Operation & Service Manual

322ARX

The Necode 322 ARX "Ringer"
Long Range Communications Without Constant Radio Monitoring

No need for constant radio monitoring - Frees station personnel for other duties.
Specifically designed for use with any HF SSB radio equipment.
Selective calling of any remote station.

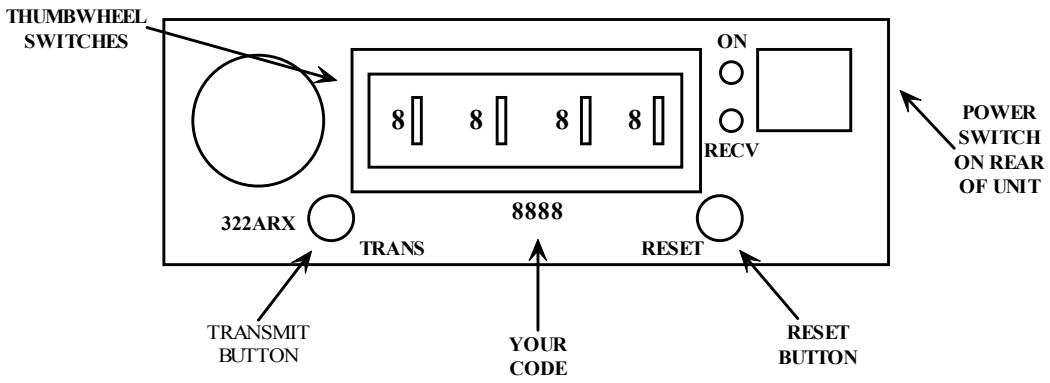
Necode ELECTRONICS
A DIVISION OF RHODES ELECTRONICS, INC

CONTENTS

OPERATION
RECEIVING A CODED CALL

1. The unit can only receive a coded call on the channel or frequency that your transceiver is monitoring. Be sure to keep the radio on your normal calling and receiving channel.
2. The four-digit number on the front of your unit is your private code number that other stations use to call your station.
3. When a coded call is received and decoded. A two-tone alarm is heard and a two-digit number is displayed in the window on the right side of the unit. This number indicates the assigned ID number of the calling station.
4. Both the audio alarm and visual read-out are reset when the reset button is pushed. After resetting respond to the calling station by normal radio procedure.

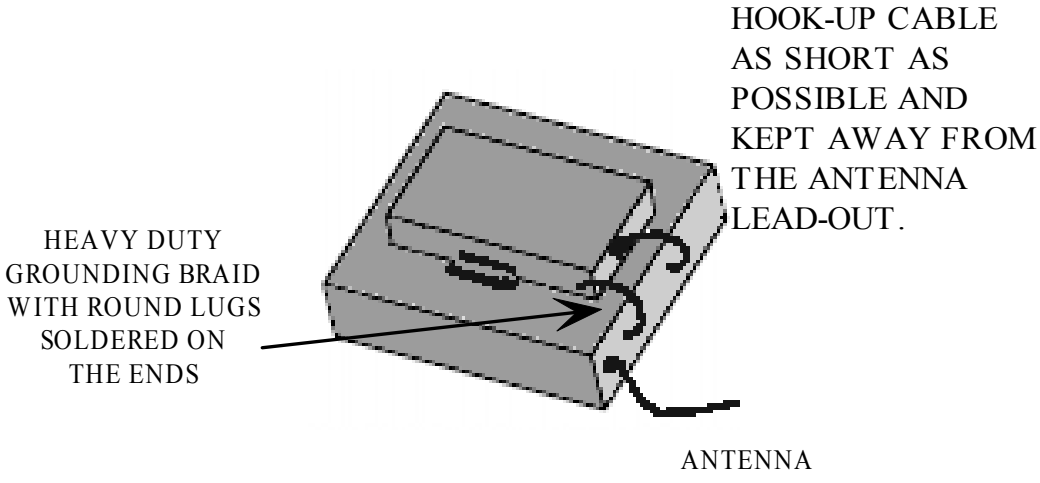
THE UNIT MUST BE RESET BEFORE A CODED CALL CAN BE TRANSMITTED



1. Set the four-digit code number of the station you wish to call on the thumbwheel switches on the front of the unit.
2. Make sure the transceiver is on the proper channel or frequency.
3. Turn the receive volume up and wait until the channel is not in use.
4. Push the transmit button momentarily and the unit will automatically transmit your code call. Do not hold the transmit button in. The ON lamp will brighten up during the transmit cycle.
5. Immediately after the code has been transmitted you will hear a two tone beep on the speaker of your transceiver if the station you called has the acknowledge option. If not, identify your station via voice using normal radio calling procedure. Wait at least three minutes for the station to respond before code calling again.

R.F. FEED-BACK

RF run-a-way is the most common problem encountered during the installation and check out of the 322ARX. RF feedback occurs when the transmitted out-put from the antenna gets back into the transmitter mike input. This causes the transmitter to run-a-way and become totally out of control. The 322ARX is an extension of the mike and receive circuits so any RF energy that gets into the circuit can cause this problem. When P2 (transmit drive) has no effect on the transmitter power you probably have RF feedback. This problem is most often encountered with radios that do not use a remote antenna tuner and also 1000w units, which make the problem much worse. So precautions taken at the beginning of the installation can save time and headaches. Here are a few simple suggestions that may help.

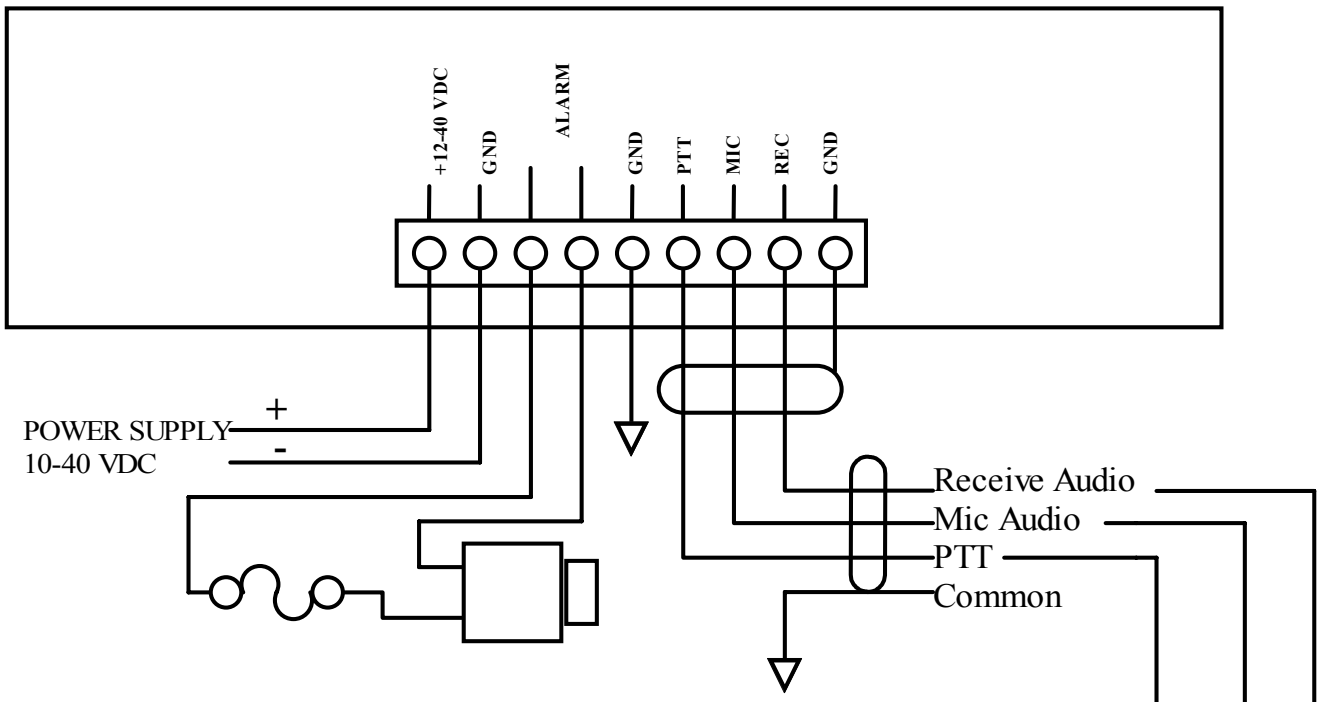


1. Determine if the radio is already in a strong RF field and is it one of the above types.
2. Is the radio bonded to a good RF ground? Like bolted to the ship's hull or grounded to the metal of a building.
3. Will the necode have to share the power supply with the radio? During transmit this can cause power supply modulation and that can cause feedback or distortion in the transmitted signal.
4. Is the antenna lead close to where the necode will be mounted? If so a RF bond between the radio and the necode will be necessary.
5. Will the necode be mounted far away from the radio? Explain the problem this might cause to the customer. Keep the hook-up cable as short as possible.
6. On LO-Z mike circuits a .01uf cap at the point of connection inside the radio will help. On HI-Z mike inputs a .01uf cap then a 100k resistor in series to the mike input. By-pass attempts work best at the radio end of the hook-up cable.
7. When possible run shielded wire for remote alarms.

INSTALLATION

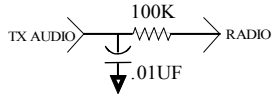
Two angle brackets are supplied with the unit, which can be used to secure the unit to a table or shelf.

GROUND THE SHIELDS TO THE RADIO CHASSIS BEFORE ENTERING THE RADIO OR IMMEDIATELY AFTER PENETRATING THE RADIO CHASSIS. DO NOT ALLOW ANY OF THE UNSHIELDED CONDUCTORS TO BE EXPOSED TO **RF** ENERGY.



HOOK THE KEYLINE BEFORE ANY ENTERLOCKS SO AS NOT TO DEFEAT THEM. ALSO THE KEYLINE CURRENT MUST BE LESS THAN 1/2 AMP

THE TRANSMIT AUDIO IS LO-Z (600 OHM) AND MAY NEED AN ISOLATION NETWORK FOR RADIOS WITH DYNAMIC OR HI-Z MIKE CIRCUITS. THE SUGGESTED NETWORK GOES IN THE RADIO.

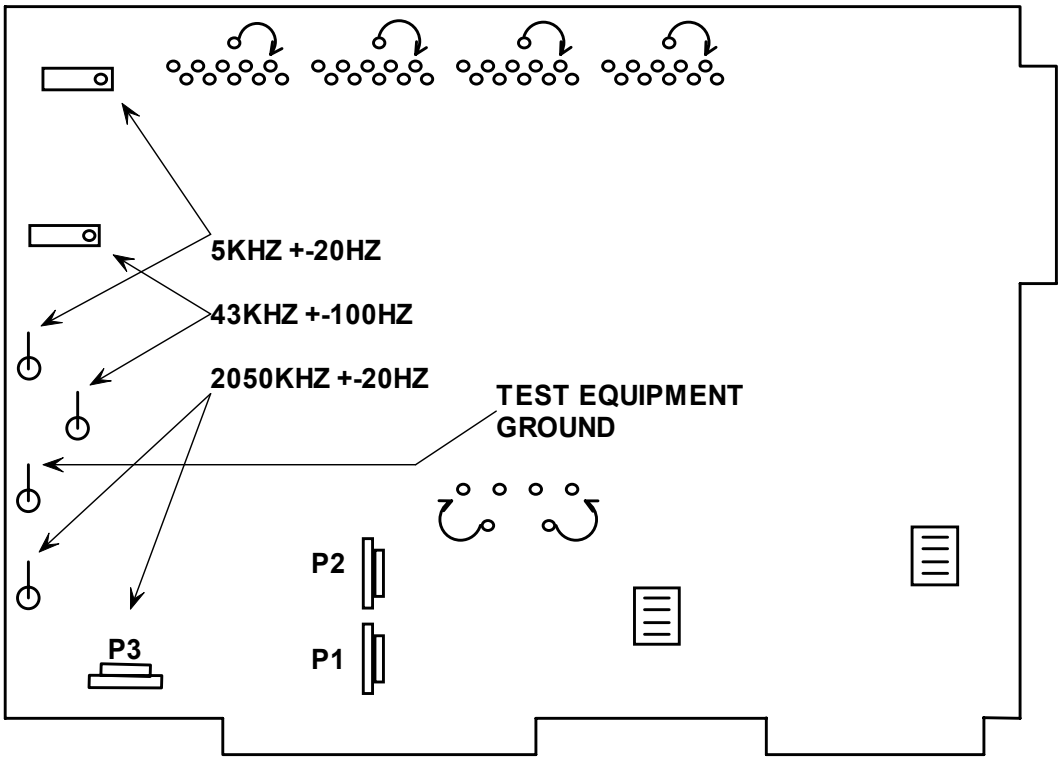


THE RECEIVER AUDIO MUST BE AT LEAST 20_{MVPP} AND CONNECTED BEFORE ANY VOLUME OR SQUELCH CONTROLS.
DO NOT HOOK TO THE SPEAKER. ALSO ANY RF GAIN CONTROL SHOULD BE DISCONNECTED OR DISABLED IN SOME MANNER

ADJUSTMENTS

After the unit has been installed apply power to both the necode and the transceiver. The ON lamp on the front of the unit should be lighted

P1 **Receive gain adjustment**. Turn the pot up from the off position until the RECV lamp on the front of the unit glows brightly on noise (not just audio peaks like voice or tones). If the receiver input is less than .5vac set the pot to maximum.
P2 **Transmit drive adjustment**. On radios with compressor mike circuits set P2 to the 1/2 open position. On older and 1kw units set the power out to about 2/3 the maximum power out. If the power goes to maximum each time the unit is keyed and P2 is not controlling the power out; you probably have RF feedback. Check all shielding and replace the cover after each adjustment. *See page 3*



P3-P4-P5 are factory set and locked with shrink tubing. Do not adjust them unless they are over 5% off on a hot unit. To adjust them leave the cover and power on for at least an hour then unplug the RP plug and set the three oscillators to the above tolerance. The 5vpp square wave at these points will overdrive some counters and cause them to give unstable and false readings.

PROGRAMING

Your necode 322ARX comes programmed with an unused receive code. To check or test your unit, perform the self-test.

SELF TESTING

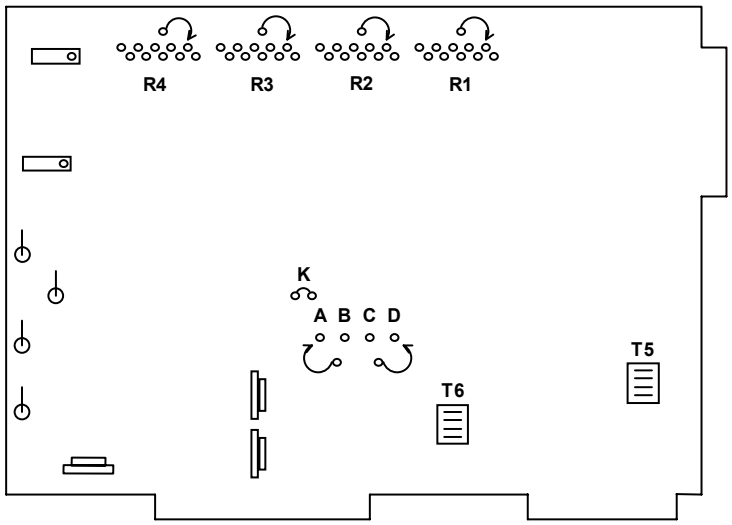
To check your programming, disconnect the PTT wire at the rear of the unit and set the thumbwheel switches to the receive code marked on the front of the unit. Momentarily press the Trans button and the unit will code call itself. The alarm will sound and a two-digit number will light in the window, this is your I.D. number programmed into T5 & T6.

REPROGRAMING RECEIVE CODE

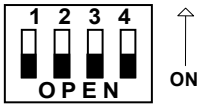
To change your receive code. Move R1 - R4 plugs to the new number and self test as described above.

PROGRAMMING I.D. NUMBERS

To change your I.D. numbers, set T5 & T6 to the desired digits. See chart below. Beware of programming T5 & T6 to illegitimate numbers. Any combination of numbers that exceed the total of 9 per switch will appear as broken digit segments in read out display windows. EXAMPLE: 1 & 2 & 4 = 11 will show up as a letter C in the display.



T5 & T6



DIGIT	SECTION
1	1
2	2
3	1 & 2
4	3
5	1 & 3
6	2 & 3
7	1 & 2 & 3
8	4
9	1 & 4

ALARM JUMPERS:
- A- Remote alarm contacts closed for 3 seconds.
- B- Remote alarm contacts closed until reset.
- C- Local alarm sounds for 3 seconds.
- D- Local alarm sounds until reset

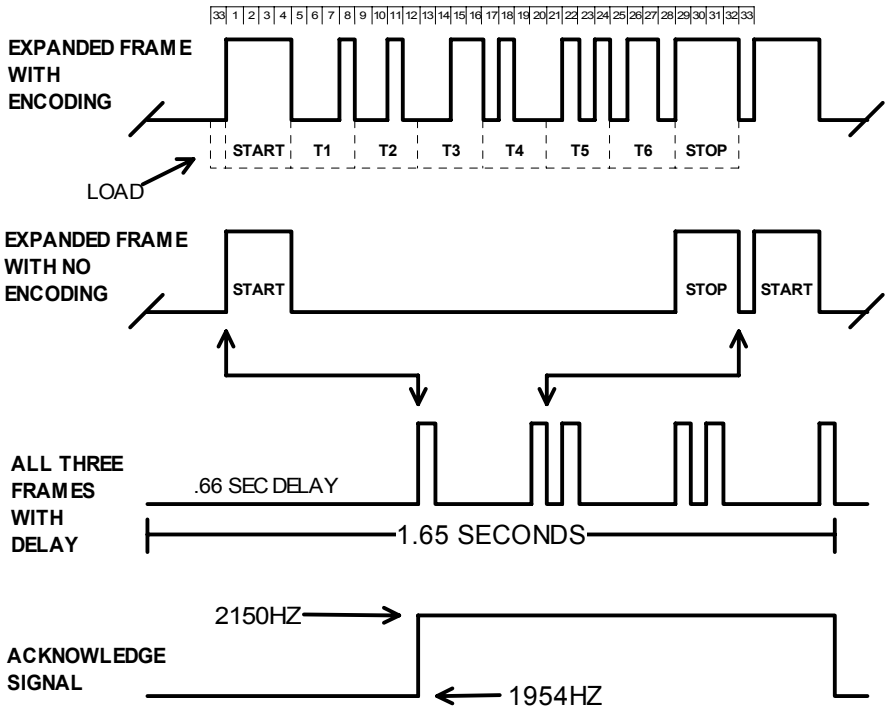
ACKNOWLEDGE DEFEAT:
- K- cut this jumper to defeat the acknowledge.

THEORY OF OPERATION

This general description of the necode 322ARX is not intended to be a complete technical guide. It is a short summation of the binary framing and decoding of the information transmitted.

ENCODING

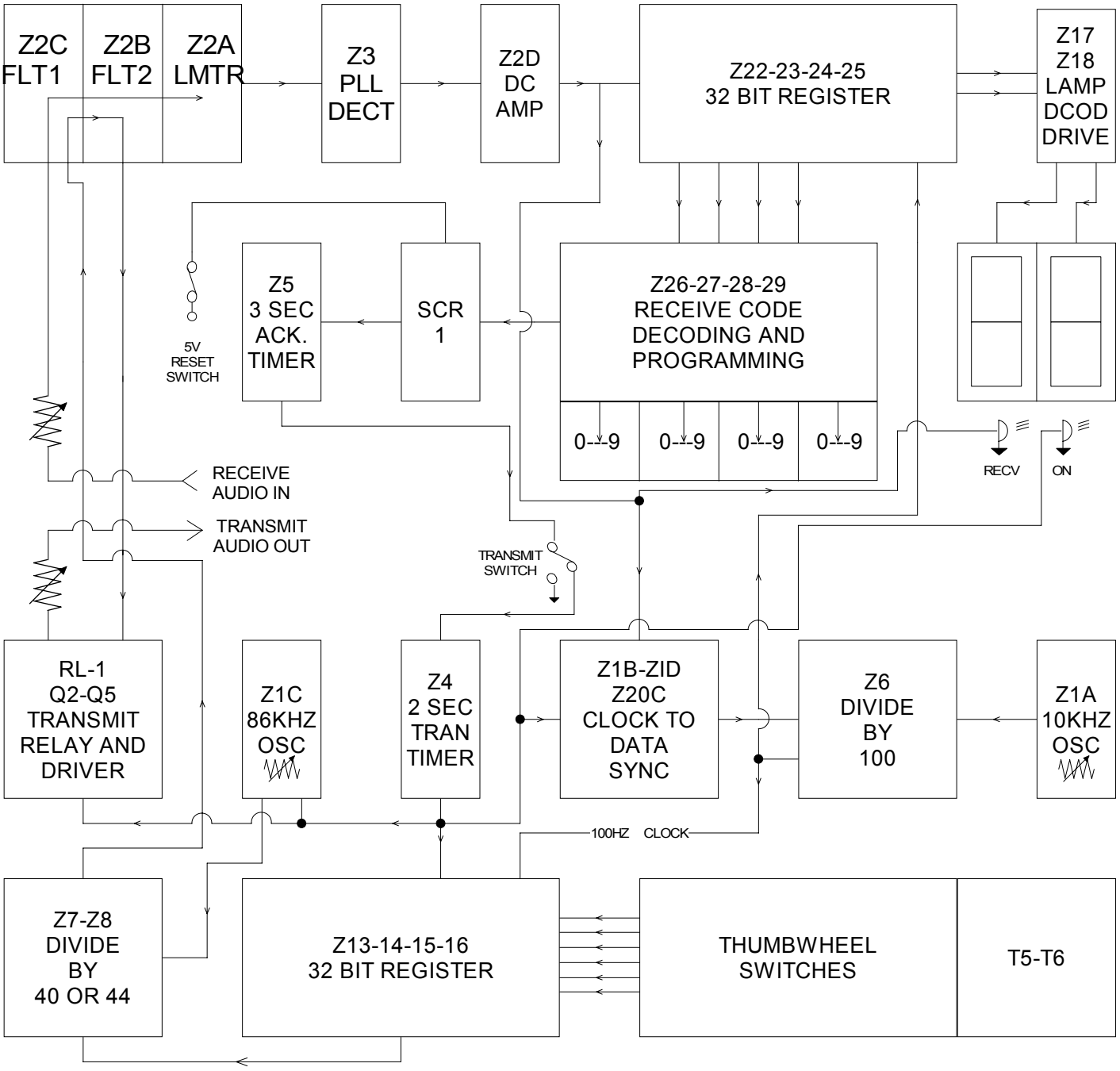
The basic transmitted frame is 320ms long when clocked by a 100hz clock. Thirty-two (32) 10ms bits compose the frame with the first four bits and last four bits designated as start and stop brackets. Bits 5 through 28 (24) are encoded with six BCD numbers. The first four numbers are programmed by the thumbwheel switches for caller identification. These frames are used to modulate a variable divider, which gives 1945hz for logic 0 and 2150hz for logic 1. The data of the Transmission is delayed at the beginning by .66 seconds to allow for transmitter warm-up. The square wave tones are filtered before being used to modulate the transmitter.



DECODING

The receive audio from the transceiver is filtered, amplified, and limited. Then presented to the phase lock loop detector, which has a free-running frequency of 2050hz. The output of the PLL is a varying DC which when amplified and clipped represents the transmitted frames. This recovered data is sent to the decoder where the data within the frames is compared to the programmed receive code. If the first four digits match, a SCR diode is pulsed and the alarm/acknowledge circuit board. Three seconds later a two-tone audio signal is transmitted back to the calling station. The normal data from the encoder is inhibited until the unit is reset, so no data is transmitted.

322 BLOCK DIAGRAM



FAULT DIAGNOSIS

INTRODUCTION

Each necode 322ARX is capable of self-testing it's own operation. If the unit is suspected of improper operation, disconnect the PTT wire and code call your own number. The unit should alarm and display your caller I.D. number on the read out.

NOTE: P2 (transmit drive) should be set to the 1/2 open position. Test and reduce P2 in steps toward the off position. A unit with normal sensitivity should continue to operate until P2 is closed, or nearly closed.

REPAIR IS ACHIEVED BY REPLACING THE DEFECTIVE PCB.
Take care to remove power from the unit, before attempting PCB removal. NO attempts should be made to replace integrated circuits due to logic design; PCB failures are difficult to repair in the field and are not recommended.

The following descriptions and drawing are included to aid the technician in location and replacing defective PCB's or associated parts.

> * CAUTION *
>
> THE USE OF UNNECESSARY HEAT ON THE BOARD WILL DAMAGE THE FOILS & MAY FORFEIT WARRANTY

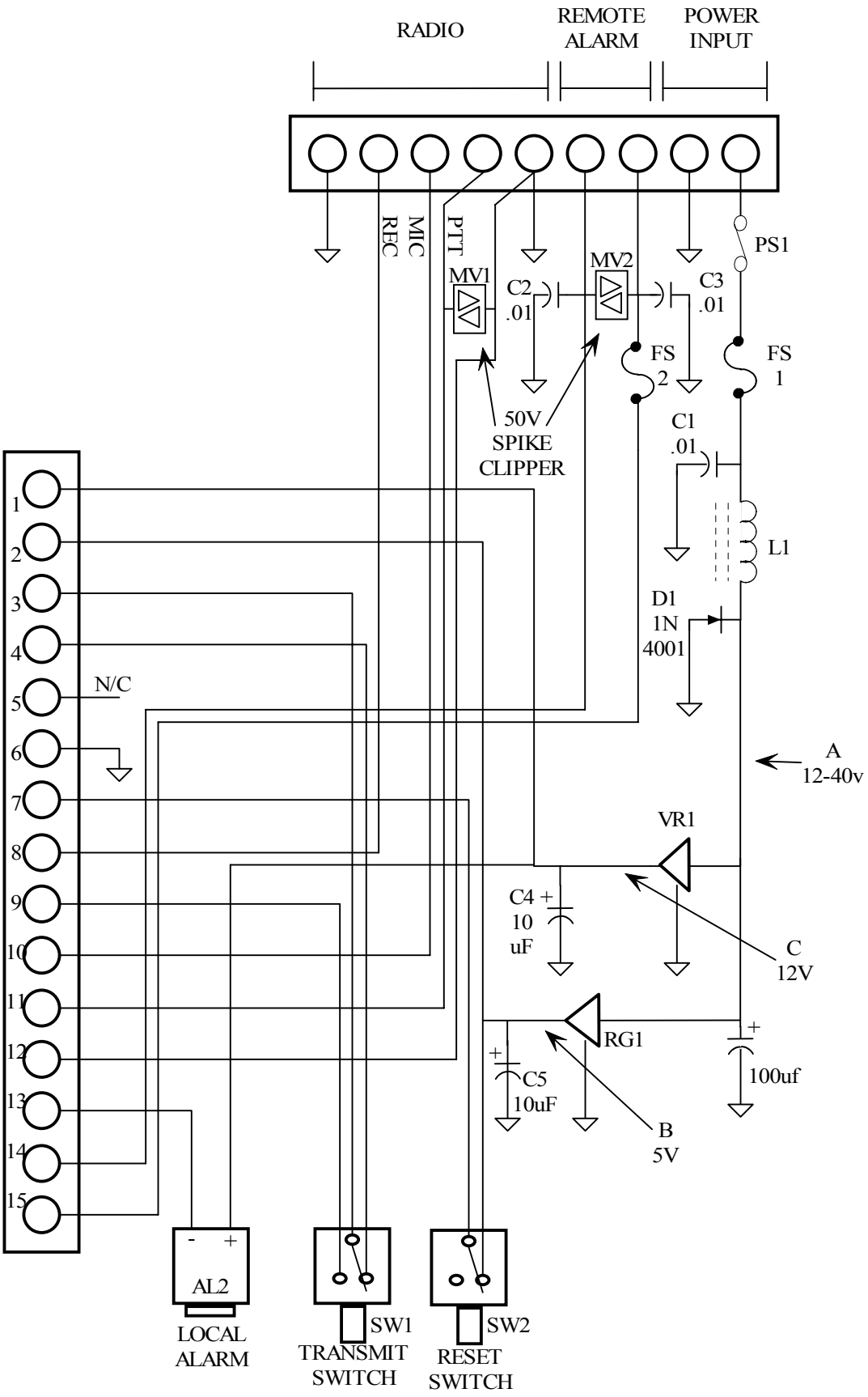
POWER SUPPLY

See main frame drawing on page 10. Remove the main PCB. Check chassis for the following voltages.

TEST POINTS:

(A) 12-40 VDC at L1.
(B) 5V +-.2v at the output of RG1.
(C) 12V +- 10% at the output of VR1.

If all voltages are correct go to page 11 for the main board test.


RADIO
REMOTE ALARM
POWER INPUT
MIC REC
PTT
MV1
C2 .01
MV2
C3 .01
PS1
FS 2
FS 1
50V SPIKE CLIPPER
C1 .01
L1
D1 1N 4001
N/C
A 12-40v
VR1
C4 + 10 uF
C 12V
RG1
C5 10uF
100uf
B 5V
AL2
LOCAL ALARM
SW1
TRANSMIT SWITCH
SW2
RESET SWITCH
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

MAIN FRAME

FAULT DIAGNOSIS CONTINUED

MAIN BOARD OSCILLATOR CHECK

Equipment needed: A frequency counter capable of tracking low frequencies at 5vpp level.

See the illustration on page 12 for oscillator test points. Note the test equipment ground connection. Check the three oscillators for operation (the necode should be disconnected from the radio during this and all other tests). The adjustment pots are locked with shrink tubing and should not be adjusted unless they are over 5% off frequency. It is normal to get low reading on cold units. See the adjustments section on page 5. If all three are operating, go to next test.

MAIN BOARD DIGIT TEST

Equipment needed: A dual trace oscilloscope with internal triggering.

See page 12 for an illustration of the main board digit test.

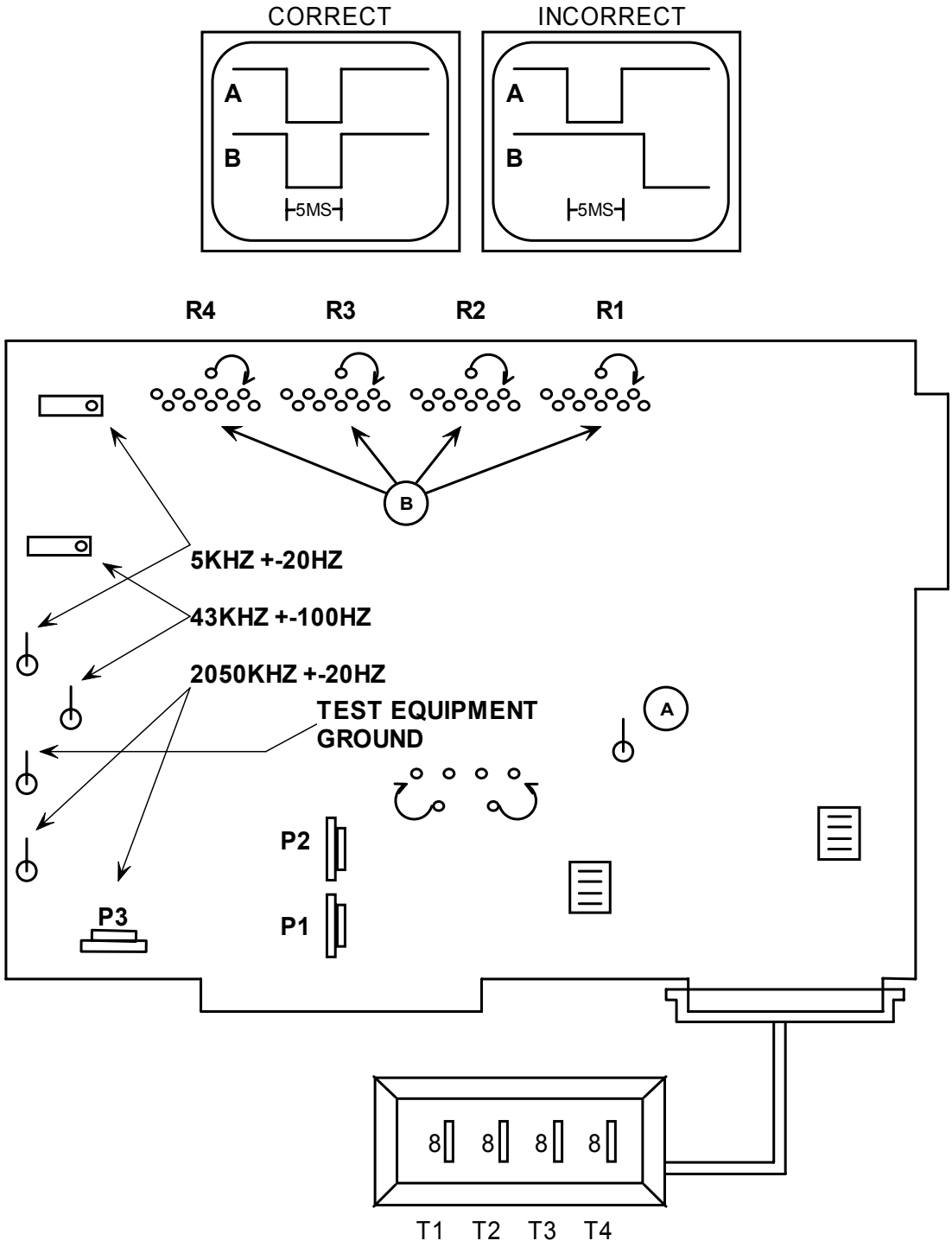
Hook the A trace probe to the gate pulse test point and set the internal trigger to negative. Connect the scope ground lead to the equipment ground. Self test and there should be a negative 5ms pulse each time bits 1-2 -3-4 and 29-30-31-32 are high in the decode register. This is the central test point for encode and decode operations. A matching B trace will be found at the proper R point. See the example on page 12.

If you fail to get the above pulses go to the encoder circuit operation on page 16 and trace the signal from Z16 on through to Z19 (the gate pulse).

:SERVICE NOTE**:**

DO NOT OVER LOOK A FAULTY THUMBWHEEL ASSEMBLY AS THEY ARE MORE DIRECTLY EXPOSED TO THE ELEMENTS.

OSCILLOSCOPE

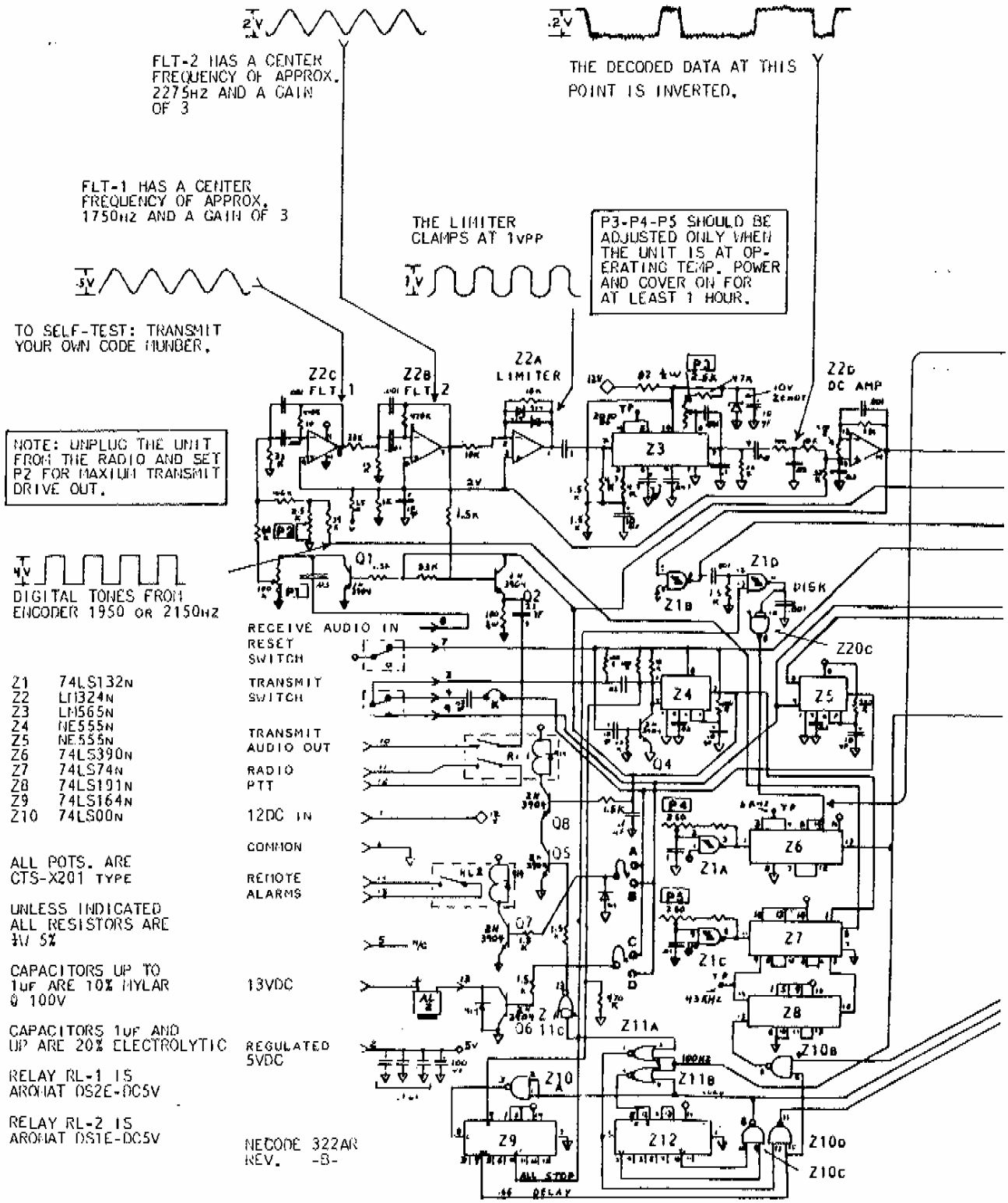


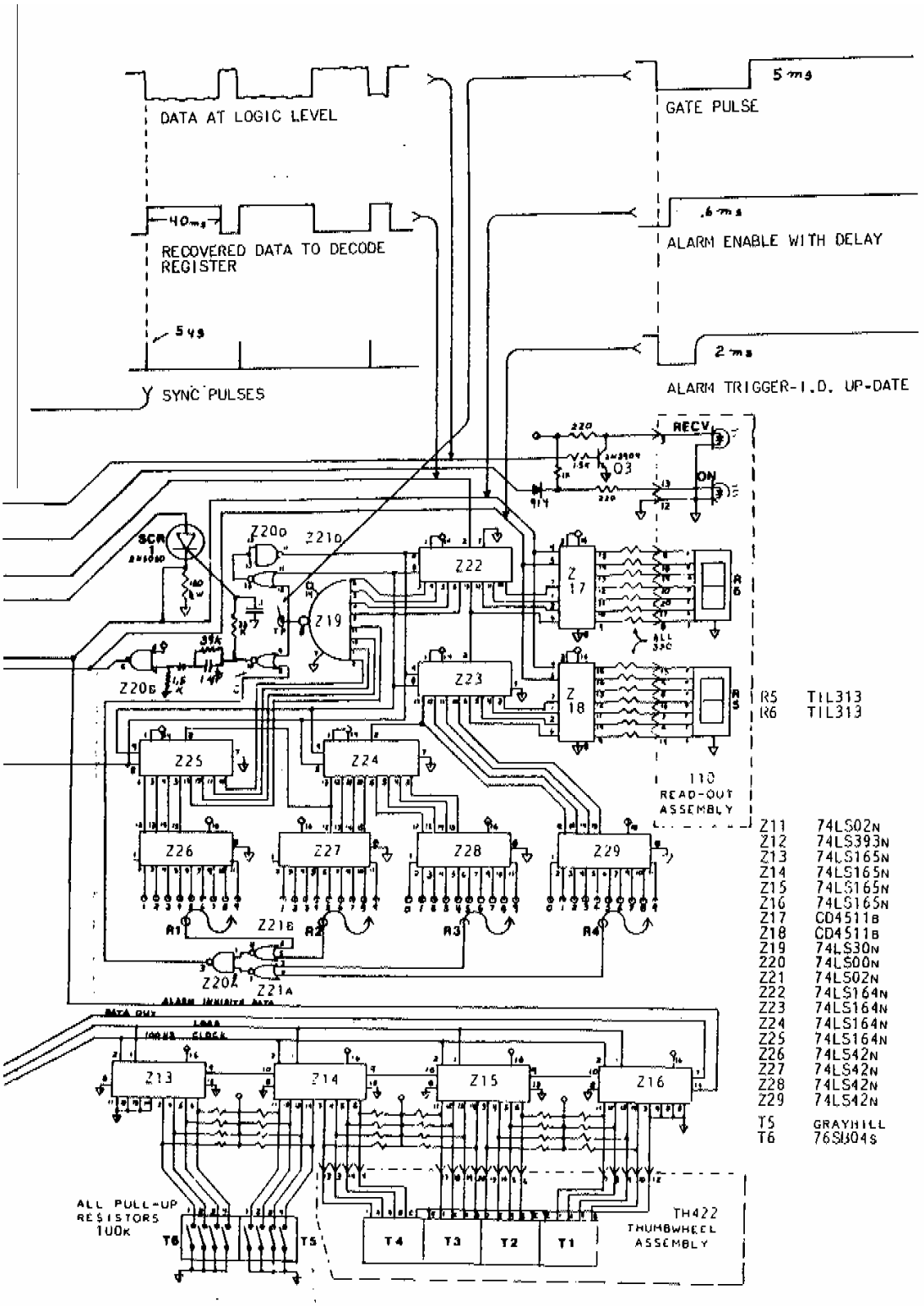
This test checks both the encoder and the decoder.

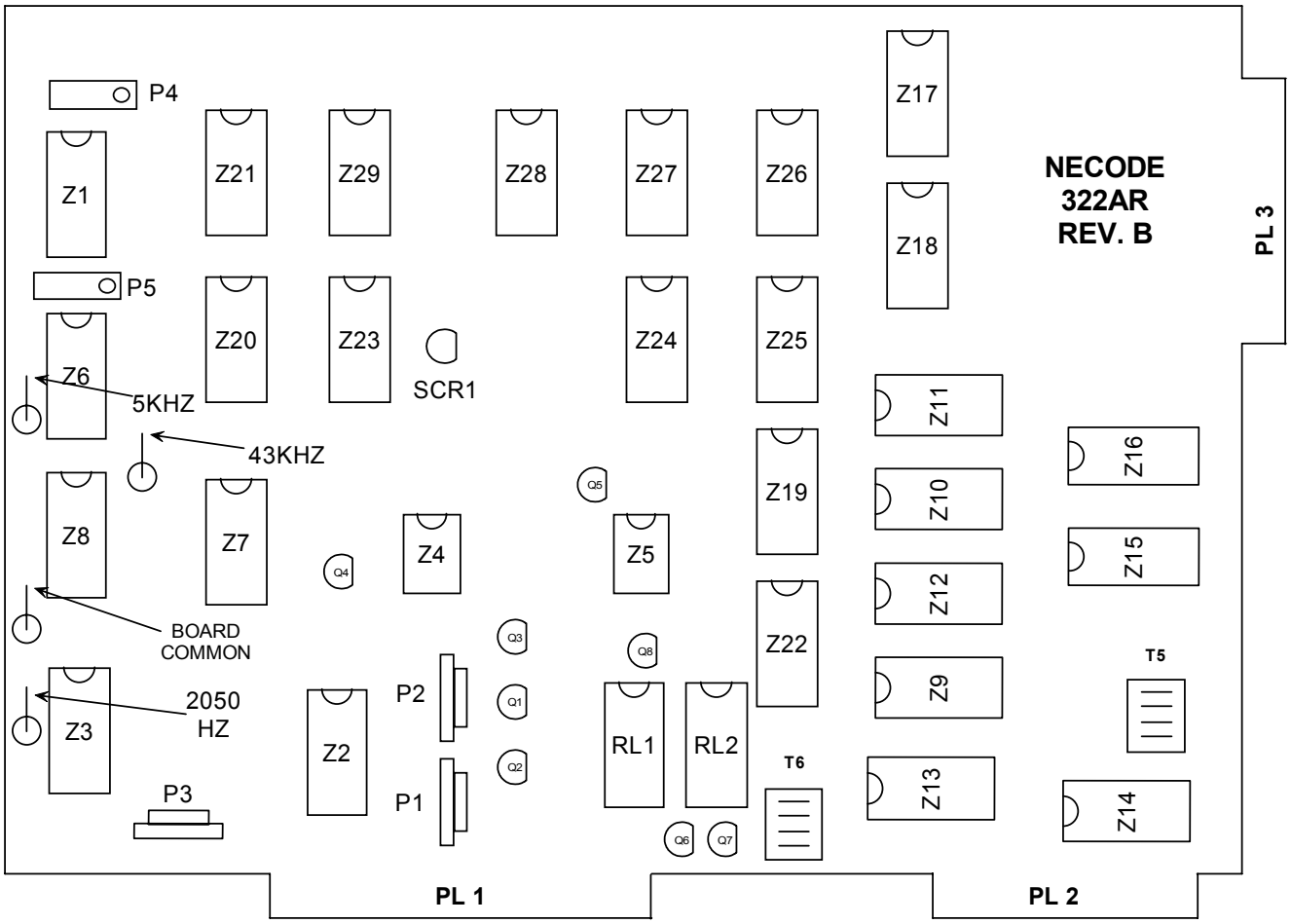
Hook the A trace probe to the test point shown with the internal trigger set to the A trace.

When self-testing the above example (where the thumbwheel switches are set to 8888) a matching B trace will be found at R1-8, R2-8, R3-8, and R4-8.

Note: When testing a zero the correct B trace will be a low straight line.


FLT-2 HAS A CENTER FREQUENCY OF APPROX. 2275HZ AND A GAIN OF 3
THE DECODED DATA AT THIS POINT IS INVERTED.
FLT-1 HAS A CENTER FREQUENCY OF APPROX. 1750HZ AND A GAIN OF 3
THE LIMITER CLAMPS AT 1VPP
P3-P4-P5 SHOULD BE ADJUSTED ONLY WHEN THE UNIT IS AT OPERATING TEMP. POWER AND COVER ON FOR AT LEAST 1 HOUR.
TO SELF-TEST: TRANSMIT YOUR OWN CODE NUMBER.
NOTE: UNPLUG THE UNIT FROM THE RADIO AND SET P2 FOR MAXIUM TRANSMIT DRIVE OUT.
DIGITAL TONES FROM ENCODER 1950 OR 2150HZ
Z1 74LS132N
Z2 LM324N
Z3 LM565N
Z4 NE555N
Z5 NE555N
Z6 74LS390N
Z7 74LS74N
Z8 74LS191N
Z9 74LS164N
Z10 74LS00N
ALL POTS. ARE CTS-X201 TYPE
UNLESS INDICATED ALL RESISTORS ARE 1/4W 5%
CAPACITORS UP TO 1uF ARE 10% MYLAR @ 100V
CAPACITORS 1uF AND UP ARE 20% ELECTROLYTIC
RELAY RL-1 IS AROMAT DS2E-DC5V
RELAY RL-2 IS AROMAT DS1E-DC5V
RECEIVE AUDIO IN
RESET SWITCH
TRANSMIT SWITCH
TRANSMIT AUDIO OUT
RADIO PTT
12DC IN
COMMON
REMOTE ALARMS
13VDC
REGULATED 5VDC
NECODE 322AR REV. -B-
Z2C FLT 1
Z2B FLT 2
Z2A LIMITER
Z2D DC AMP
Z3
Z1D
Z1B
Z20C
Z4
Z5
Q1
Q2
Q4
Q5
Q6
Q7
Q8
Z6
Z1A
Z7
Z1C
Z8
Z10B
Z11A
Z11B
Z10
Z9
Z12
Z10D
Z10C


DATA AT LOGIC LEVEL
40ms
RECOVERED DATA TO DECODE REGISTER
54s
SYNC PULSES
5ms
GATE PULSE
.6ms
ALARM ENABLE WITH DELAY
2ms
ALARM TRIGGER-I.D. UP-DATE
RECV
ON
Q3
SCR
Z20D
Z21D
Z19
Z22
Z17
Z23
Z18
Z20B
Z25
Z24
Z26
Z27
Z28
Z29
R1
R2
R3
R4
Z20A
Z21A
110
READ-OUT
ASSEMBLY
R5 TIL313
R6 TIL313
Z11 74LS02N
Z12 74LS393N
Z13 74LS165N
Z14 74LS165N
Z15 74LS165N
Z16 74LS165N
Z17 CD4511B
Z18 CD4511B
Z19 74LS30N
Z20 74LS00N
Z21 74LS02N
Z22 74LS164N
Z23 74LS164N
Z24 74LS164N
Z25 74LS164N
Z26 74LS42N
Z27 74LS42N
Z28 74LS42N
Z29 74LS42N
T5 GRAYHILL
T6 76SB04S
DATA OUT
LOAD
SHIFT CLOCK
Z13
Z14
Z15
Z16
ALL PULL-UP RESISTORS 100K
T6
T5
T4
T3
T2
T1
TH422
THUMBWHEEL
ASSEMBLY



COMPONENT LOCATOR

ENCODING CIRCUIT OPERATION

This circuit description is to be used with the schematic on pages 13 and 14. Also see the component locator on page 15.

Z1A 1/4 74LS132N	Is a 10KHZ oscillator.
Z6 74LS390N	A dual decade counter which divides the 10KHZ into a 100HZ clock for time base. NOTE: This is the 5KHZ set point for P4.
Z4 NE555N	Is a 2 second timer which supplies the encode enable voltage to Q1, Q2, Q8, Z7B, and the bright-up to the ON lamp. A negative trigger pulse from the transmit switch or Z5 (Alarm/Acknowledge) sets Z4 and Z9 in operation.
Q4 2N3904	Is a 15MS lockout for Z4 during power-up and resetting.
Z11A 1/4 74LS02N	Enabled by Z9 supplies the 100HZ clock from Z6 to Z12 and Z10D.
Z12 74LS393N	A dual binary counter divides the 100HZ by 33.
Z10C 1/4 74LS00N	Detects when a binary 33 is present in Z12 and generates a 5MS load pulse for Z10A, Z11B, Z13, Z14, Z15, and Z16.
Z10A 1/4 74LS00N	Inverts the load pulse from Z10C and drives Z9.
Z11B 1/4 74LS02N	Supplies a clock-synchronized reset to Z12 after the 5MS load pulse.
Z9 74LS164N	Is used as an event counter and shifts in the load pulses from Z10A. Pulse #2 enables Z10D and Z10B. Pulse #5 disables Z11A which completes the encode cycle.
Z10D 1/4 74LS00N	When enabled by Z9 supplies the 100HZ clock to Z13, Z14, Z15, and Z16.
Z13 through Z16 all 74LS165N	Forms a 32-bit shift register parallel in/serial out. Data from the thumbwheel and I.D. switches is loaded into the register by Z10C and shifted out by Z10D. This is done 3 times. The data output drives Z10B.
Z1C 1/4 74LS132N	Is a 86KHZ oscillator.
Z7A 1/2 74LS74N	Divides the 86KHZ by 2. NOTE: This is the 43KHZ set point for P5.
Z8 74LS191N	Is a presettable binary counter, which divides the 43KHZ by 10 or 11 depending on the data from Z10B. The output is either 4300HZ or 3908HZ and drives Z7B.

ENCODING CIRCUIT OPERATION CONTINUED

Z7B 1/2 74LS74N	Is enabled by Z4 and divides the output from Z8 to Z150HZ or 1954HZ which are the transmit tones is digital form. They are fed to Z2C through an adjustable pad P2.
Z2C and Z2B 1/2 LM324N	Is an active band-pass filter and cleans up the square wave from Z7B.
Q1 2N3904	When enabled by Z4 grounds the receive audio input during encoding.
Q2 2N3904	When enabled by Z4emittter drives the transmit tones (LO-Z) to RL-1.
RL-1 RELAY	D.P.D.T. is enabled by Q5 and Q8. Connects the transmit tones to the radios mike circuit and keys the PTT.
Q5 2N3904	Is enabled by Z11D.
Q8 2N3904	Is enabled by Z4.
Z11D 1/4 74fLS02N	Inverts the all-stop from Z9 and drives Q5.

DECODING CIRCUIT OPERATION

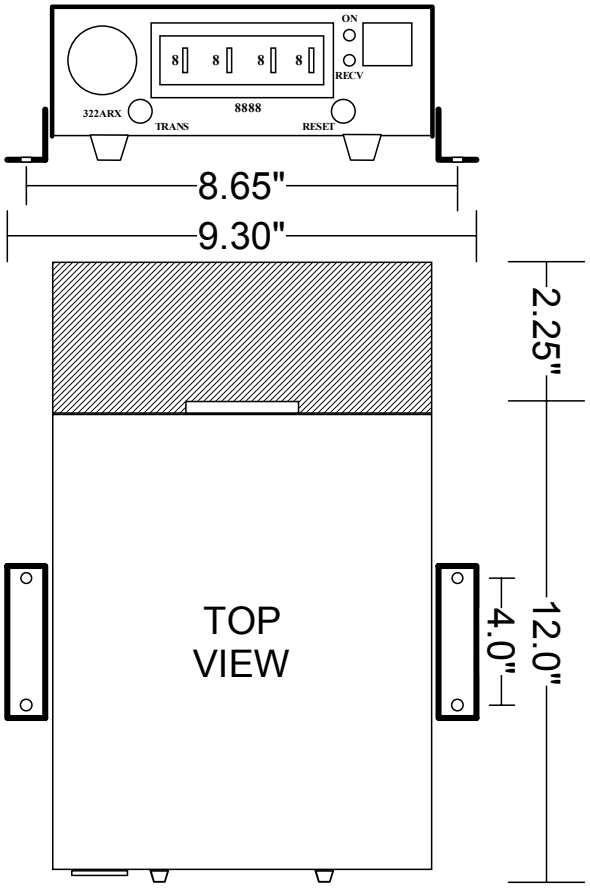
Z2C AND Z2B 1/2 LM324N	Form an active band-pass filter with the 3DB down points at approx. 1550 and 2650HZ with a gain of ten at the center.
Z2A 1/4 LM324N	Limits the filtered input signal to .7VPP.
Z3 Lm565N	Is a phase lock loop with a free running frequency of 2030HZ and detects the tone shifts of the input signal.
Z2D 1/4 LM324N	An active lo-pass filter and amp used to bring the detected tone shifts from Z3 to 5V-logic level and drives Q3 and Z1B.
Q3 2N3904	Drives the receive lamp.
Z1B 1/4 74LS132N	A schmitt trigger that cleans up the crossover point from Z2D and drives Z1D and Z22.
Z1D 1/4 74LS132N	Forms a 5us neg. pulse from the leading edge of the incoming data and is disabled by Z9 during encoding.
Z20C 1/4 74LS00N	Inverts the 5us pulse from Z1D and drives the reset pins on Z6.
Z1A 1/4 74LS132N	Is a 10KHZ oscillator driving Z6.
Z6 74LS390N	Is a dual decade counter which divides the 10KHZ to 1--HZ clock for the decoder synced to the incoming data by Z20C.

DECODING CIRCUIT OPERATION CONTINUED

Z22 THRU Z25 ALL 74LS164N	Form a 32 bit serial in parallel out shift register. Data is shifted in at Z22 from Z1B and all clock inputs are driven from Z6.
Z19 74LS30N	Gives a 5ms neg. pulse when bits 1-2-3-4 and 29-30-31-32 are all high in the register. This is the (GATE PULSE) used for all logic tests.
Z26 THRU Z29 ALL 74LS42N	Are BCD to 1 of 10 decoders and supply program points for the 4 digit receive code.
Z21A and Z21B 1/2 74LS02N	Collects and NOR's the code programmed into Z26, Z27, Z28, and Z29.
Z20A 1/4 74LS00N	NAND's the output of Z21A and Z21B into a neg. 5ms pulse. (THIS MEANS A CORRECT REVEIVE CODE)
Z21C 1/4 74LS02N	NOR' s the pulse from Z20A with the pulse from Z19 to give a pos. 5ms pulse. (ALARM PULSE).
Z21D 1/4 74LS02N	Generates a clock synchronized clear pulse from Z19 following the 5ms alarm pulse.
Z20D 1/4 74LS00N	Inverts the clear pulse from Z21D and drives the clear pins on Z22, Z23, Z24, and Z25.
SCR-1 2N5060	Is pulsed on by the alarm pulse from Z21C and supplies and enable hign to the transmit switch (SW-1), Z5, Z17, Z18, Z16, and Q7 through the B jumper and Q6 through the D jumper.
Z20B 1/4 74LS00N	Forms a neg 2ms pulse from Z21C which drives the data latch on Z17 and Z18 and triggers Z5 on.
Z17 and Z18 MC4511B	Holds and drives the display for the I.D. digits the display is turned on by SCR-1.
Z5 NE555N	Is a 3-sec. Alarm/acknowledge timer and is enabled by SCR-1 and triggered on by Z20B. At the end of the 3 sec. Output the falling edge is coupled through the K jumper to the transmit switch (SW-1) which triggers Z4 and Z9 causing the encoder to acknowledge. No data is transmitted because SCR-1 disables Z16. Z5 also drives Q7 through the A jumper and Q6 through the C jumper.
RL-2 RELAY	S.P.S.T. is for remote alarm devices and max. current should be less than 1amp. (FUSED BY FS-2)
RESET SW-2	Supplies +5v to Z4 and SCR-1 when reset is pushed all alarm, encoding, and acknowledge is halted. NOTE: A defective reset switch can disable the entire board.

SPECIFICATIONS

Case	1/16 anodized aluminum 7.2"w x 2.5"h x 12"d
Weight	8 lbs. shipping
Operating Voltage	12-40VDC
Operating Current	300MA normal/400MA alarmed
Remote Options	Relay contacts timed or latched
Transmit Tones (Z=600OHM)	ADJ 0-2VPP
Transmit Tones	0=1954 1=2150
Transmit on/time	1650MS
Transmit Code (Variable)	0001 to 9999
Transmit Code (Present I.D.)	00 to 99
Code Speed	10MS per bit
Total Transmit Data	99 bits
Acknowledge delay	Approx. 3 sec.
Acknowledge on/time	165MS
Audio input from receiver	20MV MIN
Decode programming (Jumper Select)	1100 to 9999
Allowable receiver drift	±400HZ



PARTS LIST

Part#	Replacement New Parts
322AR-REV-D	Main printed circuit board.
110-A	Read-out board with wired plug.
TH-422	Thumbwheel assembly with plug.
100S	Scan-Stop pcb.
AL-1	Sonic alarm module
SW-1 & SW2	SPDT gold plated trans/reset switch.
PS-1	Silver contact power on/off switch.
HC-1	8-pin 5ft. wired and tested hook-up cable.
AB-5	5" mounting angle brackets.

EXCHANGE REPAIR PARTS

"NOTE" OLD PARTS MUST BE RETURNED
FIRST FOR EXCHANGE.

322AR-EXCG	Reconditioned main PCB.
110-EXCG	Reconditioned read-out PCB.

WARRANTY REPAIR

The 322AR is warranted by Necode Electronics for two years from date of installation against electrical or mechanical defects when returned to the factory.

Misuse or other damage to the unit such as water, salt-water spray, or wrong supply voltage voids warranty. Necode Electronics reserves final judgment on such matters.

To receive warranty repair, ship the unit freight pre-paid to Necode Electronics. Include problem description, return information, and a telephone number of person to contact.

-----RETURN TO-----

RHODES ELECTRONIC SERVICES INC.
3206 SHARON STREET
HOUMA, LA 70363

PH# (985) 580-3111 ~ (985) 868-2401
FX# (985) 872-5681