FERRITRONICS CCT
CTCSS Compatible Trunking

RPO3

CCT REPEATER CONTROLLER

United States
1319 Pine Avenue
Niagara Falls, N.Y. 14301
(716) 282-7470
(800) 828-6884
(800) 462-7242 N.Y.

Canada
222 Newkirk Road
Richmond Hill, Ontario
Canada, L4C 3G7
(416) 884-3180
Telex: 06-966680
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Specifications</td>
<td>2</td>
</tr>
<tr>
<td>Outline Drawing</td>
<td>5</td>
</tr>
<tr>
<td>Installation Procedures</td>
<td>6</td>
</tr>
<tr>
<td>Step 1 – Rear Connector Block Wiring</td>
<td>7</td>
</tr>
<tr>
<td>Rear Connector Block (Figure 1)</td>
<td>8</td>
</tr>
<tr>
<td>Repeat Audio Filter Response (Figure 2)</td>
<td>9</td>
</tr>
<tr>
<td>Step 2 – Jumpers and Level Adjustments</td>
<td>10</td>
</tr>
<tr>
<td>Positive PTT Via Relay (Figure 3)</td>
<td>11</td>
</tr>
<tr>
<td>Step 3 – Programming Instructions</td>
<td>12</td>
</tr>
<tr>
<td>3.1.0 Introduction/Quick Look List</td>
<td>12</td>
</tr>
<tr>
<td>3.1.1 Accessing the Programming Mode</td>
<td>14</td>
</tr>
<tr>
<td>3.1.2 Quitting Programming Mode</td>
<td>15</td>
</tr>
<tr>
<td>3.1.3 Adding a User</td>
<td>15</td>
</tr>
<tr>
<td>3.1.3.1 Cross Tone Encoding</td>
<td>17</td>
</tr>
<tr>
<td>3.1.3.2 Quitting the ADD USER Function</td>
<td>17</td>
</tr>
<tr>
<td>3.1.3.3 ADD USER Error Messages</td>
<td>17</td>
</tr>
<tr>
<td>3.1.4 Deleting a User</td>
<td>18</td>
</tr>
<tr>
<td>3.1.4.1 Quitting the DELETE USER Function</td>
<td>19</td>
</tr>
<tr>
<td>3.1.4.2 DELETE USER Error Messages</td>
<td>19</td>
</tr>
<tr>
<td>3.1.5 Viewing the Users</td>
<td>19</td>
</tr>
<tr>
<td>3.1.5.1 Quitting the VIEW USERS Function</td>
<td>19</td>
</tr>
<tr>
<td>3.1.5.1 VIEW USERS Error Messages</td>
<td>19</td>
</tr>
<tr>
<td>3.1.6 Clearing the Time and Hit Accumulators</td>
<td>20</td>
</tr>
<tr>
<td>3.1.6.1 Quitting the CLEAR TIME/HITS Function</td>
<td>20</td>
</tr>
<tr>
<td>3.1.6.2 CLEAR TIME/HITS Error Messages</td>
<td>20</td>
</tr>
<tr>
<td>3.1.7 Setting Parameters</td>
<td>21</td>
</tr>
<tr>
<td>3.1.7.1 Changing the CONTROL BYTE</td>
<td>22</td>
</tr>
<tr>
<td>3.1.7.2 Changing the COS VALID TIME</td>
<td>24</td>
</tr>
<tr>
<td>3.1.7.3 Changing the Extended PTT TIME</td>
<td>24</td>
</tr>
<tr>
<td>3.1.7.4 Changing the Dropout Timer</td>
<td>25</td>
</tr>
<tr>
<td>3.1.7.5 Changing the CALL TIMEOUT Time</td>
<td>25</td>
</tr>
<tr>
<td>3.1.7.6 Changing the ACCESS CODE</td>
<td>26</td>
</tr>
<tr>
<td>3.1.7.7 Quitting the SET PARAMETERS Function</td>
<td>26</td>
</tr>
</tbody>
</table>
### TABLE OF CONTENTS CONT'D

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1.8 Initializing MEMORY</td>
<td>27</td>
</tr>
<tr>
<td>3.1.8.1 Initializing a Previously Programmed EEPROM</td>
<td>28</td>
</tr>
<tr>
<td>3.1.9 Alignment Program</td>
<td>29</td>
</tr>
<tr>
<td>3.1.9.1 Alignment Function 1: Threshold Dropout</td>
<td>29</td>
</tr>
<tr>
<td>3.1.9.2 Alignment Function 2: Charge/Discharge</td>
<td>29</td>
</tr>
<tr>
<td>3.1.9.3 Alignment Function 3: Max Read Time</td>
<td>29</td>
</tr>
<tr>
<td>3.1.9.4 Alignment Function 4: Set CTCSS Tone Levels</td>
<td>30</td>
</tr>
<tr>
<td>3.1.9.5 Alignment Function 5: Set Beep Tone Level</td>
<td>31</td>
</tr>
<tr>
<td>3.1.9.6 Quitting the ALIGNMENT Program</td>
<td>31</td>
</tr>
<tr>
<td>Final Assembly Drawing</td>
<td>32</td>
</tr>
<tr>
<td>Parts List (01A0010732 RP03 Trnkg Rep. C/W Local Contr.)</td>
<td>32</td>
</tr>
<tr>
<td>Main PCB Schematic Diagram</td>
<td>33</td>
</tr>
<tr>
<td>Main PCB Component Layout</td>
<td>34</td>
</tr>
<tr>
<td>Parts List (01A0010593 Main PCB Assembly)</td>
<td>34</td>
</tr>
<tr>
<td>LCD/Keyboard Buffer Schematic Diagram</td>
<td>35</td>
</tr>
<tr>
<td>LCD/Keyboard Buffer Component Layout</td>
<td>36</td>
</tr>
<tr>
<td>Parts List (01A0010737 LCD/Keyboard Buffer Assembly)</td>
<td>36</td>
</tr>
<tr>
<td>LCD Display Assembly</td>
<td>37</td>
</tr>
<tr>
<td>Parts List (01A0010736 LCD Display Assembly)</td>
<td>37</td>
</tr>
<tr>
<td>Warranty</td>
<td>38</td>
</tr>
<tr>
<td>Return Policy</td>
<td>38</td>
</tr>
</tbody>
</table>
INTRODUCTION

The RPO3 is designed to convert a community repeater into a trunking repeater. It is part of the Ferritronics CTCSS Compatible Trunking equipment (CCT).

As trunking provides for increased numbers of users, it is likely that more than the normal 37 EIA CTCSS tones will be required. Therefore, the RPO3 can encode and decode an additional 240 CTCSS tone pairs. These pairs comprise a tone from a low frequency group and a tone from a high frequency group. The RPO3 can also encode and decode all 37 EIA CTCSS tones.

The RPO3 validates mobile radios equipped with Ferritronics mobile trunking units (MA10, MA11, etc). The validation process consists of decoding the mobile generated signal, validating the user, opening the repeat audio path, encoding the required signal to the receiving mobile and keying the transmitter. Transparent functions are the recording of the message length and the recording of the number of hits.
SPECIFICATIONS

GENERAL

Frequency Range
All 37 EIA specified CTCSS tone frequencies (67.0 Hz to 250.3 Hz) plus 1 non-EIA tone of 97.4 Hz.

LOCAL CONTROL

Programming Access Code (Site Address)
A front panel mounted keypad and 2 line x 40 character LCD display provide user-friendly interactive control of the following functions:

Entry to Local Control Mode is contingent upon a correct 5 digit numerical code. This code is entered via the keypad and is user-programmable. The site address may be selected from a possible 100,000 combinations.

Hit Accumulation per User Group
up to 65,535

Repeater Usage Time Accumulation per User Group
65,535 minutes (1,092 hours 15 minutes)

Dropout Delay Timer
Adjustable; 0 to 255 seconds (4.25 minutes), in 1 second steps.

Extended PTT Timer
Adjustable; 0 to 25.5 seconds, in 0.10 second steps.

Time Out Timer
Adjustable; currently fixed at 5 minutes.

Operating Temperature
-30°C to +60°C

Humidity
0 to 90% non-condensing

Dimensions
refer to outline drawing.

Weight
3.3 lbs. (1.5 Kg)
ENCODER

Frequency Accuracy \( \pm 0.3\% \) of the tone frequency, at \( 25^\circ\text{C} \).

Frequency Stability \( \pm 0.05\% \) over the temperature range.

Output Impedance 3.3K ohms.

Output Level 4Vpp maximum with no load.

Distortion \( \leq 5\% \text{T.H.D.} \)

DECODER

Sensitivity \( \leq 14 \text{ dB SINAD} \)
as per EIA RS220A method

Bandwidth \( \pm 1.0 \text{ Hz} \)

Decode Time Dual Tones Adjustable; factory set at 300 mSec at 14 db SINAD.

Single Tones dependant on dual tone decode time, typically if dual tone is set for 300 mSec, then single tone decode time is 350 mSec.

Decode Dropout Time Adjustable; factory set at 300 mSec.

Input Impedance 100 K ohms

INPUT/OUTPUT CONNECTIONS

Via a rear panel removable terminal block type connector.

Tone Input Connects to the receiver discriminator.

Squelch Input (C.O.S.) Connects to the output of the receiver's squelch circuit. This is a digital signal.

PTT Output A transistor pulls to ground to key the transmitter. (VCE \( \leq 0.4\text{VDC at 400 mA DC} \)).

Audio Input (High Pass Filter Input) Connects to the receiver discriminator or to an audio input/output connection in series with the receive audio path, intended for insertion of a high pass filter.
Audio Output (High Pass Filter Output) Connects to the input of the audio amplifier or to an audio input/output connection in series with the receive audio path intended for insertion of a high pass filter.

Tone Output Connects to the transmitter tone input. The transmitter must be capable of transmitting CTCSS tone frequencies.

Power Supply 13.6 VDC ±20% relative to ground. There is a rear panel mounted ON/OFF switch. A fuse (1A fast) is mounted on the PCB.

Current Consumption 150 mA at 13.6 VDC in STANDBY
190 mA at 13.6 VDC in DECODE.

REPEAT AUDIO PROCESSING

Pass Band Ripple (300 – 3 KHz) ±1.0 dB

Pass Band Gain (1 KHz) Adjustable up to 6.0 dB into no load.

Maximum Input Level 3.5 Vpp (1.25 Vrms) @ 1 KHz

Audio Input Impedance 100K ohms

Audio Output Impedance 3.3K ohms

Attenuation of Signalling Tones Greater than 30 dB for frequencies ≤ 250 Hz.

ADDITIONAL INFORMATION

Remote control/downloading of repeater functions/information is available by the addition of a ‘Remote Control’ board AB07, Ferritronics Part Number 01A0010735. An additional RPO3 equipped with the AB07 functions as the remote control unit.
INSTALLATION PROCEDURES

There are three steps to be carried out to install the RP03. These are:

STEP 1) electrical connection of the RP03 to the repeater via the rear connector block,
STEP 2) correct selection and level adjustment of the internal circuitry, and
STEP 3) programming of the RP03.

The RP03 is intended to be mounted into a 19" rack with other repeater equipment.

Electrical hookup should be done by a qualified technician.

To facilitate hookup it is best to locate the RP03 close to the repeater, although using shielded cable, which is recommended for some connections, will provide adequate shielding for cable lengths up to 10 feet.

All connections can be made to the detachable portion of the rear connector on the RP03 before installation. Refer to STEP 1 for details.

Adjustments are required for input signal level, output tone level (deviation), and repeat audio level. To do this the top cover of the RP03 will have to be removed and the unit turned on before adjustment can proceed. This adjustment procedure is described under STEP 2 - JUMPERS AND LEVEL ADJUSTMENT. Once the unit has been aligned, the top cover must be replaced before final installation.
**INSTALLATION PROCEDURE**

**STEP 1 - REAR CONNECTOR BLOCK WIRING**

Separate the rear connector block so that you are left with the terminal portion in hand. Refer to FIGURE 1. Proceed with the following connections:

<table>
<thead>
<tr>
<th>CONNECTION</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB1-1</td>
<td>TONE IN</td>
<td>Connect this to the de-emphasized discriminator output. All EIA tone frequencies must be passed to this input. Verify this by transmitting to the receiver using a communications monitor and varying the CTCSS tone frequency, making sure the encode deviation is the same for all tones. Use a shielded lead.</td>
</tr>
<tr>
<td>TB1-2</td>
<td>CHASSIS GROUND</td>
<td>TB1-2 and TB1-6 are both connected to chassis ground via JP3 2-3. TB1-2 or TB1-6 should have a ground wire connecting it to the rack.</td>
</tr>
<tr>
<td>TB1-3</td>
<td>AUDIO IN</td>
<td>This is the input to the repeat audio filter. This filter removes the signalling tones from the received audio. This should be connected to the de-emphasized discriminator output as the filter has a flat response between 300 Hz and 3.5 KHz. Some repeaters have a connection readily available for insertion of this high pass filter and should be used. The output of the filter is TB1-7. Refer to FIGURE 2 REPEAT AUDIO FILTER RESPONSE.</td>
</tr>
<tr>
<td>TB1-4</td>
<td>SQL IN</td>
<td>This digital signal is required from the repeater receiver to tell the RP03 when to decode. This eliminates 'falsing'. Adjust the receiver's squelch pot for normal threshold position. It does not matter which polarity indicates an active channel. Refer to the 'Set Parameters' section in the programming instructions.</td>
</tr>
<tr>
<td>TB1-5</td>
<td>TONE OUT</td>
<td>Connect this to the tone input of the transmitter. It may be necessary to use a shielded lead. The transmit tone deviation is set by R108 (high tone and mid tone) and R110 (low tone). Refer to STEP 2 'Alignment' section in the programming instructions.</td>
</tr>
</tbody>
</table>
REAR CONNECTOR BLOCK
(TERMINAL PORTION)

FIGURE 1
FIGURE 2
<table>
<thead>
<tr>
<th>TB1-6</th>
<th>CHASSIS GROUND</th>
<th>TB1-2 and TB1-6 are both connected to chassis ground via JP3 2-3. TB1-2 or TB1-6 should have a ground wire connecting it to the rack.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB1-7</td>
<td>AUDIO OUT</td>
<td>This is the output of the repeat audio filter and should be connected to the voice audio input of the transmitter. Amplitude adjustment will likely be necessary, refer to STEP 2. Use a shielded lead.</td>
</tr>
<tr>
<td>TB1-8</td>
<td>PTT</td>
<td>This connection pulls to ground when a call is to be repeated. It must connect to the repeater’s TX key line. The transistor switch can pull 200 mA DC at a VCE of ≤ 0.4 VDC. Maximum sink current is 500 mA DC. If a positive PTT is needed, a relay will have to be used. Refer to FIGURE 3 for hookup.</td>
</tr>
<tr>
<td>TB1-9</td>
<td>CIRCUIT GROUND</td>
<td>Connect this to the ground of the repeater. Do not connect this ground to the rack.</td>
</tr>
<tr>
<td>TB1-10</td>
<td>+VE SUPPLY</td>
<td>Connect this to 13.6 VDC ± 20%. The supply must be capable of delivering at least 200 mA.</td>
</tr>
</tbody>
</table>

**STEP 2 - JUMPERS AND LEVEL ADJUSTMENTS**

Remove the top cover of the RPO3.

**JP1**

Install JP1 2-3 so that an audible tone (approx. 1 kHz) will be heard when the RPO3 approaches the end of its call time out cycle. If the audible signal is not desired, remove JP1.

A future function will be implemented using JP1 1-2 so do not install it in this position now.

**JP2**

When the RPO3 is received from the factory it does not contain a 5-digit access code which is normally required to enter the programming mode.

By inserting JP2 and powering up or resetting the RPO3, the programming mode will be entered directly without having to enter the access code. At this point, an access code can be entered. Refer to STEP 3 PROGRAMMING INSTRUCTIONS, to enter or change an access code.

**JP3**

JP3 2-3 makes a connection between TB1-2, TB1-6 and chassis. Make sure TB1-2 or TB1-6 are then connected to the rack via a ground wire.
STEP 3 - PROGRAMMING INSTRUCTIONS

1.0 Introduction/Quick Look List

The RP03 Local Control Repeater Panel can be programmed using its front panel keypad. There are 12 buttons, # 0-9, ENTER and RESET on this keypad.

There is one main list of functions which would be commonly used. This is the 'FUNCTION MENU'. It is available for use upon entering the Programming Mode.

FUNCTION MENU

KEY #1. ADD USER - add a single or dual tone user.

KEY #2. DELETE USERS - delete a single or dual user.

KEY #3. VIEW USERS - display the single or dual tones already programmed.

KEY #4. CLEAR TIME/HIT ACCUMULATORS - clear the accumulated TX time and hit values from an individual user in the memory.

KEY #5. SET PARAMETERS - see detailed list below.

KEY #6. INITIALIZE EEPROM - program default values into a new (blank) memory chip.

KEY #7. not used

KEY #8. not used

KEY #9. ALIGNMENT - see detailed list below.

KEY #0. EXIT PROGRAMMING MODE - restarts RP03 in normal Repeater Control operating mode.

There are two other menus, 'SET PARAMETERS MENU' and 'ALIGNMENT MENU'. These are associated with 'SET PARAMETERS' and 'ALIGNMENT respectively.
SET PARAMETERS MENU

Detailed list of SET PARAMETERS (KEY #5) functions: these parameters are normally set during the initial installation of the RPO3.

KEY #1. CONTROL BYTE
   a) Set active polarity of SQL input (COS).
   b) Set active polarity of PTT output lines.
   c) Set TX Override, (holds PTT output inactive for Repeater Panel testing).
   d) Enable Call Timeout feature.

KEY #2. SQL (COS) VALID TIME 20 mSec
   Sets the length of time which the carrier-operated squelch must be continuously on before the RPO3 begins tone decoding.

KEY #3. EXTENDED PTT 0.3 Sec
   Sets the length of time which the RPO3 keeps the TX keyed on after it switches off the CTCSS tones.

KEY #4. DROPOUT TIMER 10 Sec
   Sets the length of time which the RPO3 keeps the TX and CTCSS tones on after the received CTCSS tones fade or the COS input goes inactive. Received audio is not repeated during this interval.

KEY #5. CALL TIMEOUT 5 min
   Sets the maximum length of time which a single call is repeated before the RPO3 interrupts the call. Three one-second tones are sent at ten-second intervals before the TX is switched off.

KEY #9. CHANGE ACCESS CODE
   Allows the operator to change the five-digit access code stored in memory.

KEY #0. Returns the operator to the main Programming Mode menu.

'ALIGNMENT MENU'

Detailed list of ALIGNMENT (KEY #9) functions: these are used to align the RPO3 during initial installation, or realign its internal parameters for special (non-standard) applications.

KEY #1. THRESHOLD/DROPOUT LEVELS
   Sets the tone detect and dropout levels for the high-, mid-, and low-tone bands.

KEY #2. INCREMENT/DECREMENT PARAMETERS
   Sets the rate of tone detect and dropout for the high-, mid-, and low-tone bands.

KEY #3. MAXIMUM READ TIME
   Sets the maximum length of time after COS is valid that the RPO3 spends decoding tones (if any) before it attempts to validate them.
KEY #4. CTCSS TONE LEVELS
Allows the operator to adjust the output (transmitted) levels of the RPO3’s CTCSS tone encoders.

KEY #5. BEEP TONE LEVEL
Allows the operator to adjust the output level of the 1kHz Call Timeout ‘beep’ tone.

KEY #0. Returns the operator to the main Programming Mode menu.

1.1 Accessing the Programming Mode

There are two ways to gain access to the programming mode of the RPO3:

i. NORMAL ACCESS - VIA ENTER KEY

Once the RPO3 has been installed at the repeater site and is operating, pressing the ENTER key on the front panel will invoke the Programming Mode (as indicated on the front panel LC display).

IMPORTANT

If the RPO3 is busy repeating a call (indicated on the front panel display) OR if the RPO3 detects the COS is active, the ENTER key will be ignored until the call is completed and COS goes inactive.

(Once Programming Mode is active, however, the COS and tone inputs are ignored, and the repeater is effectively ‘down’).

When the ENTER key is pressed, the display will prompt:

*** PROGRAMMING MODE ***
ENTER ACCESS CODE>

Enter the five-digit access code, followed by pressing the ENTER key. If the password is not correct, the RPO3 will display ‘WRONG ACCESS CODE’ and resume repeater operation. If the password is correct, the RPO3 will prompt:

Press Function Key or (ENTER) for HELP

ii. INSTALLATION ACCESS - VIA JP2

Initially, accessing of the Programming Mode, for alignment or testing, is done using the JP2 jumper plug. On the main printed circuit board near the microprocessor is a 2-pin header labelled ‘JP2’. Shorting these two pins (using the jumper plug provided) will cause the RPO3 to automatically enter Programming Mode on power-up or when reset. The jumper plug MUST be removed for normal operation - the RPO3 cannot be put into normal repeater control mode with the jumper plug installed.
PROGRAMMING MODE

Pressing a valid function number (i.e. '1' for 'ADD USER') will select that function and display the appropriate prompts. Pressing ENTER will step you through the 'FUNCTION MENU', displaying a function title and its function number each time the ENTER key is pressed. For example, after pressing ENTER once, the RP03 will display:

PRESS (0) TO EXIT PROGRAMMING MODE>
or press (ENTER) to see next function

After pressing ENTER again, the display shows:

PRESS (1) TO ADD USER>
or press (ENTER) to see next function

At any point in the 'FUNCTION MENU', pressing ENTER displays the next function prompt and pressing a valid function number selects that function.

1.2 Quitting Programming Mode

To exit Programming Mode and resume normal repeater control operation, press '0' or 'RESET'.

The display will show:

****** REPEATER CONTROL MODE ******
------------- STANDBY -------------

if COS is not active, or if COS is active but no valid tones are present.

1.3 Adding a User:

Once the RP03 is in Programming Mode, pressing '1' will start the ADD USER function.

The display will show:

ADD USER: PRESS (1) FOR SINGLE TONE,
(2) FOR DUAL, (ENTER) TO EXIT>
Adding a single or dual tone user follows the same basic procedures, i.e., if you wish to add a single CTCSS tone user to the memory, press (1).

The RP03 will display:

    ENTER SINGLE TONE (4 DIGITS)(ENT)> 
    i.e. for 67.0 Hz. press (0670)(ENTER)

All tone frequencies must be entered into the RP03 as four numbers, followed by pressing the ENTER key. Tone frequencies less than 100.0 Hz. must have a leading '0' to make up four digits. For example, when programming a single CTCSS tone of 88.5 Hz., press '0885' and then ENTER. Be sure to put a 4-digit # in before pressing ENTER or the program will restart the RP03 at the beginning of the ADD USER function. Entering a valid single CTCSS tone (such as 88.5 Hz.) will cause the RP03 to briefly display:

    CHECKING LOTONE: 88.5 HITONE: .

The RP03 checks that the entered tone does not already exist in its memory as a valid single-tone user or as half of a valid dual CTCSS tone user.

The RP03 will then display:

    CROSS TONES: (0) = YES, (ENT) = NO ?>>

If cross tones are desired, press (0), but if no cross tones are desired press (ENT). This will cause the RP03 to transmit the same CTCSS tone as the one just entered.

The RP03 will briefly display:

    GRP: LTONE = 88.5/88.5 HRS = 0000:00
    001: HTONE = . / . HITS = 00000

and then restart the ADD USER function.

The GROUP number ('GRP 001') shows how many entries there are in the memory (users are always added to the end of the table). The first tone display after 'LTONE =' is the received tone which the RP03 will check to validate the user. The tone after the '/' is the tone which will be transmitted when the call is repeated.
1.3.1 Cross Tone Encoding

When the RP03 displays:

CROSS TONES: (0) = YES, (ENT) = NO ?

pressing '0' will result in the prompt:

CROSS TONES: PRESS (1) FOR SINGLE TONE,
(2) FOR DUAL, (ENTER) TO EXIT

For example, to translate a received CTCSS tone of 88.5 Hz. to a
transmitted dual CTCSS tone pair of 100.0 Hz./151.4 Hz.,
press '2'.

The RP03 will display:

ENTER LOW TONE (4 DIGITS) (ENT) >
i.e. for 79.7 Hz. press (0797) (ENTER)

Enter the low tone (100.0) first.

The RP03 will display:

ENTER HIGH TONE (4 DIGITS) (ENT) >
i.e. for 146.2 Hz. press (1462) (ENTER)

Enter the high tone (151.4).

The RP03 will briefly display:

CHECKING LOTONE: 100.0 HITONE 151.4

and then (briefly):

GRP: LTONE = 88.5/100.0 HRS = 0000:00
002: HTONE = . /151.4 HITS = 00000

indicating that a call received with a single CTCSS tone of
88.5 Hz. will be repeated with a dual CTCSS tone pair of
100.0 Hz. and 151.4 Hz. The RP03 will then restart the ADD USER
function.

1.3.2 Quitting the ADD USER Function

To return to the Programming Mode prompt, press the ENTER key when
the ADD USER prompt appears.

1.3.3 ADD USER Error Messages:

'SINGLE/DUAL TONE CONFLICT' - the single CTCSS tone entered
already exists in the memory as one tone in a dual CTCSS tone
pair; OR, one tone of the dual CTCSS tone pair entered already
exists in the memory as a single CTCSS tone user.
'USER ALREADY EXISTS...' - the single or dual CTCSS tone(s)
entered already exist in the memory.

'* CAN'T USE MIDTONE WITH DUAL TONES *' - a midtone (118.8 Hz. to
141.3 Hz.) cannot be used as the high-tone half of a dual CTCSS
tone pair.
1.4 **Deleting a User:**

To delete a user from the memory, press 2 while in Programming Mode.

The RPO3 will display:

```
DELETE USER: PRESS (1) FOR SINGLE TONE,
(2) FOR DUAL, (ENTER) TO EXIT
```

Enter 1 if the user to be deleted is a single tone user; enter 2 if the user is a dual CTCSS tone user. For example, to delete the dual CTCSS tone user whose tone pair is 88.5 Hz./162.2 Hz., press 2.

The RPO3 will display:

```
ENTER LOW TONE (4 DIGITS) (ENT)>
```

i.e. for 79.7 Hz. press (0797) (ENTER)

Enter the low-tone (88.5 Hz.).

The RPO3 will then prompt:

```
ENTER HIGH TONE (4 DIGITS) (ENT)>
```

i.e. for 146.2 Hz. press (1462) (ENTER)

Enter the high-tone (162.2 Hz.).

The RPO3 will briefly display:

```
CHECKING LOTONE: 88.5 HITONE: 162.2
```

If the entered tones were found in the memory, the RPO3 will prompt on the lower line of the display:

```
Press (0) to delete, (ENTER) to Quit
```

Press (0) to delete the displayed tones from the memory. (Pressing ENTER restarts the Delete User Function). When '0' is pressed, the RPO3 will display:

```
ENTER ACCESS CODE>
```

Enter the five-digit access code and press ENTER.

The RPO3 will display:

```
****** USER DELETED******
```
and return to the start of the DELETE USER function. However, if you simply press ENTER when the 'ENTER ACCESS CODE' prompt appears, the user tones will not be deleted and the RP03 will restart at the 'PROGRAMMING MODE' (function select) point of the program.

1.4.1 Quitting the DELETE USER Function

To return to the PROGRAMMING MODE prompt, press the ENTER key when the DELETE USER prompt appears.

1.4.2 DELETE USER Error Messages

'! USER NOT FOUND; CAN'T DELETE!' - the RP03 did not find the entered tone(s) in the memory.

'!!! FATAL WRITE ERROR...' - the RP03 was unable to adjust the memory data due to a faulty EEPROM memory chip.

1.5 View Users:

To display the contents of the memory, press 3 while in Programming Mode.

The RP03 will display:

VIEW USERS: PRESS (5) TO SCAN UP, (0) TO SCAN DOWN, (ENTER) TO QUIT

If you press '0', the RP03 will display the contents of the first valid user's entry in the table, for example:

GRP:  LTONE = 67.0 / 67.0 HRS = 0001:08
     001:  HTONE . / . HITS = 00029

If you press and hold the '0' key, the RP03 will 'scan' down through the memory, displaying each entry for about one-half second. If you scan past an entry of interest, use the '5' key to scan up (backwards). To scan at a slower rate, use single key-presesses.

1.5.1 Quitting the VIEW USERS Function

To return to the PROGRAMMING MODE prompt, press and hold the ENTER key until the prompt appears.

1.5.2 VIEW USERS Error Messages:

'User Memory is Empty (No Users)' - there are no entries in the memory to display.
1.6 Clear Time and Hit Accumulators

To clear the accumulated time and hit values of a valid user entry, press '4' while in Programming Mode.

The RP03 will display:

CLEAR TIME/HITS: PRESS (1) FOR SINGLE, (2) FOR DUAL, (ENTER) TO EXIT>

To clear the accumulators of a 67.0 Hz. single tone user, for example, press '1'.

The RP03 will display:

ENTER SINGLE TONE (4 DIGITS)(ENT)>
i.e. for 67.0 Hz. press (0670)(ENTER)

After entering the single tone, the RP03 will briefly display:

CHECKING LOTONE: 67.0 HITONE: .
PRESS (0) TO CLEAR, (ENTER) TO QUIT>

Press '0' to clear the accumulators. The RP03 will briefly display the contents of the valid user entry showing the accumulated time and hit values reset to zero, as follows:

GRP: LTONE = 67.0 / 67.0 HRS = 0000:00
001: HTONE = . / . HITS = 00000

The RP03 will then restart the CLEAR TIME/HITS function.

1.6.1 Quitting the CLEAR TIME/HITS Function

To return to the PROGRAMMING MODE prompt, press ENTER when the CLEAR TIME/HITS prompt appears.

1.6.2 CLEAR TIME/HITS Error Messages

'User memory is empty (No Users)' – there are no single or dual tones programmed into the RP03.

'*** USER NOT FOUND ***' – the RP03 could not find the entered single or dual tone in its memory.

'!!! FATAL WRITE ERROR...' – the RP03 was unable to adjust the memory due to a faulty EEPROM memory chip.
1.7 Set Parameters

The SET PARAMETERS function is normally used when the RP03 is first installed at the repeater site. This function allows the operator to examine and change various programmable parameters which are stored in memory and used by the RP03 during normal operation. When shipped, the RP03’s memory is programmed with default (typical) parameter values. However, it may be necessary to change some of the parameters to suit the equipment at the operator’s repeater site.

To access the SET PARAMETERS function, press '5' while in Programming Mode. The RP03 will display:

```
SET PARAMETERS: PRESS (ENTER) FOR HELP,
PRESS (0) FOR PROGRAMMING MODE>
```

The SET PARAMETERS function has a 'help menu' feature similar to the main Programming Mode. Pressing the ENTER key causes the RP03 to display (on the bottom line) the various sub-functions and the numbers which select them; for example, pressing '0' exits the SET PARAMETERS function and returns you to Programming Mode.
1.7.1 Changing the CONTROL BYTE

Pressing '1' while in SET PARAMETERS mode allows the operator to examine and change the Control Byte. The Control Byte sets the active polarity of the COS input and PTT output lines, and enables (or disables) the TX Override and Call Timeout features of the RPO3. This byte is stored in programmable memory. When the Control Byte option is selected, the RPO3 briefly displays:

1) Reading Control Byte...

and then either:

COS is HIGH when Busy...
Press (0) to change, (ENTER) for next

or:

COS is GROUND when Busy...
Press (0) to change, (ENTER) for next

depending on the current active state of the COS input line control. The first case ("COS is High when Busy") means that the RPO3 will sense a call in progress from the repeater site's receiver when the RPO3's COS input line is greater than +4 Vdc. The second case ("COS is Ground when Busy") means that the RPO3 detects a received call in progress when COS is less than +3.5 Vdc. Pressing '0' will change the active COS level from one state to the other, as indicated on the display. Press ENTER when the required condition of the COS active state is displayed. The condition will be saved in temporary memory.

The RPO3 will display either:

PTT is HIGH to Xmit...
Press (0) to change, (ENTER) for next

or:

PTT is GROUND to Xmit...
Press (0) to change, (ENTER) for next

depending on the current state of the PTT output line control. The PTT output line will sink (switch to ground) a positive current of 400 milliamps (maximum). The first case means that the RPO3 will switch off (open) the current sink to key the repeater transmitter. The second case means that the RPO3 will switch on (close) the current sink to transmit. Press '0' to select the required active condition of the PTT output, and then press ENTER. The PTT active state will be saved in temporary memory.
The RP03 will display either:

TX Override is DISABLED (normal)...
Press (0) to change, (ENTER) for next

or:

TX Override is ENABLED, can't Xmit
Press (0) to change, (ENTER) for next

The TX Override feature allows the installed RP03 and repeater receiver to be tested without keying the transmitter each time a valid user's single or dual tone is detected. For normal repeater operation, the TX Override feature must be set to 'disabled'. Use the '0' key to select the required TX Override condition and press ENTER.

The RP03 will now display either:

Call Timeout Disabled (normal)
Press (0) to change, (ENTER) for next

or:

Call Timeout Enabled
Press (0) to change, (ENTER) for next

The call timeout feature will terminate a call in progress if the deviation of the call exceeds the time limit set by the Maximum Call Time parameter. Use the '0' key to enable or disable the call timeout feature, and press ENTER.

The RP03 will display:

---End of Control Byte---
Press (5) to re-do, (ENTER) to QUIT

Pressing (5) will restart the Control Byte examine and change function; for example, to quickly verify the status of the Control Byte options, press (5) to restart at 'COS...', and press ENTER to view the state of each option. If all options are correct, press ENTER when the 'End of Control Byte' prompt appears again.

The RP03 will display:

--- Writing Control Byte---

and will copy the modified control byte from temporary memory to programmable memory. The RP03 will then display the SET PARAMETERS prompt.
1.7.2 Changing the COS VALID TIME

Pressing '2' while in SET PARAMETERS mode allows the operator to examine and change the COS VALID TIME. This is the length of time that the RPO3 waits after it detects an active COS level before it begins checking for tones. This delay allows the receiver's audio output and the RPO3's filters to stabilize to prevent falsing. When the COS valid time option is selected, the RPO3 will briefly display:

2] COS Valid Time is now 020 mSecond(s)
Press (0) to Change, (ENTER) to Quit>

When '0' is pressed, the RPO3 will display:

2] COS Valid Time is now 020 mSecond(s)
Press 3 digits (ENTER)>

To change the COS valid time to 60 milliseconds, for example, press '060' and enter. The RPO3 will display the entered time and prompt for a new time, or enter to quit. Pressing enter will restart the SET PARAMETERS function.

1.7.3 Changing the Extended PTT TIME

Pressing '3' while in SET PARAMETERS mode allows the operator to examine and change the extended PTT time. This is the length of time which the RPO3 keeps the transmitter keyed on after the RPO3 switches off the repeated CTCSS tones. This eliminates the 'squelch tail' heard in the mobile units. When this option is selected, the RPO3 will briefly display:

3] Extended PTT Time is now 00.3 Seconds
Press (0) to Change, (ENTER) to Quit>

When '0' is pressed, the RPO3 will display:

3] Extended PTT Time is now 00.3 Seconds
Press 3 digits (ENTER)>

To change the extended PTT time to 0 seconds, for example, press '000' and enter. The RPO3 will display the entered time and prompt for a new time, or enter to quit. Pressing enter will restart the SET PARAMETERS function.
1.7.4 Changing the Dropout Timer

Pressing '4' while in SET PARAMETERS mode allows the operator to examine and change the dropout time. This is the length of time that the RPO3 keeps the transmitter keyed on after the COS input goes inactive. When this option is selected, the RPO3 will briefly display:

4] Dropout Delay Time is now 010 Sec(s)
   Press (0) to Change, (ENTER) to Quit>

When '0' is pressed, the RPO3 will display:

4] Dropout Delay Time is now 010 Sec(s)
   Press 3 digits (ENTER)>

To change the dropout time to 2 seconds, for example, press '002' and ENTER. The RPO3 will display the entered time, and prompt for a new time, or ENTER to quit. Pressing ENTER will restart the SET PARAMETERS function.

1.7.5 Changing the CALL TIMEOUT Time

Pressing '5' while in SET PARAMETERS mode allows the operator to examine and change the CALL TIMEOUT time. This is the maximum length of time allowed for a single call before the RPO3 keys off the transmitter. The RPO3 will send three one-second-duration warning beeps at ten-second intervals before terminating the call. (Note that the CALL TIMEOUT feature will only be active if it has been enabled with the CONTROL BYTE). When this option is selected, the RPO3 will briefly display:

5] Maximum Call Time is now 005 Minutes
   Press (0) to Change, (ENTER) to Quit>

When '0' is pressed, the RPO3 will display:

5] Maximum Call Time is now 005 Minutes
   Press 3 digits (ENTER)>

To change the CALL TIMEOUT time to 15 minutes, for example, press '015' and ENTER. The RPO3 will display the entered time and prompt for a new time, or ENTER to quit. Pressing ENTER will restart the SET PARAMETERS function.
1.7.6 Changing the ACCESS CODE

Pressing '9' while in SET PARAMETERS mode allows the operator to examine and change the 5-digit access code. When this option is selected, the RP03 will display:

9] Access Code is now: 12345
   Press (0) to Change, (ENTER) to Quit>

To change the access code to 67890, for example, press (0).

The RP03 will display:

ENTER *NEW* ACCESS CODE>
Press 5 digits (ENT), i.e. (12345)(ENT)

Now press '67890' and ENTER. The RP03 will display:

9] Access Code is now: 67890
   Press (0) to Change, (ENTER) to Quit>

Pressing ENTER will restart the SET PARAMETERS function.

1.7.7 Quitting the SET PARAMETERS Function

Pressing '0' while in SET PARAMETERS mode will return the RP03 to PROGRAMMING MODE.
1.8 **Initialize MEMORY**

The INITIALIZE MEMORY function is normally used when a new EEPROM memory chip has been installed in the RPO3, or when an RPO3 is moved to a different repeater installation. The INITIALIZE MEMORY function DELETES ALL USERS from MEMORY and resets all stored parameters to their default (factory) values, but will not alter the access code in a previously programmed MEMORY.

When initializing a new (blank) MEMORY, it is recommended that the JP2 jumper be installed to access the Programming Mode.

To INITIALIZE MEMORY, press '6' while in Programming Mode. If the EEPROM is a new (blank) part, the RPO3 will display:

```
  INITIALIZE EEPROM: Clears ALL users and sets default parameter values

  ENTER *NEW* ACCESS CODE>
  Press 5 digits (ENT), i.e. (12345)(ENTER)
```

Pressing ENTER will quit the function and restart the RPO3 in Programming Mode.

Pressing five digits and ENTER will set the RPO3's access code number entered, and for verification the RPO3 will display:

```
  *NEW* ACCESS CODE IS> (number)
```

The RPO3 will then initialize the memory and parameters, display:

```
  ********** EEPROM INITIALIZED **********
```

and restart the RPO3 in Programming Mode. The RPO3 is now ready for alignment, programming and installation.
1.8.1 Initializing a Previously Programmed EEPROM

When the INITIALIZE EEPROM function is selected and the RP03 determines (by the presence of an active access code stored in EEPROM) that the EEPROM has previously been initialized, the RP03 will display:

   INITIALIZE EEPROM: Clears ALL users and sets default parameter values

   --- CAUTION: DELETES ALL USERS ---
   Press (0) to INIT, (ENTER) to Quit>

Press '0' to initialize the EEPROM (pressing ENTER causes the RP03 to restart Programming Mode). When '0' is pressed, the RP03 will display:

   --- CAUTION: DELETES ALL USERS ---
   ENTER ACCESS CODE>

To initialize the EEPROM, enter the five-digit access code and press ENTER. If the access code was entered correctly, the RP03 will display:

   OK

and then:

   ***** EEPROM INITIALIZED *****

and automatically restart at Programming Mode. If the access code was incorrect, the RP03 will display:

   'WRONG ACCESS CODE'

and restart at Programming Mode without initializing the EEPROM. If the operator pressed ENTER to abort the function, the RP03 will also restart at Programming Mode without initializing the EEPROM.
1.9 Alignment Program

The ALIGNMENT Program is normally used at the factory to set certain software parameters in EEPROM memory. The operator must use port 4 to set the levels of the CTCSS and 1kHz 'beep' tones.

The software parameters of ports 1, 2 and 3 should not be altered by the operator, but the tone level adjustment functions are useful when testing and installing the RP03.

To select the ALIGNMENT Program, press '9' while in PROGRAMMING MODE.

The RP03 will display:

ALIGNMENT: PRESS (ENT) FOR HELP, or
PRESS (0) FOR PROGRAMMING MODE

Each time the enter key is pressed, the RP03 will display, in sequence, each test function and the number-key which selects it.

1.9.1 Alignment Function 1: Threshold Dropout

This function is used at the factory to change the rate of tone detect and dropout levels in the RP03 software. The operator should not alter these parameters.

1.9.2 Alignment Function 2: Charge/Discharge

This function is used at the factory to change the rate of tone detect and dropout in the RP03 software. The operator should not alter these parameters.

1.9.3 Alignment Function 3: Max Read Time

This function is used at the factory to set the maximum time that the RP03 will spend decoding for a single tone user. The operator should not alter this parameter.
1.9.4 Alignment Function 4: Set CTCSS Tone Levels

To set the CTCSS encode tone levels, press '4' while in ALIGNMENT mode.

The RPO3 will briefly display:

4] SET CTCSS LEVELS: adjust R108 for HI/MIDTONES, adjust R110 for LOTONES

and then:

SELECT TONES: PRESS (1) FOR SINGLE, (2) FOR DUAL, (ENTER) TO QUIT>

The procedure for entering a single or dual tone is the same as that for the ADD USER and DELETE USER functions. When the single or dual tone pair has been entered, (100Hz., for example), the RPO3 will display:

CHECKING LOTONE: 100.0 HITONE: .
Press (5) for AUDIO ON, (0) for OFF>

This option allows the operator to switch the audio path (between AUDIO IN-TB1 pin 3 and AUDIO OUT-TB1 pin 7) on or off as required. Press '5' or '0' to select the AUDIO option. The RPO3 will enable the tone encoders (in this case, the low-tone encoder will be programmed to generate 100.0 Hz. and the high-tone encoder will be disabled).

The display will read:

CHECKING LOTONE: 100.0 HITONE:
Press (0) to stop tones, (ENT) to Quit

The RPO3 is now generating the programmed tone, and R110 can be adjusted to set the tone level. To stop the tone, press 'O'.

The RPO3 will display:

CHECKING LOTONE: 100.0 HITONE:
Press (5) to start tones, (ENT) to Quit

Note that although the tone has been disabled, the audio path will still be switched on or off as selected. To enable the tone again, press '5'. Before the RPO3 enables the tone encoder, it will prompt:

CHECKING LOTONE: 100.0 HITONE:
Press (5) for AUDIO ON, (0) for OFF>
Press '5' or '0' to enable or disable the audio path. This prompt will appear each time before the tone encoders are enabled.

To quit the function and return to the ALIGNMENT prompt, press ENTER when the "start tones" or "stop tones" prompts are displayed. Quitting the function at the "Press '0' to stop tones" prompt will leave the tone encoder(s) enabled and the audio path option in effect; quitting the function at the "Press '5' to start tones" prompt will leave the tone encoders off, but leave the audio path option in effect. This allows the operator to select the "SET BEEP TONE LEVEL" function with the CTCSS tones and audio enabled or disabled as required.

1.9.5 Alignment Function 5: Set Beep Tone Level

To set the 1 kHz. beep tone level, press 5 while in TEST FUNCTIONS mode.

The RP03 will display:

5) SET BEEP TONE LEVEL: adjust R127,
    Press and hold (ENT) to QUIT

it will then begin generating a 1 kHz tone at JP1 pin 2. A jumper bar must be connected between JP1 pins 2 and 3 for the 1 kHz. tone to appear at the AUDIO OUT terminal, TB1 pin 7. Adjust R127 to set the 'beep' tone level. The 'beep tone' program checks the enter key once every second (this is the 'tick' heard in the 1 kHz.
tone).

To quit the function, press and hold the ENTER key for a second until the ALIGNMENT prompt appears.

1.9.6 Quitting the ALIGNMENT Program

To quit the ALIGNMENT program and restart PROGRAMMING MODE, press '0' when the ALIGNMENT prompt appears. This will disable the tone encoders and the audio path if left on by the "SET CTCSS TONE LEVELS" function.
# LCD/KEYBOARD BUFFER COMPONENT LAYOUT

![Diagram of LCD/KEYBOARD BUFFER COMPONENT LAYOUT](image)

## PARTS LIST

### LCD/KEYBOARD BUFFER ASSEMBLY

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
<th>QTY</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>1880010737</td>
<td>PCB LCD/KEYB. BUFFER</td>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>301</td>
<td>29A0010764</td>
<td>OCTAL D FLIP-FLOP MC74HC374N</td>
<td>1.</td>
<td>1. IC 1</td>
</tr>
<tr>
<td>302</td>
<td>29A0010762</td>
<td>OCTAL BUFFER/DRIVER MC74HC244N</td>
<td>2.</td>
<td>IC 2, 3</td>
</tr>
<tr>
<td>305</td>
<td>26-2545</td>
<td>TRANS SIGNAL PNP 2N3904</td>
<td>2.</td>
<td>G 1, 2</td>
</tr>
<tr>
<td>306</td>
<td>10-2606</td>
<td>CAP CERAMIC 1 KPF 100V 10%</td>
<td>4</td>
<td>C 6, 7, 8, 9</td>
</tr>
<tr>
<td>307</td>
<td>10-1473</td>
<td>CAP CER DIP 25U 100 K PF 20%</td>
<td>3</td>
<td>C 2, 3, 4</td>
</tr>
<tr>
<td>308</td>
<td>11-1669</td>
<td>CAP TANT DIP 1 MFD 20% 35V</td>
<td>2</td>
<td>C 1, 5</td>
</tr>
<tr>
<td>309</td>
<td>37006-0507</td>
<td>RES 1/4W 5% 10 K</td>
<td>6</td>
<td>R 8, 9, 10, 11, 12, 13</td>
</tr>
<tr>
<td>310</td>
<td>37006-0516</td>
<td>RES 1/4W 3% 27 K</td>
<td>10</td>
<td>R 4, 5, 6, 7, 14, 15, 16, 17, 18, 19</td>
</tr>
<tr>
<td>311</td>
<td>70A0010810</td>
<td>DUAL ROW HEADER NSH-20DB-S2-T</td>
<td>1.</td>
<td>P1</td>
</tr>
<tr>
<td>312</td>
<td>66A0010767</td>
<td>BOX CONN. SOCKET 14 POS. DUALROW</td>
<td>1</td>
<td>J 1</td>
</tr>
<tr>
<td>313</td>
<td>70A0010807</td>
<td>DUAL ROW HEADER NSH-14DB-S2-T</td>
<td>1</td>
<td>J 2</td>
</tr>
<tr>
<td>314</td>
<td>37006-2917</td>
<td>RES, 1/4 W 0 OHMS</td>
<td>2</td>
<td>R 1, 2</td>
</tr>
</tbody>
</table>
## LCD DISPLAY ASSEMBLY

### PARTS LIST

<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>PART NO</th>
<th>DESCRIPTION</th>
<th>QTY</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>301</td>
<td>34A0010744</td>
<td>LCD DISPLAY(40 CHAR. X 2 LINES)</td>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>302</td>
<td>70A0010807</td>
<td>DUAL ROW HEADER NSH-14DB-S2-T</td>
<td>1.</td>
<td>P1</td>
</tr>
</tbody>
</table>
LIMITED TWO YEAR WARRANTY

All Ferritronics equipment is warranted to be free of defects in material and workmanship on date of shipment. Original purchaser's exclusive remedy for defective goods will be repair or replacement of such defective goods returned to the Vendor, or a refund of the purchase price. Any unauthorized alteration or modification of the equipment by the purchaser or damage caused by external sources will void the warranty.

Materials are warranted for a period of two (2) years from date of shipment. Workmanship is warranted for a period of one (1) year. Repairs to correct defects identified in the first twelve (12) months following date of shipment will be made by Ferritronics free of charge.

Purchaser is required to allow Vendor a reasonable opportunity to inspect, test, or sample goods prior to approval of their return by Vendor, and to give written notice of the defects to Vendor prior to expiration of warranty, and to include dated proof of purchase with equipment being returned under warranty.

There are no other warranties expressed or implied which are applicable to Ferritronics equipment.

RETURN POLICY

Purchaser may return Ferritronics equipment for restocking and credit, provided notification has been given to the Vendor. All equipment returned will be subject to restocking charges.

The restocking charge for Standard products in original condition and returned to the Vendor within 30 days of shipment is 20% of the purchase price.

Purchaser is to include a Return Authorization, provided by the Vendor, with equipment shipped to Ferritronics for restocking.