board J6-2

c. Run and dress cable so that it does not interfere with doors that open and close.

A.8.2 Final Adjustments

Adjustments are now required once the new board has been installed and made operational.

a. Carrier Detect Setup (see A.7.1)

b. Carrier Frequency Adjust C1 and C3 (see A.7.2)

c. Oscillator Sync Adjustment S1 and L4 (see A.7.3)

d. Turn Transmitter off and set the Jumpers for your Configuration Internal, External, or Auto mode. (JP4, 5, 6)

Refer to appropriate sections above to perform these adjustments.

A.9 Application Notes

Listed here are notes on the DX Oscillator Board 992-8069-004 for HD Radio Applications

This Oscillator board was designed to provide a near instant changeover to a DX transmitter's internal oscillator in the event of 1) a fault signal from the Exciter, or 2) an unexplained loss of external RF drive from the Exciter, with or without a fault. Refer to Fig. A-2 for typical connection.

A.9.1 Operation in Auto Mode

In order to ENABLE an external carrier to provide drive, two signals must be present at inputs to the oscillator board: A +5V failsafe signal from the ePAL or Exciter must be present at terminal J6-1. (enabled by P7 installed 1-2); and an RF drive signal of sufficient threshold must be present at J2 (enabled by P8 installed 1-2). Loss of either or both of these signals will cause the oscillator to revert to internal crystal.

A.9.2 Exciter Critial Fault Driven Event

In the event of a critical fault signal from the Exciter, RF output from the Exciter (Phase) will be muted, and the +5V failsafe signal from ePAL will go to 0 V (bypass mode). If P8 enables External Carrier sensing, the resulting loss of RF drive will cause the Oscillator board to switch, even if the +5V failsafe signal is still present for a brief few seconds. This assures that the oscillator will continue to provide needed RF drive in the event that it takes several seconds for the +5V signal to drop out. A transition of the +5V signal from ePAL from +5V to 0V is an indication that ePAL has entered BYPASS mode, switching off the Magnitude input to the transmitter, and replacing it with an alternate analog only signal. Thus, the combination of loss of RF drive and the transition of the failsafe signal together assure that both the Phase and the Magnitude signals are removed from the transmitter input.

A.9.3 Exciter No Fault Event

When the Oscillator switches from external to internal source, the status output at J8-1 will go high. This can be connected to a user remote control system to alert an operator of the failure mode that may not result in a HI to LO transition of the failsafe voltage (such as somone accidentally removing the Pahse cable, or example), it is left to the user to manually or automatically bypass the Magintude signal in those instances. An automatic sequence might use remote control software routines to sense status from the oscillator board, then sync the ePAL to BYPASS mode remotely. Operation with Magnitude but no phase is to be avoided and may cause potentially harmful interference.

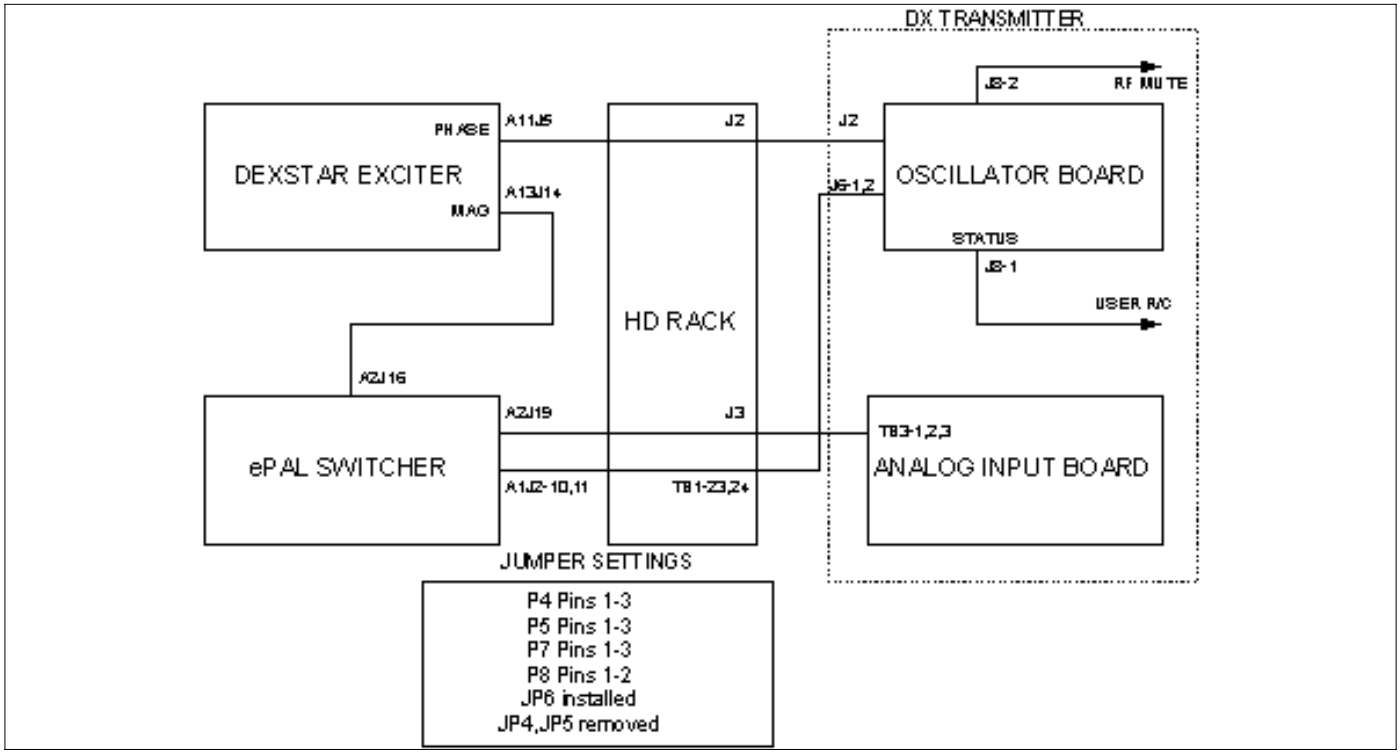
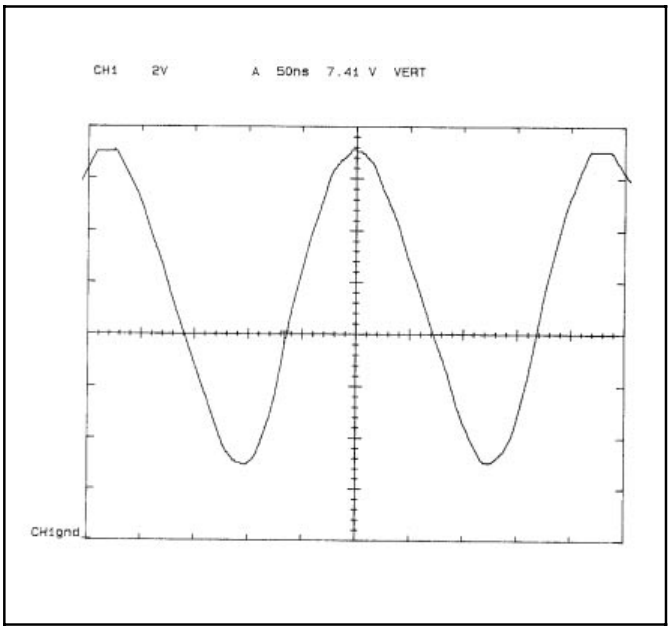
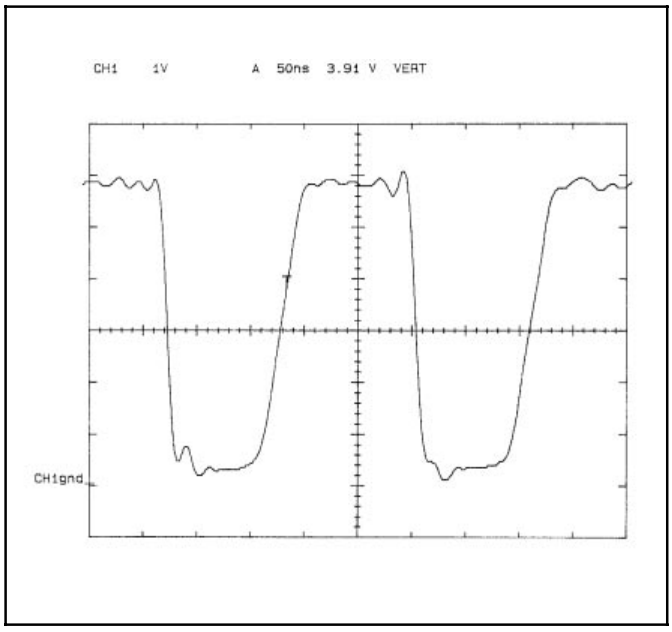


Figure A-2
Typical connections

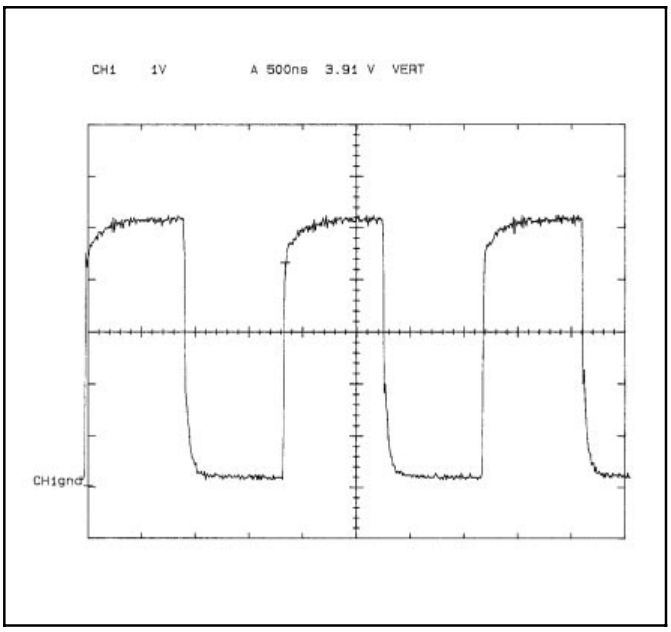
WARNING: Disconnect primary power prior to servicing.



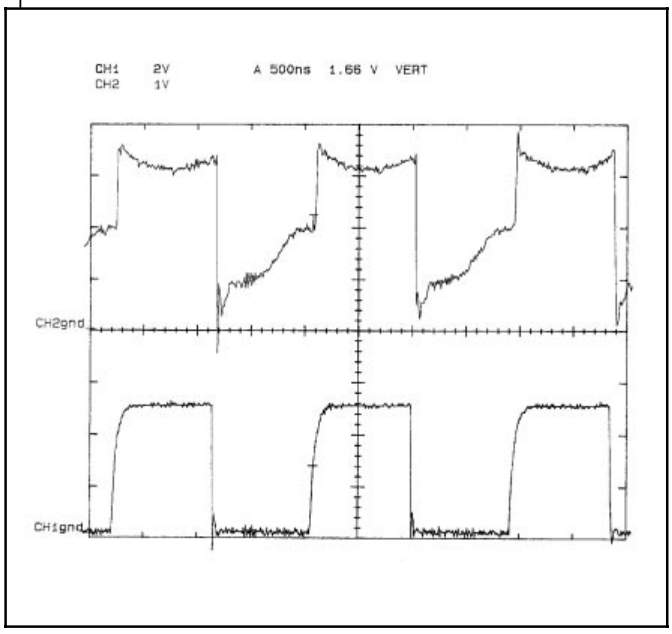
Q1 Base



Q2 Collector

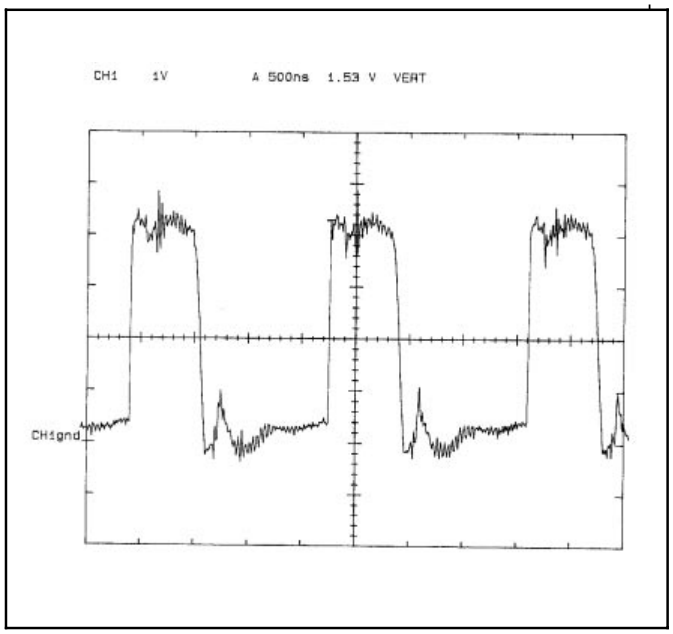


P2-1

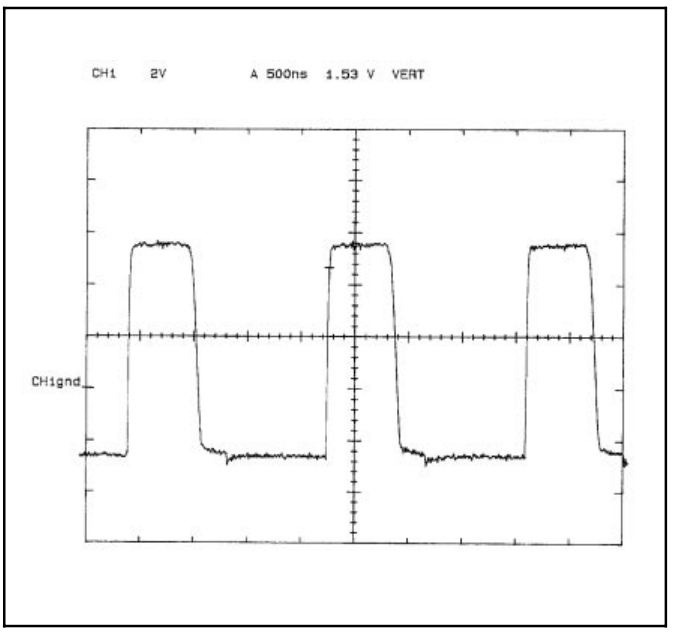


Upper Trace CH2 TP5
Lower Trace CH1 TP4

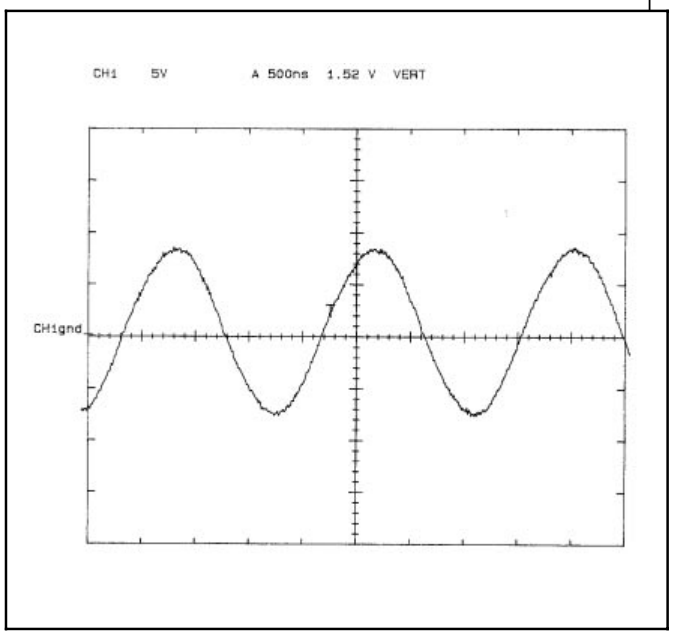
WARNING: Disconnect primary power prior to servicing.



J4-8



J5-1



J3-1

WARNING: Disconnect primary power prior to servicing.

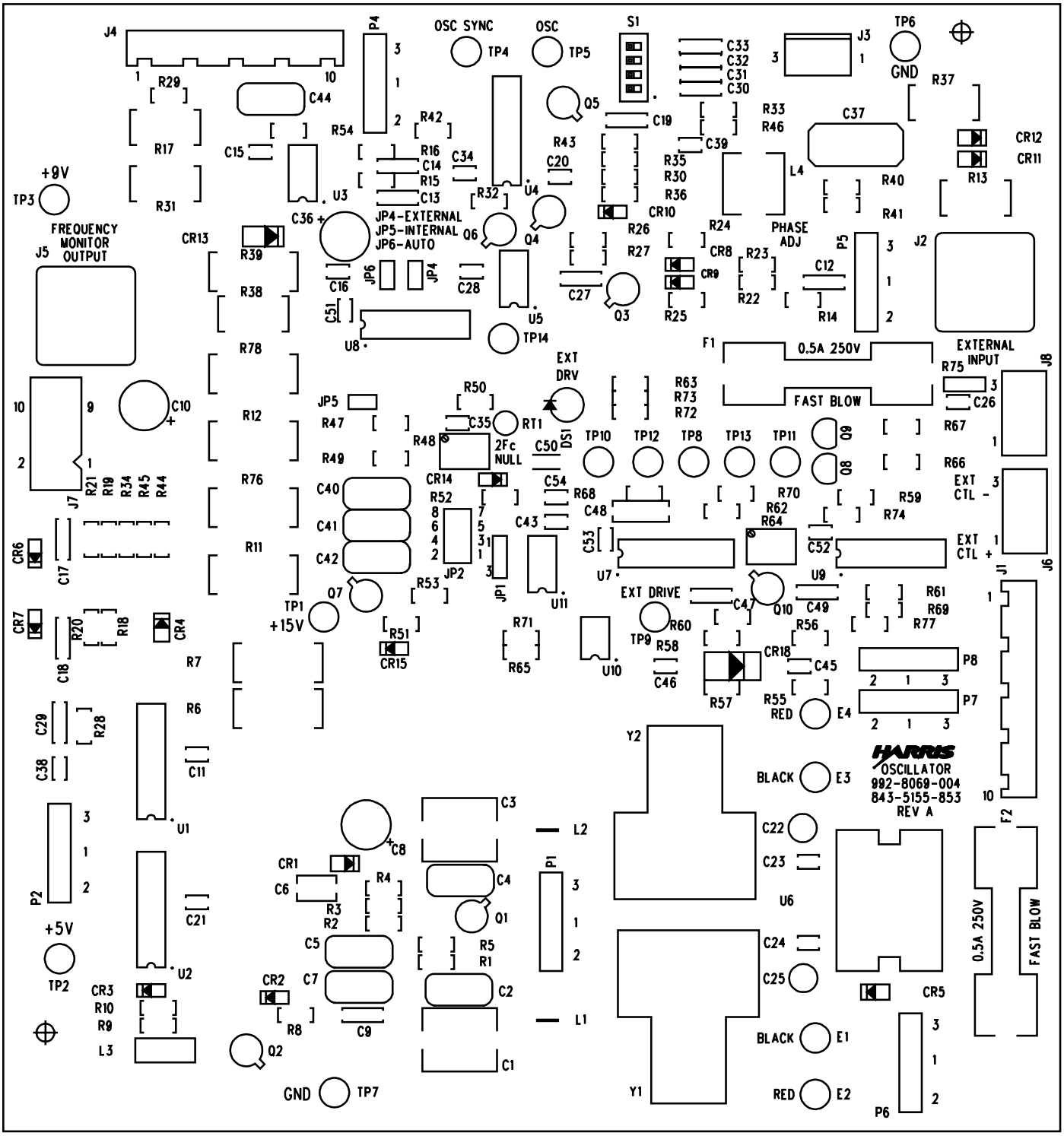


Figure A-3. Oscillator Board Component Locator

WARNING: Disconnect primary power prior to servicing.

PWA, OSCILLATOR, AUTO - 992 8069 004 (E)

Harris PN	Description	QTY	UM	Reference Designators
354 0309 000 . .	TERM SOLDER	18	EA	E001,E002,E003,E004,TP001,TP002,TP003,TP004,TP005, TP006,TP007,TP008,TP009,TP0010,TP0011,TP0012,TP0013 TP0014
358 2399 000 . .	STUD, PC BD 4-40 X 1/2	2	EA	#Y001,#Y002
380 0083 000 . .	XSTR, 2N2369 ESD	8	EA	Q001,Q002,Q003,Q004,Q005,Q006,Q007,Q010
380 0125 000 . .	XSTR, NPN 2N4401 ESD	2	EA	Q008,Q009
382 0130 000 . .	IC, MCT2/IL74 ESD	1	EA	U010
382 0360 000 . .	IC, 7915 ESD	1	EA	U006
382 0581 000 . .	IC, 74LS123 ESD	1	EA	U007
382 0708 000 . .	IC, 74LS86 ESD	1	EA	U009
382 0783 000 . .	IC, 74HC76 ESD	2	EA	U001,U002
382 1010 000 . .	IC, DS0026CN/MMH0026CP1 ESD	3	EA	U003,U005,U11
382 1077 000 . .	IC 301 ANALOG SWITCH SPDT ESD	2	EA	U004,U008
384 0205 000 . .	DIODE SILICON 1N914/4148 ESD	9	EA	CR002,CR003,CR006,CR007,CR008,CR009,CR010,CR014, CR015
384 0431 000 . .	RECT. 1N4001 ESD	1	EA	CR005
384 0679 000 . .	*LED, YELLOW T1-3/4 ESD	1	EA	DS1
384 0720 000 . .	TRANSZORB 1N6377 15V 5W ESD	1	EA	CR018
386 0082 000 . .	ZENER, 1N4744A 15V 1W 5% ESD	1	EA	CR001
386 0093 000 . .	ZENER, 1N4728A 3.3V ESD	2	EA	CR011,CR012
386 0135 000 . .	ZENER, 1N4733A 5.1V ESD	1	EA	CR004
386 0429 000 . .	ZENER 1N5346A 9.1V 5W 10% ESD	1	EA	CR013
398 0015 000 . .	FUSE,FAST CART .500A 250V	1	EA	F002
398 0017 000 . .	FUSE, FAST CART 1A 250V	1	EA	F001
402 0129 000 . .	CLIP, 1/4 DIA FUSE	4	EA	#F001,#F002
404 0513 000 . .	HEAT SINK PA1-1CB	1	EA	#U006
404 0599 000 . .	SOCKET, DIP, 6 PIN (DL)	1	EA	XU010
404 0673 000 . .	SOCKET, DIP, 8 PIN (DL)	4.0	EA	#S001,#U003,#U005,#U011
404 0674 000 . .	SOCKET, DIP, 14 PIN (DL)	3	EA	XU004,XU008,XU009
404 0675 000 . .	SOCKET, DIP, 16 PIN (DL)	3	EA	XU001,XU002,XU007
404 0790 000 . .	HEATSINK, 8-PIN DIP	1	EA	#U003
414 0087 000 . .	BEAD FERRITE SHIELD	2	EA	L001,L002
492 0639 000 . .	COIL, VAR 1.44-2.94UH	1	EA	L004
494 0196 000 . .	CHOKE RF 100UH	1	EA	L003
500 0756 000 . .	CAP, MICA, 330PF 500V 5%	1	EA	C040
500 0761 000 . .	CAP, MICA, 150PF 500V 5%	1	EA	C007
500 0812 000 . .	CAP, MICA, 30PF 500V 5%	2	EA	C002,C004
500 0837 000 . .	CAP, MICA, 510PF 500V 5%	1	EA	C005
500 0838 000 . .	CAP, MICA, 560PF 300V 5%	1	EA	C041
500 0841 000 . .	CAP, 750PF 300V 5%	1	EA	C042
500 0888 000 . .	CAP, MICA, 3900PF 500V 5%	1	EA	C037
500 0912 000 . .	CAP, MICA, 820PF 500V 5%	1	EA	C044
506 0230 000 . .	CAP .001UF 100VAC 5%	9	EA	C013,C014,C017,C018,C027,C029,C030,C047,C049
506 0232 000 . .	CAP, 0.01UF 100V 5%	2	EA	C009,C019
506 0234 000 . .	CAP .0022UF 100V 5%	1	EA	C031
506 0236 000 . .	CAP, 0.0047UF 100V 5%	2	EA	C012,C032
506 0237 000 . .	CAP, 0.0068UF 100V 5%	1	EA	C033
506 0246 000 . .	CAP, 0.47UF 63V 5%	1	EA	C006
516 0375 000 . .	CAP 0.01UF 50V -20/+80% Z5U	2	EA	C023,C024
516 0453 000 . .	CAP .1UF 100V 20% X7R	17	EA	C011,C015,C016,C020,C021,C026,C028,C034,C035,C038, C043,C045,C046,C051,C052,C053,C054
516 0516 000 . .	CAP 1UF 100V 20%	1	EA	C048
516 0725 000 . .	CAP 1.0UF 50V 20%	1	EA	C050

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516 0736 000	CAP .001UF 10% 100V X7R	1	EA	C039
520 0439 000	CAP, AIR VAR 2.4-24.5PF, 500V	2	EA	C001,C003
522 0531 000	CAP 1UF 50V 20%	2	EA	C022,C025
526 0342 000	CAP 2.7UF 35V 10%	2	EA	C008,C036
526 0358 000	CAP 22UF 35V 10%	1	EA	C010
540 1600 111	RES 27 OHM 3W 5%	1	EA	R039
540 1600 209	RES 220 OHM 3W 5%	4	EA	R011,R012,R076,R078
540 1600 212	RES 300 OHM 3W 5%	2	EA	R006,R007
546 0295 000	RES 50 OHM 3.25W 5%	5	EA	R013,R017,R031,R037,R038
548 2400 126	RES 18.2 OHM 1/2W 1%	2	EA	R066,R067
548 2400 130	RES 20 OHM 1/2W 1%	1	EA	R003
548 2400 169	RES 51.1 OHM 1/2W 1%	4	EA	R029,R040,R041,R054
548 2400 193	RES 90.9 OHM 1/2W 1%	4	EA	R055,R056,R057,R058
548 2400 201	RES 100 OHM 1/2W 1%	3	EA	R022,R025,R051
548 2400 230	RES 200 OHM 1/2W 1%	1	EA	R036
548 2400 239	RES 249 OHM 1/2W 1%	1	EA	R072
548 2400 242	RES 267 OHM 1/2W 1%	1	EA	R004
548 2400 285	RES 750 OHM 1/2W 1%	2	EA	R009,R035
548 2400 301	RES 1K OHM 1/2W 1%	15	EA	R005,R015,R016,R026,R027,R028,R030,R032,R042,R044, R053,R059,R060,R061,R062
548 2400 326	RES 1.82K OHM 1/2W 1%	1	EA	R049
548 2400 334	RES 2.21K OHM 1/2W 1%	2	EA	R008,R023
548 2400 341	RES 2.61K OHM 1/2W 1%	1	EA	R047
548 2400 366	RES 4.75K OHM 1/2W 1%	2	EA	R010,R034
548 2400 368	RES 4.99K OHM 1/2W 1%	1	EA	R070
548 2400 373	RES 5.62K OHM 1/2W 1%	3	EA	R024,R050,R052
548 2400 401	RES 10K OHM 1/2W 1%	10	EA	R019,R021,R033,R043,R045,R063,R071,R073,R074,R077
548 2400 430	RES 20K OHM 1/2W 1%	1	EA	R014
548 2400 458	RES 39.2K OHM 1/2W 1%	1	EA	R001
548 2400 501	RES 100K OHM 1/2W 1%	4	EA	R046,R065,R068,R069
548 2400 601	RES 1MEG OHM 1/2W 1%	3	EA	R002,R018,R020
550 0858 000	TRIMPOT 5K OHM 1/2W 10%	1	EA	R048
550 0961 000	TRIMPOT 50K OHM 1/2W 10%	1	EA	R064
558 0041 000	OVEN, XTAL HC6/U 19VDC	2	EA	#Y001,#Y002
559 0053 000	THERMISTOR,NTC,10K@25C,1%	1	EA	RT001
560 0121 003	POSISTOR 0.2 AMP 60VDC DISC	1	EA	R075
604 0852 000	SW, RKR DIP 4-SPST	1	EA	S001
610 0679 000	PLUG, SHORTING, .25" CTRS	7	EA	P001,P002,P004,P005,P006,P007,P008
610 0877 000	HDR, STR, 2 PIN, SQ	3	EA	JP4,JP5,JP6
610 0900 000	HEADER 3 CKT STRAIGHT	1	EA	JP1
610 0979 000	*HDR 10C VERT 2ROW TOP LATCH	1	EA	J007
610 0999 000	HDR, 10 PIN, PC BD	2	EA	J001,J004
610 1110 000	HDR 8C 2R STRT UNPOL	1	EA	JP2
610 1455 000	HDR, 3C 1ROW VERTICAL	1	EA	J003
612 0904 000	JACK, PC MT GOLD PLATED	21	EA	3XP001,3XP002,3XP004,3XP005,3XP006,3XP007,3XP008
612 1184 000	SHUNT JUMPER 0.1" CENTERS	3	EA	XJP1,XJP2,XJP4
612 1206 000	JACK, PC MT FOR .050 PINS	4	EA	#Y001,#Y002
614 0909 000	TERM STRIP, 3C PCB MODULAR 237	2	EA	J6,J8
620 1677 000	RECEPTACLE, PC MT, BNC	2	EA	J002,J005
829 9009 051	BRACKET, OSC. HEATER	2		
843 5155 851	SCH, OSCILLATOR, AUTO	0		
843 5155 853	PWB, OSCILLATOR	1		
999 2450 002	HARDWARE LIST	1	EA	

WARNING: Disconnect primary power prior to servicing.

WARNING: Disconnect primary power prior to servicing.

APPLICATIONS	DX-10 DX-15 DX-20 DX-25U DX-35 DX-50 DX-100	DX-200 DX-200PB DX-250
REFERENCE	VOLTAGE	VOLTAGE
+VA	+22VDC	+18VDC
-VA	-22VDC	-18VDC

11. SELECT JP2 AND ADJUST R48 FOR DIFFERENT DUTY CYCLE ADJUSTMENTS

10. SELECT JP4,JP5,JP6 FOR DIFFRRENT MODES OF OPERATION.

9. FOR EXTERNAL INPUT (0 dBm MINIMUM 25dBm MAXIMUM INTO 50 OHM) CONNECT P5-1 TO P5-3
FOR TTL EXTERNAL INPUT, CONNECT P5-1 TO P5-2

8. FOR Y1 AND OVEN 1 OPERATION CONNECT P1-1 TO P1-2 AND P6-1 AND P6-2
FOR Y2 AND OVEN 2 OPERATION CONNECT P1-1 TO P1-3 AND P6-1 AND P6-3

7. FOR 1251 KHz AND ABOVE DIVIDE BY 4 CONNECT P2-1 TO P2-2
FOR 1250 KHz AND BELOW DIVIDE BY 8 CONNECT P2-1 TO P2-3

12. ADJUST R64 FOR THE FOLLOWING VALUES/FREQUENCY

FREQ(KHz)	500	540	640	740	840	940	1040
OHMS(K)	23	21	17	14	11	9	8
FREQ(KHz)	1140	1240	1340	1440	1540	1640	1740
OHMS(K)	7	6	5	4	4	3	3

NOTES

UNLESS OTHERWISE NOTED:
1. ALL RESISTORS ARE 1/2 WATT, 1%.
2. RESISTANCE IN OHMS.
3. CAPACITANCE IN UF.
4. INDUCTANCE IN UH.
5. (2/A1) SHEET NUMBER, ZONE; CONTINUATION SYMBOL
6. 5% RESISTORS MAY BE SUBSTITUTED FOR ANY RESISTOR UNLESS LABELED 1% ON THIS DOCUMENT.

REVISION

LTR	ZONE	DATE	DFTM	ENG	ECO NUM
E	.	09-22-05	MAB	BK	51834
CLEANUP NETS AT U10					
D	.	06-30-05	MAB	CLL	51540
REVISE SHEET 2					

HARRIS

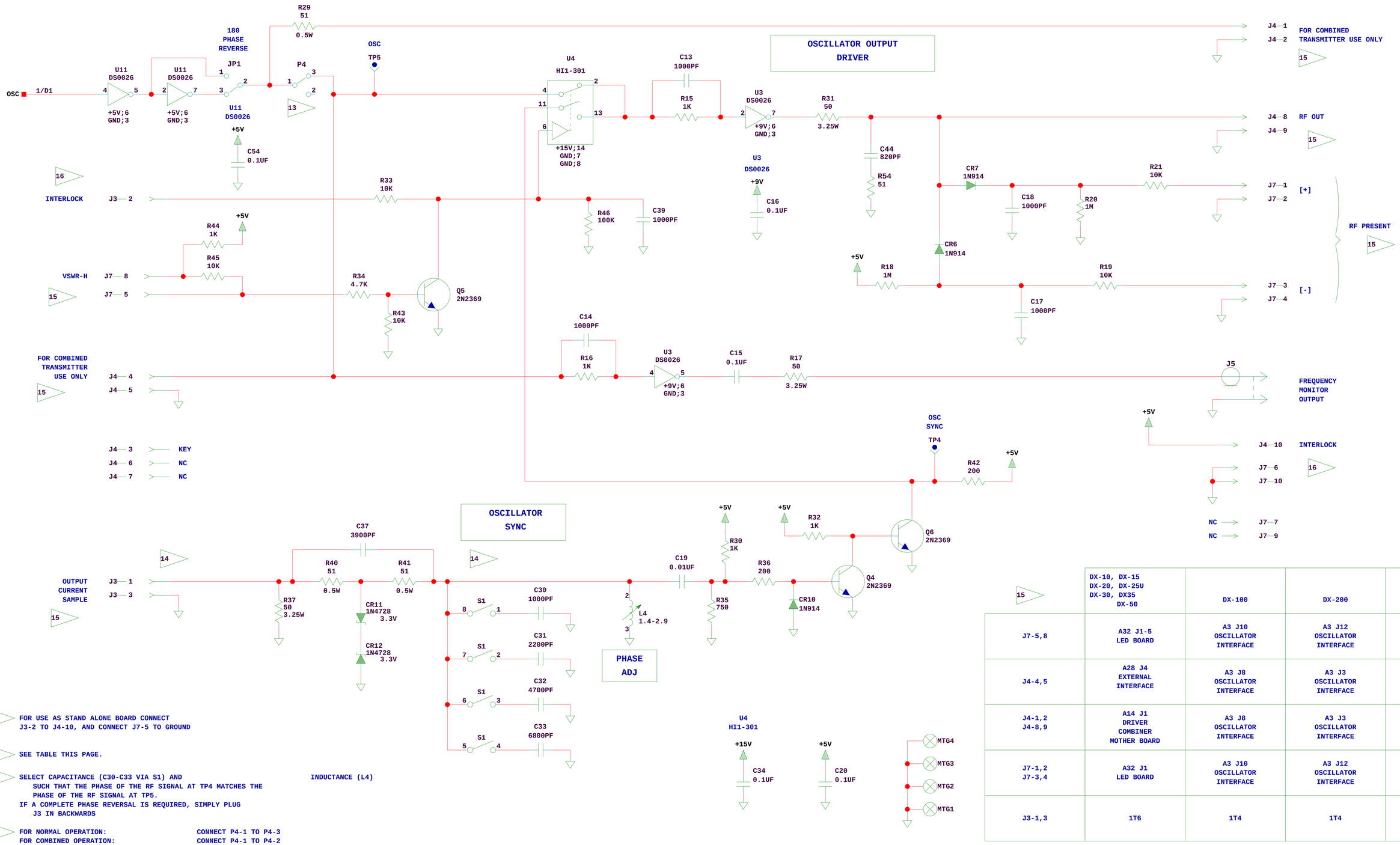
HARRIS CORPORATION
BROADCAST COMMUNICATIONS
4393 DIGITAL WAY
MASON, OHIO 45040

DRAWN BY: M BUNTE
DATE: 10-01-04
ENG CHK: C LUCKHAUPT
PROJ ENG: T HOLLENBERG
MFG ENG: S CORNWELL

TITLE: SCH, OSCILLATOR, AUTO

D SHEET 1 OF 2

DWG # 843-5155-851 REV E



16 FOR USE AS STAND ALONE BOARD CONNECT J3-2 TO J4-10, AND CONNECT J7-5 TO GROUND

15 SEE TABLE THIS PAGE.

14 SELECT CAPACITANCE (C30-C33 VIA S1) AND SUCH THAT THE PHASE OF THE RF SIGNAL AT TP4 MATCHES THE PHASE OF THE RF SIGNAL AT TP5. IF A COMPLETE PHASE REVERSAL IS REQUIRED, SIMPLY PLUG J3 IN BACKWARDS

13 FOR NORMAL OPERATION: CONNECT P4-1 TO P4-3
FOR COMBINED OPERATION: CONNECT P4-1 TO P4-2

INDUCTANCE (L4)

15	DX-10, DX-15 DX-20, DX-25U DX-30, DX35 DX-50	DX-100	DX-200	DX-250
J7-5,8	A32 J1-5 LED BOARD	A3 J10 OSCILLATOR INTERFACE	A3 J12 OSCILLATOR INTERFACE	A3 J12 OSCILLATOR INTERFACE
J4-4,5	A28 J4 EXTERNAL INTERFACE	A3 J8 OSCILLATOR INTERFACE	A3 J3 OSCILLATOR INTERFACE	A3 J3 OSCILLATOR INTERFACE
J4-1,2 J4-8,9	A14 J1 DRIVER COMBINER MOTHER BOARD	A3 J8 OSCILLATOR INTERFACE	A3 J3 OSCILLATOR INTERFACE	A3 J3 OSCILLATOR INTERFACE
J7-1,2 J7-3,4	A32 J1 LED BOARD	A3 J10 OSCILLATOR INTERFACE	A3 J12 OSCILLATOR INTERFACE	A3 J12 OSCILLATOR INTERFACE
J3-1,3	1T6	1T4	1T4	1T4

NOTES
4. INDUCTANCE IN UH.
3. CAPACITANCE IN UF.
2. RESISTANCE IN OHMS.
1. ALL RESISTORS ARE 1/2 WATT, 1%.

UNLESS OTHERWISE NOTED:

6. 5% RESISTORS MAY BE SUBSTITUTED FOR ANY RESISTOR UNLESS LABELED 1% ON THIS DOCUMENT.

5. (2/A1) SHEET NUMBER, ZONE — CONTINUATION SYMBOL

REVISION	LTR	ZONE	DATE	DFTM	ENG	ECO NUM
	E	.	09-22-05	MAB	BK	51834
	REVISE SHEET 1					
	D	.	06-30-05	MAB	CLL	51540
	R42 WAS 1K					

HARRIS CORPORATION
BROADCAST COMMUNICATIONS
4393 DIGITAL WAY
MASON, OHIO 45040

DRAWN BY	M BUNTE
DATE	10-01-04
ENG CHK	C LUCKHAUPT
PROJ ENG	T HOLLENBERG
MFG ENG	S CORNWELL

TITLE: SCH, OSCILLATOR, AUTO

D — SHEET 2 OF 2 — DWG # 843-5155-851 — REV E