



15385 Carrie Drive
Grass Valley, CA 95959
Office: (530) 477-8400
Tech. Support: (530) 477-8402
FAX: (530) 477-8403
Sales: (800) 874-8663
Email:tech@norcommcorp.com
Web:www.norcommcorp.com

MODEL NC421 MOBILE TOUCH-TONE* DECODER
INSTRUCTION MANUAL

INTRODUCTION

The Model NC421 is a miniature Mobile Dash-Mount Touch-Tone Decoder, designed for selective signalling of fleet dispatched vehicles, mobile telephone systems or other control applications. The NC421 combines THREE distinct, multi-addressable DTMF Decoders in one highly versatile unit, and is enclosed in a smartly styled high impact plastic enclosure using front panel membrane switching with panel illumination of Call, Horn and Monitor control functions. The NC421 decodes all 16 standard DTMF characters, with an address length for both primary and secondary decoders of 1 to 14 digits and 3 digits for the third decoder used for remote programming only. (Factory Option) The NC421 employs E2PROM memory for non-volatile storage of programmed codes, user functions, deadbeat disable or auxiliary outputs regardless of power interruptions, and is easily programmed by means of a conventional DTMF Encoder, or the Model NC500 Universal/P.C. Field Programmer.

SPECIFICATIONS

- SIGNAL FORMAT Decodes all 16 standard DTMF (Touch Tone) characters.
[PRIMARY 1, 2 & 3] Field programmable using any of the 16 standard DTMF characters with an address length of 1 to 14 digits.
CODE CAPACITY
[SECONDARY] Field programmable using any of the 16 standard DTMF characters with an address length of 1 to 14 digits.
CODE CAPACITY
[REMOTE PROGRAMMING] Field programmable using any of the 16 standard DTMF characters with a fixed address length of 3 digits. NOTE: This feature is a factory activated option.
CODE CAPACITY
[GROUP/ALL CALL] Field programmable using any of the 16 standard DTMF characters with an address length of 1 digit.
CODE CAPACITY
DECODE ALGORITHM The Decoding Algorithm is designed to decode all possible code combinations. As an example, decoders used in the same system and programmed to codes "1", "12", "123" and "1234" would not decode improperly even though they contain the same correct codes within their sequences.
PROGRAMMING METHOD Field programmable by use of a standard 12 or 16 button DTMF encoder or optional Model NC500 Universal/P.C. Field Programmer. [No more programming by wire jumpers, code plugs or DIP switches.]
MEMORY Programmable data is stored in non-volatile E2Prom memory with 40 years data retention and will remain regardless of power interruptions. Requires no batteries.
DECODE DELAY/INTER-DIGIT Programmable from 200ms to 12 sec.
TIMEOUT
WRONG DIGIT RESET Digit counter will reset to zero (Ø) if programmed digits sent exceed interdigit time-out, out of sequence or wrong digit is received.
INPUT SIGNAL LEVEL >100mVRMS (with 47 ohm speaker load)
<10mVRMS (with 47 ohm speaker load removed)
INPUT IMPEDANCE 47 ohms (with speaker load)
>50K ohms (with speaker load removed)
TONE ACCEPTANCE B.W. 2.5%
DIAL TONE REJECTION Notches at 350Hz and 440Hz
TWIST ±10dB
S/N RATIO <12dB SINAD
TIME BASE Crystal controlled (3.5795 Mhz)

- DATA RATE 0.5 to 14 Digits per second (DPS)
- OPERATING VOLTAGE 5.5VDC to 20VDC
- OPERATING CURRENT <15mA
- OPERATING TEMPERATURE -20°C to +80°C
- INTERFACING Micro-miniature 14 pin Molex header and 3ft color coded cable assembly.
- ENCLOSURE SIZE 2.40" W x 3.80" L x .90" H
60.45mm W x 95.72mm L x 22.67mm H
- MOUNTING Reversible swivel mounting bracket enclosure.

**--SPECIFICATIONS ARE SUBJECT TO CHANGE IN THE INTEREST OF TECHNICAL--
--IMPROVEMENT WITHOUT NOTICE OR OBLIGATION--**

THEORY OF OPERATION

PRIMARY DECODER

The Primary 1, 2 and 3 address codes are field programmable using any of the 16 standard DTMF characters with an address length of 1 to 14 digits. Upon a valid decode, the Primary Decoder provides the following user selectable functions: Latched Output, Call Light, Momentary Output, Tone Alert, Transponder Functions and Latched Output Reset Timer. Primary 1 DEFAULT=[CODE 123], Primary 2 and 3 DEFAULT=[NO CODE].

All decoders are preprogrammed to factory default setting, and are noted under each feature in [BRACKETS]. The factory default reset feature, when activated, resets all programmed features to factory default values. This is helpful if programmed configurations are unknown.

- A. Latched Relay Output: Used to control transceivers speaker output or internal squelch circuitry.
DEFAULT=[HIGH]
- B. Call Light: Program selectable for steady or pulsating at a 2 Hertz rate.
DEFAULT=[PULSATING]
- C. Horn Output: Program selectable for steady or pulsating for a duration of Ø to 12 seconds or minutes [Ø = Disabled].
DEFAULT=[STEADY/2 SEC.]
- D. Tone Alert: Program selectable for a duration of Ø to 12 seconds with alternating tone frequencies (1200/600Hz) [Ø = Disabled].
DEFAULT=[2 SEC.]
- E. Decode Delay Program selectable for a decode delay of 0.2 to 12 seconds from end of last digit in code sequence.
DEFAULT=[1 SEC.]
- F. Transponder Functions: Transpond TX Keying and Transpond Tone are activated simultaneously upon decode and are program selectable for a duration of Ø to 12 seconds [Ø = Disabled]. Primary Decoder Transpond Tone provides a 125ms pulsed, 1200 Hertz tone frequency.
DEFAULT=[3 SEC.]
- G. Timed Latched Reset: Resets all Primary Decoder functions except Call Light Output. Program selectable for a Reset delay of Ø to 12 minutes [Ø = Disabled].
DEFAULT=[DISABLED]
- H. Call Reset: The Reset digit can be selected from any 1 of the 16 standard DTMF characters. Upon reception of the Primary code followed by the selected Reset digit, all Primary decoded functions are reset and then acknowledged by a steady 1200 Hertz Transpond Tone for selected duration.
DEFAULT=[7]
- I. Group Call: The Group Call code digit is programmable from any 1 of the 16 standard DTMF characters. Upon reception of the Group Call digit for a duration of 3 seconds, all Primary Decoder functions selected will be activated with the exclusion of Momentary Output and Transpond Output Functions.
DEFAULT=[*]
- J. All Call: The All Call code digit is programmable from any 1 of the 16 standard DTMF characters. Upon reception of the All Call digit for a duration of 3 seconds, all Primary Decoder functions selected will be activated with the exclusion of Momentary Output and Transpond Output Functions.
DEFAULT=[#]
- K. Group Call Reset: The Group Call Reset digit can be programmed from any 1 of the 16 standard DTMF characters. Upon reception of the Group Call code, followed by the selected Group Call Reset digit for a duration of 3 seconds, all decoded Primary functions are reset.
DEFAULT=[8]
- L. All Call Reset: The All Call Reset digit can be programmed from any 1 of the 16 standard DTMF characters. Upon reception of the All Call code, followed by the selected All Call Reset digit for a duration of 3 seconds, all decoded Primary functions are reset.
DEFAULT=[9]
- M. PTT Input: This function is programmable for either active low or high. Upon a momentary touch of the PTT switch, the primary latched output is activated to allow monitoring of channel before transmission. The PTT input also activates the T.O.T. and busy lock-out functions.
DEFAULT=[LOW]

- N. Transmit time-out timer: Program selectable from Ø to 120 sec. (Ø=Disabled). Timer starts each time PTT input is activated. Upon time-out, the transpond PTT output returns to its inactive state and a 125ms pulsating 1800 Hertz tone is generated at the tone alert output. This condition continues until the PTT switch is released, at which time the pulsating tone stops and the T.O.T. is reset.
 DEFAULT=[**120 SEC.**]
NOTE: NC421 must be installed in series with transmitter PTT circuitry to utilize this feature.
- O. Busy lock-out: This input is programmable for either active low or high. Upon an active input, the PTT input is disabled. (If Busy Lock-out active state returns to inactive state while PTT is depressed, PTT input must first be released before PTT function is enabled.) A 125ms pulsating 1800 Hertz tone is generated at the tone alert output if the PTT input is activated during busy lock-out. This function is to alert user that channel is in use.
 DEFAULT=[**HIGH**]
NOTE: NC421 must be installed in series with transmitter PTT circuitry to utilize this feature.
- P. Monitor/Reset Input: Resets all decoded functions or activates Latched Relay Output for monitoring. Selectable for Monitor Low or Monitor High.
 DEFAULT=[**HIGH**]
- Q. PTT/TX Keying Select: This user selectable feature allows selection of either of two modes. Common mode allows the PTT Input and Keying Output to be connected to a single point in the transceivers transmitter circuitry without a lock-up condition occurring. The busy Lock-Out and T.O.T. are disabled in this mode. Following mode is used when busy lock-out and/or T.O.T. are desired and the user breaks the PTT line in the transceiver. This gives the NC421 full control over the transceivers PTT function while maintaining standard PTT operation.
 DEFAULT=[**SEPARATE**]

SECONDARY DECODER

The Secondary Decoder is distinct from the Primary Decoder and responds to a separate address code. The address code is field programmable using any of the 16 standard DTMF characters with an address length of 1 to 14 digits. The Secondary Decoder operates in either of two selectable modes: **Deadbeat Disable** or **Auxiliary**. In the Auxiliary Option Mode, upon a valid decode, the secondary Decoder provides a Latched/Timed Output and Transponder Functions. In the Deadbeat Disable Mode, upon a valid decode, the secondary decoder provides a latched output and will reset and disable all primary decoded functions. The status of either mode is stored in non-volatile memory. DEFAULT=[**CODE 456/USER MODE**]

All decoders are preprogrammed to factory default setting, and are noted under each feature in [BRACKETS].

Auxiliary Option Mode

- A. Latched Output: Program selectable for active "**HIGH**" or "**LOW**", Latched Output.
 DEFAULT=[**HIGH**]
- B. Latched Timed Reset Automatically resets Auxiliary Latched Output. Program selectable for a reset delay of Ø to 12 seconds.
 DEFAULT=[**DISABLED**]
- C. Transponder Functions: Upon a valid decode, Transpond TX Keying and Transpond Tone are activated simultaneously and provide a steady 600 Hertz tone frequency for a duration of 2 seconds.
- D. Call Reset: The Secondary Reset digit can be programmed from any 1 of the 16 standard DTMF characters. Upon reception of the Secondary code followed by the selected Reset digit, the latched output is reset and then is acknowledged by a 125ms pulsed 600Hertz tone for a duration of 2 seconds.
 DEFAULT=[**0**]
- E. Memory Decoded status is stored in non-volatile E²Prom memory and will remain even if power is interrupted for in excess of 40 years.

Deadbeat Disable Mode

- A. Latched Output: Program selectable for active "**HIGH**" or "**LOW**" Latched Output.
- B. Disable: All Primary Decoder outputs are reset and disabled.
- C. Transponder Functions: Upon a valid decode, Transpond TX Keying and Transpond Tone are activated simultaneously and provide a 125ms alternating tone (600/1200Hz) for a duration of 2 seconds.
- D. Deadbeat Disable Check: The Decoder may be interrogated repeatedly for verification of Deadbeat status. Upon reception of a valid code, Secondary Decoder Transpond TX keying and Transpond Tone are activated while all Primary Decoder functions remain disabled.
- E. Memory: Decoded status is stored in non-volatile E²Prom memory and will remain even if power is interrupted for in excess of 40 years.
- F. Call Reset: The Reset digit can be programmed from any 1 of the 16 standard DTMF characters. Upon reception of the Secondary code followed by the selected Reset digit, the Latched Output is reset, all primary functions are enabled and then is acknowledged by a 125ms pulsed 600Hertz tone for a duration of 2 seconds.

Remote Programming (Optional)

The third decoder is distinct from the primary and secondary decoders and responds to a separate three (3) digit address. The 3 digit address must be initially programmed by the factory and then can be user reprogrammed to any 3 digit code combination, using the 16 standard DTMF characters.

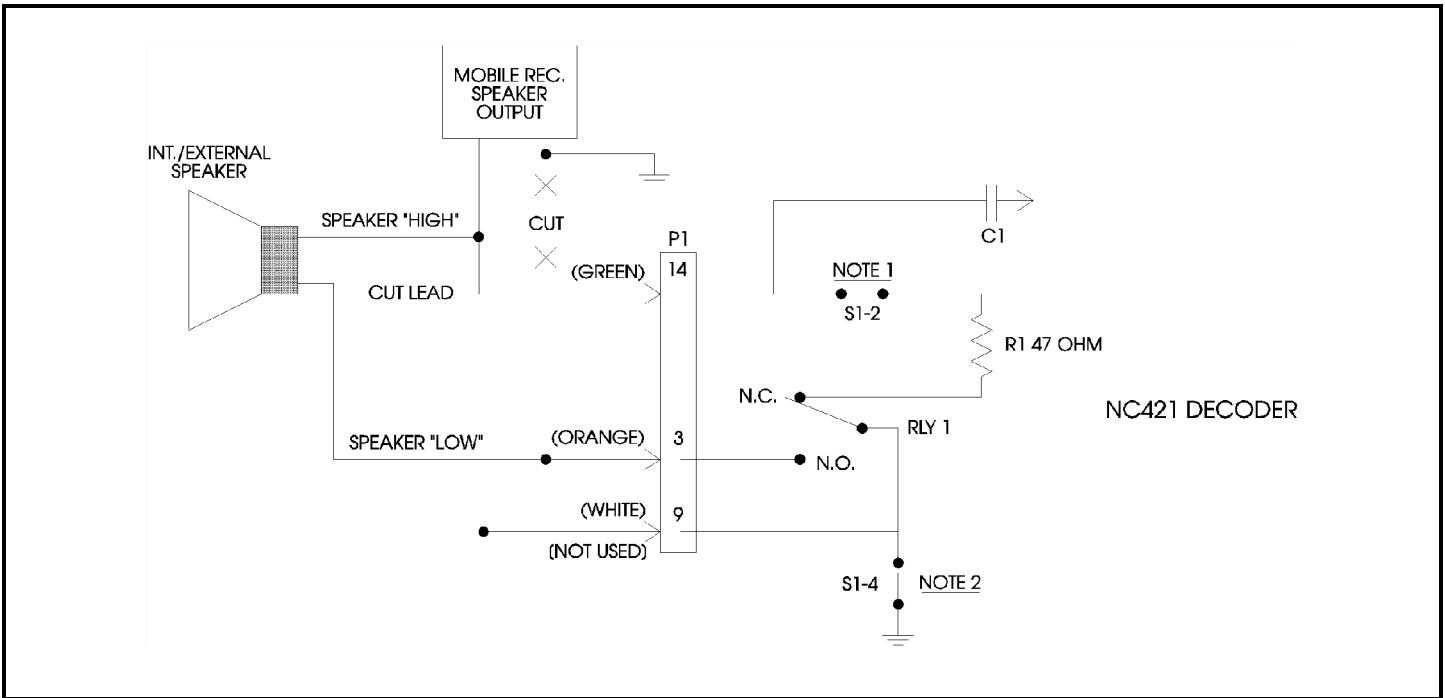
INTERFACING INSTRUCTIONS

The Model NC421 comes complete with a swivel mounting bracket, a three (3) foot plug and a jacketed cable assembly. The enclosure has been designed for above or below dash mounting by use of the swivel bracket. Because of the size and light weight of the NC421, it may be desirable to remove the bracket and attach the enclosure by means of Velcro Strips or other type of tape adhesive.

Although the Model NC421 is engineered for maximum immunity to R.F., it's suggested that all leads be kept to minimum lengths and away from transmitter final circuitry.

- BROWN (PIN 13) Default programmed for active "**HIGH**". This configuration activates the Primary Latched Relay Output circuitry for channel monitoring when removed from ground and resets along with all primary decoded functions when returned to ground. This input function is most useful in today's front mount radios when connected to the circuitry provided by the microphone's hang-up button or when used with a hang-up box.
[MONITOR/RESET INPUT]
- RED (PIN 2) Connect to 5.5VDC to 20VDC.
[+SUPPLY]
- BLUE (PIN 6) Connect to vehicle horn relay. This output is a form A relay and will sink to ground 1 Amp @ 30VDC.
[HORN OUTPUT] To prevent damage to the relay contacts, place a 1N4002 diode or equivalent across horn relay. This output is default programmed for "**2 seconds**" of **steady** output.
- GRAY (PIN 8) Default programmed for PTT "**LOW**". Connect to transceiver circuitry that provides a low when keyed.
[LATCH/T.O.T./PTT INPUT] To connect to circuitry that provides a high when keyed, program this function for PTT "**HIGH**". **NOTE:** The decoder must be placed in series with transceiver's PTT line and PTT/TX keying select set for following mode to enable use of T.O.T. and Busy Lock-out.
- BLACK (PIN 10) Connect to system ground.
[-SUPPLY]
- YELLOW (PIN 11) Default programmed for latching decode "**HIGH**" and is an open collector transistor that will sink to ground
[SECONDARY 150mA @ 4VDC
LATCHED OUTPUT] WHITE/BLUE (PIN 12)
- WHITE/BLUE (PIN 12) Default programmed for "**2 seconds**". Connect to transmitter PTT circuitry. This output is an open
[TRANSPOND/T.O.T./BUSY collector transistor and will sink to ground 100mA @ 40VDC.
LOCK-OUT KEYING OUTPUT] **NOTE:** In order for this output to control PTT function for purpose of using T.O.T. and Busy Lock-out, decoder
must be installed in series with transceiver's PTT line and PTT/TX keying select set for following mode.
- BLACK/WHITE (PIN 1) Connect to transmitter audio input circuitry. Adjust R23 for desired TX deviation.
[TRANSPOND TONE OUTPUT] (See "Component Locator" for location of R23)
- GREEN (PIN 14) Connect to mobile speaker "**HIGH**" output. Refer to "Speaker Interfacing -Figure 1".
[SPEAKER HIGH/HI-Z INPUT]
- WHITE (PIN 9) This is the "**COMMON**" connection for output relay and is not generally used.
[RELAY COMMON]
- VIOLET (PIN 7) Default programmed for active "**HIGH**". Connect to receiver's squelch circuitry that provides a minimum of
[BUSY LOCK-OUT INPUT] +2VDC when channel is busy. For reverse operation, program this function for active "**LOW**". Connect to squelch
circuitry that provides a minimum of +2VDC and goes to \emptyset (Ground) when channel is busy. **NOTE:** This feature may be
utilized by soldering a wire onto the pad for hook-up to transceiver.
- ORANGE (PIN 3) Cut lead from "**LOW**" (Ground) side of speaker. Place cut speaker lead coming from Receiver to ground.
[SPEAKER LOW/N.O. Connect "**ORANGE**" lead from Decoder to remaining side of cut speaker lead (Speaker side).
RELAY CONTACT] Refer to "Speaker Interfacing - Figure 1".

SPEAKER INTERFACING - FIGURE 1



NOTES:

- 1) S1-2 TO "ON" POSITION (CLOSED).
- 2) S1-4 TO "ON" POSITION (CLOSED).

CAUTION: Since the decoder "listens" to the high side of the speaker line for its decode tones, the volume control of your radio must not be completely turned down. Doing so will result in lowering the signal below decode level. One solution is to place a 47Ω resistor in series with low side of the volume control.

PROGRAMMING INSTRUCTIONS

The Model NC421 is field programmable via the audio input lead or serial ports. Any DTMF encoder may be used; or if one is unavailable, an inexpensive Universal/P.C. Field Programmer is available from NorComm.

To Program the NC421, perform the following:

1. Remove both screws from bottom of enclosure.
2. Lift away top half of enclosure.
3. Connect "RED" lead to + supply and "BLACK" lead to system ground.
4. Connect "GREEN" lead to output of DTMF Encoder.

If NorComm's Model NC500 Universal/P.C. Field Programmer is being utilized, simply plug the NC421 into the programmers plug assembly. Both audio and visual confirmation are provided via the tone alert and call light while in the programming mode.

The program mode is entered by placing switch S1-1 in the "OFF" position. Any feature may now be programmed in any order. Each key entry is confirmed by an audible beep with corresponding light flash. Each correctly entered program line is accepted with a series of audible beeps and light flashes. Any error or invalid program line entry results in a 1 second tone and light activation (the feature being programmed remains unchanged). The program line consists of the following entries: a *, followed by the address number of the desired feature, followed by a #, followed by the index number (if used) and the parameters.

Examples:

To program a primary code of 1234:

1. Place switch S1-1 in the "OFF" position.
2. Connect audio input to DTMF Encoder.
3. Enter * 1 # 1234 and wait for confirmation.
4. Place switch S1-1 in the "ON" position or continue programming.

To program the momentary function for a pulsating output and a duration of 5 seconds:

1. Place switch S1-1 in the "OFF" position.
2. Connect audio input to DTMF Encoder.
3. Enter * 7 # 35 and wait for confirmation. (Sets 5)
4. Enter * 8 # 31 and wait for confirmation. (Sets pulsed)
5. Enter * 8 # 40 and wait for confirmation. (Sets seconds)
6. Place switch S1-1 in the "ON" position or continue programming.

NOTE: If you get a steady error tone, simply enter the program line again.

REPROGRAMMING OF REMOTE ACCESS CODE (FACTORY OPTION)

Example: To change the factory pre-programmed remote access code from 789. **NOTE:** The remote access code can be changed by this method only. Remote Programming can not be used to change the remote access code.

1. Place switch S1-1 in the "OFF" position.
2. Connect audio input to DTMF Encoder.
3. Enter * A # and three digit code and wait for confirmation.
4. Place switch S1-1 in the "ON" position.

NOTE: Address must be a three (3) digit code.

REMOTE PROGRAMMING (FACTORY OPTION)

Example: To use remote programming to change the primary code of another NC421 Decoder on the same system to 1234, and let's assume an access code of 789 and secondary code of 456 have been programmed into this remote decoder, perform the following:

1. Key local transceiver (transceiver must have a DTMF encoder).
2. Enter 789 * 456 * 1 # 1234 (A 2.5 second timeout is in effect once programming function is started. The remote programming function will terminate if there is a pause exceeding 2.5 seconds.)
3. Wait for transpond acknowledgement for the remote decoder. Programming is completed.
4. To program another feature, start again at step 1 and repeat the same procedure using 789 * 456, followed by the address code, timed output or decoded output configuration to be programmed.

FACTORY OPTIONS

The Model NC500 Universal/P.C. Field Programmer is a small, smartly styled battery powered plastic enclosure with keyboard for service shop or field programming of the Model NC421 DTMF Decoder.

The Model NC500 menu driven software provides all programming data to be input or read from the NC421 and edited on the screen along with a print-out of all data. Software is supplied on both a 5.25" and 3.5" floppy disk and operates under MS-DOS (version 3.01 or later) on any IBM-PC/XT, AT or Compatible computer. For further details concerning this option, call 1-800-874-8663.

Factory initialization of remote programming code is \$10.00 per unit.

Decoders may be ordered pre-programmed to customers specifications for a charge of \$5.00 per unit.

WARRANTY POLICY

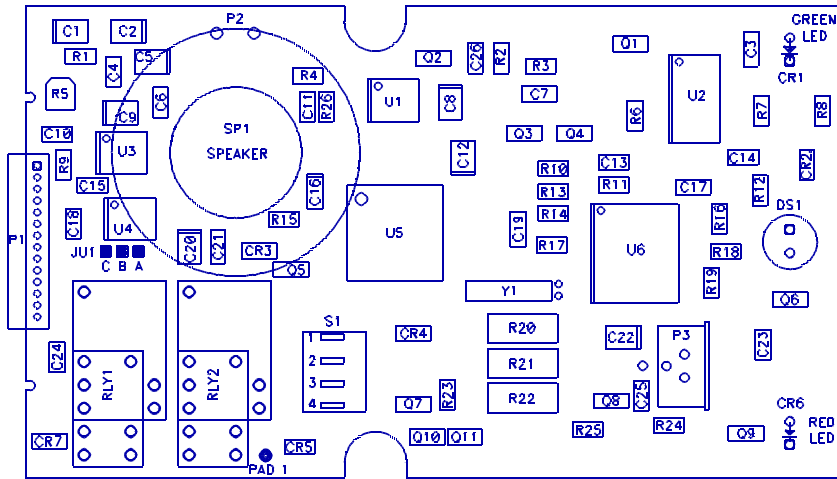
NorComm products are unconditionally guaranteed for two (2) years on materials and labor from date of purchase.

All Warranty repairs must be performed at NorComm's Customer Service Department in Grass Valley, CA. Units under warranty can be returned for repair or replacement without prior authorization, however, a letter explaining the defect should be enclosed with the unit. Out of warranty units returned constitute Purchaser's authorization for NorComm to repair or replace equipment and to invoice Purchaser for any and all reasonable costs of repair labor, parts and freight.

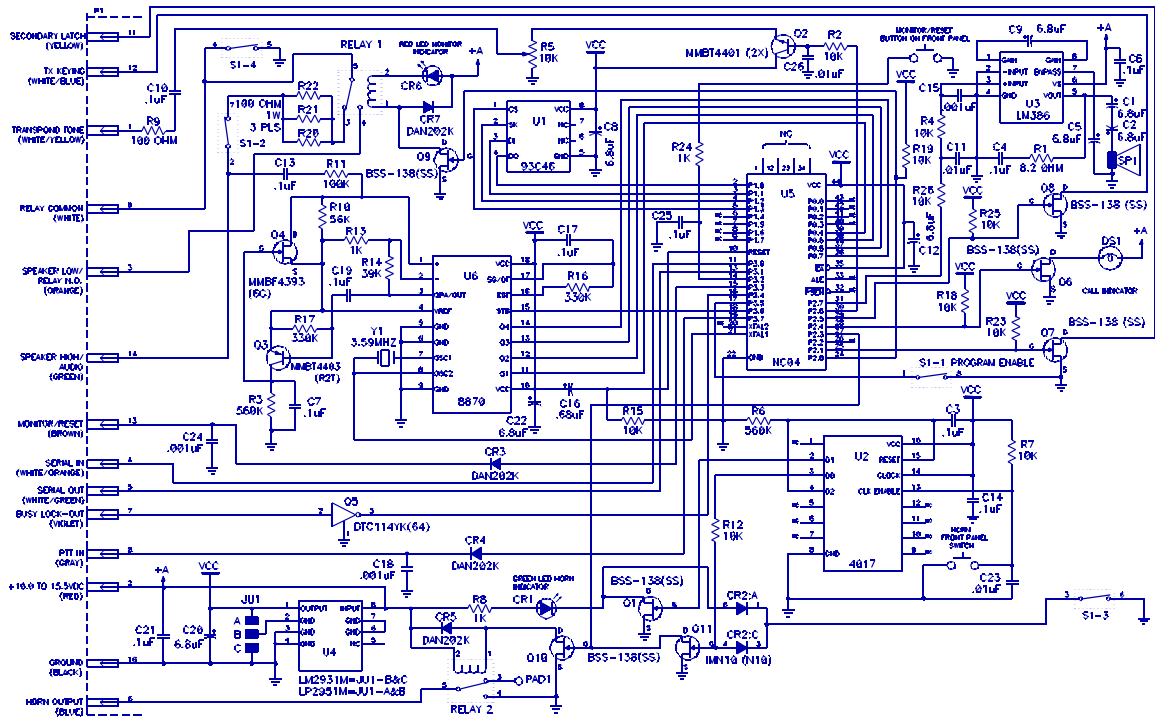
NorComm shall not be obligated to repair or replace equipment rendered defective, in whole or in part, by causes external to the equipment, such as, but not limited to, catastrophe, power failure, or transients, environmental extremes, improper use, and maintenance or interfacing applications. NorComm further assumes no liability for any incidental or consequential damages which may result from the applications of its products by the Purchaser or any other party.

COMPONENT LOCATOR

TOP SIDE



SCHEMATIC LAYOUT



ADDRESS CODES

FUNCTION	FEATURE NUMBER	INDEX NUMBER	ADDRESSING PARAMETERS	SEQUENCE LENGTH
Set Primary 1 Address	1	None	All 16 DTMF Characters	1 - 14
Set Primary 2 Address	B	None	All 16 DTMF Characters	1 - 14
Set Primary 3 Address	C	None	All 16 DTMF Characters	1 - 14
Set Primary 1 Reset Digit	2	None	All 16 DTMF Characters	1
Set Primary 2 Reset Digit	D	1	All 16 DTMF Characters	1
Set Primary 3 Reset Digit	D	2	All 16 DTMF Characters	1
Set Secondary Address	3	None	All 16 DTMF Characters	1 - 14
Set Secondary Reset Digit	4	None	All 16 DTMF Characters	1
Set Group Call & Reset Digits	5	None	All 16 DTMF Characters	2
Set All Call & Reset Digits	6	None	All 16 DTMF Characters	2
Set Remote Access Code (SEE PAGE 6)	A	None	All 16 DTMF Characters	2

NOTE: Both Group Call or All Call digit and reset digit must be programmed as one sequence.

TIMED OUTPUTS

FUNCTION	FEATURE NUMBER	INDEX NUMBER	TIMING PARAMETERS
Alert Tone Output	7	1	1 to 12 Seconds [NOTE A]
Transpond Tone Output	7	2	1 to 12 Seconds
Momentary Output	7	3	1 to 12 Seconds/Minutes
Primary Timed Reset	7	4	1 to 12 Minutes
Decode Delay	7	5	.2 to 12 Seconds [NOTE B]
TX Time-out Timer (T.O.T.)	7	6	10 to 120 Seconds
Secondary Timed Reset (User)	7	7	1 to 12 Seconds

Select 1 to 9, * for 10/100 secs. or # for 12/120 secs. 0 disables function.
 [NOTE A] 0 =CONTINUOUS ALERT TONE AND [NOTE B] 0 =200mS DECODE DELAY.

DECODED INPUT/OUTPUT CONFIGURATIONS

FUNCTION	FEATURE NUMBER	INDEX NUMBER	ACTIVE PARAMETERS
Pri. Latched Output Polarity	8	1	Ø = LOW 1 = HIGH
Call Light Output Select	8	2	Ø = STEADY 1 = PULSE
Momentary Output Select	8	3	Ø = STEADY 1 = PULSE
Momentary Timer Select	8	4	Ø = SECONDS 1 = MINUTES
Monitor/Reset Input Polarity	8	5	Ø = LOW 1 = HIGH
Busy Lock-out Input Polarity	8	6	Ø = LOW 1 = HIGH
PTT Input Polarity	8	7	Ø = LOW 1 = HIGH
PTT/TX Keying Select	8	9	Ø = FOLLOWING 1 = COMMON
Deadbeat/User Select	9	2	Ø = USER 1 = DEADBEAT
Primary 2 Select	9	3	Ø = GROUP/ALL 1 = PRIMARY
Primary 3 Select	9	4	Ø = GROUP/ALL 1 = PRIMARY
Sec. Latched Output Polarity	9	1	Ø = LOW 1 = HIGH

FACTORY DEFAULT PROGRAMMING

RESET TO FACTORY DEFAULTS	0	00	ENTER * 0 # 0 0
----------------------------------	----------	-----------	------------------------