

TECHNICAL MANUAL
888-2001-862

SYNTHESIZER
992-9764-435

HARRIS

T.M. No. 888-2001-862

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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 perform 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).

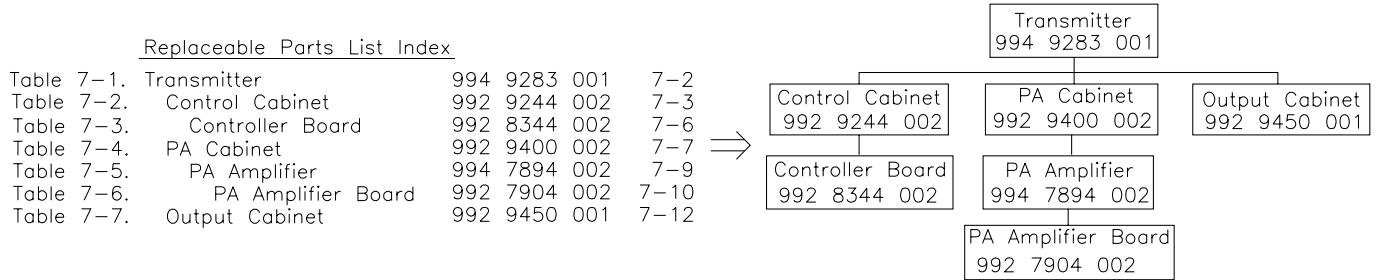
NOTE

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

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:



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.

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.

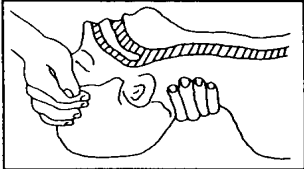
TREATMENT OF ELECTRICAL SHOCK

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

PLACE VICTIM FLAT ON HIS BACK ON A HARD SURFACE

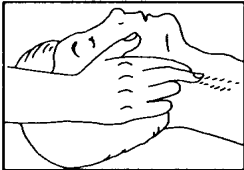
(A) AIRWAY

IF UNCONSCIOUS,
OPEN AIRWAY



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

CHECK
CAROTID PULSE



IF PULSE ABSENT,
BEGIN ARTIFICIAL
CIRCULATION

(B) BREATHING

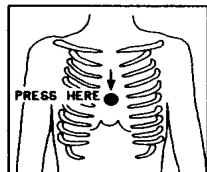
IF NOT BREATHING,
BEGIN ARTIFICIAL BREATHING



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

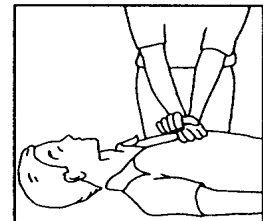
(C) CIRCULATION

DEPRESS STERNUM 1 1/2 TO 2 INCHES



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

APPROX. RATE
OF COMPRESSIONS { TWO RESCUERS
--60 PER MINUTE { 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)

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1 Introduction

This technical manual contains installation, operating and maintenance procedures for the HARRIS Synthesizer Assembly. Harris part number 992-9764-435; the schematic for the Synthesizer proper is 839-8220-560 (wiring Diagram) and 843-5400-871 (printed wiring board).

1.1 Organization of Technical Manual

The manual is divided into these sections:

- Section 1 – Introduction and Overall Description, describes the synthesizer assembly and lists the sections of this technical manual.
- Section 2 – Installation, describes the mounting, environmental requirements and initial setup of the synthesizer assembly.
- Section 3 – Operator’s Guide, explains operation of the synthesizer assembly.
- Section 4 – Theory of Operation, explains the functioning of each part of the synthesizer and aid to servicing of the product.
- Section 5 – Maintenance, describes the adjustments available to the user.

1.2 General Description

The Harris synthesizer assembly generates clock signals from 1 KHz to 10 MHz in 10 Hz steps. The synthesizer has an external 10 MHz reference input and generates a 10 MHz reference output which is either internal or external depending on whether there is a signal present on the external reference input. It has 4 clock outputs, 2 TTL and 2 ECL level. See Figure 1-1 for an illustration of the Synthesizer assembly.

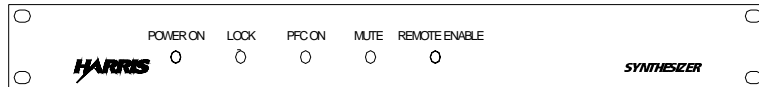


Figure 1-1 Synthesizer assembly

The synthesizer assembly is a rack-mountable unit 19” wide by 1.75” high by 9.75” deep. All interconnections are via the rear panel. This unit can accept a 10 MHz external frequency standard. An external standard is used whenever the user requires extremely high precision. The synthesizer has an ultra high stability OCXO internal oscillator that would satisfy most stability requirements.

The synthesizer assembly can be installed on a standard 19" rack unit or for testing, it can also be operated on any flat surface.
Front panel LED's indicate fault conditions and status.

Harris Synthesizer Specifications:

General

| | |
|---------------------|------------------------------------|
| RF load impedance | 50 Ohm |
| RF Output Connector | BNC |
| Frequency Range | 1KHz to 10MHz in 10 Hz steps |
| External Input | 10 MHz sinusoid, 0 to +10 dBm, BNC |

Performance

| | |
|--|--|
| Internal Reference Frequency and Stability | 10 MHz, 0.5 PPM per year (first year), 0.2 PPM after first year. |
| Frequency Offsets | 10 Hz |
| Maximum Spurs | <= -80 dB |

Service Conditions

| | |
|-------------------------|-----------------------------------|
| Ambient temperature | 0-50 degree Celsius |
| Ambient humidity | 0 to 90% relative, non condensing |
| Physical Dimensions | 19" wide, 7.75" deep, 1.75" high |
| Weight | 5 pounds |
| Electrical Requirements | 85VAC-264VAC 47-63Hz |
| Power Consumption | 10 Watts typical |

2 Installation

2.1 Introduction

Synthesizer assemblies sold as part of a transmitter will normally have been tested in the transmitter before shipment. The synthesizer may be removed for shipment, to be reinstalled after the transmitter is in place. Installation is a simple process, as described in 2.2 below.

Synthesizer sold for use in test facilities can either be rack mounted or operated on a work surface.

2.2 Installing the Synthesizer

The synthesizer is 1.75" high and 19" wide to allow mounting in a 1 rack unit space in a standard 19" EIA rack. A minimum of 12" depth in the mounting rack is needed to allow space for the synthesizer and for its connecting cables.

For installation outside a transmitter or rack cabinet, the synthesizer may be placed on a convenient desk or operating surface.

2.3 Signal Connections

Input and output connections are at the rear of the synthesizer. Figure 2-1 shows the connections. These connections are listed and discussed below.

2.3.1 REF IN Connector (BNC)

REF IN (BNC) is the (Optional) reference frequency input. It is used when very precise frequency control is required. The input impedance is 50 Ohm and the level should be between 0 and +10 dBm.

2.3.2 REF OUT Connector (BNC)

REF OUT (BNC) is a 10 MHz frequency output that is driven by either the internal OCXO 10 MHz reference or the REF IN reference depending on the presence of a signal on the REF IN input. This output is an AC coupled ECL level output.

2.3.3 ECL OUT (BNC)

This is an ECL level signal output which frequency is set by the synthesizer setting. It is a square wave signal. This signal could be used to drive the local oscillator or the external oscillator in AM transmitters.

2.3.4 TTL OUT (BNC)

This is a TTL level signal output which frequency is set by the synthesizer setting. It is a square wave signal. This signal could be used to drive the local oscillator or the external oscillator in AM transmitters.

2.3.5 RS-232 (DB-9)

This is a 9 Pin serial port interface connector. It is used to communicate with the microcontroller which is running the synthesizer. This input is for factory use only!

2.3.6 Remote (DB-25)

This port allows the mute and un-muting of the synthesizer, changing of the frequency setting and monitoring the PLL lock and mute signals.

2.4 Power

AC Power is applied through a standard power cord to the connector at the left corner of the rear panel as shown in Figure 2-1. The AC inlet connector is an assembly containing the power switch and two protection fuses. 0.5A 250V fuses should be installed. The power supply used will accept AC input voltages from 85 VAC to 264 VAC without the need to adjust or tap for changing line voltage. Connect the power cord from the rear of the synthesizer to the power source. Energize the synthesizer by turning on the ac power switch located on the left corner of the synthesizer, as shown in figure 2-1.



Figure 2-1 Synthesizer Inputs and Outputs

2.5 Setting Synthesizer Frequency

The output frequency is set by 6 BCD switches (S1-S6) in the synthesizer module of the synthesizer unit.

For example: To set the output frequency to 1234.50 KHz; set S6 (MHz) to 1, S1 (100 kHz) to 2, S2 (10 KHz) to 3, S3 (1 KHz) to 4, S4 (100 Hz) to 5, S5 (10 Hz) to 0.

3 Operator's Guide

3.1 Introduction

The front panel of the synthesizer is shown in Figure 3-1.

The synthesizer includes several LED indicators on the front panel to signal both normal and abnormal conditions. Green indicates normal, Red indicates abnormal or fault.

- POWER ON Unit is powered up.
- LOCK Green: PLL is locked (normal), Red: PLL is un-locked (fault).
- PFC ON Indicates a signal is present on the REF IN input. External reference is used instead of the internal reference
- MUTE Synthesizer output is muted. Either PLL is un-locked or mute engaged.
- REMOTE ENABLE Synthesizer frequency allowed to be changed from Remote input (not used).

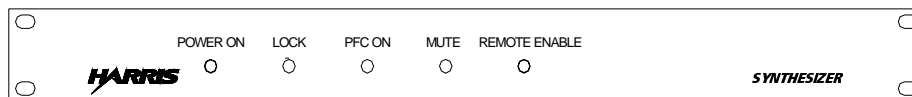


Figure 3-1 Synthesizer Front Panel View

4 Synthesizer Theory of Operation

4.1 General Description

The synthesizer generates a clock signal by locking a PLL at a multiple of the desired output frequency and then dividing this frequency down by the appropriate dividing value. The reference oscillator can either be the internal OCXO or external REF IN signal. If the REF IN signal is present, the synthesizer switches automatically to replace the internal reference with the external reference. The Synthesizer is powered from an internal +5VDC and +/- 15VDC power supply. Re-settable fuses are installed on the 5 and +/- 15 Volt power supply inputs to protect the printed wiring circuit board from current overload.

To mute the output simply ground pin 12 of the REMOTE connector, the front panel mute LED should be on. To un-mute simply leave the same pin floating.

Command inputs are conditioned by an integrated circuit de-bouncer to eliminate switch bounce. Isolation is provided by opto-isolator IC's before routing to the input registers. The output registers status lines are buffered outputs.

The 8-bit microprocessor contains on-board flash, SRAM, and an EEPROM. The microprocessor boots from the on-board flash memory which contains the factory loaded software. The clock is a 3.68 MHz crystal which directly interfaces with the microprocessor.

The only adjustments in the PLL circuitry are R47 and R64 which control the PLL loop bandwidth.

Reference schematic 843-5400-871.

5 Troubleshooting

5.1 Power Supply

The power supply voltages are current limited by resistors R61, R54 and R38. Reference schematic 839-8220-560 for power supply inputs. A first order check of the +5, +/- 15 Volt power supply can be done by checking LED indicators DS1, DS3 and DS4. Measuring the supply input voltages with a voltmeter is the preferred method of power supply verification because the watchdog IC will reset the microprocessor at 4.4V and a lower than normal power supply may still illuminate the LED. Measured voltage after R54 should be 4.75V minimum. The 5 volt current draw is 600mA or less. The +15 volt power supply requirements are 150mA. If power supply inputs are within normal levels the Power On front panel led should be on.

5.2 Microprocessor Circuitry

If the microprocessor is working properly, the micro OK LED DS10 should be blinking at approximately a 1 second rate. If DS10 is not blinking, check if the reset LED DS2 is on. If DS2 is on check the 5 volt power supply input. The power supply input must be greater than 4.4 volts. If DS10 is not blinking and DS2 reset LED is not on, press the manual reset switch S7 to reset the microprocessor.