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Digalog DS-400 Installation Manual

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DIGI-SCAN
DS-400

OWNERS MANUAL

DIGALOG TECHNOLOGY, INC.

4216 North Maxson Road
El Monte, California 91732 U.S.A.

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DIGI-SCAN
Model DS-400

Operation and Installation Manual
1-15-81

This manual applies directly to
Digalog Technology, Inc. (D.T.I.) Model DS-400

CERTIFICATION

D. T. I. certifies that this instrument was thoroughly tested and inspected and found to meet the published specifications. Each unit is exposed to a minimum of 48 hours of burn in.

DISCLAIMER

D. T. I. Digi-Scan systems are manufactured as receiving systems only, and to use them for transmission in the United States is in direct violation of the Federal Communications Commission.

ALL PRICES & SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

Table of Contents

Section 1
Operation

The D.T.I. DS-400 system is designed to expand the receiver frequency range of most 40-channel PLL transceiver systems now in use. The 400 is field programmable, which allows operation on different types of radios with one unit. The 400 automatically displays the receiver frequency with a 5-digit frequency monitor system. The operating frequency range of the receiver is now increased to a maximum of 28.000 MHz* in 5 KHz steps. This gives the AM-SSB operator a total of 1200 channels. This system should be installed by a licensed technician only.

The Digi-Scan 400 will adapt to most 40-channel SSB, PLL radios. The applications chart beginning on Page 4 lists the radios which can be used with the 400.

Different types of radios have different frequency ranges. D. T. I. has developed a system whereby the user can tell if his radio is operating on the frequency displayed by the 400. The system is called an "out of lock" indicator. If, for any reason, the radio should go out of lock, the first digit on the 400 will become an "L" instead of a "2". (Shown in Fig. 1)

Identification: D. T. I. uses a basic numerical serial number series. Refer to the title page for any change that may affect your unit. All changes will be noted by serial number effectivity for easy reference. The serial number of the Digi-Scan is located on the bottom.

*Frequency range is dependent on type of radio used.
See applications chart for radio ranges.

CONTROLS AND FUNCTIONS

This section covers the various controls and basic description of their operation.

Fig. 1 — Controls and Functions
(DS-400 shown in an unlocked condition)

Scan Switch: A momentary toggle switch which controls the scan function. Push the scan switch down or up and hold for changes in frequency. (10 steps/second)

Step Switch: A momentary toggle switch which controls the frequency selection one step (5 KHz) at a time. Push the step switch up or down and release for each frequency change desired.

SPECIFICATIONS

Frequency Range	25.995 MHz to 28.000 MHz* in 5 KHz steps
Readout	1/2" high, 5 digit, 7 segment LED
Resolution	least significant digit = 1 KHz
Power Consumption	450 Ma at 13.8 VDC (27.155)
Size	1½" x 5" x 5½"
Scan Rate	10 steps/sec.
Operating Temperature Range	10° to 40°C
Storage Temperature Range	– 40° to 75°C

** Frequency range is dependent on the type of radio used.*

Section 2
Applications & Installations

APPLICATIONS CHART

RANGE CODE LEGEND	
1	25.995 - 28.000 MHz
2	26.150 - 28.000 MHz
3	26.300 - 28.000 MHz
4	26.500 - 28.000 MHz
5	26.700 - 28.000 MHz
6	26.960 - 28.000 MHZ

MANUFACTURER	MODEL	TYPE AM or SSB	PROGRAM CODE	INSTAL-LATION	PLL CHIP USED	TYPICAL RANGE CODE
BOWMAN	DB-950	S	2	4	PLL-02A	6*
COBRA	21 XLR	A	1A	6	858	4
	29 XLR	A	1A	6	858	4
	138 XLR	S	1	5	858	2
	139 XLR	S	1	5	858	2
	140 GTL	S	6	1	8719	1
	142 GTL	S	6	1	8719	1
	148 GTL	S	5	2	8719	4
	2000 GTL	S	5	3	8734	4
COLT	1200	S	2	4	PLL-02A	6*
	485	S	2	4	PLL-02A	6*
COURIER	Gladiator	S	1	8	858	2
	Spartan	S	1	7	858	2
	Centourian	S	1	8	858	2
	Galaxy	S	5	2	8734	4
FANNON	Fanfare 350-F	S	1	7	858	2
GEMTRONICS	6TX-77	S	2	4	PLL-02A	6*
JC PENNEY	981-6247	S	2	4	PLL-02A	6*
	981-6241	S	9	13	SM5104	4
LAFAYETTE	SSB-140	S	2	4	PLL-02 A	6*
MIDLAND	78-976	S	2	4	PLL-02A	6*
	78-999	S	2	4	PLL-02A	6*
	79-893	S	1	7	858	2
	79-892	S	2	4	PLL-02A	6*
	79-900	S	6	1	8719	1
	78-892	S	2	4	PLL-02A	6*

*PLL-02 chassis can be modified for lower frequency operation. See Installation #4.

MANUFACTURER	MODEL	TYPE AM or SSB	PROGRAM CODE	INSTAL-LATION	PLL CHIP USED	TYPICAL RANGE CODE
NDI	PC200	S	15	13	NDC-40013	3
PALOMAR	SSB-500	S	10	9	145106	4
	SSB-500	S	10	10	7120	4
PRESIDENT	Adams	S	1	5	858	2
	Andrew J (old)	A	1A	6	858	3
	Dwight D (old)	A	1A	6	858	3
	Grant (old)	S	1	5	858	2
	Honest Abe	A	1A	6	858	3
	John Q	A	1A	6	858	3
	Madison (old)	S	1	5	858	2
	Teddy R	A	1A	6	858	3
	Washington (old)	S	1	5	858	2
	Zachary T	A	1A	6	858	3
	Washington	S	6	1	8719	1
	Grant	S	5	2	8719	4
	McKinley	S	6	1	8719	1
	Madison	S	5	2	8719	4
REALISTIC	TRC-449	S	1	5	858	2
	TRC-455	S	1	5	858	2
	TRC-458	S	1	5	858	2
	TRC-457	S	1	5	858	2
ROBYN	SB-505	S	6	1	8719	1
	SB-510D	S	1	5	858	2
	SB-520D	S	1	5	858	2
SBE	27CB	S	4	14	Descrete	2
	39CB	S	4	14	Descrete	2
	40CB	S	4	14	Descrete	2
SCOTT	DAK 10	S	2	4	MC145106	6*
SEARS	663.38060600	A	1	6	858	3
	934.38110700	S	9	11-12	SM5104	4
	934.38260700	S	9	11-12	SM5104	4
	934.28360700	S	9	11-12	SM5104	4
TEABERRY	T Command	A	1A	6	858	5
	Stalker 101	S	1	5	858	2
	Stalker 102	S	1	5	858	2
TRAM	D-80	S	5	2	8734	4
	D-300	S	5	2	8734	4

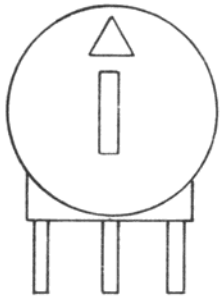
*PLL-02 chassis can be modified for lower frequency operation. See Installation #4.

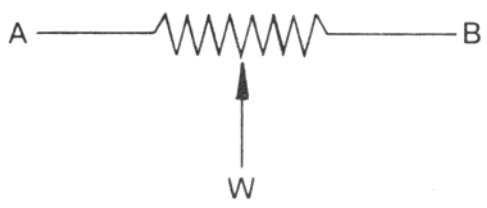
INSTALLATIONS

-IMPORTANT-

One of two styles of potentiomters for the loop filter will be supplied with the 400. The diagram below indicates pin locations for both.

STYLE "B"





WIPER

INSTALLATION #1

Uniden 8719 Chassis (11.1125 crystal)

1. Remove the transceiver case and the 400 case.
2. Locate and identify the MB 8719 PLL chip—normally close to the channel selector.
3. Remove the MB 8719 PLL chip. Exercise caution not to damage the PC board during this exercise.
4. Locate R72 and cut one lead. R201 (11.325)
5. Connect the shields of Coax #1 and Coax #2 to ground. *See Fig. 2.*
6. Connect the center lead of Coax #1 to TP-10. *See Fig. 2.*
7. Connect the center of Coax #2 to TP-9. *See Fig. 2.*
8. Loop Filter installation: Locate the 10K trimpot and 10uf capacitor supplied with the 400. Solder the wiper of the trimpot to ground *(see Fig. 2).* Install the 10uf capacitor between one end of the trimpot and TP-9. Observe polarity; the negative (–) lead of the capacitor must connect to the trimpot. Remember to keep leads as short as possible during this procedure. (See page 6)

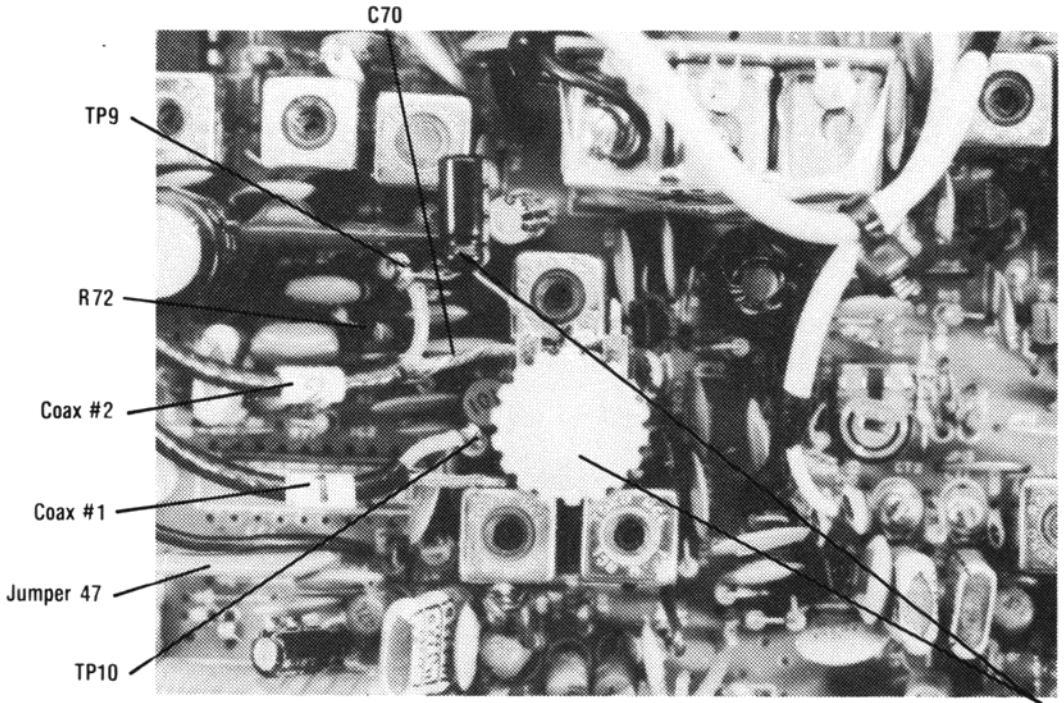


Fig. 2 — Location of Test Points
(MB 8719 PLL, 11.1125 crystal)

9. Connect the black wire to **radio circuit ground** near the power supply or modulator section.
10. Connect the red wire to a 12V source in the radio. (Example: to the power switch normally located on the back of the volume control.)
11. Remove C70 or equivalent from the radio. (Fig. 2)

C89/70 (11.325)

12. Cut the jumper wire *(see Fig. 2, labeled #47)*, located behind the channel selector to comply with FCC regulations.

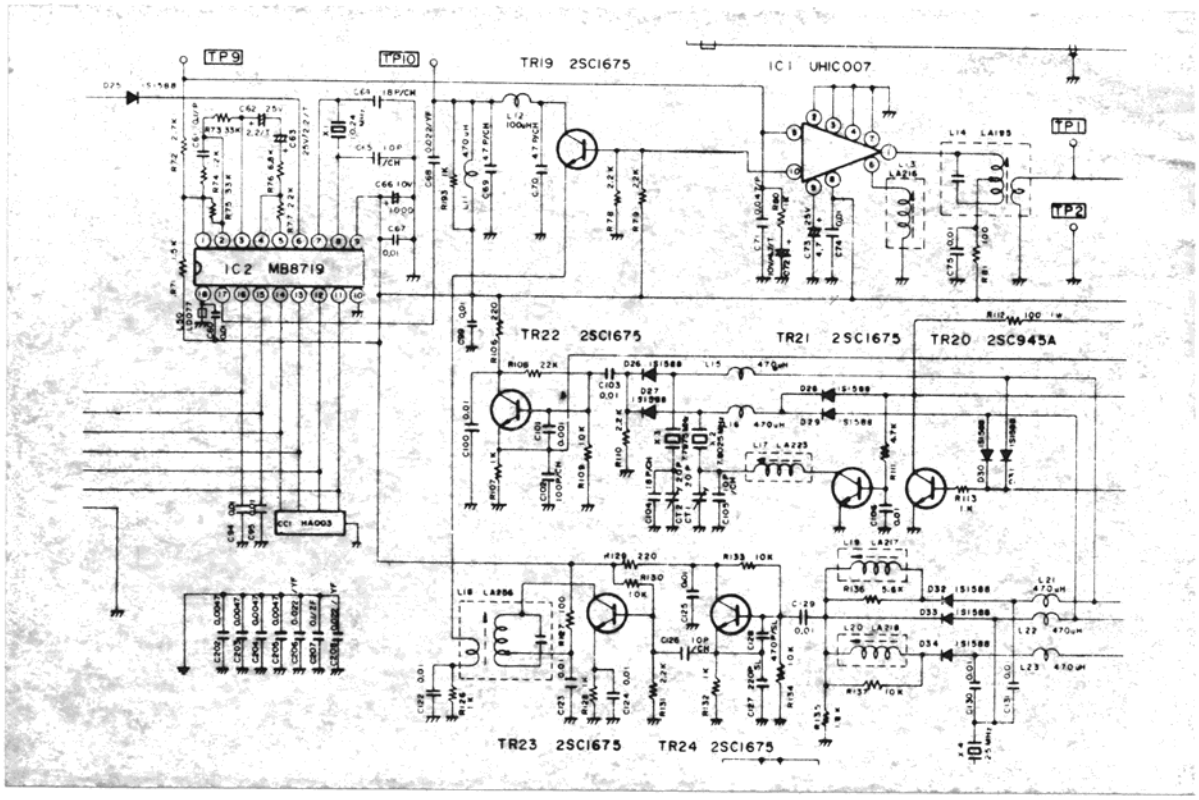


Fig. 3 — Schematic Diagram
(MB8719 PLL, 11.1125 crystal)

This completes the installation procedure. Before operation, the 400 must be programmed and the radio must be realigned. Turn to the programming section and proceed.

INSTALLATION #2

Uniden 8734 / 8719 Chassis (11.3258 crystal)

Installation #2 is identical to Installation #1 except for the following:

1. Step #4: Locate R207 and cut one lead.
2. Reference installation to *Figs. 4 & 5* rather than Figs. 2 & 3.
3. Step 11: Remove C89/C70 to prevent down mixer oscillation.

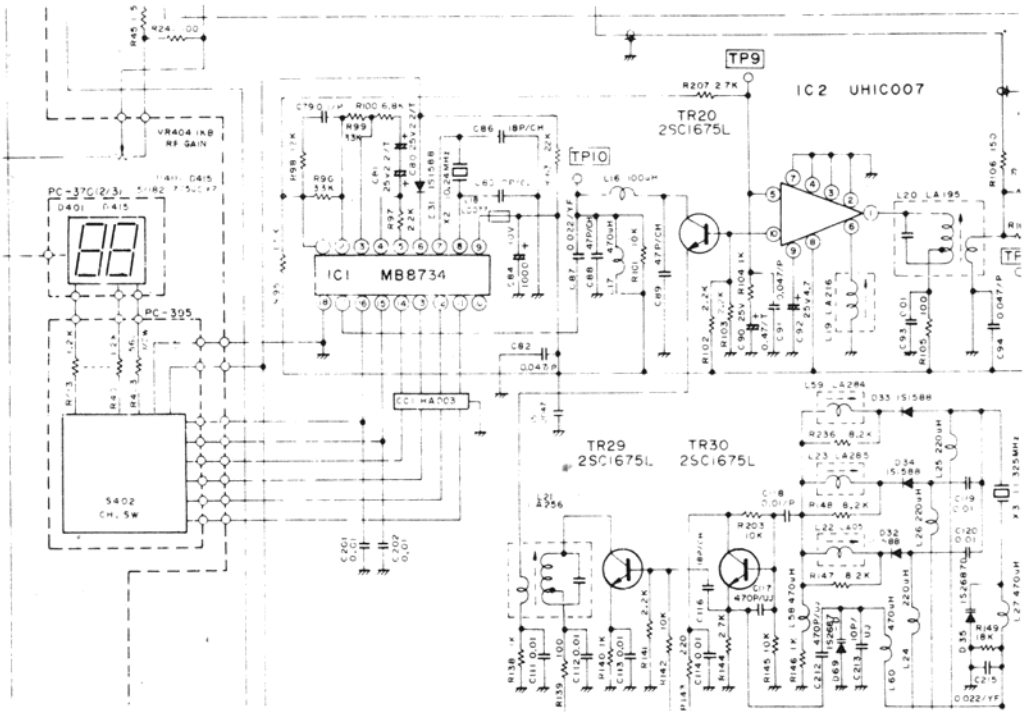


Fig. 4 — Schematic Diagram
(MB8719-MB8734 PLL/11.3258 crystal)

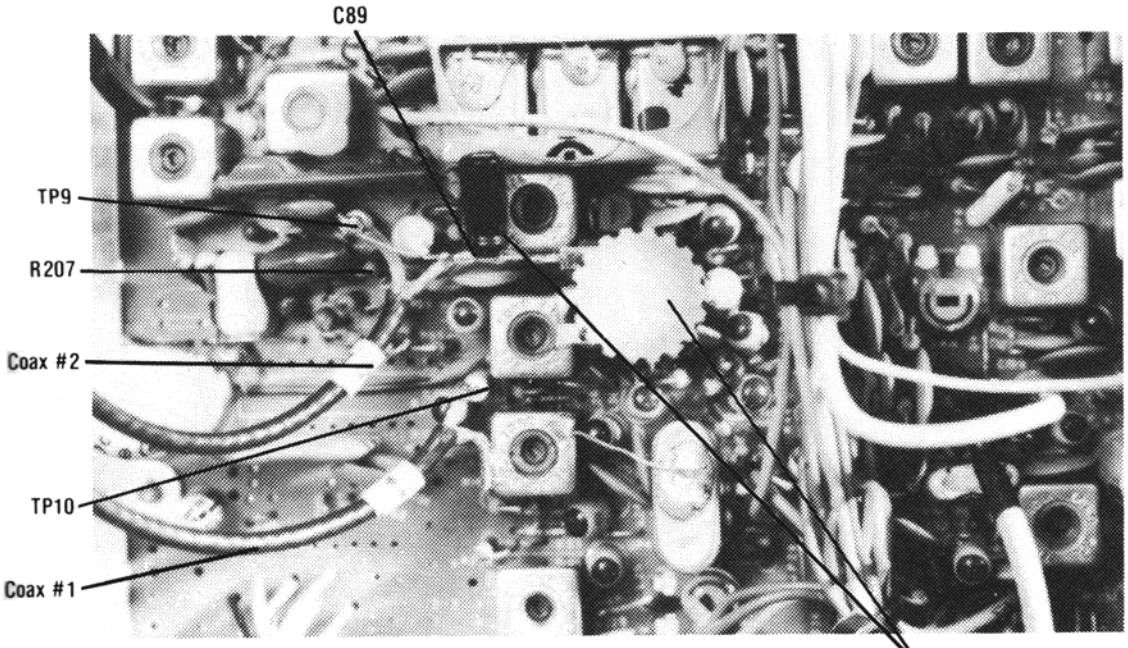


Fig. 5 — Test Point Location
(MB8719-MB8734 PLL 11.3258 crystal)

This completes the installation procedure. Before operation, the 400 must be programmed and the radio must be realigned. Turn to the programming section and proceed.

INSTALLATION #3

Cobra 2000 GTL

The Cobra 2000 GTL installation is identical to Installation #2 except for the following:

1. Add a 2000uf 16V capacitor between power supply ground and radio ground. Observe polarity! *See Fig. 6.*

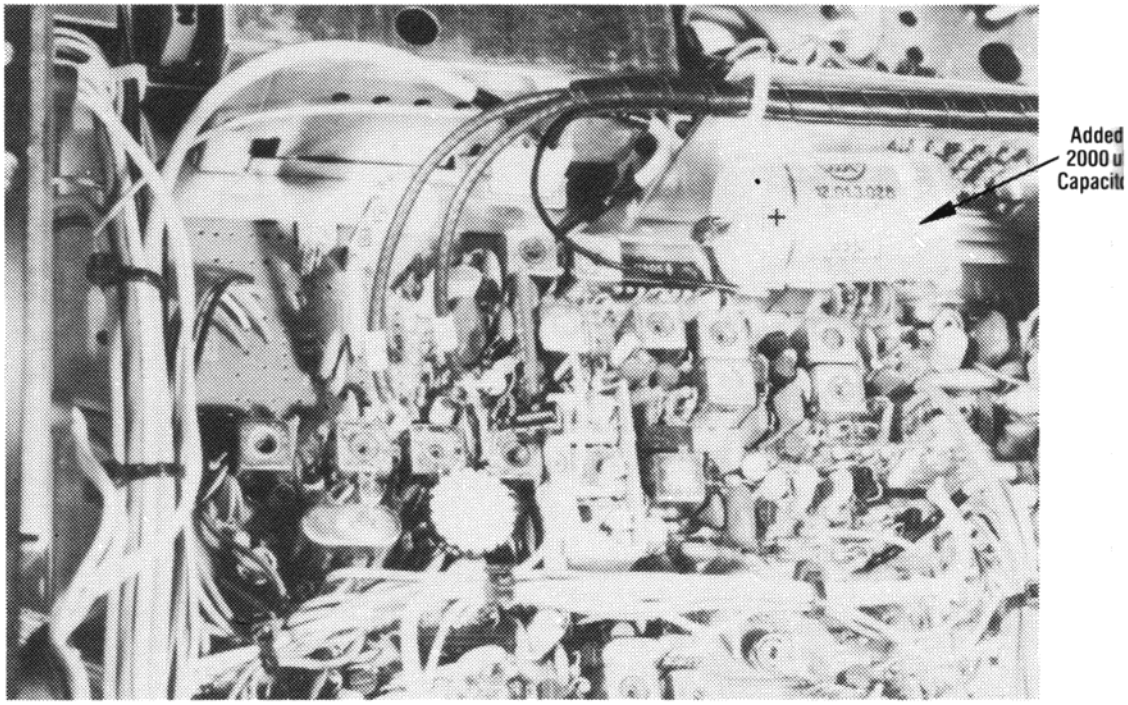


Fig. 6 — Cobra 2000 GTL with modified ground loop.

This capacitor is needed because the 2000 GTL switches the ground of the radio for power control. The added capacitor allows the radio to get a better ground from the power supply.

This completes the installation procedure. Before operation, the 400 must be programmed and the radio must be realigned. Turn to the programming section and proceed.

INSTALLATION #4

For Cybernet Radios (PLL 02A / MC145106)

This section describes the installation of the 400 to Cybernet radios (PLL 02A / MC145106).

NOTE: Cybernet chassis using the PLL 02A or MC145106 PLL will not operate below 26.960 MHz without changing the 10.0525 crystal (X1) to 9.87 MHz. 9.87 MHz crystals are available from D. T. I. *at $3.50 each.*

When X1 is changed, the radio offsets must be realigned and the program code will change. The program chart on page 24 lists 3 possible codes for the 02A chassis.

Installation:

1. Remove the transceiver and the 400 cases.
2. Locate and identify the PLL 02A chip—normally close to the channel selector of the transceiver *(see Fig. 7).*
3. Turn transceiver over and unsolder the PLL chip and remove it. Note where pin 2 was connected.
4. Locate where pin 2 of the PLL 02A chip was connected *(see Fig. 7)* and connect the center of Coax #1 to this point.

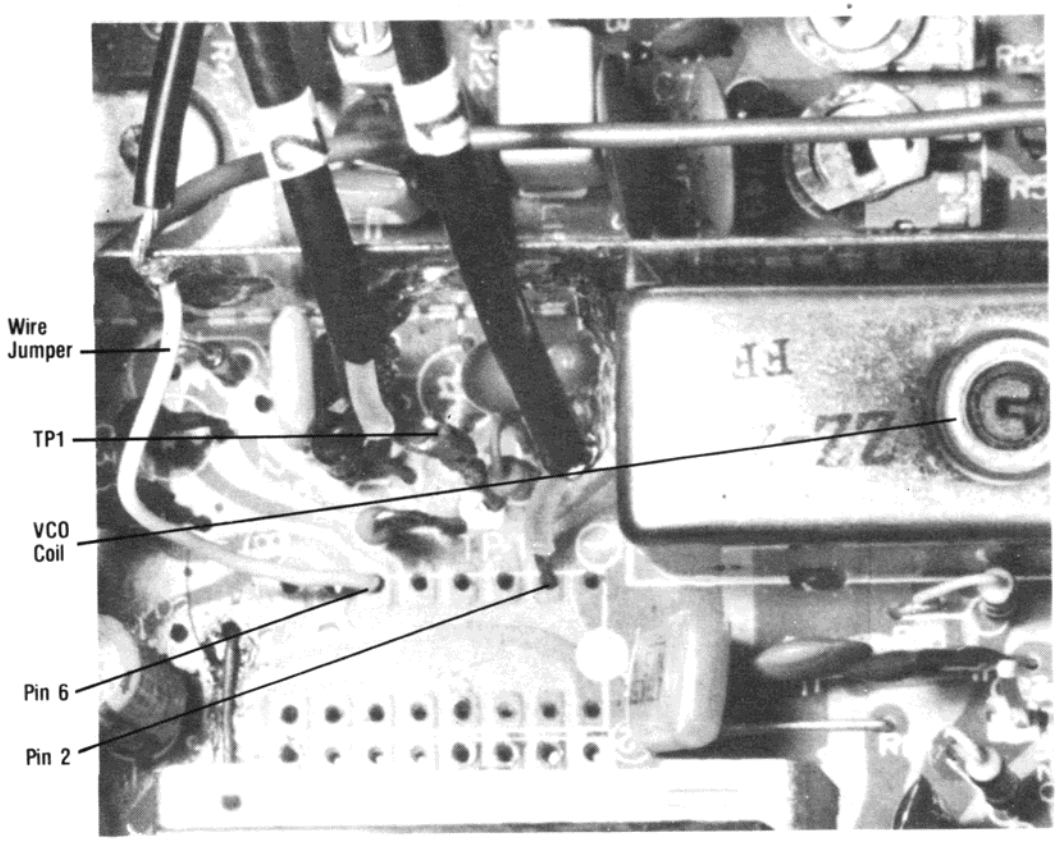


Fig. 7 — Location of Test Points (PLL 02A / MC145106)
(Loop Filter not shown)

5. Locate test point #1 (TP1) and connect the center of coax #2 to this point.
6. Loop Filter Installation: Locate the 10K trimpot and 10uf capacitor supplied with the 400. Solder the wiper of the trimpot to ground. Install the 10uf capacitor between one end of the trimpot and TP1. Observe polarity; the negative (–) lead of the capacitor must connect to the trimpot. Remember to keep leads as short as possible during this procedure.
7. Connect the ground shield of both coax cables to ground. (Example: *see Fig. 7).* CAUTION: avoid excessive heat.

   NOTE: Steps 8 & 9 must be performed to comply with FCC regulations.
8. Lccate where pin 6 of the PLL 02A was connected *(see Fig. 7).*
9. Install a 20-22 GA insulated wire jumper between pin 6 and any convenient ground point.
10. Connect black wire from controller to a good **radio circuit board ground.**
11. Connect the red wire to the 12 volt source in the radio. (Example: to the power switch normally located on the back of the volume control).

This completes the installation procedure. Before operation, the 400 must be programmed and the radio must be realigned. Turn to the programming section and proceed.

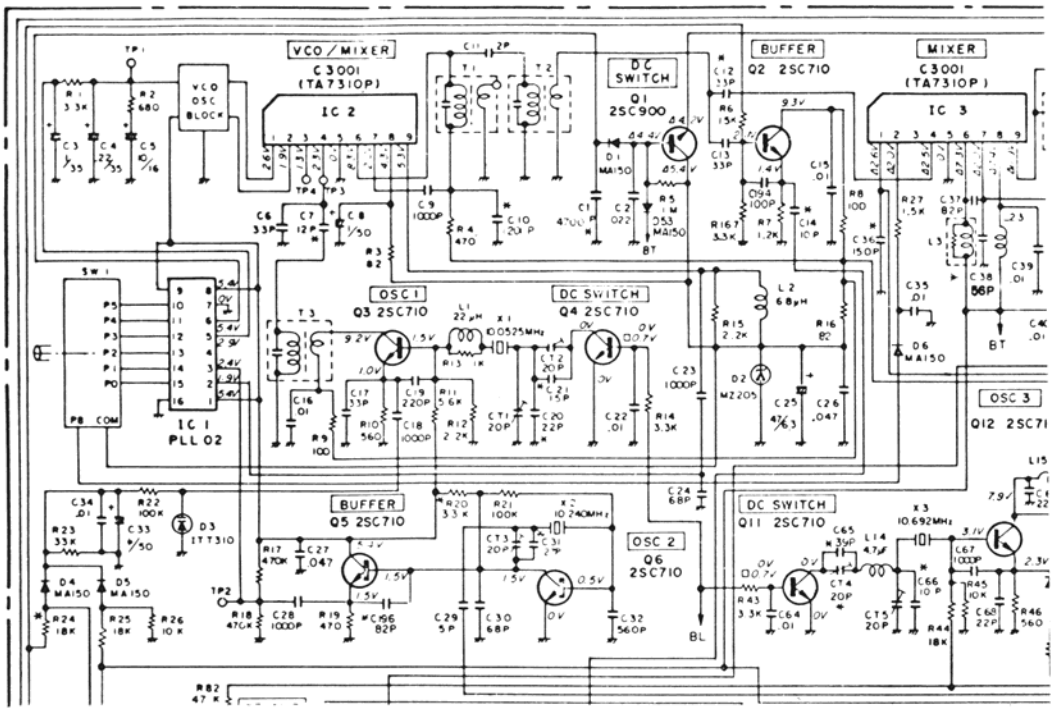


Fig. 8 — PLL 02A Synthesizer Schematic Diagram

INSTALLATION #5

Uniden SSB Radios (858)

This section describes the installation of the 400 to the earlier Uniden 858 SSB radios.

Installation:

1. Remove the transceiver and 400 cases.
2. Locate and identify Pin 11 of the PLL chip—normally close to the channel selector in the transceiver *(see Fig. 9).* Solder the center of Coax #1 to Pin 11 of the D858 PLL Chip. Use caution and avoid excessive heat as it will damage the PLL Chip.
3. Locate and identify R158 15K ohm resistor that connects Pin 2 of D858 and Pin 3 *(se Fig. 9).* Remove the 10.240 crystal (X5) from the radio.

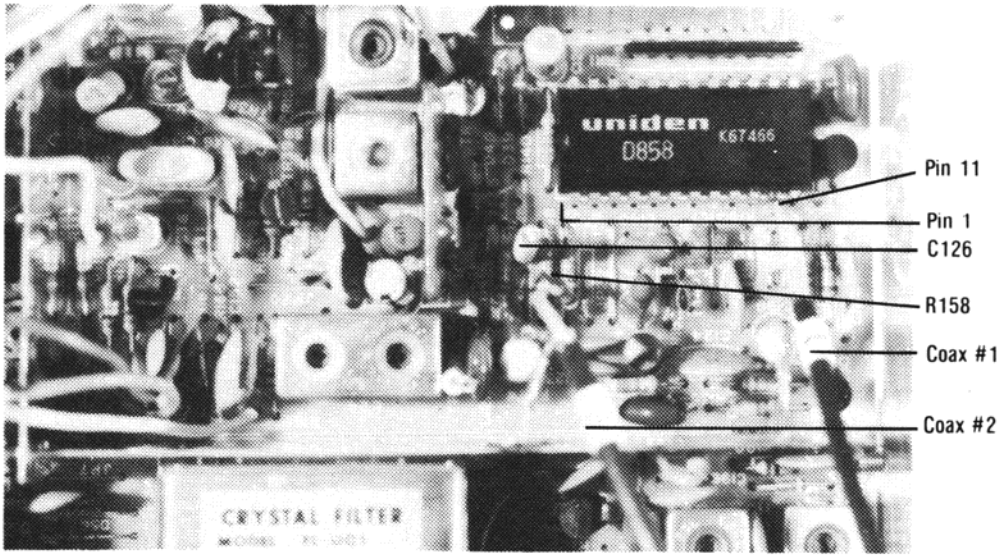


Fig. 9 — Parts Location (D858 SSB Chassis)

4. Remove the one side of R158 that is connected to Pin 2 of the D858 PLL Chip and install the center of Coax #2 to this lead of R158 as per Fig. 9.
5. Connect the ground shields of both coaxes to ground. (Example: *see Fig. 9).* CAUTION: Avoid excessive lead length.
6. Locate and identify C126, a 1 mfd capacitor, and install a 20-22 gauge jumper wire across it's leads to remove it from the circuit.
7. Connect the black wire from the 400 to a good ground point in the radio near the power supply or modulator section. **Radio circuit ground.**
8. Connect the 12 volt red wire to the foil marked #184 located near the transmit-receive relay which is operational on receive only.

This completes the installation procedure. Before operation, the 400 must be programmed and the radio must be realigned. Turn to the programming section and proceed.

INSTALLATION #6

Installation #6 applies to older Uniden 858 AM radios. This installation is identical to installation #5 except for the following:

1. Step #3—Locate and identify R104 (5.6K) that connects Pin 2 to Pin 3 of the 858 chip.
2. Step #—Remove the one side of R104 that is connected to Pin 2 of the D858 PLL Chip and install the center of Coax #2 to this lead of R104.
3. Step #6—Locate and identify C140, a 1 mfd capacitor, and install a 20-22 gauge jumper wire across it's leads to remove it from the circuit.
4. Step #8—Connect the red wire to the 12 volt source of the radio.
5. Remove TR-22 to comply with FCC regulations.

NOTE: Loop Filtering: On some 400 installations additional loop filtering may be required because of the close channel spacing and large badwidth. By adding the modifications below, low end stability will improve.

1. Add a 1K resistor in series with R103.
2. Series a 10uf electrolytic capacitor and a 10K pot from TP5 to ground. Adjust 10K pot for best VCO stability. Observe polarity.

This completes the installation procedure. Before operation, the 400 must be programmed and the radio must be realigned. Turn to the programming section and proceed.

INSTALLATION #7

This section describes the installation to 858 SSB radios with the PLL circuitry contained on a separate board.

1. Remove the transceiver and 400 cases.
2. Locate and identify Pin 11 of the PLL Chip—normally close to the channel selector in the transceiver *(see Fig. 10).* Solder the center of Coax #1 to Pin 11 of the D858 PLL Chip. Use caution and avoid excessive heat as it will damage the PLL Chip.
3. Locate and identify R154 15K ohm resistor that connects Pin 2 of D858 and Pin 3 *(see Fig. 10).*
4. Remove the one side of R154 that is connected to Pin 2 of the D858 PLL Chip and install the center of Coax #2 to this lead of R154 as per Fig. 10.
5. Connect the ground shields of both coaxes to ground. (Example: *see Fig. 10).* CAUTION: **Avoid excessive lead length.**
6. Locate and identify C508, a 33 mfd capacitor, and install a 20-22 gauge jumper wire across it's leads to remove it from the circuit.
7. Connect the black wire to radio circuit ground near the power supply or modulator section.
8. Connect the red wire to a 12V source in the radio.
9. Remove TR-22 to comply with FCC regulations.

Refer to Programming Section and proceed.

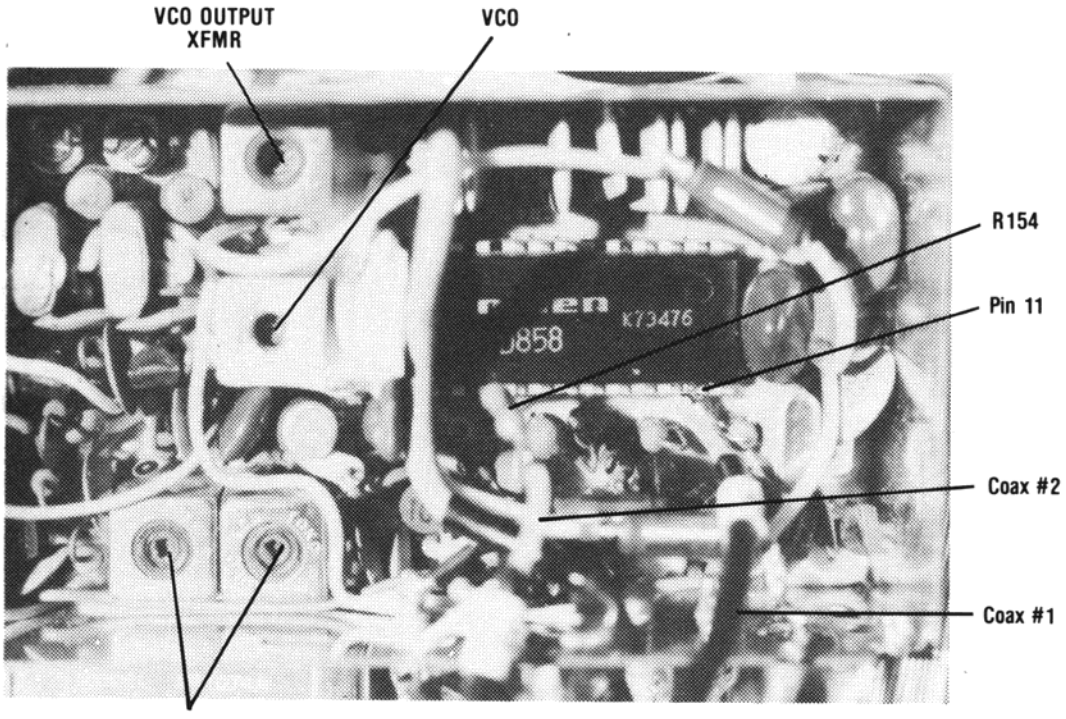


Fig. 10 — Parts Location (D858 PLL)

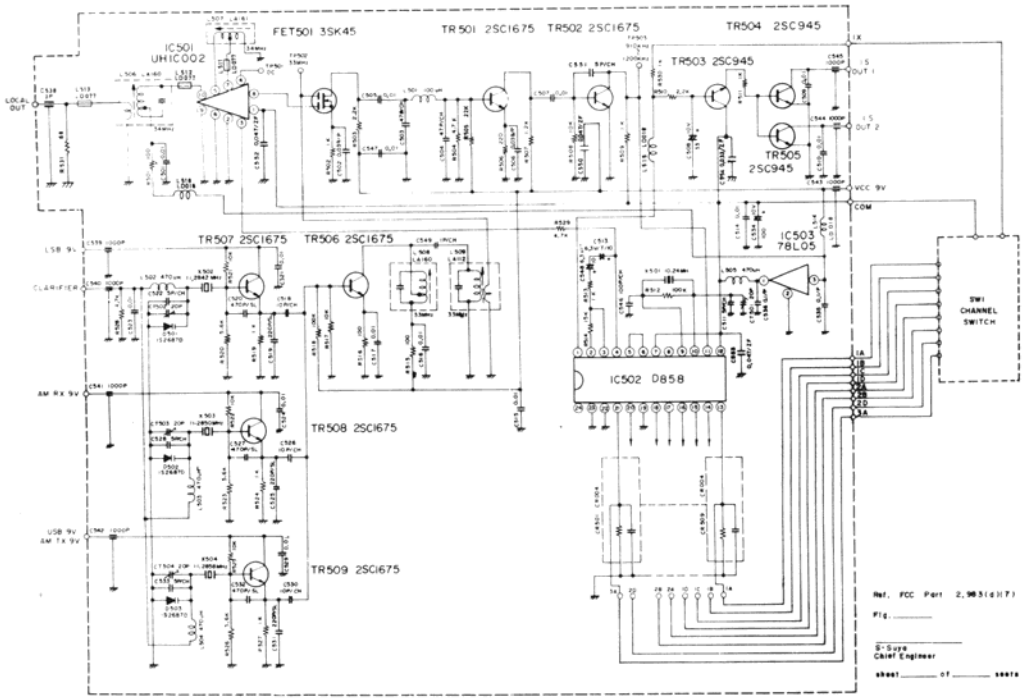


Fig. 11 — Schematic Diagram (D858 PLL)

This completes the installation procedure. Before operation, the 400 must be programmed and the radio must be realigned. Turn to the programming section and proceed.

INSTALLATION #8

Installation #8 is identical to Installation #7 except for the following:

1. Steps #3 & 4—R154 becomes R14.
2. Step #6—C508 becomes C8.

This completes the installation procedure. Before operation, the 400 must be programmed and the radio must be realigned. Turn to the programming section and proceed.

INSTALLATION #9

This section describes the 400 installation to Palomar chassis with the 145106 PLL Chip.

1. Remove the transceiver and 400 cases.
2. Locate the MC145106 PLL Chip, unsolder and remove it.
3. Locate and remove capacitor C125.
4. Connect the center of Coax #1 to the junction of C125 and R137.
5. Connect the center of Coax #2 to the junction of R151 and R153.
6. Install the loop filter supplied between the center of Coax #2 and ground.
7. Connect the shields from Coax #1 and Coax #2 to ground *(see Fig. 12).*
8. Connect the black wire to a good ground point near the power supply or modulator section.
9. Connect the red wire to a 12V power source in the radio.
10. To comply with FCC regulations remove FET-7.

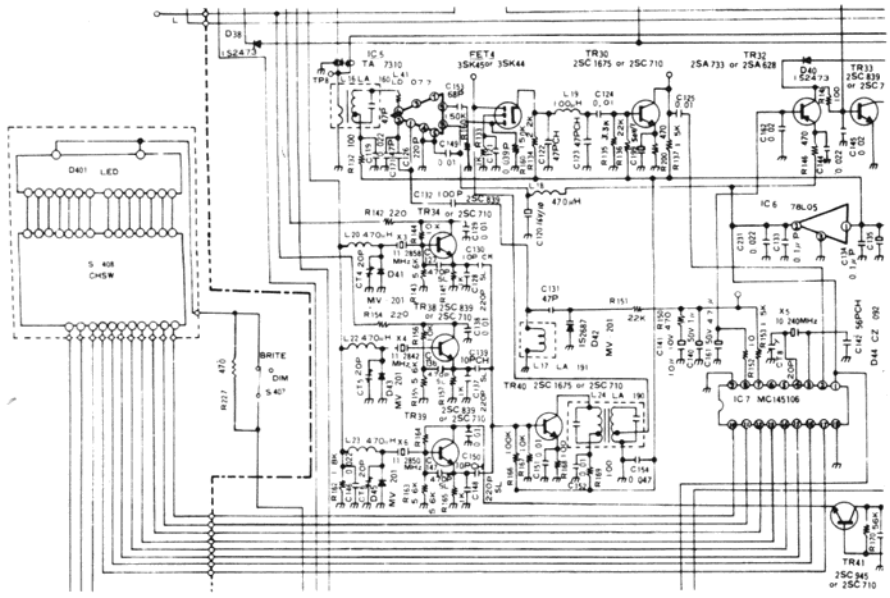


Fig. 12 — Schematic Diagram, Palomar SSB 500 (MC/145106 PLL)

This completes the installation procedure. Before operation, the 400 must be programmed and the radio must be realigned. Turn to the programming section and proceed.

INSTALLATION #10

This section describes the 400 installation to Palomar chassis with the LC7120 PLL Chip. This installation is identical to Installation #9 except for the following:

1. Steps 1 & 2—Leave the LC7120 Chip in circuit.
2. Step 6—Remove R153 from the circuit. Connect the center of Coax #2 to the junction of R151 and R153.
3. Cut the foil trace on the PCB connecting to Pin 16 of the LC7120 Chip.

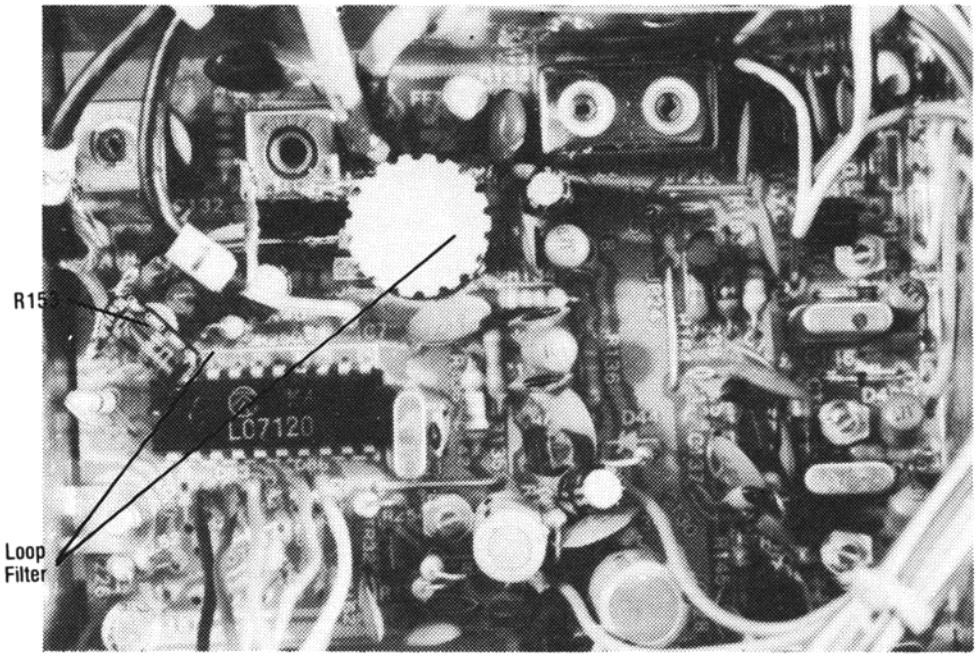


Fig. 13 — Palomar SSB 500 Synthesizer Parts Location (LC7120 PLL)

This completes the installation procedure. Before operation, the 400 must be programmed and the radio must be realigned. Turn to the programming section and proceed.

INSTALLATION #11

This section describes the 400 installation to the SM5104 chassis.

1. Locate and remove the SM5104 PLL Chip.
2. Connect the center of Coax #1 to the point where Pin 2 of the SM5104 was connected.
3. Connect a jumper wire between the points where Pins 7 and 8 were connected.
4. Remove the varactor diode D307.
5. Reinstall the cathode (banded end) of D307 to the point where the anode was connected.

6. Solder the anode of D307 to ground.
7. Disconnect the side of R330 (10K) going to Q306.
8. Connect the center of Coax #2 to the disconnected lead of R330.
9. Install the variable loop filter as shown in Figs. 14 and 15. **(See page 6)**
10. Short the 1K resistor (R5) inside 400. Refer to *Fig. 21.*
11. To comply with FCC regulations remove Q704.
12. Connect the black wire to a good ground point. **(Radio circuit ground)**
13. Connect the red wire to a 12V source. Refer to programming section.

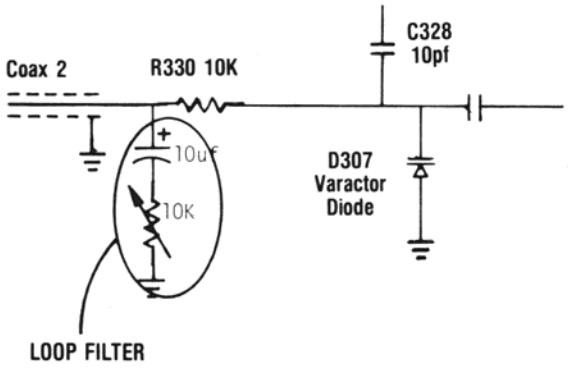


Fig. 14 — Schematic Diagram of modified SM5104 chassis

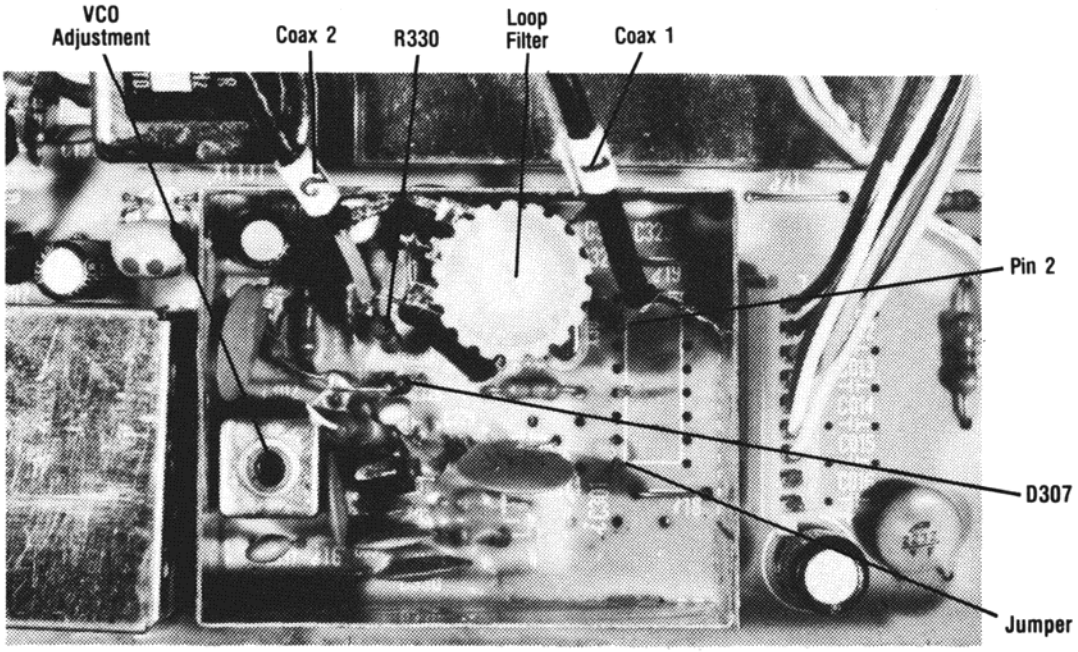


Fig. 15 — Sears Roadtalker Parts Location, SM5104 chassis

This completes the installation procedure. Before operation, the 400 must be programmed and the radio must be realigned. Turn to the programming section and proceed.

INSTALLATION #12

This section applies to the 400 installation on SM5104 chassis. This installation is almost identical to Installation #13 except for the following:

1. D307 becomes D707.
2. R330 becomes R731.
3. C328 becomes C722.

This completes the installation procedure. Before operation, the 400 must be programmed and the radio must be realigned. Turn to the programming section and proceed.

INSTALLATION #13

This section applies to the PC200 chassis by NDI. *Note:* USB will be 5 KHz below the frequency display.

1. Connect the center of Coax #1 to Pin 2 of the NDC 40013 PLL Chip.
2. Remove R03 (1K). *(See Fig. 19)*
3. Connect the center of Coax #2 to the junction of R02 and R04.
4. Change 10.000 MHz crystal Y1 to 10.240 MHz. Crystals are available from Digalog Technology, Inc. (D. T. I.)
5. Remove CR-03.
6. Connect the coax shields to ground.
7. Connect the black wire to a good ground point near the power supply or modulator section.

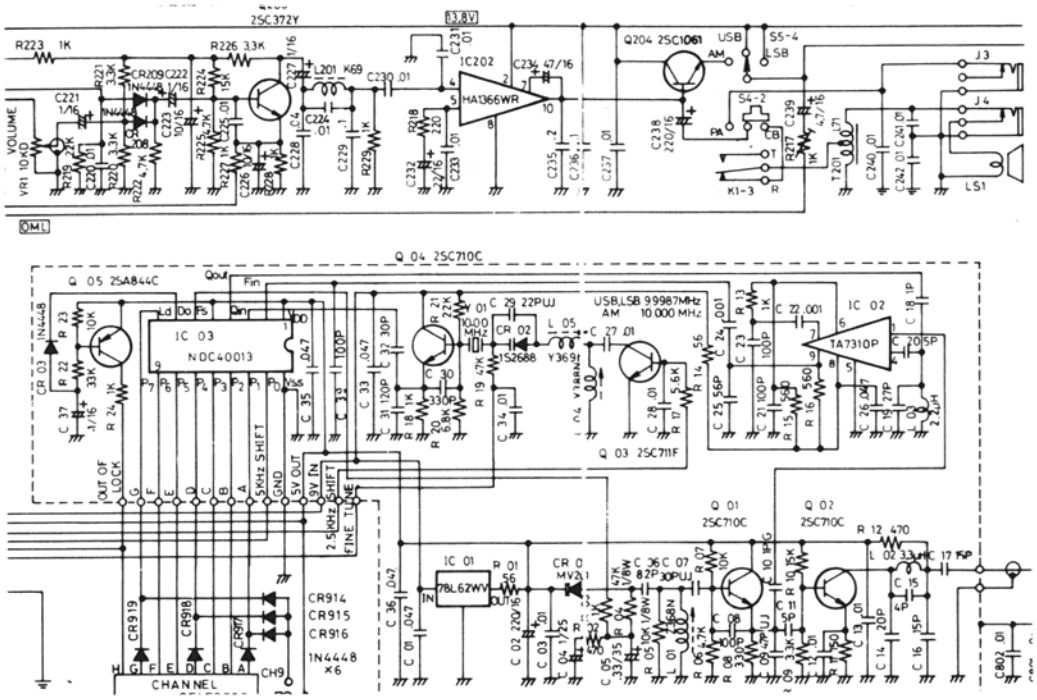


Fig. 16 — NDI PC-200 Synthesizer Schematic (NDC40013 PLL)

8. Connect the red wire to a switched 12V source in the radio.
9. To comply with FCC regulations remove Q705.

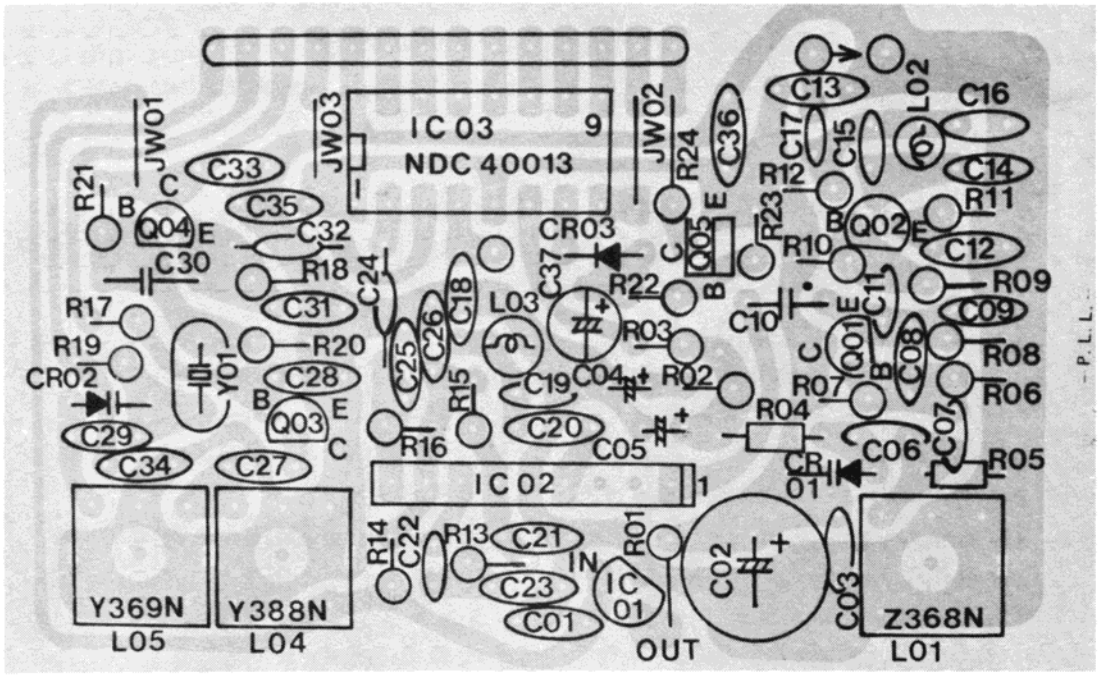


Fig. 17 — Part Location, NDC 40013 PLL Synthesizer

This completes the installation procedure. Before operation, the 400 must be programmed and the radio must be realigned. Turn to the programming section and proceed.

INSTALLATION #14

This section applies to 400 installation on SBE chassis. *Note:* USB will be 5 KHz below the frequency display.

1. Remove D901 from the radio. *(See Fig. 21)*
2. Replace crystal X1 (10.000 MHz) with a 26.965 MHz crystal.
3. Desolder Pin 13 of IC 901.
4. Leave an open connection between the pin and the foil trace.
5. Connect the center of coax 2 to the foil trace that was connected to pin 13 of IC901. (See Fig. 20).
6. Connect the center of Coax #1 to Pin 6 of IC 902.
7. Remove D904.
8. Connect the shields to ground.
9. Connect the red wire to a 12V source in the radio.
10. Connect the black wire to a good ground point near the power supply or modulator section of the radio.
11. To comply with FCC regulations remove Q501.

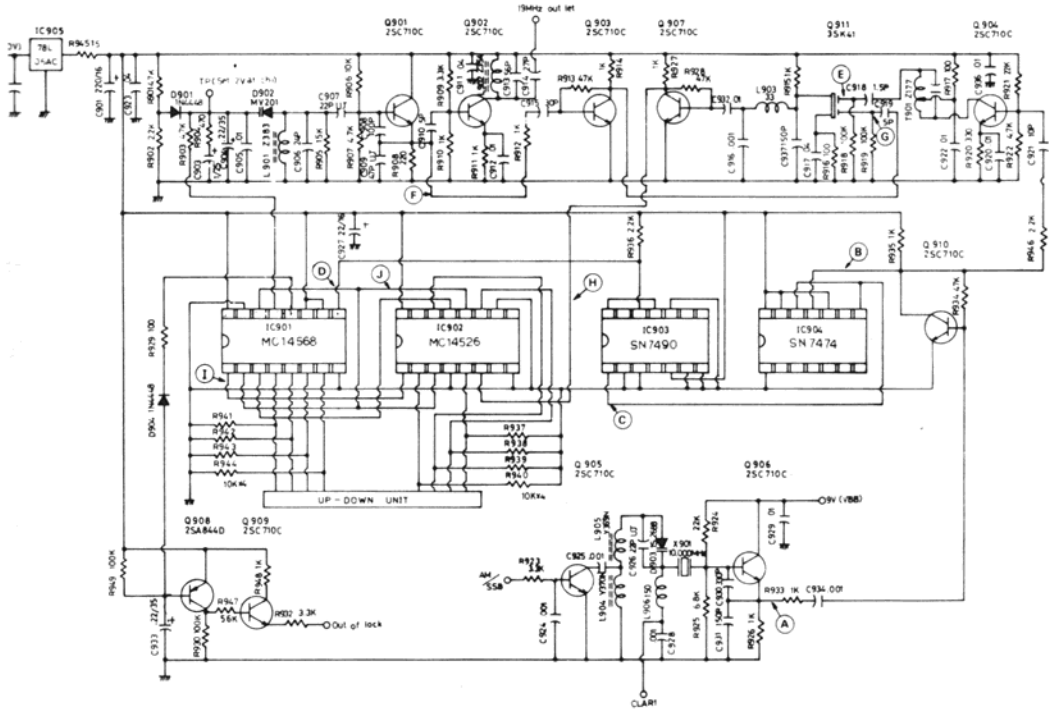


Fig. 18 — SBE Synthesizer Schematic

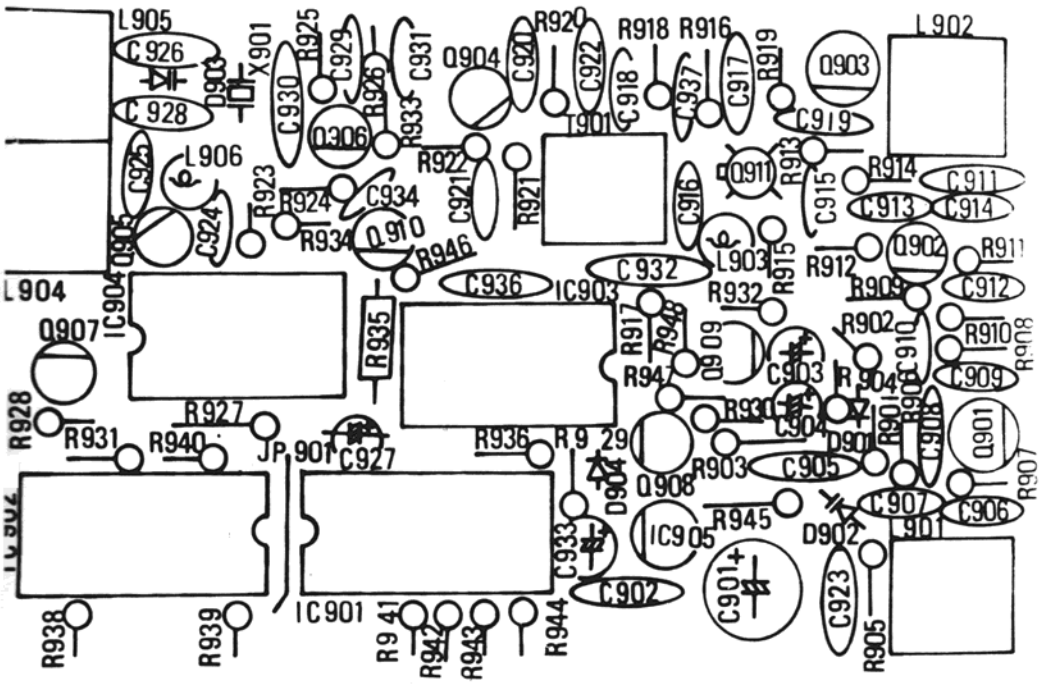


Fig. 19 — Parts Location, SBE Chassis

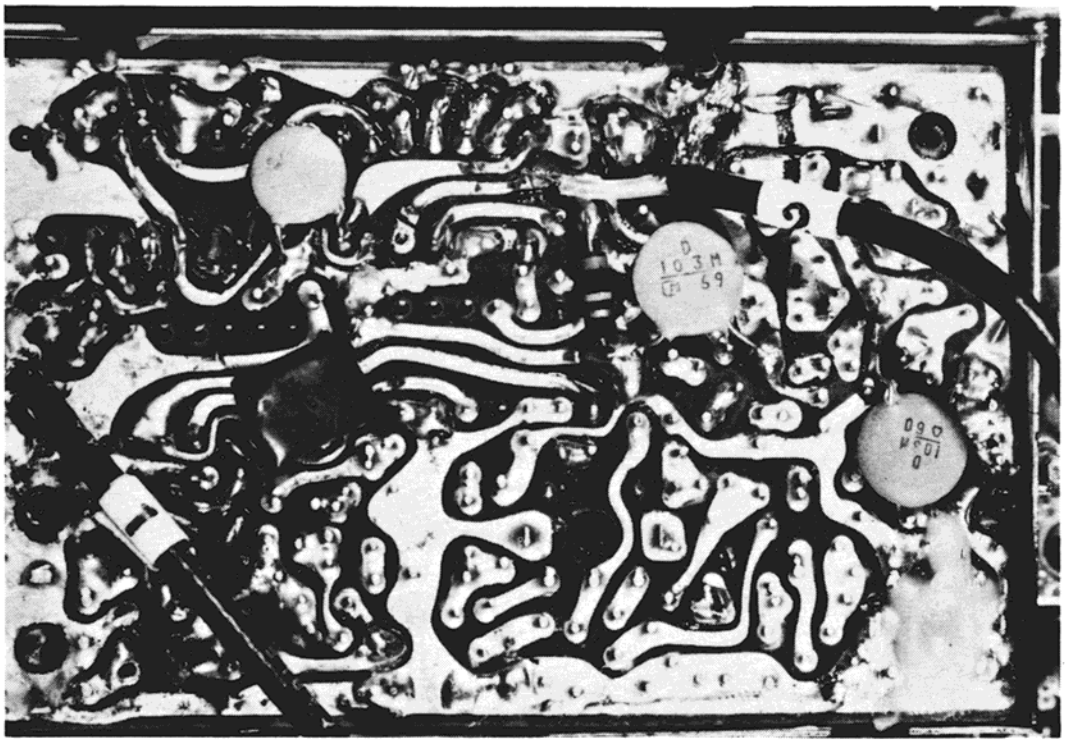


Fig. 20 — DS-400 Installation to SBE

This completes the installation procedure. Before operation, the 400 must be programmed and the radio must be realigned. Turn to the programming section and proceed.

INSTALLATION #15

For radios of other manufacture. The 400 can be installed to almost any PLL synthesizer provided the following conditions exist:

1. If a 10-meter conversion is intended, the VCO must not shift between transmit and receive.
2. As the VCO control voltage is increased, the radio operating frequency must also increase.
3. The VCO should have at least a 1.5 MHz range. (0-5V change on control voltage input to VCO).
4. The down mixer frequency output must not exceed 4 MHz.
5. The down mixer signal must have enough output signal to drive the 400.
6. The VCO output must not be doubled or tripled as this will cause 10 or 15 KHz steps.

If these conditions above are met, the 400 system should work on the receiver. The frequency range will be determined by the various circuits; i.e. bandwidth, sensitivity, etc. If the installer has any questions regarding the installation, please contact the factory.

DS-400 PROGRAMMING

Programming the 400 synchronizes the radio frequency to the frequency displayed on the 400. The 400 is programmed by setting the rocker switch actuators to either the ON or the OFF position. ON and OFF markings are located on the right end of the programming switch when facing the displays.

The direction which the radio will scan is determined by jumpers J1 and J2. Should the program code call for a reversed scan direction, rewire jumpers J1 and J2 as shown in Fig. 21.

The 400 is shipped from the factory preprogrammed for a Code 6 in a normal scan direction.

EXAMPLE: To program the 400 for a Code 6, set switches 3, 7, and 9 to the ON position leaving switches 1, 2, 4, 5, 6 and 8 in the OFF position. The 400 is now set at a program code 6. Keep in mind that power must reset for any changes in the program code to take effect. Once the program switches are set, avoid bumping the switch, especially when reassembling the 400, as this could change the position of the rocker switch.

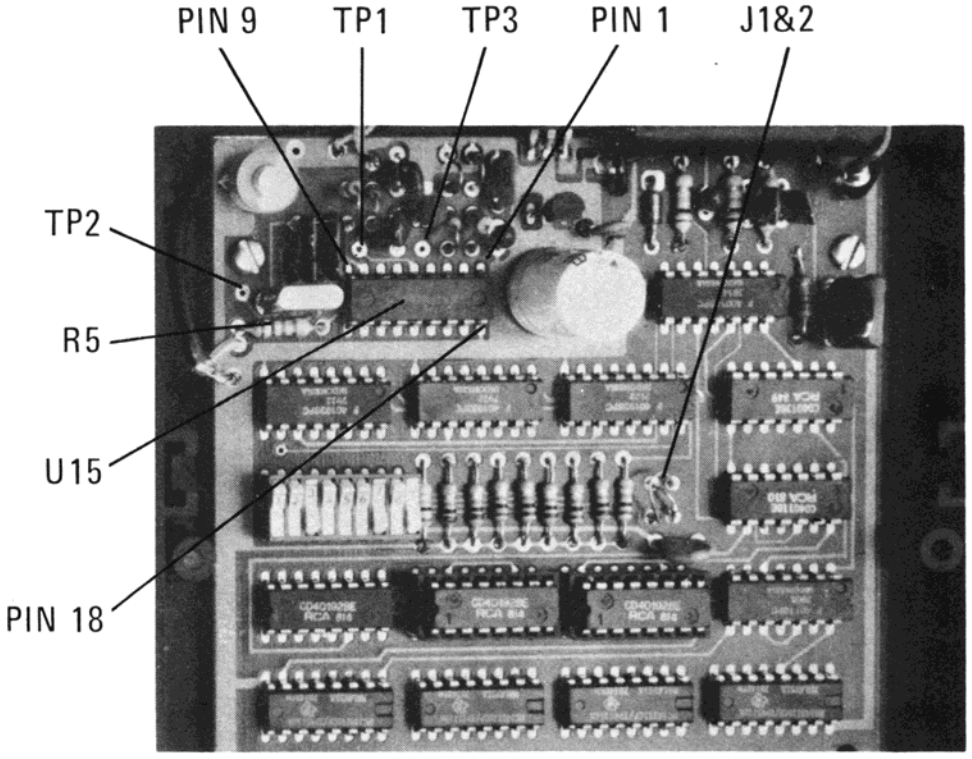


Fig. 21 — DS-400 shown is reversed scan direction

NOTE: When working with jumpers J1 and J2, use caution not to damage the PC board.

To program the 400, first look up the radio in the applications chart and make note of the program code. Turn to the program chart; find the proper code and begin programming.

After programming is complete, refer to the preliminary performance test.

CODE #	PLL CHIP #	REFERENCE CRYSTAL FREQ.	NINE-POLE ROCKER SWITCH									DIRECTION
			1	2	3	4	5	6	7	8	9	
1	858	11.2850	F	F	O	O	F	O	O	O	F	Normal
1A	858	36.570	F	F	F	F	F	F	F	F	O	Normal
2	02 or 02A	10.0525	F	F	F	O	F	O	O	O	O	Reversed
2A	02 or 0A	10.000	O	O	O	O	O	F	F	O	O	Reversed
2B	02 or 02A	9.87	O	F	O	F	F	F	O	F	O	Reversed
4	Descrete	26.965-3	F	F	O	F	F	O	F	F	O	Normal
5	8719-8734	11.3258	F	F	O	F	F	F	O	O	F	Normal
6	8719	11.1125	F	F	O	F	F	F	O	F	O	Normal
9	SM-5104		O	F	O	F	O	F	F	F	O	Normal
10	MC145106	11.2850	O	O	F	F	F	O	F	O	O	Normal
15	40013	10.240	F	F	F	F	O	F	O	O	F	Reversed

Fig. 22 — Program Chart

O - ON: Rocker to be in "ON" position
F - OFF: Rocker to be in "OFF" position

	FREQUENCY CHANGE CHART – DS-400								
ROCKER #	1	2	3	4	5	6	7	8	9
FREQUENCY CHANGE	10 KHz	5 KHz	20 KHz	40 KHz	160 KHz	80 KHz	320 KHz	640 KHz	1280 KHz

PRELIMINARY PERFORMANCE TEST

1. Apply power to the radio and 400. The 400 will display 27.155 unless the home channel option has been installed.
2. Check the first digit on the 400 for a full 2 display. If the first digit displays an L, refer to the troubleshooting section of this manual.
3. To insure the receiver is operating on 27.155, connect a signal generator to the antenna connector. Set the generator output frequency to 27.1550 MHz (Ch. 16) and the output amplitude to 100uV. The radio should receive this signal when the 400 is set to 27.155.

This test indicates correct 400 installation and programming. In most cases the receiver will operate prior to any alignment. To attain maximum range and performance, refer to the alignment section.

Section 3
Alignment

GENERAL ALIGNMENT INSTRUCTIONS

This section describes the alignment procedures for various radios. Listed below are the *methods* used to align the various radio circuits. The following pages indicate coil locations and part designations (L18, C4, etc.) for individual radios.

The following alignment must be performed after all installations.

VCO ALIGNMENT

NOTE: Use a non-metallic alignment tool GC9440 or equivalent.

1. Scan the 400 to the upper limit, 28.000.
2. Turn the VCO adjustment to a point where the radio is near 27.950. The first digit on the 400 will display an L, indicating the PLL synthesizer is *out of lock.*
3. Align the VCO adjustment until the radio just locks on 28.000 MHz. Do not turn the adjustment past this point as it can make other adjustments more difficult. The first digit on the 400 will now show a full 2 indicating the PLL is locked.

DOWN MIXER ALIGNMENT

1. Connect an oscilloscope (5 MHz or better vertical amplifier frequency response) to TP-3 (inside the 400). Adjust the scope triggering to give a stable trace.
2. Align L18 for maximum output without double peaking. Check for correct alignment throughout the band.

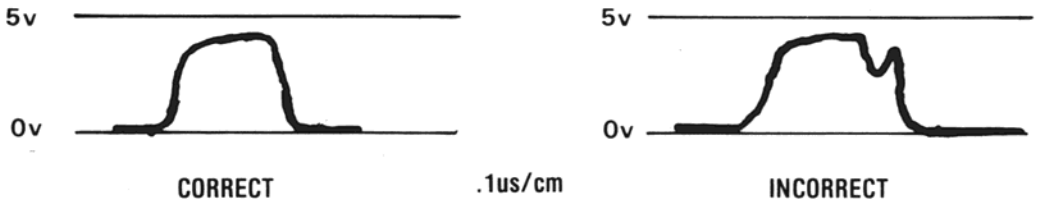


Fig. 23 — Down Mixer Waveforms

LOOP FILTERING ALIGNMENT

There are many schools of thought on loop filtering alignment but the best procedure is to listen to the radio. The loop filter is aligned for best SSB clarity. The radio must be tested on several frequencies to insure correct alignment.

Most radios will require 300-700 ohm resistance for the trimpot R100. If the resistance of the trimpot is too low, the radio will *warble (a byproduct of FM)* on higher frequencies, 27.800 range. Should the trimpot have too much resistance the radio will lose selectivity (splatter or bleedover) on lower frequencies, 26.600 range.

The loop filtering can *make or break* an otherwise good 400 installation. Loop filtering adjustments are critical for a clean-sounding radio.

ALIGNMENT PROCEDURE #1

This alignment procedure refers to Uniden 8719 chassis using an 11.1125 MHz reference crystal.

Alignment: Align L13, L18 and the loop filter as per the general alignment procedure described on page 27.

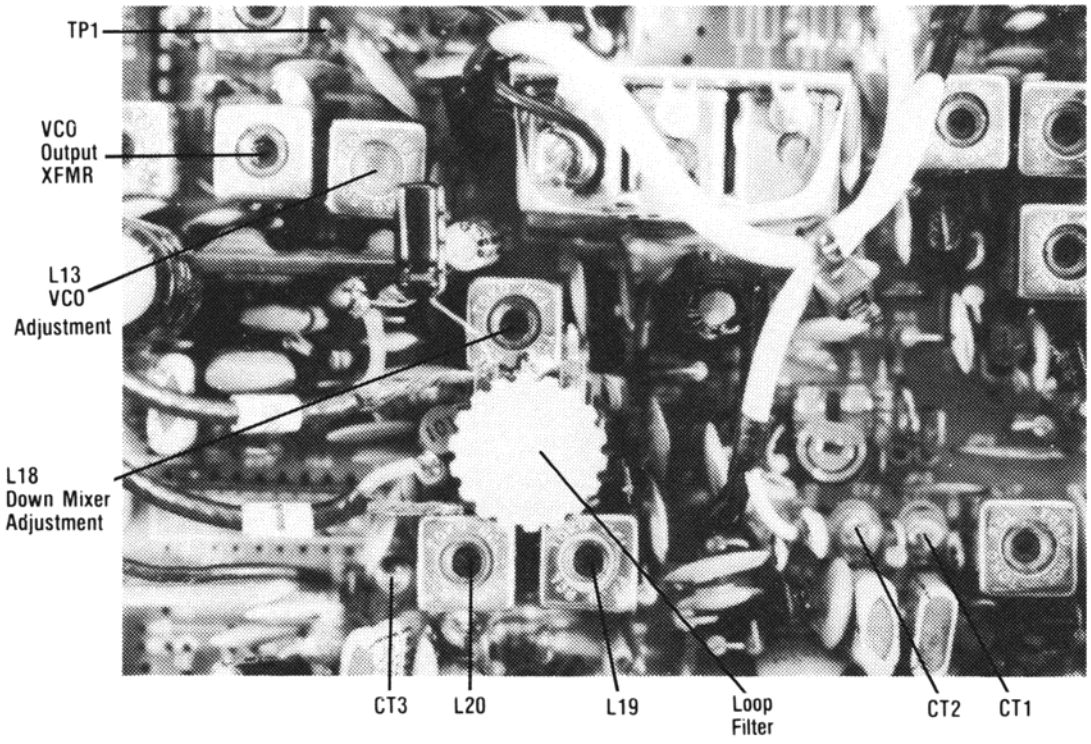


Fig. 24 — Parts Location

NOTE: The following alignment is not necessary in most cases. Alignment of 8719 chassis offsets 11.1125 crystal.

Radio Control Settings:
Clarifier - centered
Mode - USB DS-400 - 27.155

1. Connect a frequency counter to TP-1.
2. Adjust CT-3 for 34.9575 MHz ± 20 Hz.
3. Set mode switch to AM and align L20 for 34.9550 MHz ± 20 Hz.
4. Set mode switch to LSB and align L19 for 34.9525 MHz ± 20 Hz.

7.8 MHz Offset Alignment

5. Connect the frequency counter to TP-3 (inside radio). With the radio still set to LSB align CT-2 for 7.7975 MHz + 0 − 5 Hz.
6. Set the mode switch to USB and align CT-1 for 7.8025 MHz + 5 − 0 Hz.

This completes the alignment procedure.

ALIGNMENT PROCEDURE #2

This alignment procedure refers to Uniden 8719 and 8734 chassis using an 11.3258 MHz crystal.

Alignment: Align L19, L21 and the loop filter as per the general alignment procedure described on page 27.

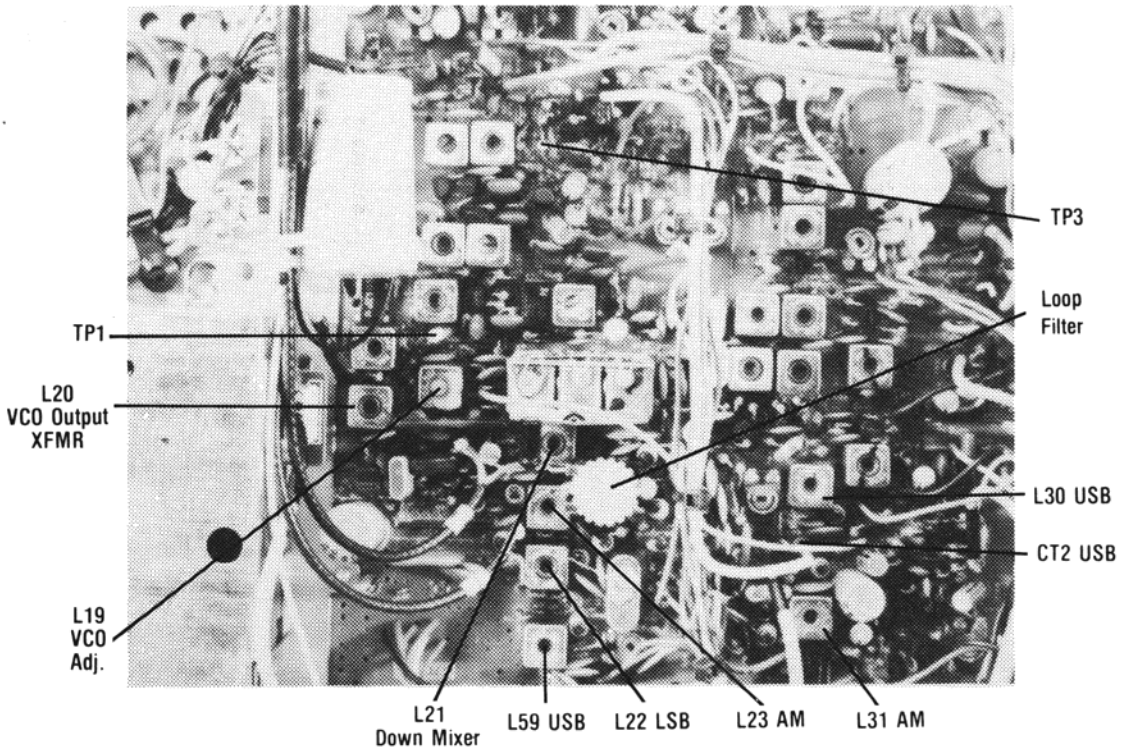


Fig. 25 — Parts Location

NOTE: The following adjustments are not normally necessary.

Alignment of Offsets

Radio Control Settings:
Clarifier - centered
Mode - USB
DS-400 - 27.155

1. Connect a frequency counter to TP-1.
2. Adjust L59 for a frequency of 34.9565 MHz ± 20 Hz.
3. Turn the mode switch to AM and adjust L23 for 34.9550 MHz ± 20 Hz.
4. Set the mode switch to LSB and adjust L22 for 34.9535 MHz ± 20 Hz.
5. Connect the frequency counter to TP-3. Set the mode switch to USB and align CT2 for 7.8015 MHz + 5 Hz − 0 Hz.
6. Set the mode switch to LSB and align for 7.7985 MHz + 0 Hz − 5 Hz.

This completes the alignment procedure

ALIGNMENT PROCEDURE #3

Alignment: Align the VCO as per instructions on page 27.

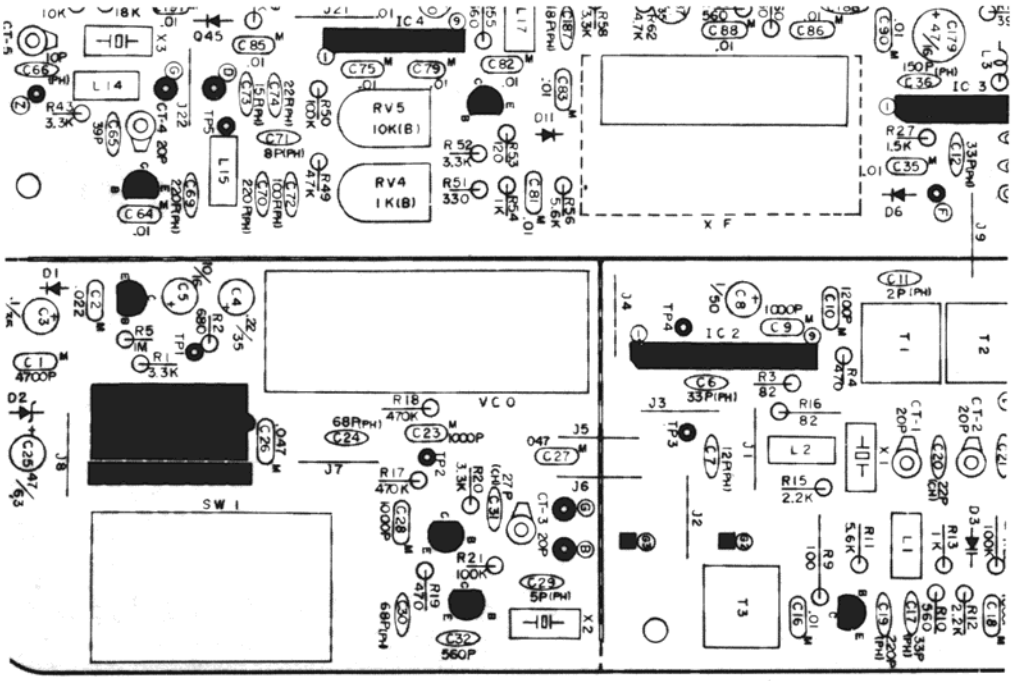


Fig. 26 — Parts Location 02A Chassis

Offset Alignment:

Clarifier - centered
Mode - USB

1. 10.0525 MHz Frequency Alignment

Connect both oscilloscope and frequency counter to the test point TP3 and adjust the core of T3 maximum amplitude of scope display (10.0525 MHz × 2), then adjust the trimming capacitor CT1 to obtain the reading of: *20.105 MHz ± 40 Hz.*

Next, place the mode switch in the LSB position and adjust CT2 to obtain the reading of: *20.1035 MHz ± 40 Hz.*

NOTE: If X1 is changed, C20 and C21 must be removed.

Use this procedure if X1 has been changed to 9.87 MHz.

2. 9.87 MHz Frequency Alignment Mode: USB

Connect both oscilloscope and frequency counter to the test point TP3 and adjust the core of T3 maximum amplitude of scope display (9.87 MHz × 2), then adjust the trimming capacitor CT1 to obtain the reading of: *19.7450 MHz ± 40 Hz.*

Next, place the mode switch in the LSB position and adjust CT2 to obtain the reading of: *19.7435 MHz ± 40 Hz.*

Use this procedure if X1 has been changed to 10.000 MHz.

3. 10.000 MHz Frequency Alignment Mode: USB

Connect both oscilloscope and frequency counter to the test point TP3 and adjust the core of T3 maximum amplitude of scope display (10.0025 MHz × 2), then adjust the trimming capacitor CT1 to obtain the reading of: *20.005 MHz ± 40 Hz.*

Next, place the mode switch in the LSB position and adjust CT2 to obtain the reading of: *20.0035 MHz ± 40 Hz.*

4. 10.695 MHz Frequency Alignment

Connect the frequency counter to TP5 and adjust CT5 to read 10.695 MHz in the USB mode of operation. Next, place the mode switch in LSB and adjust CT4 to read: *10.692 MHz ± 50 Hz.*

This completes the alignment procedure. The receiver is ready for operation.

ALIGNMENT PROCEDURE #4

This section applies to the alignment of Uniden 858 SSB chassis.

Alignment: Align L17 and L24 as per the general alignment procedure described on page 27.

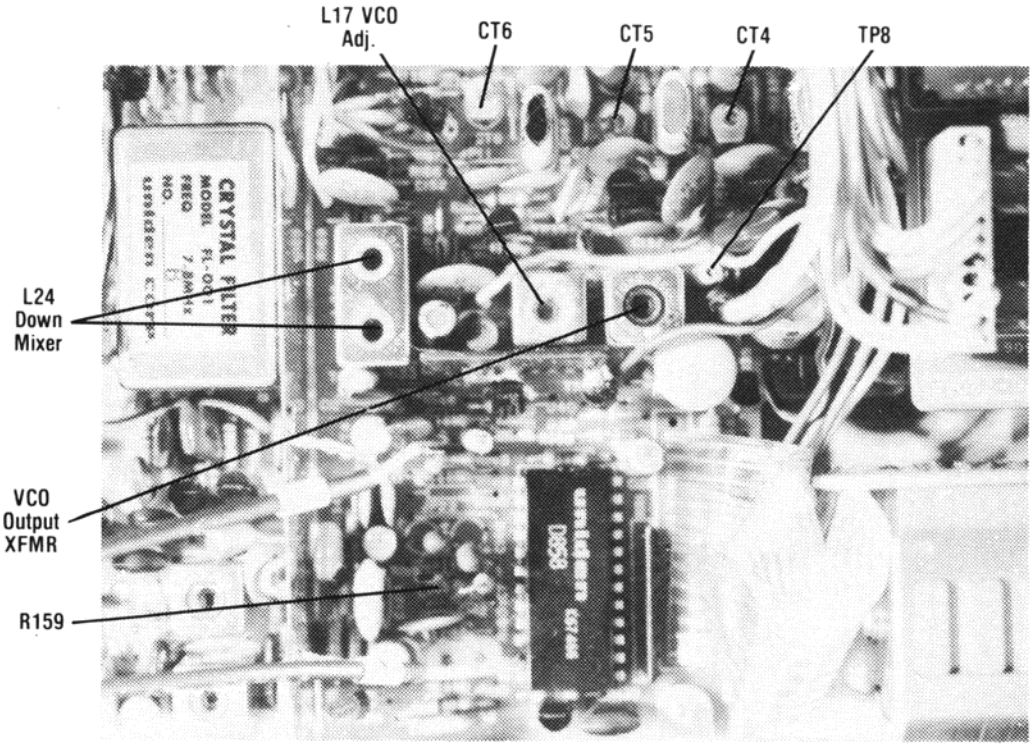


Fig. 27 — Parts Location 858 Chassis SSB

NOTE: The following alignment is not necessary in most cases.

Alignment of Offsets

Radio Control Settings:
Clarifier - centered
Mode - AM
DS-400 - 27.1555

1. Connect a frequency counter to TP8.
2. Adjust CT6 for 34.9550 MHz ± 20 Hz.
3. Set the mode switch to USB and adjust CT4 for 34.9575 MHz ± 20 Hz.
4. Set the mode switch to LSB and adjust CT5 for 34.9525 MHz ± 20 Hz.
5. Disconnect the counter from TP8 and connect the probe to TP9.
6. With the radio on LSB adjust CT2 for 7.8025 MHz + 5 Hz − 0 Hz.
7. Set the mode switch to USB and adjust CT3 for 7.7975 MHz + 0 Hz − 5 Hz.

This completes the offset alignment procedure.

NOTE: 858 SSB radios have been known to have problems on lower frequency Am operation. If the radio is to be used on AM below 26.700, change the value of R159 from 1K to 510 ohms.

ALIGNMENT PROCEDURE #5

This section applies to the Palomar 500 chassis alignment.

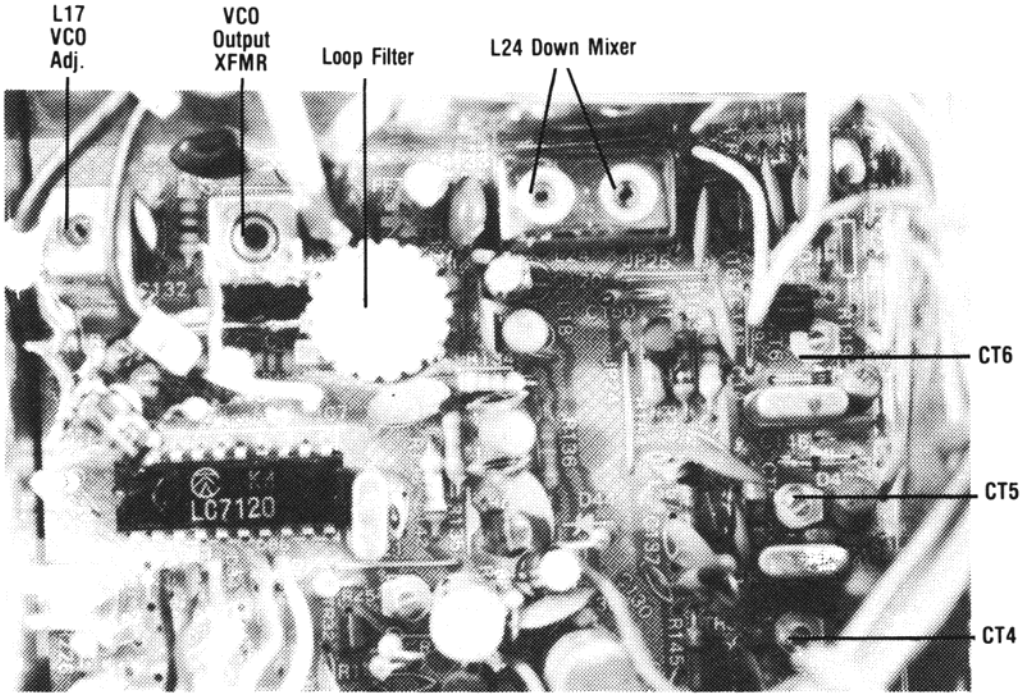


Fig. 28

NOTE: The alignment of L16 is critical for a clean sounding radio. If L16 is out of alignment, the radio may warble on LSB.

For alignment refer to alignment procedure #4.

This completes Alignment Procedure #5. The receiver is ready for operation.

ALIGNMENT PROCEDURE #6

This section applies to chassis using the NDC 40013 PLL chip.

Alignment: Align L01 as per the general alignment procedure described on page 27.

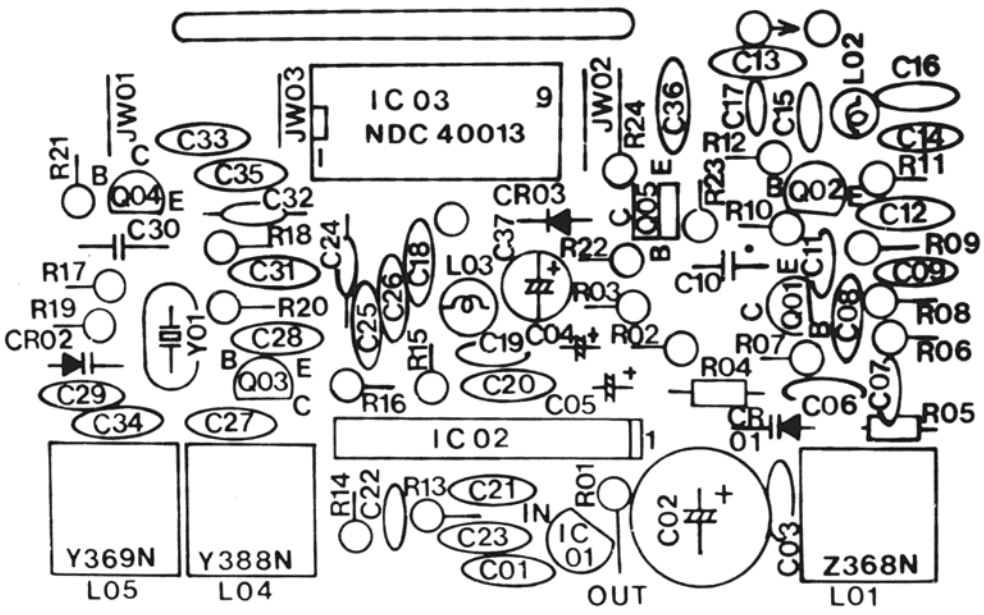


Fig. 29 — Parts Location 40013 Chassis

NOTE: This chassis has no down mixer adjustment. Because Y01 has been changed, the following adjustments will be necessary:

1. Adjust L05 for correct AM frequency.
2. Adjust L04 for correct LSB frequency.

This completes ALignment Procedure #6.

NOTE: If L6 has no effect on the LSB frequency, Q03 is most likely faulty.

ALIGNMENT PROCEDURE #7

This section applies to the alignment of SBE chassis.

Alignment: Align L901 and T1 as per the general alignment procedure described on page 27.

Because X901 has now changed frequency, L904 and L905 must be realigned.

1. Align L905 for the correct AM frequency.
2. Align L904 for the correct LSB frequency.

This completes Alignment Procedure #7.

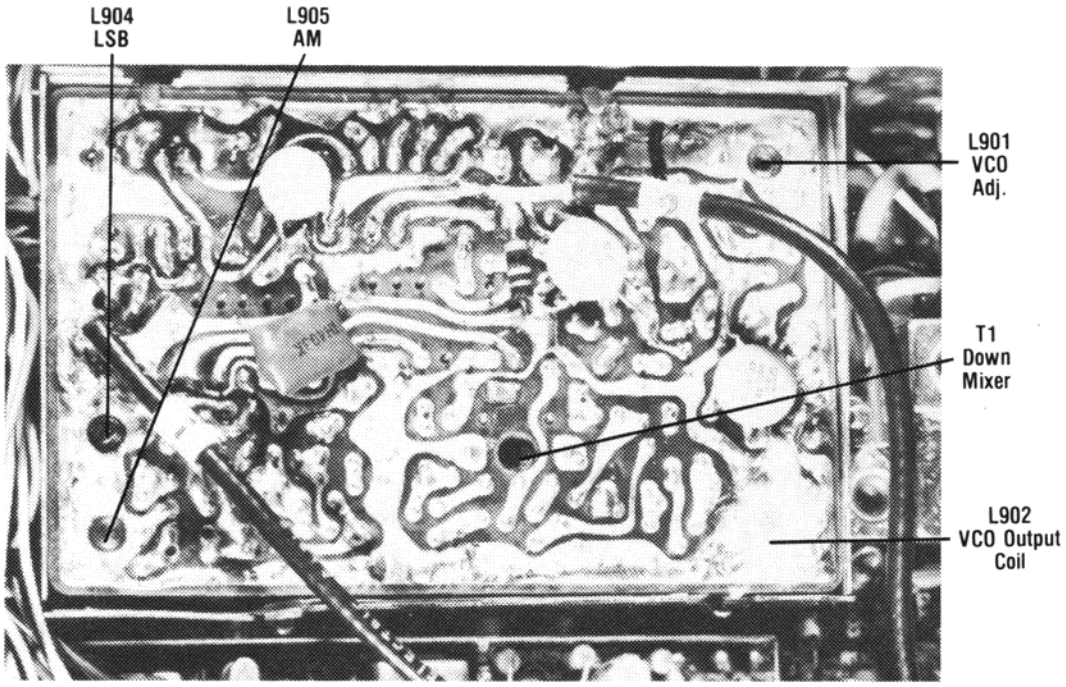


Fig. 30 — Parts Location SBE Chassis

Section 4
Troubleshooting

TROUBLESHOOTING DS-400 INSTALLATIONS

Two basic troubleshooting methods are discussed in this section. The first method is a hit-or-miss type of system using a graph. This method is simple to use but it will not reveal all possible problems. The second system uses a flow chart and will take the problem to one particular circuit. Before using this system, it is highly recommended that you read and understand the section of this manual on "theory of operation". If attempting to locate a problem using these procedures is unsucessful, contact Digalog for any new information that may be available.

DEFINITION OF SYMPTOMS

OUT OF LOCK: In an "out of lock" condition, varying the 400 frequency setting will not change the radio frequency. A voltage measurement on the TP-2 will quickly determine a locked or unlocked condition; 5v for locked, 0v for unlocked. The first digit on the 400 will display a 2 for a locked condition and an L for an out-of-lock condition.

LIMITED RANGE: An "out-of-lock" condition at the top or bottom end of the band.

WARBLE: A warble is detected on SSB. This can cause SSB communications to be distorted or difficult to clarify.

RADIO OFF FREQUENCY BY A MULTIPLE OF 5KHz: Radio is in lock, but the operating frequency is constantly off by some multiple of 5KHz.

RECEIVES 2 OR MORE CHANNELS AT ONCE: When receiving, the same incoming signal can be heard on several frequencies.

WILL NOT LOCK WHEN POWER IS RESET: A radio may function normally after realignment, but when the power is turned off and then turned on again, it may not relock. The reason this condition can exist is as follows: (1) Power is first applied, and the 400 circuitry has no input on Coax #1 because the VCO has not begun to oscillate; (2) The 400 senses the lack of input and puts out a high (5v) state on Coax #2; (3) The VCO then oscillates at its maximum frequency, and because of inherent design its amplitude decreases at higher frequencies; (4) Therefore, the down mixer output is low and the 400 cannot get enough drive from the radio on Coax #1. The PLL chip does not get enough drive and the loop is unable to recover. The problem is solved by increasing the gain of the down mixer in the radio or input amplifier in the 400 or readjusting the VCO coil to a point where the VCO will not free run as high in frequency.

TROUBLESHOOTING CHART
METHOD 1

POSSIBLE CAUSE	VCO Alignment	Down Mixer Alignment	Shorted Coax #1	Shorted Coax #2	Input Amplifier	Programming	10.240 Osc. off Frequency	Radio Offsets off Frequency	Loop Filtering	Ground Connections	R-207 (or Equiv.) Not Cut	Radio Reference Crystal	Low Drive to DS-400	Open PC Pads (8719 & 8734)	VCO Output XFMR Alignment
OUT OF LOCK	●	●	●	●	●	●					●		●	●	
WILL NOT LOCK WHEN FIRST TURNED ON	●	●											●		
LIMITED RANGE	●	●			●				●		●	●			
WARBLE	●								●	●	●				●
RADIO OFF BY MULTIPLE OF 5 kc						●									
RECEIVES 2 OR MORE CHANNELS AT ONCE									●		●				
RADIO LESS THAN 5kc OFF FREQUENCY							●	●							
NO SIGNAL ON TP3			●		●							●			
LOW SIGNAL ON TP3	●	●			●								●		
TP1 NOT 5.1200 MHz							●								
CHANNEL SPACING INCORRECT							●								
WILL NOT LOCK ON SOME FREQUENCIES	●	●											●		
RADIO LOCKED BUT STEPS & SCANS WRONG DIRECT.						●									

LOOP FILTERING

Symptoms of the loop filtering being incorrect may be: distorted SSB, warble on SSB, difficult to clarify SSB, or, in extreme cases, squeal on AM and bleedover may be present. In most cases the problems described above are cured by the adjustment of the variable loop filter. This loop filter is between the center of Coax #2 and ground.

The loop filter is aligned for best SSB clarity. If the resistance of the trimpot is too low, the radio will warble on higher frequencies; and if the resistance is too high, bleedover may be experienced on lower frequencies.

GROUND CONNECTIONS: For proper operation the 400 must have a good ground loop to the radio. Best results are achieved by connecting the coax shields near the VCO and connecting the black wire to a ground near the voltage regulator.

BROKEN PC PADS: The pads under the PLL chip are sometimes damaged during chip removal. The 8v source is connected through one of the pads and the circuit must be complete through the pad to attain a locked condition on 8719 installations.

VCO OUTPUT TRANSFORMER ALIGNMENT: On some chassis, mostly Uniden 858 and Palomar 500, misadjustment of the VCO output transformer can cause warble on SSB. Slightly detuning the transformer slug will generally stop the warble on these chassis.

DOWN MIXER OSCILLATION: Uniden 8719 & 8734 chassis requires removal of C70 or C89 to prevent the down mixer from oscillating.

ALTERNATOR WHINE

In mobil applications, 8719 and 8734 chassis have had an occasional problem with "alternator whine". This problem is cured by reconnecting the red wire (presently connected to the power switch) to the radio side of T1, T1 will then filter the alternator noise from the 12V power for the 400.

SQUEAL ON TX AM (HIGH PITCH)
ADUST LOOP FILTER RESISTOR OR
ADD 2K RESISTOR (OR) BETWEEN COAX #2 AND TP9

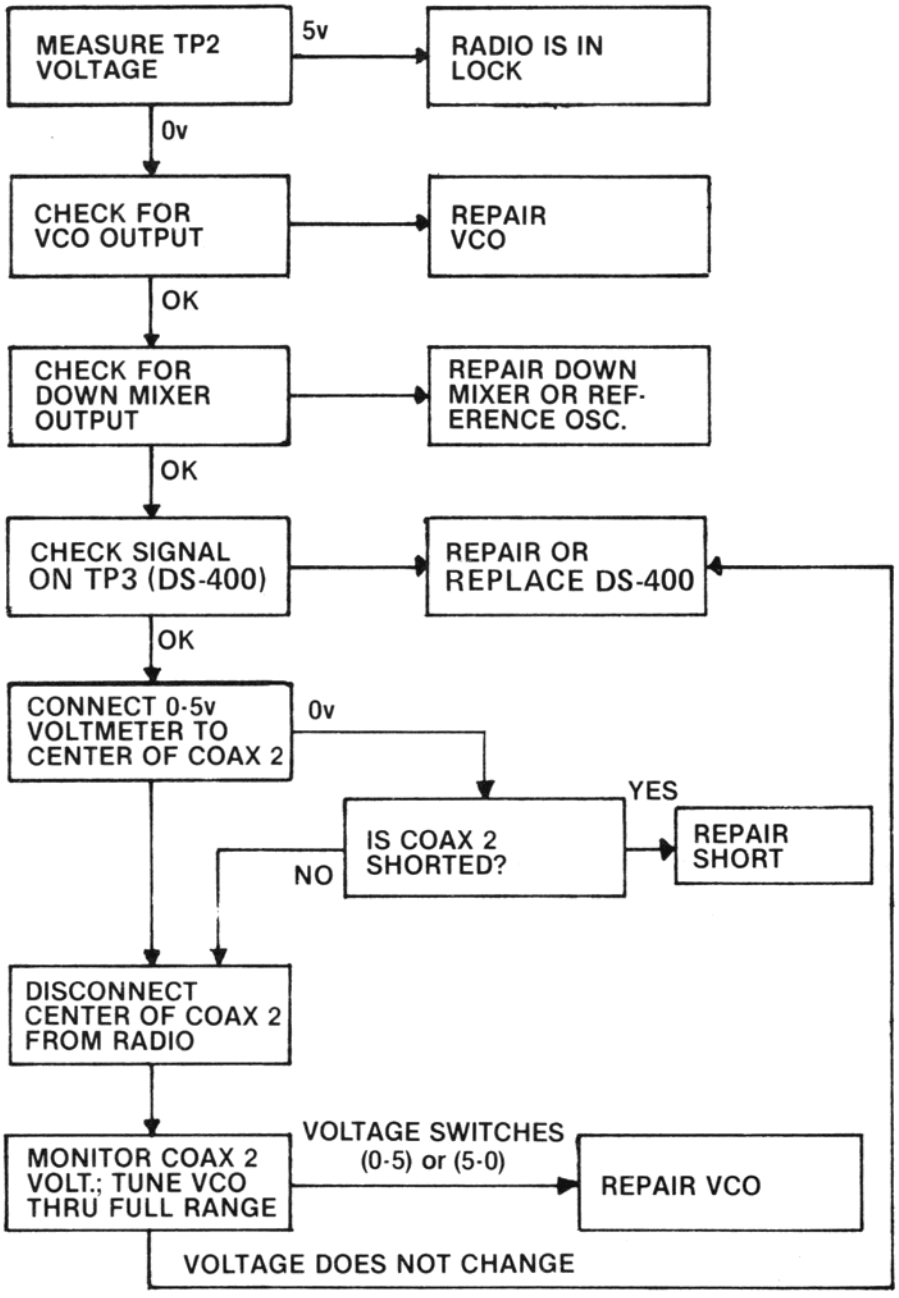
LOSS OF SOME FREQS BUT NOT CONSECTIVECT ADD 1K RESISTOR IN PINS 17 & 18 OF PLL IC1

TUNE L45, L46 for ↑ FREQs AND L38 for LOW FREQS.

TROUBLESHOOTING AN OUT OF LOCK CHASSIS

FLOW CHART METHOD 2

The following flow chart describes troubleshooting an out of lock condition. Align the VCO for an operating frequency about 200 KHz above the 400 setting. Program 400 correctly.



*As the VCO is adjusted through the frequency displayed by the 400, the voltage on Coax #2 should change its logic state.

Section 5
Theory of Operation

DS-400 — THEORY OF OPERATION AND DETAILED ANALYSIS

The information contained in this section is considered to be highly technical. Before attempting to read and understand this section, be advised that it is written in condensed form. It assumes the reader has been previously exposed to digital and analog technology. We recommend reading the entire section first, then go back and review the material in detail. This will ensure a better understanding of PLL technology.

Engineering Department

INTRODUCTION

PLL synthesizer modifications have become popular in recent years. However, the actual synthesizer operation is not often explained in detail. CB radio synthesizers of today have come a long way from the crystal synthesizers of yesteryear. Understanding PLL operation will allow troubleshooting of a PLL system to be no more difficult than troubleshooting other common radio circuitry. Trouble shooting a PLL may seem more difficult at first because it is a closed loop system. If any part of this loop should fail (with exception of the oscillator) the result will be the same; an out-of-lock condition.

The following pages explain the operation of a PLL synthesizer. In Fig. 31 two large blocks are shown. The D.T.I. DS-400 synthesizer circuitry is shown in the upper block and the transceiver circuitry is shown in the lower block. Figure 31 is a block diagram showing the interface between the radio and 400. The radio circuitry is shown from a Uniden 8719 chassis with a 11.1125 MHz reference crystal. This chassis is used because of its popularity on today's market. Operation of most PLL synthesizers is essentially the same. As the PLL circuitry is analyzed, occasionally refer back to Figure 31 and the mystery of the phase locked loop synthesizer will unfold.

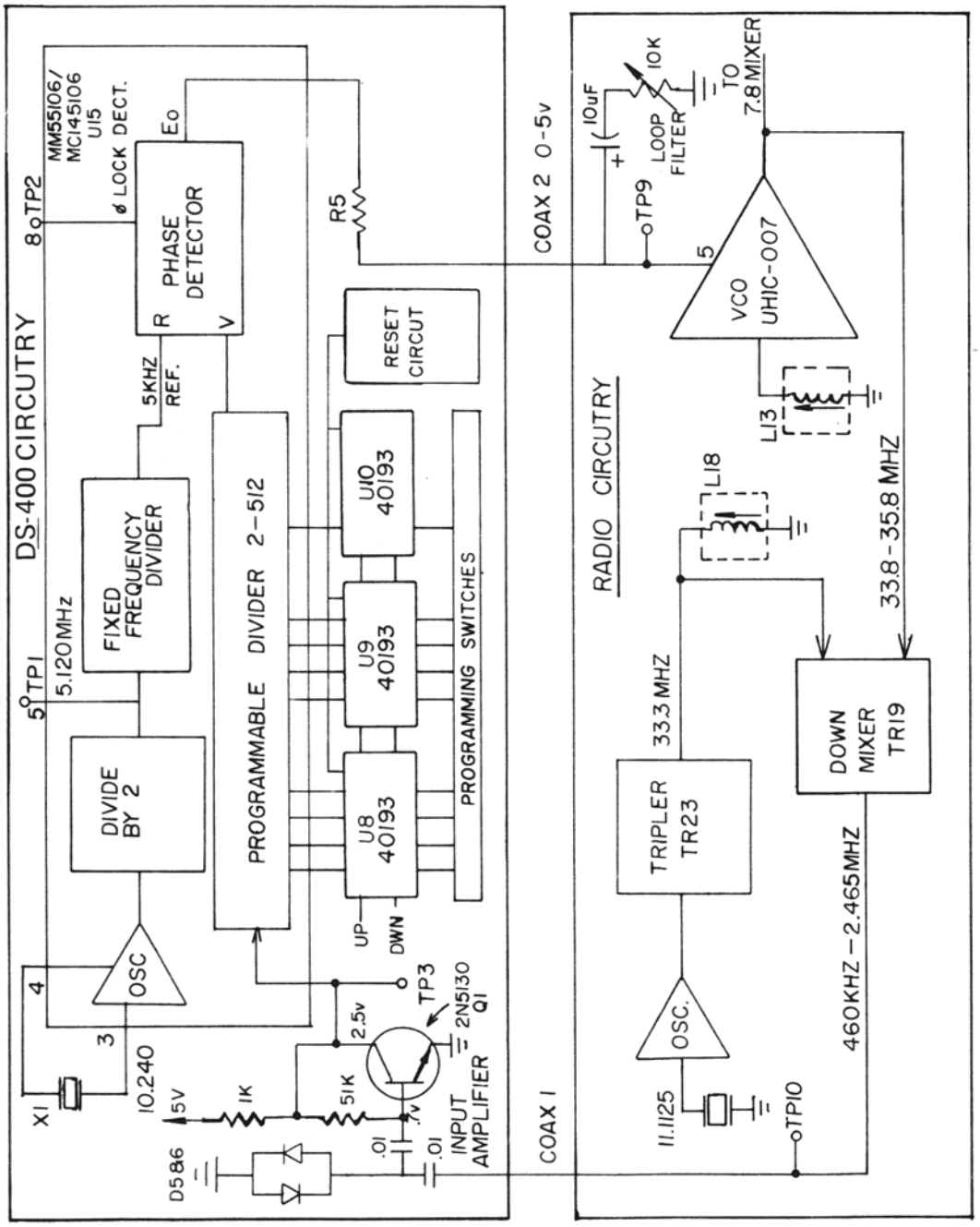

DS-400 CIRCUTRY
MM55106/
MC14510G
U15
LOCK DECT.
PHASE
DETECTOR
Eo
R
V
5KHZ
REF.
FIXED
FREQUENCY
DIVIDER
5.120MHz
TP1
TP2
DIVIDE
BY 2
PROGRAMMABLE DIVIDER 2-512
U10
40193
U9
40193
U8
40193
RESET
CIRCUT
PROGRAMMING SWITCHES
UP
DWN
OSC
4
3
10.240
X1
5V
1K
51K
2.5v
TP3
2N5130
Q1
INPUT
AMPLIFIER
.01
.01
D586
R5
COAX 2 0-5v
COAX 1
RADIO CIRCUTRY
10uF
10K
LOOP
FILTER
TO
7.8 MIXER
TP9
VCO
UHIC-007
5
L13
L18
33.8-35.8 MHZ
333 MHZ
TRIPLER
TR23
DOWN
MIXER
TR19
OSC.
11.1125
TP10
460KHZ-2.465MHZ

Fig. 31

DETAILED ANALYSIS

1. 11 MHz REFERENCE OSCILLATOR

This oscillator runs at 11.1125 MHz on the AM mode and the frequency is offset slightly higher or lower for USB or LSB respectively. The frequency of this oscillator is also shifted slightly on receive by the clarifier circuitry. TR-23 and L18 triple this oscillator giving a resultant frequency of 33.335 MHz for one of the down mixer inputs. The second input will come from the VCO.

2. VCO

The VCO will run at the operating frequency plus the local oscillator frequency (7.800 MHz). This puts the VCO between 33.755 MHz at an operating frequency of 25.995 MHz, and 35.800 MHz at an operating frequency of 28.000 MHz. The frequency of the VCO is controlled by a DC voltage varying between 0 and 5V coming from Coax #2. The higher the voltage, the higher the operating frequency.

NOTE: A Varactor diode is the key to the VCO. This type of a diode changes capacitance as reverse bias is changed. The greater the reverse bias, the less capacitance and, therefore, the higher the frequency of the VCO. This diode is inside the VCO chip.

3. DOWN MIXER

TR-19 acts as the down mixer and mixes the VCO frequency with the 33 MHz reference. The difference in the frequency of the two inputs will be the down mixer output signal (460-2456 KHz). As an example, at a frequency of 27.155 MHz (Ch. 16), the VCO frequency will be 34.955 MHz. The down mixer will mix this frequency with the 33.335 MHz reference giving a difference of 1.620 MHz for Channel 16 (See Fig. 34). This signal will be present on TP10 and is used to drive the 400.

4. INPUT AMPLIFIER

The input amplifier inside the 400 is driven by the down mixer via Coax #1. Diodes D5 and D6 protect the transistor Q1 from voltage spikes which would otherwise open the base emitter junction to Q1. The diodes also tend to square the signal waveshape. Q1 then amplifies the down mixer signal to the necessary level to drive U15, the PLL synthesizer chip. U15 requires 3V peak to peak minimum to drive its input. This signal is present on TP3 inside the 400 (See Figs. 21 & 31).

5. PROGRAMMABLE DIVIDER (DIVIDE BY N)

The programmable divider divides the down mixer signal by a preset number. The divider can divide by 2 through 512 depending upon the logic states (0 or 5V) on its input pins 9-17. For proper operation the programmable divider must have a 5 KHz output, the same as the fixed frequency divider. For Channel 16 the input frequency must be 1.620 MHz. Therefore, the programmable divider must divide by 324 to give a 5 KHz output. Frequency selection is accomplished by changing the logic states on the input pins. Pin 17 is the least significant input and will change the VCO frequency by 5 KHz. Pin 9, the most significant pin, will change the frequency by 1280 KHz.

6. COUNTERS

The 40193 counters in the 400 drive pins 9-17 of the programmable divider. Figure 34 gives some examples of what is happening in various parts of the synthesizer for various frequencies. The 40193 binary counters add or subtract from the programmable divider input when the 400 is stepped up or down.

7. PROGRAMMING SWITCHES

The programming switches preset the 40193 counters, such that radio will be on 27.155 when the power is first applied. In other words, they control the starting points for the counters. The display automatically starts at 27.155 each time power is applied. Programming switches synchronize the radio starting frequency with the 400 starting frequency.

8. PLL REFERENCE FREQUENCY AND DIVIDER

Crystal X1 oscillates at 10.240 MHz using the oscillator in U15. This signal is divided by 2 which gives an output of 5.1200 MHz on TP1 (See Fig. 31). The fixed frequency divider then divides its input frequency of 5.120 MHz by 1024. This results in a 5 KHz output which is used for the channel spacing reference.

9. PHASE DETECTOR

The phase detector is considered the heart of the PLL and is the most difficult to understand. Keep in mind for a proper "locked" condition, both phase detector inputs must be the same frequency. The reference input is always 5 KHz whereas the variable input could change frequency if the VCO frequency were to change.

The detector uses a combination of digital logic gates which compare the phase of the variable input to the phase of the reference input. The phase detector looks at the rising edge of both its inputs simultaneously. As shown in Figure 32, if the phase of the reference and variable inputs are the same, the output will be at a mid-state or high impedence level. The reason for this will be explained in charge pump operation. If the frequency of the variable input should increase (variable lagging phase), the output (Eo) will go to a low (0V) state. Should the frequency of the variable input decrease causing the variable input to be leading phase, the output Eo will go to a high (5V) level.

9.1 LOCK DETECTOR

Figure 32 also illustrates the operation of the lock detector. If the PLL is in lock, TP2 will be high (5V). If the PLL is out of lock, TP2 will be a low (0V) level. TP2 also drives the out of lock indicator circuitry which will change the first digit on the 400 to an L when the PLL is out of lock.

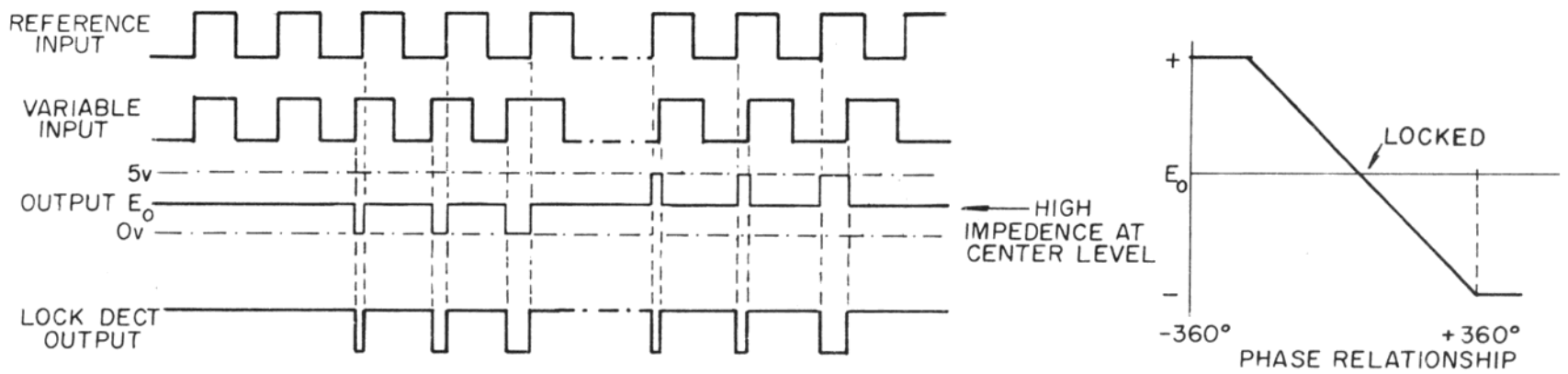


Fig. 32 — Phase Detector Operation

9.2 CHARGE PUMP

The schematic of the charge pump is shown below. The charge pump is considered part of the phase detector.

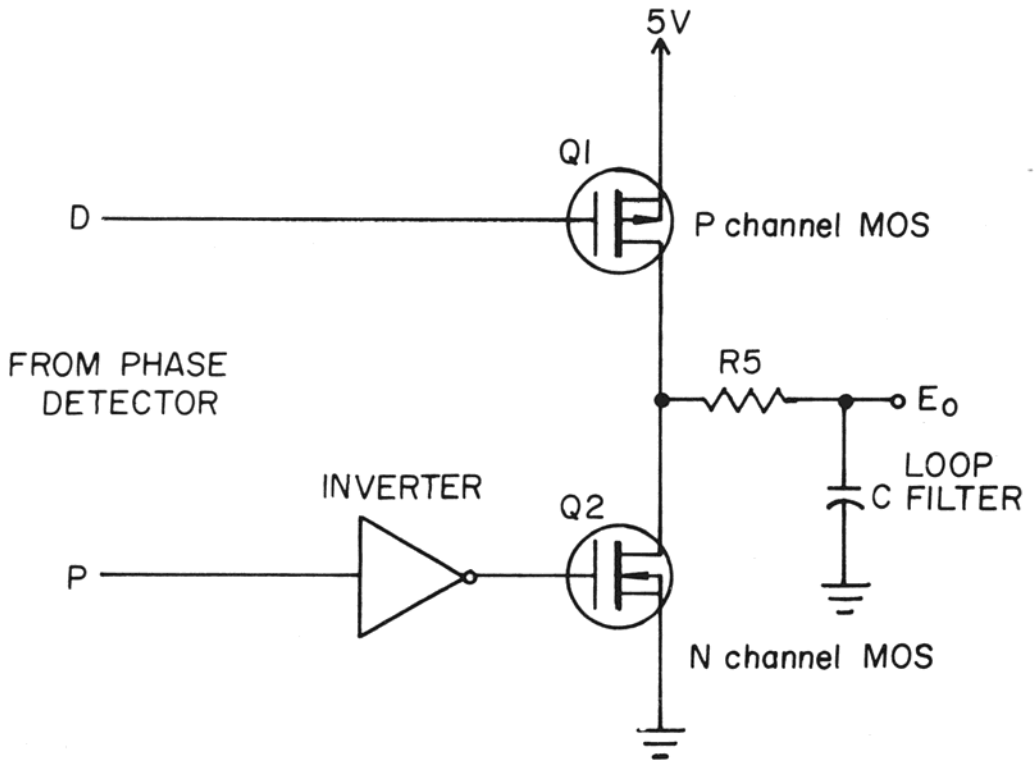


Fig. 33 — Charge Pump

A CMOS IC is used for the charge pump. As shown in Figure 33, this circuit is a push-pull circuit with an inverter connected to one input. When D is 1 and P is 0, a positive voltage is applied to Q2 (N channel) by the inverter. Q2 is turned on and C discharges. When D is 0 and P is 1, Q1 (P channel) is turned on and C is charged. When both D and P are 1, both Q1 and Q2 are turned off, Eo is floating and the voltage of C is held at the previous value.

The hold time is inversly proportional to the gate leakage current of Q1 and Q2. However, when the hold time becomes longer, Eo is maintained at a fixed value and the VCO controlled by Eo is maintained at a constant frequency for an extended period of time.

Operating Frequency	VCO Frequency	Down Mixer Output	Programmable Divider ÷ By	LOGIC STATES AT PROGRAMMABLE DIVIDER 17	16	15	14	13	12	11	10	9
25.995	33.795	.46	92	0	0	1	1	1	0	1	0	0
26.500	34.300	.965	193	1	0	0	0	0	0	1	1	0
27.000	34.800	1.465	293	1	0	1	0	0	1	0	0	1
27.150	34.950	1.615	323	1	1	0	0	0	0	1	0	1
27.155	34.955	1.62	324	0	0	1	0	0	0	1	0	1
27.160	34.960	1.625	325	1	0	1	0	0	0	1	0	1
27.500	35.300	1.965	393	1	0	0	1	0	0	0	1	1
28.000	35.800	2.465	493	1	0	1	1	0	1	1	1	1

This chart is correct for Uniden 8719 chassis with 11.1125 crystal only.

0 Represents 0v **1 Represents 5v**

Figure 34

SUMMARY

Considering overall PLL operation, if the frequency of the VCO is assumed to be higher than desired:

1. The down mixer output frequency will be higher than desired.
2. The programmable divider output frequency will be above 5 KHz.
3. The phase detector will sense the variable input leading phase and send out negative going pulses.
4. These pulses are filtered by the loop filter.
5. The decreased reverse bias is applied to the varactor diode on pin 5 of the VCO chip.
6. Because the capacitance of the varacotor diode controls the oscillating frequency of the VCO, the VCO frequency will decrease and become locked at the objective frequency.

LIMITED 6 MONTH WARRANTY PARTS & LABOR

D. T. I.) warrants this product to be free from defects in material and workmanship for a period of six months from date of original sale to the ultimate user. D. T. I. will repair free of charge any D. T. I. product which in the judgment of D. T. I. has proven to be defective within the six month period when said product is returned at customer expense to D. T. I. or one of D. T. I.'s Authorized Warranty Stations. This warranty does not cover any expenses incurred in the removal and re-installation of this product.

This warranty does not apply to any D. T. I. product damaged by accident, misuse, abuse, improper line voltage, fire, flood, lightning, or other acts of God, or by being altered or repaired by anyone other than D. T. I. or one of its Authorized Warranty Stations. This warranty does not cover marred cabinets, or any other accessory used in connection with the product or damage due to a defect in the product.

This warranty is in lieu of all other warranties expressed or implied including any implied warranty of merchantability, and no person is authorized to assume for D. T. I. any other liability in connection with the sale of the product.

If problems develop, properly pack the 400 and enclose a brief description of the problem. Send to:

DIGALOG TECHNOLOGY, INC.

4216 N. Maxson Rd.
El Monte, CA 91732 U.S.A.

Technical questions can be answered from 8:00 a.m. to 12:00 p.m. (Pacific Standard Time) Monday through Friday at this number:

(213) 579-2842