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C4 Systems

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OPERATION AND MAINTENANCE MANUAL
FOR THE

SINGLE INPUT 253 TRACKING RECEIVER

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Revision History

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SECTION 1

1 INTRODUCTION

1.1 PURPOSE AND FUNCTIONS

The Tracking Receiver performs the tracking signal RF-to-DC conversion. Its input is a beacon or other tracking signal at the down link frequency. It produces outputs which include a DC signal proportional to received signal strength for Steptrack and up to three error signals (cross-elevation, elevation and polarization) for monopulse. Monopulse operation requires additional RF signal processing components in the feed area.

1.2 CAPABILITIES AND PERFORMANCE CHARACTERISTICS

The key features of the Tracking Receiver are a multiline display, an acquisition range of ± 150 kHz, a dynamic range of 45 dB, three selectable IF bandwidths and a fast acquisition time in a low carrier-to-noise ratio.

The unit provides a great deal of control and status. These are explained more fully in Section 2.4, but are listed below. Controls are divided into operating and configuration classes. The operating controls are those that may be used from day to day in actual operation. The configuration controls are typically set up once at installation and remain unchanged.

Operating controls include:

- Local/Remote Control Select
- Beacon Frequency Select
- 2.5/4/280 kHz Bandwidth Select
- Auto/Manual VCO Control
- Auto Sweep Width Used In Acquisition Select from ±20 KHz to ±150 KHz
- Constant/Random/Off Monopulse Scan Select
- Monopulse Error Signal Display Scale Factor
- Monopulse Phasing
- Clearing of Monopulse Track Fault
- Signal Strength Display Offset

Configuration controls include:

- Serial Port Setup
- Band Setup
- Beacon Select of CW/PM or 800 Hz BPSK

Status indications include:

- Status of All Operating Controls
- Status of All Configuration Controls
- RF Synthesizer Locked/Unlocked
- IF Synthesizer Locked/Unlocked
- RCVR Synthesizer Locked/Unlocked
- Signal Strength
- Monopulse Error Signals
- Monopulse Track Fault
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- Internal Chassis Temperature
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The unit contains two serial data links that may be used for remote control and status monitoring. Each link can be individually configured for EIA-232C or EIA-422 operation. Status may be requested over the data links at any time. Control functions will be honored only if remote control is manually selected at the front panel. The only functions not offered over the serial links are manual VCO control and configuration controls. The only statuses not available over the data links are the ones for configuration and summary fault.

Key specifications for the Tracking Receiver include the following:

CHASSIS SPECIFICATION	
Size	3 ½"H x 19"W x 22"D
Input Power	115/230 VAC, 50/60 Hz, 60 VA, Universal Input
Temperature Range	0 to 50° C
Frequency Range	Various, Standard Bands Include: .95 – 1.75 GHz 2.0 – 2.8 GHz 3.4 – 4.2 GHz 4.0 – 4.8 GHz 7.25 – 7.75 GHz 10.7 – 11.5 GHz 11.45 – 12.25 GHz 12.2 – 13.0 GHz 10.7 – 13.0 GHz
Frequency Resolution	1 kHz
Input Beacon Level	-55 to –100 dBm

CHASSIS SPECIFICATION	
Input Impedance	50 Ohms, Unbalanced
Predetection Bandwidths	2.5, 4 or 280 kHz
Output DC Level	-5 to +5 VDC and 0 to +10 VDC
Output Slope	5 dB/V with highest Voltage at highest input level
Modulation Formats	CW, PM (to 1.2 rad), 800 Hz BPSK
Acquisition C/N	40 dB/Hz for CW, 48 dB/Hz for 800 Hz BPSK
Acquisition Sweep	Selectable from ±20 kHz to ±150 kHz

1.3 UNIT OVERVIEW

The unit is shown in the TRACKING RECEIVER drawing, Figure 1-1. It is a 3.5 inch high rack mount chassis which includes the user interface, down converters, if used, and receiver module.

The Tracking Receiver has one RF signal input which contains the sum signal for both steptrack and monopulse. It also contains error signals for monopulse. The error signals are modulated onto the sum signal. The sum signal represents the total received signal power. Signal level indication is derived from the sum signal. The bandwidth of the displayed sum signal may be selected from 2.5, 4, or 280 kHz. The monopulse error signals are processed in a synchronous demodulator.

1.4 INTERFACE INFORMATION

UNIT NAME: TRACKING RECEIVER UNIT

PART NUMBER: 201615

MECHANICAL DIMENSIONS: REFER TO THE FIGURE 1-1

CHASSIS DEPTH: 24 INCHES (PLUS CLEARANCE FOR MATING CONNECTORS AND CABLE BEND RADIUS)

WEIGHT: 25 LBS

POWER REQUIREMENTS:

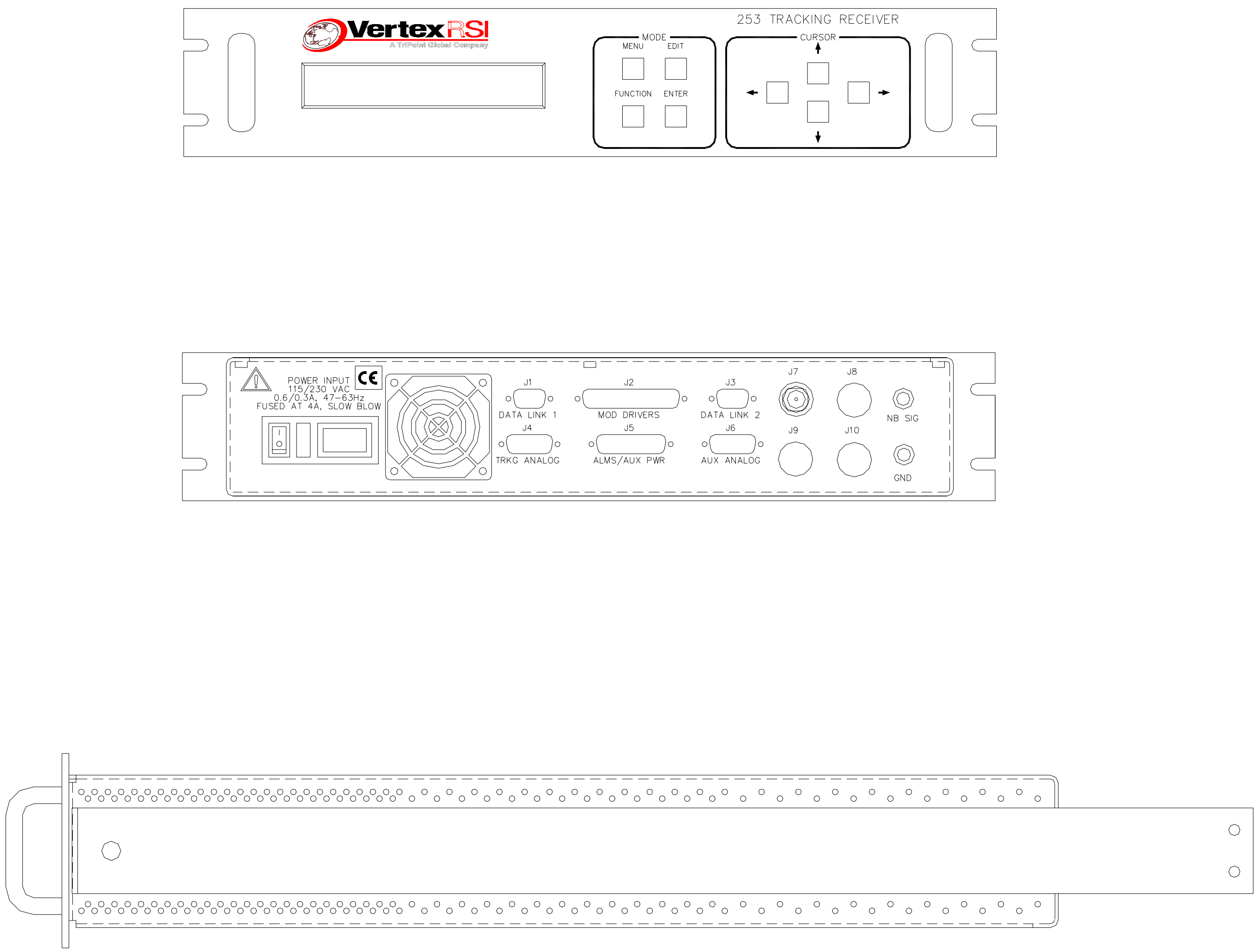
VOLTAGE: 90 TO 132 OR 175 TO 264 VAC, 47 TO 63 Hz

POWER: 60VA

POWER LOSS 50W

ENVIRONMENT: INDOOR

FIGURE 1-1: TRACKING RECEIVER



TEMPERATURE RANGE:

OPERATIONAL:	0° TO 50° C (32° TO 122° F)
STORAGE:	-40° TO 70° C (-40° TO 158° F)

HUMIDITY RANGE:

OPERATIONAL:	95% NON-CONDENSING
STORAGE:	95% NON-CONDENSING

J1 - DATA LINK #1 TYPE: 9-PIN D-SUB RECEPTACLE			J3 - DATA LINK #2 TYPE: 9-PIN D-SUB RECEPTACLE	
PIN #	**422**	**232**	**422**	**232**
1	RX+	N/C	RX+	N/C
2	RX-	RX+	RX-	RX+
3	TX+	TX+	TX+	TX+
4	TX-	N/C	TX-	N/C
5	GND	GND	GND	GND
6	N/C	N/C	N/C	N/C
7	N/C	N/C	N/C	N/C
8	N/C	N/C	N/C	N/C
9	N/C	N/C	N/C	N/C

J2 - MOD DRIVERS FOR MONOPULSE TYPE: 37-PIN D-SUB RECEPTACLE					
PIN	**DESCRIPTION**	**PIN**	**DESCRIPTION**	**PIN**	**DESCRIPTION**
1	DIGITAL PHASE SHIFT 0+	14	GND	27	DIGITAL PHASE SHIFT 7-
2	DIGITAL PHASE SHIFT 1+	15	+5V	28	AXIS SHIFT OUTPUT 0-
3	DIGITAL PHASE SHIFT 2+	16	-12V	29	AXIS SHIFT OUTPUT 1-
4	DIGITAL PHASE SHIFT 3+	17	+12V	30	AXIS SHIFT OUTPUT 2-
5	DIGITAL PHASE SHIFT 4+	18	N/C	31	AXIS SHIFT OUTPUT 3-
6	DIGITAL PHASE SHIFT 5+	19	N/C	32	GND
7	DIGITAL PHASE SHIFT 6+	20	DIGITAL PHASE SHIFT 0-	33	+5V
8	DIGITAL PHASE SHIFT 7+	21	DIGITAL PHASE SHIFT 1-	34	N/C
9	AXIS SHIFT OUTPUT 0+	22	DIGITAL PHASE SHIFT 2-	35	-12V
10	AXIS SHIFT OUTPUT 1+	23	DIGITAL PHASE SHIFT 3-	36	+12V
11	AXIS SHIFT OUTPUT 2+	24	DIGITAL PHASE SHIFT 4-	37	N/C
12	AXIS SHIFT OUTPUT 3+	25	DIGITAL PHASE SHIFT 5-		
13	GND	26	DIGITAL PHASE SHIFT 6-		

J4 – TRACKING SIGNALS - ANALOG	
TYPE: 15-PIN D-SUB RECEPTACLE	
PIN #	**DESCRIPTION**
1	N/A
2	N/A
3	Σ SIGNAL/+5V TO –5V / 10 HZ FILTER
4	Σ SIGNAL RETURN
5	XEL Δ 10 HZ FILTER
6	XEL Δ RETURN
7	EL Δ 10 HZ FILTER
8	EL Δ RETURN
9	POL Δ 10 HZ FILTER
10	POL Δ RETURN
11	GND
12	GND
13	N/C
14	N/C
15	N/C

J5 – ALARMS/AUXILIARY POWER	
TYPE: 25-PIN D-SUB RECEPTACLE	
PIN #	**DESCRIPTION**
1	SUMMARY FAULT COMMON
14	SUMMARY FAULT NORMALLY OPEN (CLOSED W/FAULT)
2	SUMMARY FAULT NORMALLY CLOSED (OPEN W/FAULT)
15	TRACK FAULT COMMON
3	TRACK FAULT NORMALLY OPEN (CLOSED W/FAULT)
16	TRACK FAULT NORMALLY CLOSED (OPEN W/FAULT)
4	N/A
17	N/A
5	N/A
18	N/A
6	STATUS BIT 0
19	STATUS BIT 1
7	STATUS BIT 2
20	STATUS BIT 3
8	STATUS BIT 5
21	STATUS BIT 5
9	STATUS BIT 6
22	STATUS BIT 7
10	+12V OUT (LNA POWER, 200 mA MAX)
23	+12V OUT (LNA POWER, 200 mA MAX)
11	+12V OUT (LNA POWER, 200 mA MAX)
24	GND (LNA POWER, 200 mA MAX)
12	GND (LNA POWER, 200 mA MAX)
25	GND (LNA POWER, 200 mA MAX)
13	N/C

J6 - AUXILIARY TRACKING - ANALOG	
TYPE: 15-PIN D-SUB RECEPTACLE	
PIN #	**DESCRIPTION**
1	N/A
2	N/A
3	Σ SIGNAL / 0-10V/1 HZ FILTER
4	Σ SIGNAL RETURN
5	XEL Δ 1 HZ FILTER
6	XEL Δ RETURN
7	EL Δ 1 HZ FILTER
8	EL Δ RETURN
9	POL Δ 1 HZ FILTER
10	POL Δ RETURN
11	GND
12	GND
13	N/C
14	N/C
15	N/C

J7 - RF INPUT	
ALL UNITS	TYPE N FEMALE 50 OHM

TEST POINTS	
TP1	RETURN
TP2	SIGNAL STRENGTH MONITOR 0-10V
TP3	N/A

SECTION 2

2 OPERATING INSTRUCTIONS

The Tracking Receiver provides two general operating modes categorized as REMOTE and LOCAL. REMOTE operation is accomplished through the two serial links. Each is separately configurable for EIA-232C or EIA-422 communication standards. The maximum baud rate available is 19200 baud. The maximum command rate over the data link is 5 per second. The Tracking Receiver Interface Specification, drawing number 95-062-5124 (Section 6), provides the data format for all available commands. Either link can be used for external monitoring regardless of current control mode. Control commands received over either link, in REMOTE control mode, are honored. This requires external logic to ensure only one link is in control.

LOCAL operation is accomplished at the front panel through the use of eight keys, four mode keys and four cursor keys, and a 4 line by 40 character backlit liquid crystal display. The front panel keys do not support an auto-repeat function. This interface is screen oriented with user editable fields and status.

2.1 CONTROLS AND INDICATORS

2.1.1 Unit Level

The Power Switch Assembly is located on the rear panel towards the right if viewed from the front of the unit. It contains a replaceable fuse. The supply is rated at 55 Watts, with autoswitching to accept inputs at 115 or 230 VAC.

The Front Panel Keys used for local operator control consist of four mode keys and four cursor keys. The front panel keys do not support an auto-repeat function.

The Contrast Potentiometer, located on the switch PCB towards the front of the unit, controls the LCD contrast. Access to the potentiometer is gained by inserting a flat head screwdriver through the hole in the top of the unit.

The Dot Matrix Liquid Crystal Display is 4 lines by 40 characters in size and backlit. The display uses multiple screens to provide the local operator with all current Control and Status information for the TRU.

The Signal Strength Test Points are banana jacks located on the rear panel individually labeled for the signal strength present at the test point.

2.1.2 Tracking Receiver Board

Switches S1 and S2 are used to select either EIA-232C or EIA-422 operation of the serial ports. Switch position 1 selects EIA-232C operation and position 2 selects EIA-

422 operation. There are no indicators on the Tracking receiver board. The configuration settings for the serial ports and the serial port modems are covered in Section 2.2.2.1.

The board also contains Positive Temperature Coefficient Thermistors (PTCs) for DC power going to external connections.

2.1.3 RF Board

The RF board has no switch or jumper settings. No periodic maintenance or alignment is required.

2.2 CONFIGURATION SETTINGS

2.2.1 Unit Level

Configuration settings for the Tracking Receiver Unit are set locally on the display configuration screens (Section 2.4.3.1).

2.2.2 Tracking Receiver Board

Refer to the TRACKING RECEIVER BOARD ASSEMBLY, drawing number 98-119-5050, of Section 6 for the location of configuration settings.

2.2.2.1 Serial Ports

The following table gives the serial port configuration associated with the switch settings:

SWITCH	POSITION	CONFIGURATION
S1	1	EIA-232C, Port 1
S1	2	EIA-422, Port 1
S2	1	EIA-232C, Port 2
S2	2	EIA-422, Port 2

If 12-Volt modems are required, resistors must be installed in the following locations:

PORT	RESISTOR	VALUE	CONFIGURATION
Port 1 RX	R116	NC	NO 12V MODEM
Port 1 TX	R109	NC	NO 12V MODEM
Port 1 RX	R116	10K	12V MODEM
Port 1 TX	R109	10K	12V MODEM
Port 2 RX	R114	NC	NO 12V MODEM
Port 2 TX	R115	NC	NO 12V MODEM
Port 2 RX	R114	10K	12V MODEM
Port 2 TX	R115	10K	12V MODEM

Note: NC is no-connect, designating the component is omitted.

2.2.2.2 EIA-422/485 Serial Port Control

When switch S1 or S2 is in position 2, data links 1 and 2 may be configured as EIA-422 or EIA-485. Specifically, when configured as EIA-485, the driver can be effectively disconnected from the transmission line and is considered to be in a high impedance state. Jumper block J23 provides this control as shown in the following table:

J23 JUMPER BLOCK		
PIN CONNECTION	**CONFIGURATION**	**DATA LINK**
1-3 3-5	EIA-422 EIA-485	1 1
2-4 4-6	EIA-422 EIA-485	2 2

Note: Default configuration is EIA-422 for both data links.

The EIA-485 configuration is not currently used.

2.2.2.3 Auxiliary Outputs

There is one sum signal auxiliary output, NB SUM (SUM 2), that may be configured as either -5 to +5 Volt output or 0 to +10 Volt output. The resistors that set the output range and their configuration settings are given in the following table:

OUTPUT	RESISTOR	VALUE	CONFIGURATION
AUX NB SUM (SUM 2)	R41	NC	-5 TO +5 VOLTS
AUX NB SUM (SUM 2)	R41	150K	0 TO +10 VOLTS

Note: NC is no-connect, designating the component is omitted.

2.2.2.4 Digital Inputs

There is one set of eight digital status lines that may be configured in a pull-up or pull-down state. The jumper blocks controlling these lines and their configuration settings are given in the following table:

J16 JUMPER BLOCK	
PIN CONNECTION	**CONFIGURATION**
1-2	PULL-UP
2-3	PULL-DOWN

2.2.2.5 Battery Configuration

Jumper blocks J6 and J17 are used to configure the board when an external battery is used to provide backup to the static RAM on the board. The battery configurations are given in the following table.

JUMPER BLOCK	PIN CONNECTION	CONFIGURATION
J6	1-2	BATTERY
J6	2-3	NO BATTERY
J17	1-2	NO BATTERY
J17	NC	BATTERY

Note: NC is no-connect, designating the jumper is omitted.

2.3 START UP PROCEDURE

To start up the Tracking Receiver Unit, plug it into a source of compatible AC power and turn on the rear panel mounted power switch.

The Tracking Receiver Unit performs a series of tests upon start up, displaying the name of the test being performed sequentially on the screen from left to right. If the TRU halts operation, the test associated with the last displayed message has failed. Section 4.3.1 should be consulted for more detail on the possible causes of failure for that test.

The Tracking Receiver Unit software initializes all parameters from non-volatile memory (RAM) upon successful completion of the start up tests. It loads default parameters from EPROM if a fault was determined in the RAM parameters. It then begins normal operation.

If this is the first time the unit has been started then the Configuration and Operating screens should be reviewed for correct parameter settings.

2.4 NORMAL OPERATION

The selection of control between REMOTE, utilizing serial links, and LOCAL, utilizing front panel keys, is accomplished only at the front panel. When in LOCAL control, the serial link commands are not acknowledged unless requesting status. When in REMOTE control, the operator is allowed to monitor any screen, but may only modify the control selection field of the summary screen.

All parameters are stored in non-volatile memory (battery backed up RAM) and are loaded into the unit upon powering up under normal conditions. A standard default set of parameters is loaded into RAM from EPROM when an error is detected in the stored set of parameters upon powering up the TRU. This normally occurs following battery replacement. Refer to Appendix A for a listing of supplied parameter values. This appendix should be updated if any parameters are changed. The default set does not load frequency band parameters (START, STOP, LCL OSC frequencies). The correct band setups must be entered in order for the unit to be operational. Refer to Table 1 of the test procedure for the TRU.

2.4.1 Mode Keys

The function of the mode keys are as follows:

MENU - The menu key sequences uni-directionally through the available display screens of the active screen group upon each actuation, returning to the top level screen after all screens have been displayed. Actuation of the menu key while in edit mode operates as normal. In addition, the unit exits from edit mode and restores the value of the selected field prior to editing.

EDIT - The edit key changes the state of edit mode upon each successive actuation. The current edit mode state can be determined by the cursor appearance, an underline when in edit mode and a blinking block otherwise. Also, the edit character (a reverse video E), appears in the upper right-hand corner of the screen while in edit mode.

The current edit mode state is used to determine cursor key action. When in edit mode, the cursor keys modify the data in the editable field containing the cursor. When not in edit mode, the cursor keys move between editable fields on a screen. Leaving edit mode through the actuation of the edit key restores the value of the field prior to editing.

FUNCTION - The function key changes the active screen group, displaying the top level screen of the group, upon each successive actuation. There are two screen groups, configuration and operating.

ENTER - The enter key is used to store the edited value of the field containing the cursor and exit edit mode. If the edited value is invalid, pressing the enter key restores the value of the field prior to editing. Actuation of the enter key while not in edit mode has no effect.

2.4.2 Cursor Keys

There are four cursor keys - left, right, up and down. Key action is dependent upon the current edit mode state.

When not in edit mode, the left and right keys move the cursor in their respective direction from the present editable field to the next editable field. The key action rolls over both in the left and right directions. For instance, if the cursor is on the last (right) editable field, pressing right arrow moves the cursor to the first (left) field on the same line. No action of the left or right key causes the cursor to change lines.

When not in edit mode, the up and down keys move the cursor in their respective direction from the present editable field line to the next editable field line. The key action rolls over both in the up and down directions. For instance, if the cursor is on the last (bottom) editable line, pressing the down arrow moves the cursor to the first (top) editable line. When changing lines, the cursor always moves to the left most field.

When in edit mode, the left and right keys move the cursor to successive adjacent digits within a field. The key action rolls over in both directions. For instance, if the cursor is on the last (right) digit, pressing the right arrow moves the cursor to the first (left) digit.

When in edit mode, the up and down keys change the value of the digit underlined by the cursor. The up key increments the value and the down key decrements. The key action rolls over in both directions. For instance, if the value of the digit is a "9", pressing the up arrow changes the digit to a "0". Data can be either numeric or alpha.

2.4.3 Display

The screen descriptions are listed below in the sequence displayed upon successive actuation of the menu key. The backlit dot matrix liquid crystal display provides a maximum screen size of 4 lines by 40 characters. The screen examples shown are not in edit mode and therefore do not have the edit mode character, a reverse video E, in the upper right hand corner. All editable fields for a screen are shown in bold on the screen examples in the following sections.

2.4.3.1 Configuration Screens

The configuration screen group consists of those screens containing unit configuration options.

2.4.3.1.1 Serial Port Setup

The serial port setup screen is used to set up the communication rate and format for the two available serial ports. The standard hardware configuration is EIA-422 for serial port 1 and EIA-232C for serial port 2, as determined by internal serial configuration switches. Command structure format for the serial links is specified in the TRACKING RECEIVER INTERFACE of Section 6.

```
  SERIAL PORT 1     BAUD: 4800
PARITY: EVEN    DATA: 8    STOP: 1
  SERIAL PORT 2     BAUD: 4800
PARITY: EVEN    DATA: 8    STOP: 1
```

The editable field options are as follows:

BAUD - 1200, 2400, 4800, 9600 and 19200 baud rates available.

PARITY - ODD, EVEN and NONE data parity selection available.

2.4.3.1.2 Band Setup

The band setup screen is used to set up the frequency range and hardware configuration for up to six frequency bands. The range is set by the START and STOP frequencies. When a block converter is used to down convert a frequency range to L-Band, the input frequency to the L-Band board is determined by the difference between the command frequency and LCL OSC. The RELAYS field sets the value of band select outputs.

BAND	START	STOP	LCL OSC	RELAYS
1	**950**	**1750**	**0**	**00000000**
2	**3400**	**4200**	**5150**	**00000000**
3	**3000**	**2000**	**0**	**00000000**

The editable field options are as follows:

START and STOP – 69 to 30000 MHz with 1 MHz resolution. These fields should be set to the actual ranges allowed by the RF hardware. For example, L-Band is 950 to 1750 MHz. Unused bands should have a start value greater than the stop value.

LCL OSC – 0 to 30000 MHz with 1 MHz resolution. This should be set to frequency of the block down converter's local oscillator. If no block converter is used, this should be set to 0.

RELAYS – 00000000 to 11111111, adjustable one bit at a time. Each bit can control a band switching RF relay. Single band units should have a value of 00000000.

2.4.3.1.3 Frequency Response Correction

At some isolated frequencies, the receiver can exhibit a spurious response without the presence of an input signal. Should this occur at a frequency corresponding to a desired beacon, the frequency response correction screens can be used to correct the situation. The values used for this correction should be in the 950 to 1750 MHz range.

NO	START FREQ	STOP FREQ	OFFSET
1	**0.000**	**0.000**	**+0.0 MHz**
2	**0.000**	**0.000**	**+0.0 MHz**
3	**0.000**	**0.000**	**+0.0 MHz**

The editable fields are as follows:

START FREQ – This is the starting frequency (placed before the desired frequency) where the correction is to start. A value equal to the desired frequency less 300 kHz is the suggested entry. (EXAMPLE: 1199.700 START FREQ for a spurious signal at 3950 MHz.)

STOP FREQ – This is the ending frequency (placed after the desired frequency) were the correction is to stop. A value equal to the desired frequency plus 300 kHz is the suggested entry. (EXAMPLE: 1200.300 STOP FREQ for a spurious signal at 3950 MHz.)

OFFSET – This is the degree of correction to be done. The first value to try is 400 kHz. Values up to ± 2 MHz can be used.

2.4.3.1.4 Configuration Screen

The configuration screen is used to set tracking mode and display copyright information for the unit, including software version and date.

```
CONFIG: STEPTRACK   BEACON: CW
COPYRIGHT RSI PRECISION CONTROLS
      VERSION:
      SOFTWARE DATE
```

The editable field options are as follows:

CONFIG – This is used to select between STEPTRACK and the monopulse tracking modes of AZ/EL/POL, AZ/EL and POL.

BEACON – This field is used to select between CW/PM beacon modulation or 800 Hz BPSK modulation. This selection is available for software versions 1.261.6.17 and later.

2.4.3.2 Operating Screens

The operating screen group consists of those screens which are utilized in the normal operation and monitoring of the Tracking Receiver unit.

2.4.3.2.1 Summary

The summary screen is used to select beacon frequency and control mode. The FREQ selected is range tested against the valid ranges of the frequency control screen to determine the band utilized. CONTROL selects the source of commands for the unit.

This screen also displays the status of the phase lock loop, the selected IF bandwidth and summary fault. The status of the tracking loop is indicated by PHASE LOCK, UNLOCKED or FIXED TUNE. The fixed tune mode is used only for the widest IF bandwidth of 280 kHz. For these bandwidths, the tracking loop is disabled and the VCXO is fixed tuned.

```
 FREQ: 1500.000 MHz  CONTROL:    REMOTE
SIGNAL LEVEL: -123.4 dBm   PHASE LOCK

 IF BANDWIDTH   2.5 kHz         NO FAULT
```

The editable field options are as follows:

FREQUENCY – Any value can be selected that is allowed by the band setup screen.

CONTROL - LOCAL and REMOTE modes available.

2.4.3.2.2 Analog Status

The analog status screen provides current status of the power supply voltages, battery voltage, internal chassis temperature and VCO offset. This screen is useful in determining the source of a fault indicated on the digital status/fault screen.

```
+12:  +11.7V  -12:  -12.1V  +5:  +4.9V
              BATT:  +3.2V
      INTERNAL  CHASSIS  TEMP:    +28° C
          VCO OFFSET:   123.4 kHz
```

There are no editable fields on this screen.

2.4.3.2.3 Digital Status/Fault

The digital status/fault screens provide current status for all possible sources of a summary fault. The screen displays the status of the RF, IF, and RCVR synthesizers, individual faults and the external status inputs.

```
RF SYNTH LOCKED    IF SYNTH LOCKED
RCVR SYNTH LOCKED  VCO NEAR LIMIT
DC POWER FAULT     PLL NEAR LIMIT
EXT STAT: 10010011 TEMP FAULT
```

There are no editable fields on these screens. The displayed messages and their causes are as follows:

RF SYNTH UNLOCKED/LOCKED – Indicates the lock status of the RF synthesizer in use. The synthesizer reports a locked status when the frequency commanded is maintained. Unlocked status of the synthesizer generates summary and track faults.

IF SYNTH UNLOCKED/LOCKED – Indicates the lock status of the IF synthesizer. The synthesizer reports a locked status when the frequency commanded is maintained. Unlocked status of the synthesizer generates summary and track faults.

RCVR SYNTH UNLOCKED/LOCKED - Indicates the lock status of the DDS multiplier PLL. This synthesizer reports a locked status when the frequency commanded is maintained. Unlocked status of the DDS multiplier PLL generates summary and track faults.

VCO NEAR LIMIT - Indicates that the VCO offset is near the limit of its range and the nominal beacon frequency selected should be reevaluated. This condition generates a summary fault.

PLL NEAR LIMIT - Indicates that the Phase-Locked Loop offset is near the limit of its range and the nominal beacon frequency selected should be reevaluated. This condition generates a summary fault.

DC POWER FAULT - Indicates that one of the power supply voltages or the battery voltage is not within tolerance. This condition generates summary and track faults. The tolerance ranges are as follows:

+12: +11.4 to +12.6 -12: -13.1 to -10.8   +5: +4.75 to +5.5
BATT: +2.50 TO +4.00

TEMP FAULT - Indicates that the internal chassis temperature range is not within the recommended operating range of the unit, 0° C to 65° C. This condition generates summary and track faults.

EXT STAT – Indicates the state of the eight external status bits, STATUS BIT 7 to STATUS BIT 0. Their status is also reported over the serial data link. Status Bits 7 through 0 are used for generation of a track fault condition.

2.4.3.2.4 Parameter

The parameter screen is used to select the IF bandwidth filter utilized and signal level offset. The signal level offset is added to the signal level prior to displaying it on the summary screen.

```
   IF BANDWIDTH:   4.0 kHz
SIGNAL LEVEL OFFSET:   +0 dB
```

The editable field options are as follows:

IF BANDWIDTH – 2.5, 4.0 and 280 kHz filters are available.

SIGNAL LEVEL OFFSET - +100 dB to -200 dB with 1 dB resolution.

2.4.3.2.5 Monopulse

The monopulse screen is used to select the monopulse scanning mode for processing error signals and the error signal display scaling. The track fault field is both an indication of a track fault condition and a means to reset the fault. The voltage level of each individual error signal is divided by its respective scale factor prior to being displayed on the summary screen.

```
MONOSCAN:  CONSTANT  TRACK  FAULT:  RESET
XEL    SCALE:  123.4 V/°   PHASING     0.0°
EL     SCALE:  123.4 V/°   PHASING     0.0°
POL    SCALE   123.4 V/°   PHASING     0.0°
```

The editable field options are as follows:

MONOSCAN - CONSTANT, RANDOM and OFF scanning modes available.

TRACK FAULT - When the RESET field is displayed in reverse video, the track fault is active. Editing the field and actuating the enter key will reset the track fault. A track fault inhibits monopulse operation of the antenna control system.

SCALE - 0.1 V/° to 250.0 V/° with 0.1V/° resolution.

PHASING – 0 TO 359.9° with 0.1° resolution.

2.4.3.2.6 Autophase

The autophase screen is used to enable autophasing for the EL and XEL error channels. In order to accomplish autophasing, each channel must be aimed off axis for a 3 dB reduction in signal level. For the EL channel, the antenna is aimed up in elevation and for the XEL channel, the antenna is aimed clockwise in azimuth. In addition, this screen shows signal level, STATUS and the EL and XEL errors.

```
    AUTOPHASE COMMAND:  PHASE EL
MODE:  AUTO     STATUS:  NEEDED
       SIGNAL LEVEL:    -79.6 dBm
XEL ERROR:  -0.000     EL ERROR:  -0.000
```

Status – Indicates the status of autophase as NEEDED, COMPLETE or PHASE EL (XEL).

The editable field options are as follows:

MODE – AUTO to enable and MANL to disable autophase.

AUTOPHASE COMMAND – Select either the EL or XEL channel to autophase.

2.4.3.2.7 VCO Control

The VCO control screen is used to select the VCO control mode and VCO sweep width for automatic control mode. It also allows the operator to manually tune the VCO, displaying all required data, when in manual control mode. The VCO control mode is forced to automatic if the MENU key is actuated to depart the screen. The auto sweep width field allows the operator to alter the auto beacon search sweep width. The manual VCO step field allows the operator to adjust the increment by which the VCO frequency is changed when in manual control mode. Changing the frequency is accomplished by editing the STEP field. Signal level is provided as a monitor to aid manual tuning.

```
VCO CONT: AUTO    AUTO SWP:  +/-120  kHz
   MANL VCO STEP: 10.0 kHz      STEP
   VCO OFFSET:   -30.0 kHz    UNLOCKED
        SIGNAL LEVEL:  -105.0 dBm
```

The editable field options are as follows:

VCO CONT - AUTO and MANL control modes are available. In auto control, the software controls the VCO in acquisition and gives control of the VCO to the hardware phase-locked loop at the end of the acquisition cycle. In manual control, the phase-locked loop is always commanded off and the operator manually steers the VCO via the STEP field. When going from auto to manual operation, the VCO is commanded to its nominal present position. When going from manual to auto, the phase-locked loop is commanded to lock about the present VCO position without performing an acquisition process.

AUTO SWP - ± 20 kHz to ± 150 kHz with 1 kHz resolution. Note: In order to use narrow acquisition ranges, the frequency tuning error of the tracking receiver must be accounted for. To determine the tuning error, input a known frequency at -80 dBm. Tune the TRU to this frequency with ±150 kHz AUTO SWP. Verify phase lock and note the VCO offset. This offset should be added to the command frequency of the TRU in order to correct for the time base errors of the unit. For example, if the input frequency is 11200 MHz and the TRU indicates a -23.6 kHz VCO OFFSET, the command frequency must be reduced by 24 kHz to 11199.976 MHz. Verify that the VCO OFFSET is less than 0.7 kHz with the corrected tune frequency. These steps are required since the frequency error may be greater than the acquisition range. NOTE: Software versions 1.282 and earlier have ±40 kHz minimum sweep.

MANUAL VCO STEP - 0.1 kHz to 50.0 kHz with 0.1 kHz resolution.

STEP - This field allows the operator to increment the VCO, by the manual VCO step, in the direction of the cursor key actuated while in manual control mode.

2.5 OPERATION UNDER ADVERSE OR ABNORMAL CONDITIONS

Side band lock may occur due to spurious signals, high noise level, excessive modulation or other conditions requiring local manual VCO control to acquire the beacon frequency.

2.6 SHUT DOWN PROCEDURE

The Tracking Receiver Unit on/off switch is located on the rear of the chassis towards the right side as viewed from the front panel. Turning the switch off shuts down the unit.

SECTION 3

3 PRINCIPLES OF OPERATION

3.1 UNIT LEVEL

The Tracking Receiver Block Diagram is shown in FIGURE 3-1. Also refer to the schematic which is included on the top level assembly drawing. The Tracking Receiver consists of the following major subassemblies: the L-Band Board, Tracking Receiver Board and block down converters as required to cover the desired input frequency range.

The L-Band Board has an input frequency range of 950 to 1750 MHz. Block down converters are used to convert other frequency bands to L-Band. Multiple down converters are required to cover an input frequency range greater than 800 MHz. The L-Band Board uses multiple conversions in order to track and measure the input signal from –55 to –100 dBm. The Tracking Receiver Board provides control to and receives status and signal strength from the L-Band Board.

3.2 RF BOARD (A11)

The block diagram of the L-Band Board is shown in FIGURE 3-2. In addition, a portion of the Tracking Receiver Board is also shown.

The RF input signal passes through a low pass filter before driving the first mixer. The input filter rejects image and other spurious signals. The RF input is down converted to 835 MHz by mixing with the output of the RF synthesizer. A high side LO is used and therefore the RF synthesizer covers a frequency range of 1785 to 2585 MHz. The Tracking Receiver Board provides the frequency control word and monitors the phase lock status of the RF synthesizer.

The 835 MHz IF output of the first mixer is filtered, amplified and filtered again before driving the second mixer. The band pass filters have nominal bandwidths of 25 MHz. A high side LO signal of 905 MHz from the IF synthesizer is used to down convert the first IF to 70 MHz. The IF synthesizer is controlled and monitored by the Tracking Receiver Board.

A low pass filter prevents the LO and RF signals to the second mixer from overdriving the 70 MHz amplifier. This amplifier drives an 11 dB coupler and a 4 MHz wide band pass filter. The nominal gain from the RF input to the 70 MHz coupled output is -16 dB.

The output of the 4 MHz wide band pass filter is down converted to 10.7 MHz by mixing with a LO frequency of 59.3 MHz. This LO is generated by using a phase locked loop to multiply the output of a DDS (direct digital synthesizer) by 10. The DDS is controlled by the Tracking Receiver Board to cover a mixer input frequency range of 70 MHz +/-150 kHz. An amplifier follows the mixer to drive a 400 kHz wide band pass filter that then drives the final mixer.

FIGURE 3-1: TRACKING RECEIVER BLOCK DIAGRAM

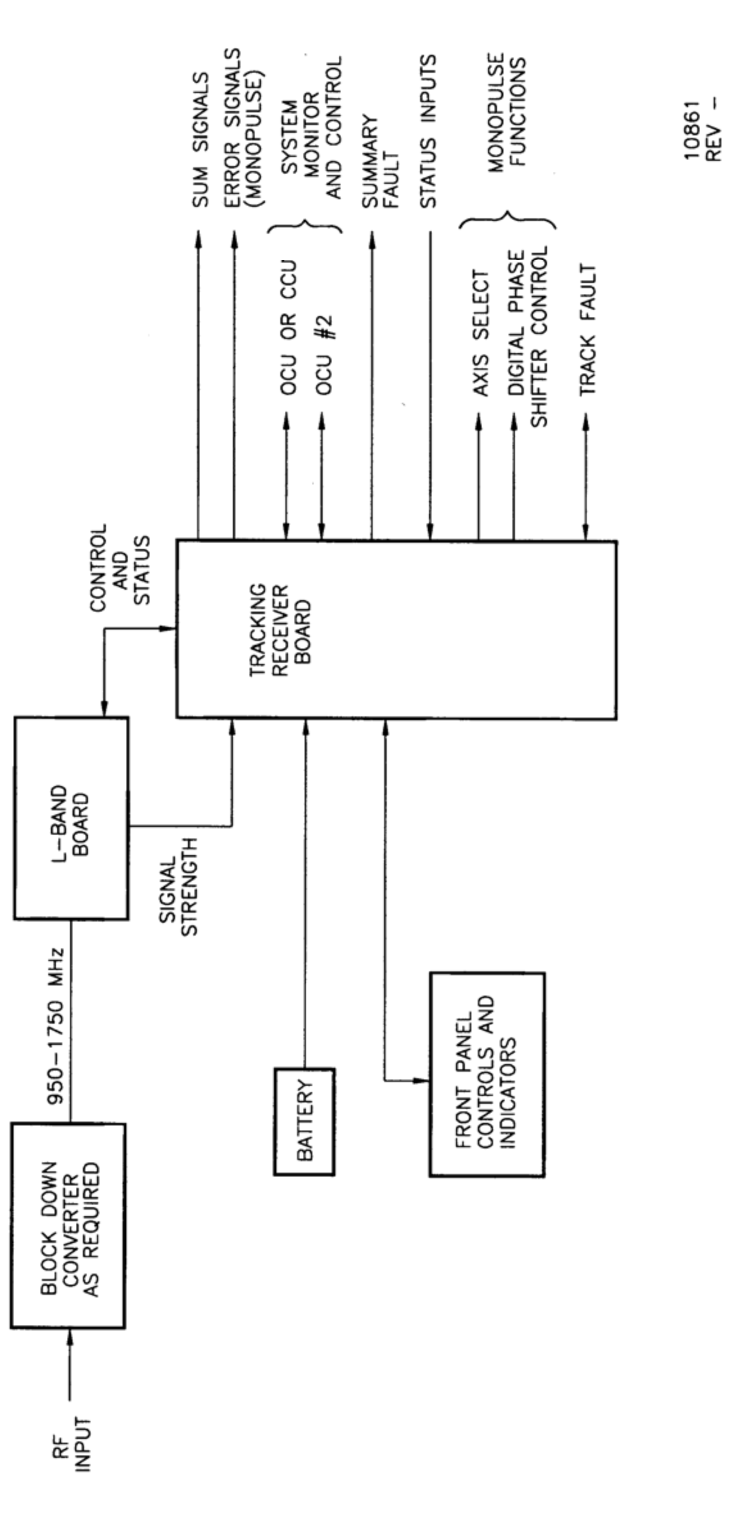
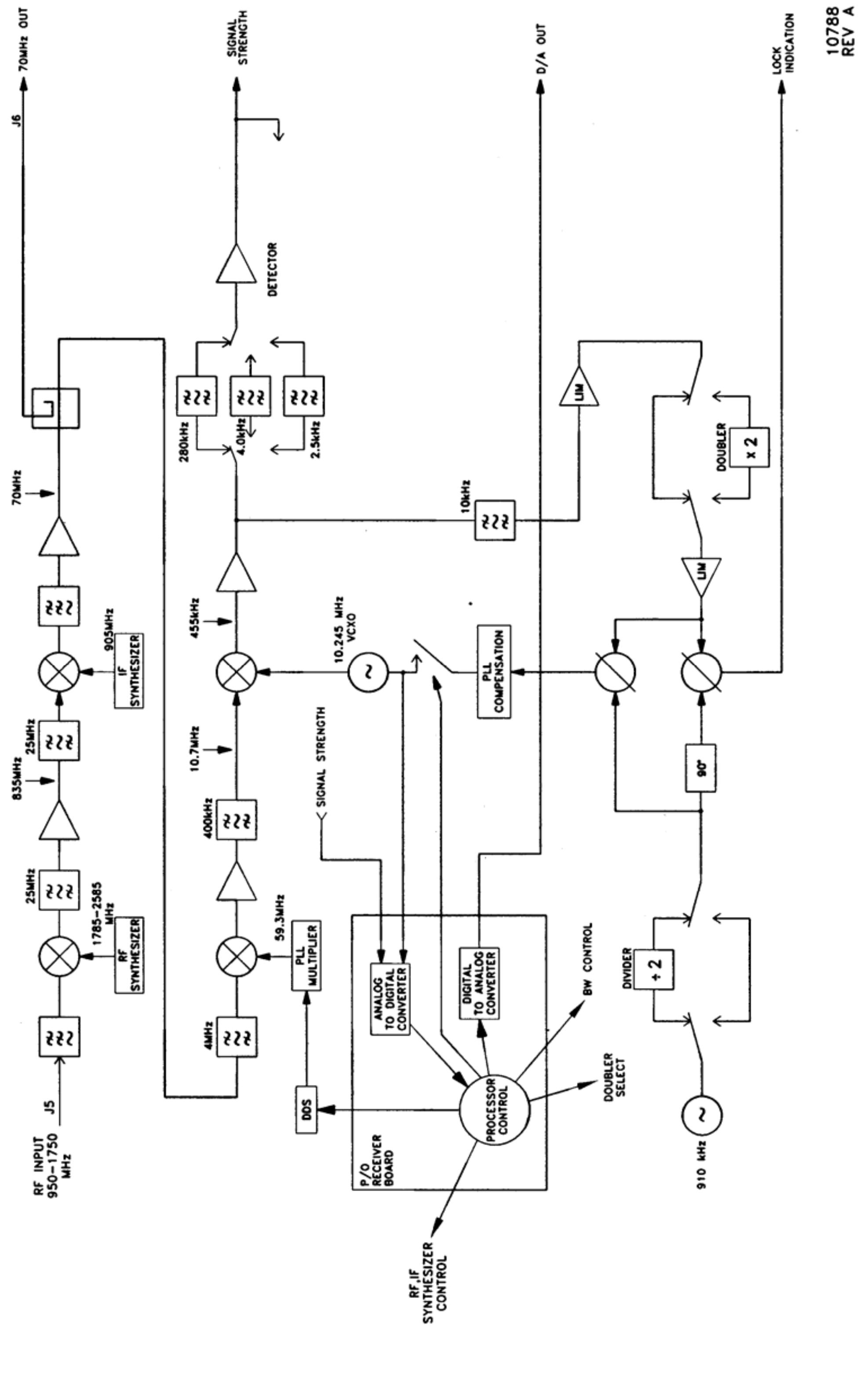


FIGURE 3-2: L-BAND RECEIVER BLOCK DIAGRAM



The final mixer down converts the 10.7 MHz IF to 455 kHz. The LO is generated by a VCXO (voltage controlled crystal oscillator). This oscillator is used open loop to acquire a signal and then controlled by a phase-locked loop which tracks the input signal. The Tracking Receiver Board monitors the frequency of this VCXO and adjusts the first LO using the DDS to keep the VCXO at center frequency.

The 455 kHz IF output of the second mixer is amplified and split into two paths. One path is filtered by a 10 kHz wide bandpass filter and limited to drive the phase locked loop circuitry. The limiter output can be doubled in frequency or connected directly to the input of the second limiter. The output of this limiter drives two phase detectors. A 910 kHz signal is divided either by two or not to drive the other inputs to the phase detectors. Therefore, the phase detectors can operate at either 455 kHz or 910 kHz.

This selection is controlled by the Tracking Receiver Board. The doubler is used when operating with carriers directly modulated by BPSK. In this case, the 910 kHz signal bypasses the divider and the doubler is used to double the 455 kHz output of the first limiter. In the normal mode of operation (not BPSK), the divider is used and the doubler is not, so the phase detectors operate at 455 kHz. This mode is shown on the block diagram. The output of one phase detector provides the error signal to the PLL compensation circuitry. If the Tracking Receiver Board commands the switch to the VCXO to close, the loop will lock and track the input signal. The second phase detector is driven in quadrature from the first in order to provide a phase-locked indication to the Tracking Receiver Board.

The other path generates the signal strength signal. A predetection bandwidth of 2.5, 4.0 or 280 kHz is selected before detection. The detector provides a log voltage proportional to signal level at a scale factor of 5 dB/volt.

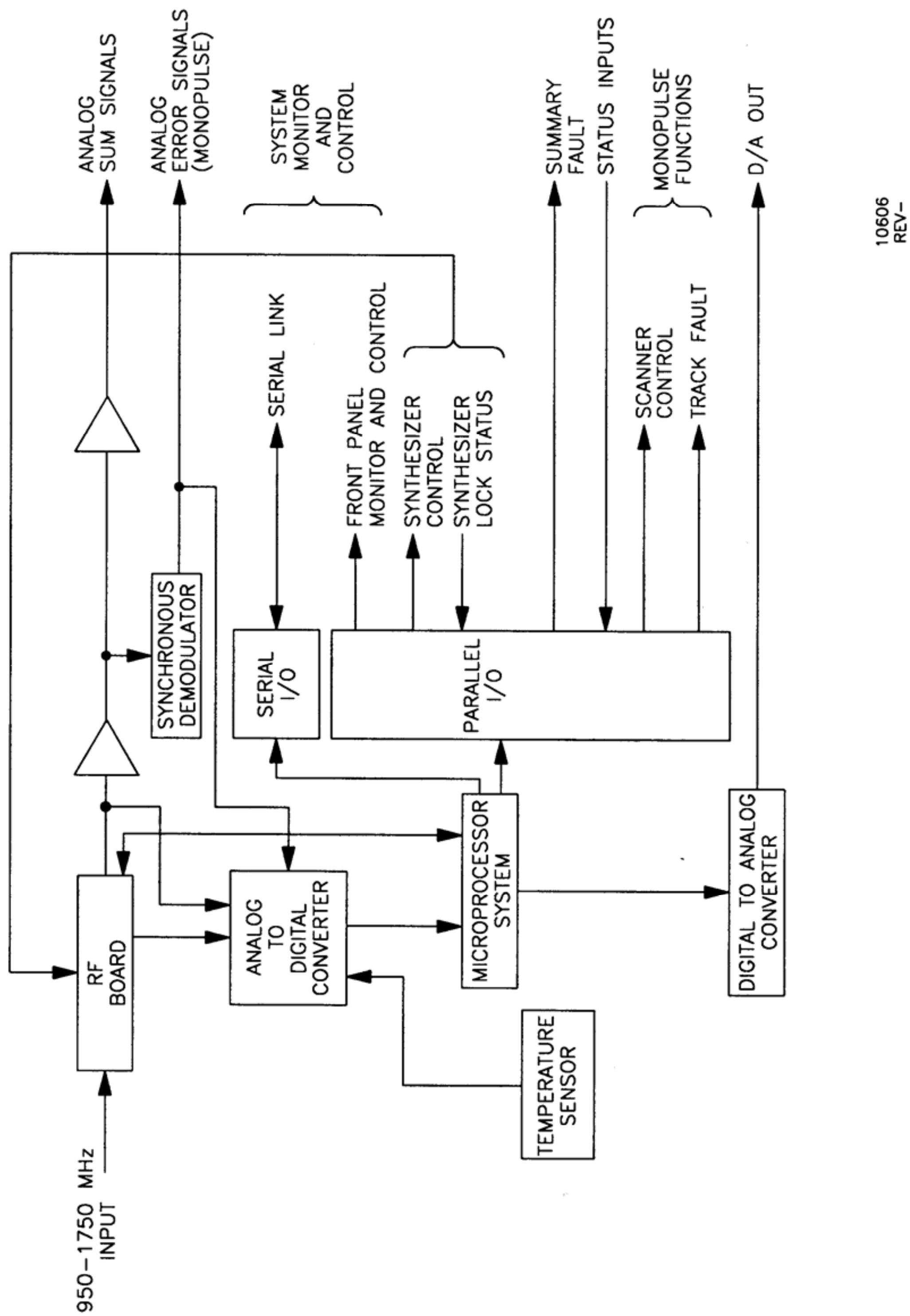
3.3 TRACKING RECEIVER BOARD (A10)

The Tracking Receiver Board Block Diagram, Figure 3-3, is used to describe the board functions.

The Tracking Receiver Board contains a digital-to-analog converter whose output can be used for various functions. The board also contains an analog-to-digital converter which has many inputs. These include feedback from the VCXO, both wide and narrow bandwidth sum signals, all monopulse error signals, a temperature sensor and all power supply voltages, including the battery used in the tracking receiver chassis.

The synchronous demodulator uses one of the two sum signals to derive two monopulse error signals (cross-elevation and elevation). These error signals are amplitude modulated on to the sum signals. The demodulator's timing functions come from the microprocessor system. The same timing functions also control the scanner output lines which produce the error signal amplitude modulation by controlling RF devices in the feed area.

FIGURE 3-3: TRACKING RECEIVER BOARD BLOCK DIAGRAM



The last monopulse function is track fault. The track fault output is a signal which goes directly to the CCU in the drive cabinet and which inhibits active monopulse tracking. The track fault can come from internal receiver status or from external status on up to eight switchable RF components in the feed area. For steptrack systems, the eight points are available for status monitoring.

The microprocessor system also controls the two serial EIA-232C/422 data links, the front panel display and key switches (when an integrated down converter is provided with the receiver) and a DDS (Direct Digital Synthesizer) for receiver functions. The microprocessor system consists of the processor itself, address latching and decoding, data buffers, a watchdog timer, read only memory (ROM) for program storage and random access memory (RAM) for program execution.

3.4 DC POWER SUPPLY AND BATTERY

The DC power supply is a 55W continuous, 65W peak, high performance quad output, ±12V and + 5V, supply with automatic selection of AC input range of 90-132 VAC or 175-264 VAC for 47-63 Hz single phase input power. The +5V output is adjustable between 4.75V and 5.5V.

The battery is a 3.6V high-energy lithium battery, with a velcro mounting strip, providing 1900 mA H. The battery has an estimated service life of 10 years. It is used to prevent loss of data in the non-volatile RAM when power is not applied to the Tracking Receiver Unit.

SECTION 4

4 MAINTENANCE AND SERVICING INSTRUCTIONS

4.1 TOOLS AND TEST EQUIPMENT REQUIRED

Horsehair Brush
Screwdrivers - Slot and #2 Phillips Head
7/16 Open End Wrench
5/16 Open End Wrench
Vacuum
Multimeter
Oscilloscope

4.2 INSPECTION, CLEANING AND LUBRICATION

4.2.1 General

Once a year, brush and vacuum the interior of the unit to remove dust and lint. Shut down the unit prior to removing the cover.

4.2.2 Air Filter Cleaning

Frequency of cleaning is dependent upon the operating environment of the unit and should be determined accordingly.

The mesh screen may be cleaned from the back panel using the vacuum and horsehair brush. Optionally, the screen guard may be removed carefully with a slot head screwdriver prior to cleaning. This allows access to a greater surface area of the screen. Replace screen guard when finished.

4.3 TROUBLESHOOTING

4.3.1 Start Up Fault Messages

The start-up fault messages are displayed should a given function fail at start up. A failure will cause both summary and track faults and halt operation of the Tracking Receiver. The fault conditions and the potential sections of the tracking receiver board or unit assemblies causing the fault are as follows:

FAULT CONDITION	POTENTIAL SOURCE
RAM ERROR	RAM
SOFTWARE FAULT	EPROM
TIMERS FAULT	Microprocessor
SERIAL PORTS FAULT	Microprocessor
POWER SUPPLY FAULT	Power Supply A/D Conversion
VCO CONTROL FAULT	D/A Conversion A/D Conversion

4.3.2 Operating Fault Messages

The operating fault messages are those indicated by the digital status/faults screen. The fault conditions and the potential sections of the tracking receiver board or unit assemblies causing the fault are as follows:

FAULT CONDITION	POTENTIAL SOURCE
RF, IF, or RCVR SYNTHESIZER UNLOCKED	Synthesizer Circuitry (RF Board) Digital Inputs To RF Board (from Receiver Board)
VCO NEAR LIMIT	Beacon Drift Phase-Locked Loop
PLL NEAR LIMIT	Beacon Drift Phase-Locked Loop
DC POWER FAULT	Power Supply Battery A/D Conversion
TEMPERATURE FAULT	Cooling Fan Ambient Temp. Drift Temperature Sensor A/D Conversion

4.3.3 Other Faults

Failure to lock may be caused by any or all of the following:

- Tuned To Wrong Frequency
- Auto Sweep Width Too Narrow
- Input Beacon Level Too Low
- L-Band Board Problem

4.4 SPECIALIZED ASSEMBLY, REPAIR OR REPLACEMENT INSTRUCTIONS

All ESD precautions must be followed when working inside the TRU chassis.

4.4.1 Software Upgrade Installation

Software for the Model 253 Tracking Receiver Unit (TRU) is located on the Tracking Receiver Board (A3), programmed in two PLCC EPROMs. Changes or upgrades in software code will require these EPROMs to be replaced with a new version chip set. The following discussion details the procedure to perform this change.

<u>Replacing EPROMS</u>

Prior to replacing software, record parameters on charts in Appendix A.
Disconnect power and pull TRU out from rack. Remove top lid of unit.

ATTENTION

Components inside the TRU chassis are static sensitive. Use precautionary handling procedures to prevent damage from electrostatic field forces.

Locate PLCC EPROM at U36 and U39. Remove chip from PLCC socket. Replace chip with new version. Install –01 EPROM in socket U39. Install -02 EPROM in socket U36.

Replace lid on TRU and connect power. Place the power switch in the "ON" position and verify TRU display is active. Re-enter parameters, if necessary.

4.4.2 Input AC Power Fuse Replacement

The input AC power fuse is located in the power entry module at the rear of the chassis. Prior to replacing the fuse the power cord should be disconnected from the power entry module.

The fuse housing is removed from the module with a flat head screwdriver. The housing has a compartment to hold a spare fuse to expedite replacement of the blown fuse. If the spare is used a new spare should be placed in the housing at the earliest possible time. The fuse, measuring 5x20 mm, is rated at 250V and 4A.

4.4.3 Battery Replacement

Prior to removing the battery, all parameters must be recorded on chart in Appendix A.

The battery should be replaced at the earliest convenience once a DC power fault has occurred due to battery voltage falling below 2.5 V. Normal non-volatile memory operation will continue until the battery voltage reaches 2.1 V.

The battery can be replaced once the power switch is off and the top cover is removed. The screws for the L-Band Board must be removed so that it may be lifted off the Tracking Receiver Board, allowing access to the battery connector.

Re-enter recorded parameter values after replacing the battery.

Note: If you do not enter band select values, you will be unable to select correct frequency.

4.4.4 DC Power Supply Adjustment

The DC power supply adjustment is a potentiometer which adjusts the +5 V output only. This output should be adjusted to +5.1 V with the power supply loaded normally.

Reference the DC Power Supply Drawing (Section 7.1) for location of the adjustment potentiometer.

SECTION 5

5 SPECIALIZED SHIPPING PRECAUTIONS

The Tracking Receiver and circuit board assemblies are sensitive to ESD and must be packaged in protective metal film bags and padded with electro-static resistant bubble wrap. Provide sufficient padding within the shipping crate to prevent any breakage.

SECTION 6

6 DRAWINGS AND PARTS LIST

The following drawings are grouped by major assembly.

Section 1 - Assemblies

BLOCK DOWN CONVERTER ASSEMBLY	201396
TRACKING RECEIVER ASSEMBLY	201615

Section 2 - Interface Specifications

TRACKING RECEIVER INTERFACE	95-062-5124-00

Section 3 - Test Procedures

TEST PROC, ACCEPT, TRACKING RECEIVER	CG-0293

Section 4 - SPECIFICATIONS

BLOCK DOWN CONVERTERS	9046 D

SH 1 | DWG. NO. 95-062-5124 | CAGE NO. 0P0N7

DASH NO. REV STATUS					REVISIONS			
DASH	-01	-02	-03	-04	REV	DESCRIPTION	DATE	APPROVED
REV					A	PER ECN 6105	99/12/01	
					B	PER ECN 6688	00/05/05	
					C	PER ECN 7299	00/12/15	
					D	PER ECN 10415	03/02/19	P. TRAUBERT
					E	PER ECN 11238	03/08/14	P. TRAUBERT
					F	PER ECN 13742	05/06/28	P. TRAUBERT

Notes:

1. **Engineering Drawing Practices in accordance with ASME Y14.100.**

DWN	D. YORK	VertexRSI® GENERAL DYNAMICS
CHK	C. EMMONS	
ORIG	P. TRAUBERT	
PROD MGR	J. MULLER	DWG TITLE **TRACKING RECEIVER SOFTWARE INTERFACE**
CE MGR		

	SIZE	CAGE NO.	DWG NO.
THIS DOCUMENT IS FOR REFERENCE ONLY AND MAY NOT BE INCORPORATED INTO A DESIGN OR USED FOR MANUFACTURE OR PROCUREMENT FROM SOURCES OTHER THAN GENERAL DYNAMICS C4 SYSTEMS VERTEXRSI. THE CONTENTS OF THIS DOCUMENT MAY BE DISCLOSED ONLY TO CUSTOMERS HAVING INTERFACE, OPERATION OR MAINTENANCE REQUIREMENTS SPECIFIC TO THIS EQUIPMENT.	A	0P0N7	95-062-5124
	SCALE NONE	REV F	SHEET 1 OF 37

FORM 4501 VDD

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TRU INTERFACE SPECIFICATIONS

1.0 GENERAL

This document provides details about the data traveling between the CU and TRU. This document is written in programmer's terms because a programmer will be responsible for the interface creation and maintenance.

1.1 GENERAL SPECIFICATIONS

Baud rate: minimum-1200, maximum-19200
Transmission link: RS232/RS422
Data format:

- Data Bits: 8
- Parity: Odd, Even or None
- Stop Bits: 1

Commands may be sent at any frequency up to three per second, regardless of baud rate.

NOTES: **The 70 MHz, remote control only TRU, PN 98-119-5315-01 has the following serial figuration:**

J2-M&C SERIAL

RS-232, 4800 BAUD, 8 BIT, ODD PARITY

J3-TRKG SERIAL

RS232, 4800 BAUD, 8 BIT, ODD PARITY

Streaming Signal Strength at a nominal update rate of 2 times a second.

2.0 DEFINITIONS

TRU Tracking Receiver Unit.

CU Control Unit - The unit controlling the tracking receiver over a serial link, refers to either the CCU or OCU depending upon system configuration, for PCD supplied systems.

Packet/data packet - This refers to all of the data sent to accomplish one logical command or response. It is unidirectional.

XEL Cross-Elevation axis.

EL Elevation axis.

POL Polarization axis.

3.0 COMMUNICATIONS PACKET FORMAT

All of the data packets originating from the CU contain the same basic structure. The packets originating from the TRU have two formats that positively acknowledge or negatively acknowledge the packets sent from the CU.

3.1 CU PACKET FORMAT

The packets vary in length. They all begin with a packet designator and end with a checksum and EOT character, respectively.

The packet designator is a 0-7F hexadecimal value that corresponds to one logical executable command. The designator is a printable ASCII character until the number of packets exceeds the number of printables in the ASCII table.

The checksum is the exclusive-OR of all bytes in the packet, excluding the EOT. It is used for transmission checks.

The EOT character can be any hex value with the MSB set; hex 80 will be used for most applications.

The decryption key is always a hexadecimal value of 0.

General packet format:

BYTE#	DESCRIPTION
1	packet designator; 0-7FH; required
2	decryption key; 0H; required only if arguments exist.
3-	first byte of argument list; a variable length field; optional.
last-1	checksum
last	EOT = 80 Hexadecimal.

3.2 TRU PACKET FORMAT

The data packet originating from the TRU is either an acknowledgement (ACK) packet or a negative acknowledgement (NACK) packet. The ACK packet informs the CU that the packet it recently sent, identified within the ACK packet, was processed correctly. The NACK packet informs the CU that the packet it recently sent, identified within the NACK packet, was not processed correctly.

The format of the ACK packet contains the packet designator, data arguments, checksum and EOT, respectively. Data arguments are optional just like the CU packet format. The ACK packet designator contains the designator of the CU packet that it is acknowledging. Data arguments contain data requested by the CU.

The format of the NACK packet contains the NACK designator, an CU packet designator, checksum and EOT. The NACK packet designator contains special ASCII characters that identify the reason that the CU packet was not processed. The CU packet designator identifies the CU packet that was not processed. The checksum and EOT follow the same rules as the CU format.

NOTE: The data packets originating from the TRU are not encrypted.

ACK Format:

Byte#	Description
1	Packet Designator; Required
2-	Data Arguments; Optional
last-1	Checksum ; Required
last	EOT ; Required

NACK Format:

Byte#	Description
1	NACK Characters; Required
2	CU Packet Designator; Required
3	Checksum ; Required
4	EOT ; Required

The following NACK characters will be used to identify the type of NACK packet being sent:

Hex	Char	Description
7b	'{'	CU is not in control
7c	'|'	Packet Sent Was Not Of The Proper Length
7d	'}'	Invalid Packet Was Sent
7e	'~'	Packet Failed Checksum
7f	'⌂'	Packet Data Was Bad

4.0 COMMANDS

Table 1
List of Commands

COMMAND DESIGNATOR	LOGICAL DESCRIPTION
A	Select Frequency.
C	Select Narrow Band Sweepwidth
E	Clear Track Fault. - Monopulse only.
F	Request Frequency.
I	Request System Status.
K	Request Signal Strength.
M	Select Scanning Mode - Monopulse only.
N	Set XEL/EL/POL Phase Shifts - Monopulse only.
O	Set XEL/EL/POL Tracking Slopes - Monopulse only.
P	Request Scanning Mode - Monopulse only.
Q	Request XEL/EL/POL Phase Shifts - Monopulse only.
R	Request XEL/EL/POL Tracking Slopes - Monopulse.
S	Request XEL/EL/POL Errors - Monopulse only.
Z	Select Xel Autophase - Monopulse only.
[	Select EL Autophase - Monopulse only.
\	Select Autophase Undo - Monopulse only.
]	Select Phase Commit - Monopulse only.
^	Select Phase Commit Acknowledgeable - Monopulse only.
`	Request Software Revision.
b	Select IF Bandwidth.
g	Request Narrow Band Sweep Width.
h	Request Narrow Band IF Bandwidth.
j	Request Analog Status.
l	IF Doubler Enable
n	IF Doubler Enable Status Request

4.1 DETAILED COMMAND LIST

The detailed description of the packets listed above contain:

Format:

Shows the contents of the packet beginning with the packet designator and ending with a checksum and eot. Only those packets that contain arguments include a key. Details for arguments include what they represent, the range, argument length. All arguments are represented in ASCII.

Acknowledgement:

This field shows the format of the TRU ACK packet that is sent to acknowledge the CU packet.

Non Acknowledgement:

This field shows the format of the TRU NACK packet that is sent to non-acknowledge the CU packet.

Action:

This field shows how the software reacts to receiving the CU packet.

Notes:

This field points out special handling characteristics.

4.1.1 Select Frequency

Format:

A<key>FFFFFFFF<checksum><eot>

Acknowledgement:

A<checksum><eot>

FFFFFFFF spans 8 bytes containing the frequency to select in MHz. Represented in ASCII, in a range of 950.000 to 20000.00 MHz : FFFFF.FFF. (See Notes)

Non Acknowledgement:

<nack type>A<checksum><eot>

Action:

Software calculates the new frequencies, then loads them into the synthesizers.

Notes:

30000.00 maximum on some models

Frequency is fixed for 70 MHz units

4.1.2 Select Narrow Band Sweep Width

Format:

C<key>SSS<checksum><eot>

SSS spans 3 bytes containing the range over which the carrier of the beacon is to be found during a narrow band acquisition. Represented in ASCII, in a range of 40 to 150 kHz.

Acknowledgement:

C<checksum><eot>

Non Acknowledgement:

<nack type>C<checksum><eot>

Action:

Software sets the current value of the NarrowBandSweep parameter specified to the value specified.

Notes:

Acquisition sweep is ± range commanded.

Dash 28 TRU has sweep ranges of ±40 to ±225 kHz.

4.1.3 Clear Track Fault

Format:

E<checksum><eot>

Acknowledgement:

E<checksum><eot>

Non Acknowledgement:

<nack type>E<checksum><eot>

Action:

Software clears the TrackFault, and then initializes the current RF path to the new path selected for monopulse units only.

Notes:

Software will set TrackFault when the discrete bits representing an RF path have changed.

Monopulse Only.

4.1.4 Request Frequency

Format:

F<checksum><eot>

Acknowledgement:

Fffffffff<checksum><eot>

ffffffff spans 8 bytes containing the current frequency that the synthesizers have been tuned to. Represented in ASCII, in a range of 950.000 to 20000.000 MHz : fffff.fff. (See Notes.)

Non Acknowledgement:

<nack type>F<checksum><eot>

Action:

Software grabs the current frequency the synthesizers have been tuned to and sends it back to the CU.

Notes:

On some models the maximum is 30000.00 MHz.

4.1.5 Request System Status

Format:

I <checksum><eot>

Acknowledgement:

IXXXX<checksum><eot>

XXXX spans 4 bytes contains faults and status of the TRU. Represented in binary with each bit representing the logic state of each fault/status; Bit7 is reserved. The following Faults/Status is reported:

Byte 1
Bit7 - 0:Reserved
Bit6 - Temperature Fault - refer to Analog Status
Bit5 - DC Power Fault - refer to Analog Status
Bit4 - PLL Near Limit
Bit3 - VCO Auto Control = 1, Manual = 0
Bit2 - Reserved
Bit1 - Remote Mode = 1, Local Mode = 0
Bit0 - Reserved

Byte 2
Bit7 - 0:Reserved
Bit6 - Autophase Required , Yes = 1, No = 0
Bit5 - Phasing Complete, Yes = 1, No = 0
Bit4 - VCO Near Limit
Bit3 - Status 7
Bit2 - 0:Reserved
Bit1 - Track Fault Active = 1, Inactive = 0
Bit0 - Summary Fault Active = 1, Inactive = 0

Byte 3 : External Status
Bit7 - 0:Reserved
Bit6 - 0:Reserved
Bit5 - 0:Reserved
Bit4 - 0:Reserved
Bit3 - IF Synthesizer Unlocked = 1, Locked = 0
Bit2 - Receiver Synthesizer Unlocked = 1, Locked = 0
Bit1 - RF Synthesizer Unlocked = 1, Locked = 0
Bit0 - PLL locked = 1; unlocked =0

Byte 4 : External Status
Bit7 - 0 Reserved
Bit6 - Status 6
Bit5 - Status 5
Bit4 - Status 4
Bit3 - Status 3
Bit2 - Status 2
Bit1 - Status 1
Bit0 - Status 0

Non Acknowledgement:

<nack type>I<checksum><eot>

Action:

Software sends the current System Status to the CU.

4.1.6 Request Signal Strength

Format:

K<checksum><eot>

Acknowledgement:

K±SSSS±SSSS<checksum><eot>

±SSSS spans 5 bytes containing the receiver signal strength in dBm ±SSS.S.

±SSSS spans 5 bytes containing the receiver signal strength, in dBm ±SSS.S.

Non Acknowledgement:

<nack type>K<checksum><eot>

Action:

Software will send the receiver signal strength.

Notes:

The signal strength source is determined by IF Bandwidth Choice.

For TRU, PN 98-119-5315-01, signal strength is continually send out the serial2 port at 2 times per second.

4.1.7 <u>Select Scanning Mode</u>

Format:

M<key>S<checksum><eot>

S spans 1 byte containing the desired mode to be used during scan cycle. Represented in ASCII: 'C' for a constant scan cycle period. 'R' for a pseudorandom scan cycle period, or 'O' to turn off the scanning process. For monopulse units only.

Acknowledgement:

M<checksum><eot>

Non Acknowledgement:

<nack type>M<checksum><eot>

Action:

Software will set the current value of the ScanModeSelect parameter to the value specified.

Notes:

Monopulse Only.

4.1.8 Set Phase Shifts

Format:

N<key>XXXXEEEEPPPP<checksum><eot>

For monopulse units only.

XXXX spans 4 bytes containing the desired value of the XEL axis phase shifter. Represented in ASCII, in a range of 0.0 to 359.9° : XXX.X

EEEE spans 4 bytes containing the desired value of the EL axis phase shifter. Represented in ASCII, in a range of 0.0 to 359.9° : EEE.E

PPPP spans 4 bytes containing the desired value of the POL axis phase shifter. Represented in ASCII, in a range of 0.0 to 359.9° : PPP.P

Acknowledgement:

N<checksum><eot>

Non Acknowledgement:

<nack type>N<checksum><eot>

Action:

Software will set the current value of each PhaseShift parameter to the values specified.

Note:

Monopulse Only.

4.1.9 Set Tracking Slopes

Format:

O<key>XXXXEEEEPPPP<checksum><eot>

For monopulse units only.

XXXX spans 4 bytes containing the desired value of the XEL axis tracking slope. Represented in ASCII, in a range of 0.0 to 200.0 Volts/°: XXX.X

EEEE spans 4 bytes containing the desired value of the EL axis tracking slope. Represented in ASCII, in a range of 0.0 to 200.0 Volts/°: EEE.E

PPPP spans 4 bytes containing the desired value of the POL axis tracking slope. Represented in ASCII, in a range of 0.0 to 200.0 Volts/°: PPP.P

Acknowledgement:

O<checksum><eot>

Non Acknowledgement:

<nack type>O<checksum><eot>

Action:

Software will set the current value of each TrackSlope parameter to the values specified.

Notes:

Monopulse Only.

4.1.10 Request Scanning Mode

Format:

P<checksum><eot>

Acknowledgement:

PS<checksum><eot>

S spans 1 byte containing the current scanning mode used during scan cycle. Represented in ASCII: 'C' for a constant scan cycle period, 'R' for a pseudorandom scan cycle period, or 'O' for no scanning process.

Non Acknowledgement:

<nack type>P<checksum><eot>

Action:

Software will send the current value of the ScanModeSelect parameter.

Notes:

Monopulse Only.

4.1.11 Request Phase Shift Settings

Format:

Q<checksum><eot>

Acknowledgement:

QXXXXEEEEPPPP<checksum><eot>

XXXX spans 4 bytes containing the current value of the XEL axis phase shifter. Represented in ASCII, in a range of 0.0 to 359.9° : XXX.X

EEEE spans 4 bytes containing the current value of the EL axis phase shifter. Represented in ASCII, in a range of 0.0 to 359.9° : EEE.E

PPPP spans 4 bytes containing the current value of the POL axis phase shifter. Represented in ASCII, in a range of 0.0 to 359.9° : PPP.P

Non Acknowledgement:

<nack type>Q<checksum><eot>

Action:

Software will send the current values of the PhaseShift parameters.

Notes:

Monopulse Only.

4.1.12 Request Tracking Slopes

Format:

R<checksum><eot>

Acknowledgement:

RXXXXEEEEPPPP<checksum><eot>

XXXX spans 4 bytes containing the current value of the XEL axis tracking slope. Represented in ASCII, in a range of 0.0 to 200.0 Volts/°: XXX.X

EEEE spans 4 bytes containing the current value of the EL axis tracking slope. Represented in ASCII, in a range of 0.0 to 200.0 Volts/°: EEE.E

PPPP spans 4 bytes containing the current value of the POL axis tracking slope. Represented in ASCII, in a range of 0.0 to 200.0 Volts/°: PPP.P

Non Acknowledgement:

<nack type>R<checksum><eot>

Action:

Software will send the current values of the TrackSlope parameters.

Notes:

Monopulse Only.

4.1.13 Request Error Signals

Format:

S<checksum><eot>

Acknowledgement:

S±XXXX±EEEE±PPP<checksum><eot>

±XXXX spans 5 bytes containing the current value of the XEL error signal. Represented in ASCII, in a range of -9.999° to + 9.999° : ±X.XXX

±EEEE spans 5 bytes containing the current value of the EL error signal. Represented in ASCII, in a range of -9.999° to + 9.999° : ±E.EEE

±PPP spans 4 bytes containing the current value of the POL error signal. Represented in ASCII, in a range of -9.99° to + 9.99° : ±P.PP

Non Acknowledgement:

<nack type>S<checksum><eot>

Action:

Software will send the current value of each error signal.

Notes:

Monopulse Only.

4.1.14 Select XEL Autophase

Format:

Z<checksum> <eot>

Acknowledgement:

Z <checksum> <eot>

Non Acknowledgement:

<nack type>Z<checksum><dot>

Action:

Software will execute Autophase for the XEL axis.

Notes:

For monopulse units only.

4.1.15 **Select EL Autophase**

Format:

[<checksum><eot>

Acknowledgement:

[<checksum><eot>

Non Acknowledgement:

<nack type>[<checksum><eot>

Action:

Software will execute Autophase for the EL axis.

Notes:

For monopulse units only.

4.1.16 Select Phase Undo

Format:

\<checksum><eot>

Acknowledgement:

\ <checksum><eot>

Non Acknowledgment:

<nack type>\<checksum><eot>

Action:

Software will undo current Autophase results if this command Is sent before Select Phase Commit is sent.

Notes:

For Monopulse units only

4.1.17 Select Phase Commit

Format:

]<checksum><eot>

Acknowledgement:

] <checksum><eot>

Non Acknowledgement:

<nack type>]<checksum><eot>

Action:

Software will commit the current phasing calculated by the Autophase commands for the XEL and EL axis.

Notes:

For monopulse units only.

4.1.18 Select Phase Complete Acknowledgement

Format:

^<checksum><eot>

Acknowledgement:

^<checksum><eot>

Non Acknowledgement:

<nack type>^<checksum><eot>

Action:

Sent to confirm that Autophase sequence has been completed.

Notes:

For monopulse units only.

4.1.19 Select Phase Info

Format:

_<key>C<checksum><eot>

C spans 1 byte containing the current Phase Shift Mode selected at the OCU. Represented in ASCII: 'M' for Manual or "A" for Autophase.

Acknowledgement:

_<checksum><eot>

Non Acknowledgement:

<nack type>_<checksum><eot>

Action:

Software will set the current Phase Shift Mode type parameter to the value specified.

Notes:

Only for monopulse units with Autophase.

4.1.20 Request Software Revision

Format:

`<checksum> <eot>

Acknowledgement:

`RRRRRRRRRRDDDDDDDDDDDTTTTTTTT

<checksum> <eot>

RRRRRRRRRRRRRRRR is the revision number 1.234.5.4 (field padded with spaces if the length of the revision number is less than 10.)

DDDDDDDDDDD is the date of revision: 1998/01/01 (padded with 1 space),

TTTTTTTT is the time of revision: 18:06:23.

Non Acknowledgement:

<nack type>`<checksum> <eot>

Action:

Software sends the TRU software revision information.

Notes:

4.1.21 Select Narrow IF Bandwidth

(Referred to as SUM 2 Bandwidth in some units.)

Format:

b<key>X<checksum><eot>

X spans 1 byte containing the new IF bandwidth to be used for narrow band signal strength. Represented in ASCII:

‘1’ for Bandwidth #1
‘2’ for Bandwidth #2
‘3’ for Bandwidth #3

Acknowledgement:

b<checksum><eot>

Non Acknowledgement:

<nack type>b<checksum><eot>

Action:

Software sets the current value of the IFNarrowBW Select parameter to the value specified.

Notes:

Specific units have different filter values. In some units, the wide IF or Sum 1 Channel is not used. Refer to the documentation for the RF Board to determine which bandwidths are used in a specific system. Some examples of filter values used in different systems are shown below.

UNIT	BW1	BW2	BW3	
A	2.5	6.7	100	kHz
B	2.5	6.7	10	kHz
C	2.5	6.7	10	kHz
D	2.5	4.0	280	kHz

4.1.22 Request Narrow Band Sweep Width

Format:

g<checksum><eot>

Acknowledgement:

gSSS<checksum><eot>

SSS spans 3 bytes containing the current value of the NarrowBandSweep parameter. Reperesented in ASCII, in a range 40 - 150 kHz.

Non Acknowledgement:

<nack type>g<checksum><eot>

Action:

Software sends the current sweep width.

Notes:

4.1.23 Request Narrow IF Bandwidth

(Referred to as SUM 2 Bandwidth in some units.)

Format:

h<checksum><eot>

Acknowledgement:

hX<checksum><eot>

X spans 1 byte containing the current IF bandwidth used for narrow band signal strength. Represented in ASCII.

'1' for Bandwidth #1
'2' for Bandwidth #2
'3' for Bandwidth #3

Non Acknowledgement:

<nack type>h<checksum><eot>

Action:

Software sends the current value of the IFNarrowBW Select parameter.

Notes:

Program specific units may have different filter bandwidths, refer to 4.1.21.

4.1.24 Request Analog Status

Format:

j<checksum><eot>

Acknowledgement:

j±AA±BBBBBB±CC±DDD±EEE±FFF±GGG±HH
<checksum><eot>

±AA spans 3 bytes containing the battery Voltage, ± A.A Volts.

± BBBBBB spans 7 bytes containing the VCO Voltage offset from 0 kHz ± BBBBB.B kHz.

± CC spans 3 bytes containing the Voltage of the +5 V power supply, ± C.C Volts.

± DDD spans 4 bytes containing the Voltage of the 12 V power supply, ± DD.D Volts.

± EEE spans 4 bytes containing the Voltage of the -12 V power supply, ± EE.E Volts.

± FFF spans 4 bytes containing the Voltage of the + 15 V power supply, ± FF.F Volts.

± GGG spans 4 bytes containing the Voltage of the - 15 V power supply, ± GG.G Volts.

± HH spans 3 bytes containing the temperature in the TRU, ± HH °C.

Non Acknowledgement:

<nack type>j<checksum><eot>

Action:

Software retrieves the current Analog Status and sends it to the CU.

4.1.25 BEACON CONTROL

Format:

I<key>X<checksum><eot>

X spans 1 byte containing the bandwidth desired. Represented in ASCII: "0" for CW, "1" 800HZBPSK.

Acknowledgement:

I<checksum><eot>

Non Acknowledgement:

<nack type>I<checksum><eot>

Action:

Software will set the current value of the IF Doubler Enable parameter to the specified value.

Notes:

4.1.26 BEACON CONTROL REQUEST

Format:

n<checksum><eot>

Acknowledgement:

n X <checksum><eot>
Where: X is represented in ASCII
"1" = 800HZBPSK, "0" = CW

Non Acknowledgement:

<nack type>n<checksum><eot>

Action:

Software sends current status of the IF Frequency Doubler Enable.

Notes:

5.0 DATA REPRESENTATIONS

All data transmitted to/from the TRU is represented in ASCII. The exception to this rule is EOT which must be different from the ASCII characters.

6.0 ERROR DETECTION

Transmission errors due to the RS232 link are identified by the packet checksum. If the packet fails the checksum, then a NACK packet is sent back to the CU.

DATE: ______________________________

253 S/N: ______________________________

QUALITY CONTROL: ______________________________

CUSTOMER: ______________________________

JOB NO: ______________________________

PERFORMED BY: ______________________________

____

____

WITNESSED BY: ______________________________

____

____

TABLE OF CONTENTS

1.0 SCOPE

This procedure details the tests, measurements and performance criteria for a Factory Acceptance Test of a Tracking Receiver, VertexRSI Part Number 201615 & 201660.

1.1 TEST CONDITIONS

All tests will be performed under factory ambient conditions of temperature, atmospheric pressure and humidity.

Temperature will typically be within the range of 65° F (18° C) to 86° F (30° C), and relative humidity between 20 and 95 percent.

1.2 TEST DATA

This document provides for the recording of test data. Test steps followed by the word "Record" require a measurable value to be recorded in the space provided. Test steps followed by the word "Check" require a mark (✓) to be made in the space provided upon successful completion of the observation or function.

Any additional data generated during the performance of this test (recordings, notes, calculations, etc.) are considered to be part of this test procedure and shall be attached hereto.

1.3 ACCEPT/REJECT CRITERIA

Most individual test measurements have tolerance limits specified in this procedure. The basis for acceptance of the equipment is:

a. All measurements are within the tolerance allowed.

b. All applicable test functions or observations are successfully completed.

2.0 REFERENCE DRAWINGS

The following drawings are listed for reference only.

Tracking Receiver Assembly/Schematic 201615 & 201660

3.0 TEST EQUIPMENT

The following items, or equivalent, are required for the performance of this testing:

3.1 COMMERCIAL TEST EQUIPMENT

a. Spectrum Analyzer

Hewlett-Packard 8593E ______________ (Record)
Serial No. ______________ (Record)
Calibration Due Date ______________ (Record)

b. Digital Voltmeter

Fluke 77 ______________ (Record)
Serial No. ______________ (Record)
Calibration Due Date ______________ (Record)

c. RS-232 Terminal ______________ (Record)

d. Signal Generator

Hewlett-Packard 83752A ______________ (Record)
Serial No. ______________ (Record)
Calibration Due Date ______________ (Record)

e. Oscilloscope

Tektronix TDS210 ______________ (Record)
Serial No. ______________ (Record)
Calibration Due Date ______________ (Record)

f. Signal Generator

Gigatronics 1018 ______________ (Record)
Serial No. ______________ (Record)
Calibration Due Date ______________ (Record)

3.2 VERTEXRSI SUPPLIED SPECIAL TEST EQUIPMENT

a. Tracking Receiver Test Set
b. Noise Test Set
c. 75 ohm to 50 ohm Minimum Loss Pad (75 ohm input only)
d. Monopulse Test Set

4.0 FUNCTIONAL TEST

The following tests will verify the functional operation of the Tracking Receiver.

4.1 CONFIGURATION DATA

4.1.1 Enter the following data below:

Unit Part Number (including dash) ____________________

Unit Serial Number ____________________

Software Version and Date ____________________

4.2 POWER UP

4.2.1 Plug in the unit to AC power. Turn on the unit. Verify that the display momentarily shows self test and then the top level screen. Select local control.

_____ (Check)

4.2.2 Turn the display contrast adjust pot and verify that the contrast is altered. Verify that contrast increases as the pot is turned clockwise. Adjust to an easily viewable level.

_____ (Check)

4.2.3 Verify that the fan is energized with air directed into the chassis.

_____ (Check)

4.2.4 Press all four cursor keys in succession and verify that the cursor moves in response to each key.

_____ (Check)

4.2.5 Display the top level screen selection parameter on the configuration menus. Select "STEPTRACK" if testing for steptrack only or “AZ/EL/POL" if testing for both monopulse and steptrack.

_____ (Check)

4.2.6 In the Band Select screen, select the Start-Stop frequencies Local Oscillator frequencies and Relays as required per Table 1.

TABLE 1

DASH NUMBER	START (MHz)	STOP (MHz)	LCL OSC (MHz)	RELAYS
01	950	1750	N/A	0000 0000
02	2000	2800	3750	0000 0000
03	3400	4200	5150	0000 0000
04	4000	4800	5750	0000 0000
05	7250	7750	6300	0000 0000
06	10700	11500	9750	0000 0000
07	11450	12250	10500	0000 0000
08	12200	13000	11250	0000 0000
09	10700	11500	9750	0000 0100
09	11450	12250	10500	0000 1000
09	12200	13000	11250	0001 0000
10	950	1750	N/A	0000 0000
11	10900	11700	9950	0000 0000
12	11700	12500	10750	0000 0000
13	10700	11500	9750	0000 0100
13	11450	12250	10500	0000 1000
14	3400	4200	5150	0000 0100
14	4000	4800	5750	0000 1000
15	3400	4200	5150	0000 0001
15	10700	11500	9750	0000 0100
15	11450	12250	10500	0000 1000
15	12200	13000	11250	0001 0000

4.2.7 Record the values displayed on the analog status screen for voltages.

Voltage	Tolerance	DISPLAY VALUE (RECORD)
+12V	± .5V	____________________
-12V	± .5V	____________________
+5V	+.2V, -.1V	____________________
(BATT) +3.6V	± .2V	____________________

Verify that the display values are within tolerance. _____ (Check)

4.3 PARAMETER SET-UP

Enter the following parameters on the parameters screen:

SIGNAL LEVEL OFFSET- 0 dB

_____ (Check)

5.0 UNIT TEST PROCEDURE

5.1 INITIAL SETUP

Connect the signal generator output to input of the spectrum analyzer. Set both the generator and analyzer to the appropriate test frequency per Table 2. Adjust the signal generator output level for -80 dBm displayed level on the spectrum analyzer. Record the signal generator output level and calculate the cable loss. This loss must be accounted for when setting the input level to the receiver.

Cable loss = generator output level ________ -(-80 dBm) = ________

In addition, the loss of the 50 ohm to 75 ohm matching pad (5.7 dB nominal) must be accounted for when testing 75 ohm input receivers.

TABLE 2

Dash Number	Test Frequency (MHz)
01, 10	1350
02	2400
03, 14, 15	3800
04	4400
05	7500
06	11100
07, 09, 15*	11850
08	12600
11,13	11300
12	12100

* Use as initial -15 test frequency

5.1.1 For -15 assembly only, calculate the cable loss for the second test frequency:

Cable loss = generator output level ________ -(-80 dBm) = ________

5.2 SIGNAL STRENGTH

5.2.1 Disconnect the signal generator from the spectrum analyzer and connect it to the RF input of the tracking receiver. Adjust the signal generator as required to produce an input level of -80 dBm to the receiver. Select the test frequency on the receiver. Monitor front panel signal strength and record displayed level for each bandwidth listed below.

Bandwidth	Displayed Signal Strength (Record)
2.5 kHz	______________________
4.0 kHz	______________________
280 kHz	______________________

Verify that the difference between any two readings is 3 dB maximum.

_____ (Check)

5.2.2 Adjust the signal generator output level to produce a displayed signal level of -60 dBm. Record the output voltage at J4, J6 and at the NB SIG test point.

Output Voltage J4-3 (+), J4-4 (-)	____________	+4.0 ± 0.4 VDC
Output Voltage J6-3 (+), J6-4 (-)	____________	+9.0 ± 0.4 VDC
Output Voltage NB SIG TP	____________	+9.0 ± 0.4 VDC

5.2.3 Select 4 kHz bandwidth and adjust the signal generator for an input level of -80 ± 0.5 dBm to the receiver. Then set the signal generator and tracking receiver to the appropriate frequencies listed below and record displayed signal strength.

*For -15 assembly, use cable loss value recorded in Section 5.1.1

DASH 01, 10	
FREQUENCY (GHz)	**SIGNAL STRENGTH**
0.950	
1.150	
1.350	
1.550	
1.750	

DASH 02	
FREQUENCY (GHz)	**SIGNAL STRENGTH**
2.000	
2.200	
2.400	
2.600	
2.800	

DASH 03, 14, 15*	
FREQUENCY (GHz)	**SIGNAL STRENGTH**
3.400	
3.600	
3.800	
4.000	
4.200	

DASH 04, 14	
FREQUENCY (GHz)	**SIGNAL STRENGTH**
4.000	
4.200	
4.400	
4.600	
4.800	

DASH 05	
FREQUENCY (GHz)	**SIGNAL STRENGTH**
7.250	
7.400	
7.600	
7.750	

DASH 06, 09, 13, 15	
FREQUENCY (GHz)	**SIGNAL STRENGTH**
10.700	
10.900	
11.100	
11.300	
11.500	

DASH 07, 09, 13, 15	
FREQUENCY (GHz)	**SIGNAL STRENGTH**
11.450	
11.650	
11.850	
12.050	
12.250	

DASH 08, 09, 15	
FREQUENCY (GHz)	**SIGNAL STRENGTH**
12.200	
12.400	
12.600	
12.800	
13.000	

DASH 11	
FREQUENCY (GHz)	**SIGNAL STRENGTH**
10.900	
11.100	
11.300	
11.500	
11.700	

DASH 12	
FREQUENCY (GHz)	**SIGNAL STRENGTH**
11.700	
11.900	
12.100	
12.300	
12.500	

Verify that all readings are -80 ± 4dbm _______(Check)

5.3 VCO CONTROL OF RECEIVER

5.3.1 Adjust the signal generator output to -80 dBm at the test frequency per Table 2. Connect the signal generator to the RF input of the receiver. Set the tracking receiver to the test frequency and 4 kHz Bandwidth. Verify phase lock.

_____ (Check)

5.3.2 Select the VCO control screen and record the value for VCO offset in kHz.

VCO Offset _________ (Record)

Verify that the offset is less than 55 kHz.

_____ (Check)

5.3.3 Increase the frequency of the signal generator by 100 kHz. Verify phase lock and record the value for VCO offset.

VCO Offset _________ (Record)

Verify that the offset is 100 ± 10 kHz different from the value recorded in 5.3.2.

_____ (Check)

5.3.4 Decrease the frequency of the signal generator by 200 kHz. Verify phase lock and record the value for VCO offset.

VCO Offset _________ (Record)

Verify that the offset is 200 ± 10 kHz different from the value recorded in 5.3.3.

_____ (Check)

5.4 CARRIER TO NOISE

5.4.1 Connect the output of the Gigatronics signal generator to the LO input of the noise test set. Adjust the generator for an output of +8 dBm at a frequency 70 MHz below the test frequency from Table 2. Connect the output of the HP 83752A sweep generator to the SIGNAL input of the noise test set. Adjust the sweep generator for an output of -50 dBm at the frequency. Turn on the noise source.

5.4.2 Monitor the RF output of the noise test set with the spectrum analyzer. Adjust the spectrum analyzer as follows:

Freq = test frequency, Span = 50 kHz, Res BW = 3 kHz and VBW = 30 Hz.

5.4.3 Adjust the noise output level to -110 ± 0.3 dBm/Hz. Use the noise marker mode of the spectrum analyzer for this measurement.

5.4.4 Turn off the noise marker mode and adjust the output level of the sweep generator as required to produce a signal power level of -70 ± 0.3 dBm as measured on the spectrum analyzer. Leave the noise on for this adjustment. Record the output level of the sweep generator.

Output Level _________ (Record)

5.4.5 Disconnect the signal from the spectrum analyzer and connect it to the J7 input of the tracking receiver. Set the tracking receiver to the test frequency and 4.0 kHz Bandwidth. For tracking receivers, using Version 1.261.6.17 Software or later, set CW Beacon Mode. Verify phase lock.

_____ (Check)

5.4.6 Decrease the carrier level from the sweep generator in 1 dB steps to the point where phase lock is lost. Record this level.

Unlock Output Level _________ (Record)

5.4.7 Calculate the difference between the dropout level and the level recorded in 5.4.4.

Output Level (5.4.4) ______ - Unlock Level (5.4.6) ______ = ______

Verify that this difference is 3 dB or greater.

_____ (Check)

5.4.8 For tracking receivers, using Version 1.261.6.17 Software or later, set 800 Hz BPSK Beacon Mode. Adjust the output level of the sweep generator 6 dB greater than the output level recorded in 5.4.4. Record the output level and verify phase lock.

Output Level ___________ (Record)

Phase Lock _____ (Check)

5.4.9 Decrease the carrier from the sweep generator in 1 dB steps to the point where phase lock is lost. Record this level.

Unlock Output Level ___________ (Record)

5.4.10 Calculate the difference between the dropout level and the level recorded in 5.4.8.

Output Level (5.4.8) ______ - Unlock Level (5.4.9) ______ = ______

Verify that this difference is between 2 and 7 dB. _____ (Check)

5.4.11 Set the Beacon Mode to CW.

_____ (Check)

5.5 DOPPLER TRACKING

5.5.1 Set the receiver frequency to the test frequency and ±140 kHz Auto Sweep. Set the sweep generator as follows:

CF = test frequency, SPAN = 240 kHz, TIME = 14 sec and SINGLE TRIGGER. Toggle the SINGLE TRIG button if necessary to turn off the SWEEP indication on the sweep generator. Observe the VCO control screen on receiver and verify that the unit is locked and the magnitude of VCO offset is approximately 120 Hz.

_____ (Check)

5.5.2 Press the SINGLE TRIG button once to start a sweep as shown by the SWEEP indication. Observe the VCO control screen and verify that the unit remains locked and that the VCO offset tracks the sweep from approximately + 120 kHz to -120 kHz or from -120 to + 120 kHz.

_____ (Check)

5.5.3 Return the receiver back to ±120 kHz Auto Sweep.

_____ (Check)

5.6 STATUS AND FAULTS

5.6.1 Select the digital fault/status screen.

_____ (Check)

5.6.2 Using the test set, toggle each of the external status bits in turn and verify that they are correctly indicated on the display.

_____ (Check)

5.6.3 Select the analog status screen.

_____ (Check)

Verify that the internal chassis temperature display is between 29° C and 39° C.

_____ (Check)

5.7 MONOPULSE ERROR SIGNALS

5.7.1 Connect the monopulse test set to J2 of the tracking receiver. Connect the MOD output of the test set to the AM modulation input of the HP 8648 signal generator. Adjust the signal generator as follows: Freq = 1350 MHz, Output level = -70 dBm, Ext AM modulation and 5% AM. Connect the output of the signal generator to the J5 input of the L-band board using the matching pad, if necessary. Set the receiver for a center frequency of 1350 MHz, 4 kHz BW, AZ/EL/POL and CONSTANT monopulse scan mode. Verify phase lock.

_____(Check)

5.7.2 Set the monopulse test set to XEL, EL and POL ON. Adjust the level of the test set such that the modulation window of the signal generator indicates 5%. Set the monopulse scale factors for XEL, EL and POL to 10V/deg. Monitor the error display on the TRU and adjust the ± switch on the test set such that the XEL error reading is positive. Record the XEL, EL and POL error readings below.

XEL ______________ EL ______________ POL ______________

Verify that the XEL reading is 0.011 ± 0.002. _____(Check)

Verify that the EL reading is –0.011 ± 0.002. _____(Check)

Verify that the POL reading is 0.11 ± 0.02. _____(Check)

5.7.3 Measure and record the error signals at the J4 and J6 with the DVM.

		Specification
J4 pins 5 (+) and 6 (-)	_______________	-0.115 ± 0.020 VDC
J4 pins 7 (+) and 8 (-)	_______________	0.115 ± 0.020 VDC
J4 pins 9 (+) and 10 (-)	_______________	-1.00 ± 0.2 VDC
J6 pins 5 (+) and 6 (-)	_______________	-0.115 ± 0.020 VDC
J6 pins 7 (+) and 8 (-)	_______________	0.115 ± 0.020 VDC
J6 pins 9 (+) and 10 (-)	_______________	-1.00 ± 0.2 VDC

Verify that the error signals are within specification. _____(Check)

5.7.4 Switch the ± switch on the test set to the other position and record the error readings.

XEL ______________ EL ______________ POL ______________

Verify that the XEL reading is -0.011 ± 0.002. _____(Check)

Verify that the EL reading is 0.011 ± 0.002. _____(Check)

Verify that the POL reading is -0.11 ± 0.02. _____(Check)

5.8 AXIS SELECT AND DIGITAL PHASE SHIFT BITS

5.8.1 Set the phasing values for XEL, EL and POL to 120°. Use the ± switch on the test set to select the two phase shift values. Logic 1 is indicated by an ON LED on the test set and logic 0 by an OFF LED. Record the two phase shift values.

Binary Value 1	Binary Value 2
0101 0101	1101 0101

_____(Check)

5.8.2 Set all phasing values to 240° and record the two phase shift values.

Binary Value 1	Binary Value 2
1010 1010	0010 1010

_____(Check)

5.8.3 Monitor the AS0+ to AS3+ test points with the oscilloscope.

Verify that the AS0+ waveform is high (3-5V) for 1 msec and low (<0.5V) for 0.5 msec.

_____(Check)

Verify that the AS1+ waveform is high (3-5V) for 0.5 msec and low (<0.5V) for 1 msec.

_____(Check)

Verify that the AS2+ waveform is high (3-5V) for 0.5 msec and low (<0.5V) for 1 msec.

_____(Check)

Verify that the AS3+ waveform is high (3-5V) for 0.5 msec and low (<0.5V) for 1 msec.

_____(Check)

5.9 TRACK FAULT

5.9.1 Verify that no track fault is indicated on the TRU. If one exists, clear it.

_____(Check)

5.9.2 Turn OFF the RF input from the signal generator. Verify that a track fault is now indicated on the TRU.

_____(Check)

5.9.3 Turn ON the RF input signal and verify that no track fault is indicated.

_____(Check)

5.9.4 Remove the input signal to the L-band board and reconfigure the TRU for normal operation. Select STEPTRACK unless monopulse is used.

_____(Check)

5.10 SERIAL PORTS

Set the Serial Port Selection Switch S1 on the Tracking Receiver Board (A10) to RS-422 configuration. Set Serial Port Selection Switch S2 to RS-232 configuration. Select remote control on the top level screen. Set the RS-232 terminal to 4800 Baud, odd parity, 8 data bit and 1 stop bit.

_____ (Check)

5.10.1 Connect the RS-232 terminal to the Data Link 2 Port on the unit rear panel. Type in the following command at the terminal:

FF$80 (Request Frequency Command)

_____ (Check)

Verify the following response on the terminal from the unit:
FXXXXXXXX(Checksum)80
where XXXXXXXX is the commanded frequency and
(Checksum) is a two byte number dependent on the
commanded frequency

_____ (Check)

5.10.2 Reconfigure the terminal for RS-422 operation. Connect the terminal to the Data Link 1 Port. Type in the following command at the terminal:

FF$80 (Request Frequency Command)

_____ (Check)

Verify the following response on the terminal from the unit:
where XXXXXXXX is the commanded frequency and
(Checksum) is a two byte number dependent on the
commanded frequency

_____ (Check)

5.10.3 Disconnect the terminal. Select local control on the top level screen.

_____ (Check)

F – Added -15	M. Neely	4-20-05	B. Thomas	4-20-05	5719
E – 5.5.1 cgd, 5.5.3 added	M. Neely	1-05-05	B. Thomas	1-05-05	5574
D – Added -14	M. Neely	6-17-04	B. Thomas	6-17-04	5285
C – Added -13	M. Neely	3-26-04	B. Thomas	3-26-04	5114
B – Chgd -05, -06, -07 (Tbl 2)	M. Neely	3-16-04	B. Thomas	3-16-04	5070
A – Added -10, -11, -12	M. Neely	2-27-04	B. Thomas	2-27-04	5047
- Original Release	M. Neely	1-13-04	B. Thomas	1-13-04	4969
Rev. No/change	Revised By	Date	**Approved By**	Date	ECO#

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Block Downconverters

Introduction

VertexRSI BDC-Series Block Down–converters are specifically designed to translate a block of C-Band or Ku-Band input frequencies to L-Band. These block downconverters have the quality, stability and performance required for demanding receiver applications in today's diverse satellite communications systems.

Features

- C-Band or Ku-Band Input
- L- Band Output (800 MHz Bandwidth)
- Phase-locked Oscillator
- Stable Internal Reference
- INTELSAT/EUTELSAT Compliant Phase Noise

Options

- Type N Connectors
- 25 dB conversion gain
- Custom Specifications

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www.tripointglobal.com

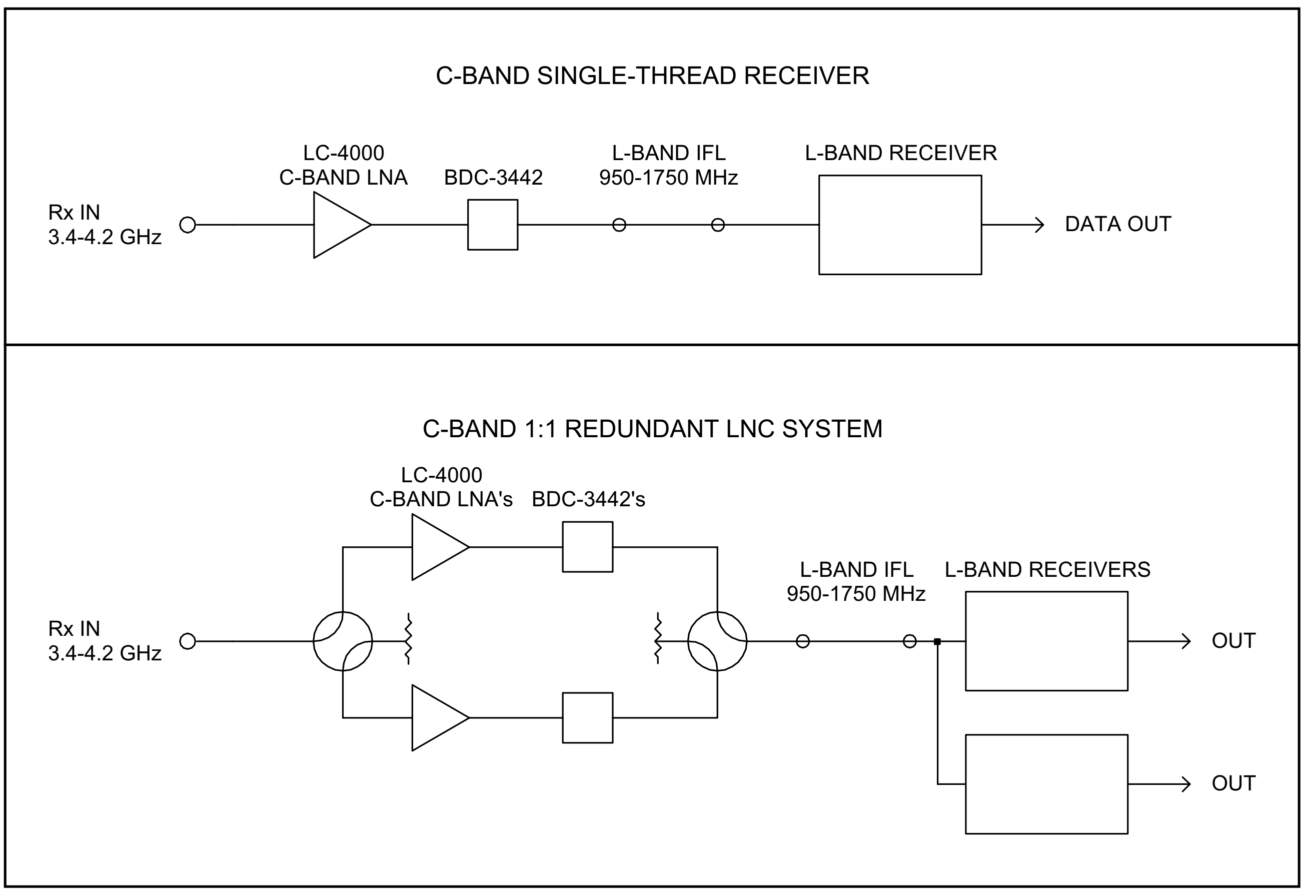
Table 1 — Part Number/Ordering Information

BDC- [ ] [ ]

Options
/2 = 25 dB Gain
/7 = Type N Connectors
/C = Custom Specifications

Designator	Input Frequency	Output Frequency	LO Frequency
3442	3.4-4.2 GHz	950-1750 MHz	5.15 GHz
12000F	10.70-11.75 GHz	950-2000 MHz	9.75 GHz
12000B	10.90-11.70 GHz	950-1750 MHz	9.95 GHz
12000J	11.70-12.75 GHz	950-2000 MHz	10.75 GHz
12000C	12.20-13.00 GHz	950-1750 MHz	11.25 GHz

Figure 2 — Typical Applications



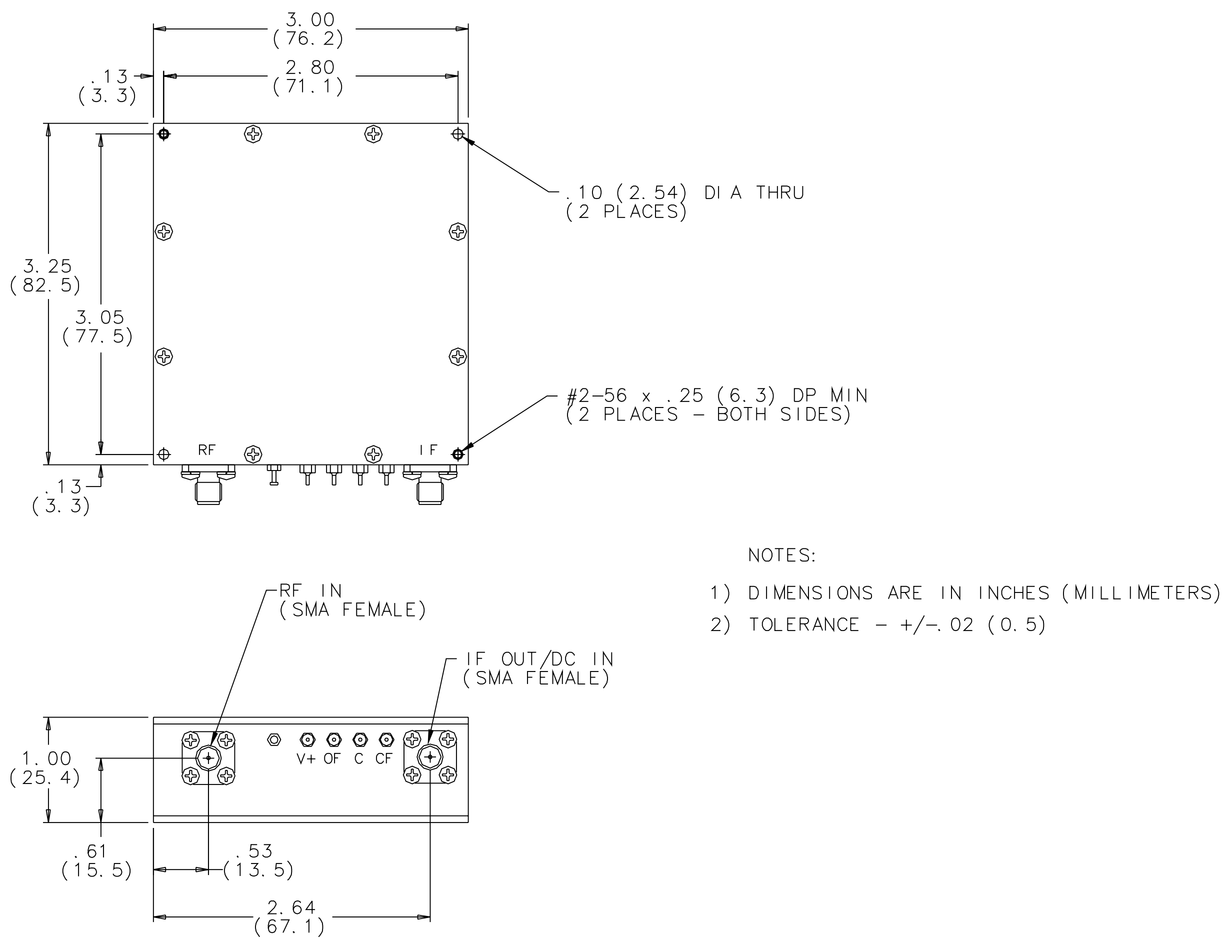
SPECIFICATIONS BDC-Series

Parameter	Notes	Min	Nom./Typ.†	Max	Units
Input Frequency			See Table 1		
Output Frequency			See Table 1		
Local Oscillator Frequency	Phase-locked, Internal		See Table 1		
Output Spectrum	BDC-3442		Inverted		
	BDC-12000x		Non-Inverted		
Local Oscillator Stability	Over temperature		±2	±2.5	ppm
LO Phase Noise	100 Hz		-62	-60	dBc/Hz
	1 kHz		-80	-70	dBc/Hz
	10 kHz		-82	-80	dBc/Hz
	100 kHz		-92	-90	dBc/Hz
	1 MHz		-120	-100	dBc/Hz
Spurious	Signal related; IF Band			-65	dBc
	Non-signal related; IF Band			-95	dBm
Gain (Nominal)	Standard	13	14	15	dB
	Option 2	23	25	27	dB
Gain Flatness	Full-band			±1	dB
	Per 40 MHz			±0.2	dB
Gain Stability	Per week, constant temp			±0.5	dB
	vs. temp.			±1.5	dB
Power Output	At 1 dB compression	+8	+10		dBm
3rd Order Output Intercept Point		+18	+20		dBm
Noise Figure	At +23 °C		13	15	dB
VSWR	Input (50 ohms)		1.35	1.50	:1
	Output (50 ohms)		1.35	1.50	:1
Image Rejection		40			dB
Fault Alarm	Phase lock		Form-C Contact (100 V/50 mA)		
Connectors	L-Band Out/DC In		SMA (F)		
	RF In		SMA (F)		
	DC In/Alarm Out		RFI Feedthrough		
Power Requirements	Voltage	+12		+25	Vdc
	Current		300	350	mA
Operating Temperature	$T_{amb.}$	-40		+70	° C

NOTES

† When there is only one entry on a line, the Nom./Typ. column is a nominal value; otherwise it is a typical value. Typical values are intended to illustrate typical performance, but are not guaranteed.

Outline Drawing



Outline 9084

Application Notes

The BDC-Series Converters may be powered by one of two methods. Either supply +12 to +25 Vdc between the center conductor and ground of the L-Band output cable (cable powered) or apply +12 to +25 Vdc to the DC power RFI and the ground lug.

The alarm RFIs provide a Form-C contact which indicates a fault if phase lock is lost. The alarm circuit is rated at 100 V at 50 mA.

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9046 Rev. D 10/18/01
Specifications are subject to change at VertexRSI's discretion.

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SECTION 7

7 VENDOR DATA

7.1 POWER SUPPLY

POWER-ONE MAP Series

MAP 55-4003

Application Data Sheet

FEATURES

- 55/65 Watts Peak Power
- Four Outputs
- Automatic 110/220 Input Selection
- FCC & VDE EMI, Class "B" (conducted)
- Fully Regulated, All Outputs
- Combination Terminal Block/Quick Disconnect Locking Wafer Connectors
- Two Year Warranty
- VDE, IEC, CSA & UL Safety Specs

DESCRIPTION

The MAP 55 Series is a 55W continuous with peak to 65W, high performance line of quad output power supplies in 6.0" x 3.3" x 1.6" open frame chassis. Engineered with an "International" philosophy the MAP55 series gives the system designer the features that allow maximum flexibility. Features like Automatic AC input Selection and onboard FCC & VDE "B" filtering are standard. The chassis accepts M4 or 6-32 screws and has .170" through holes at each corner for worldwide mounting. Universal input and output terminations are provided with Power-One's unique combination terminal block/quick disconnect locking wafer connectors.

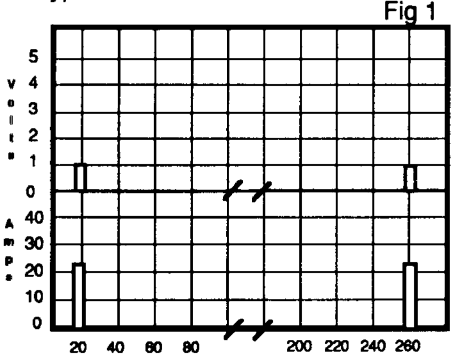
INPUT

SYMBOL	PARAMETER	CONDITIONS	MIN	NOM	MAX	UNITS
P_{out}	Output Power	50 ° C Ambient convection cooled 50 ° C Ambient convection cooled, peak (2 minute)			55 65	Watts
V_{in}	Input Voltage	AC Input	90 175		132 264	VAC
I_{in}	Input current	Vin = 90VAC @ 55W		1.6		Arms
$I_{in\ pk}$	Inrush Surge Current	Vin = 264VAC Cold Start			38	Apk
f_i	Input Frequency	With AC input	47		63	Hz
t_{hu}	Hold Up Time	After last AC charge point with 90VAC (55 watts). Approx. .56 msec increase per volt increase in VAC. See Fig. 2	5			msec
t_{ini}	Power up Initialization period	Cold start @ Full Load, 90VAC			5.0	sec
η	Efficiency	V_1 @ 5A, V_2 @ 2.5A (120 VAC)	73			%

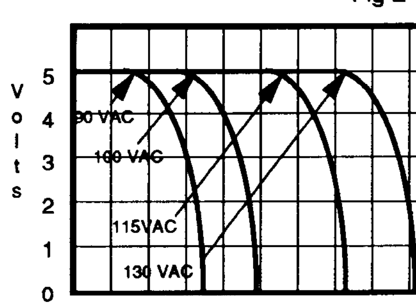
All measurements @ 25 °C unless otherwise noted.

DRAWING NO. 59712 REV G

Typical Overload Characteristics
Fig 1



Typical Hold Up as a Function of VAC
Fig 2



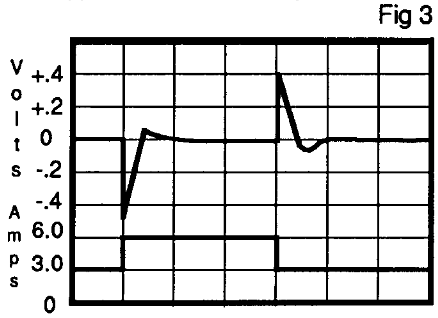
1/27/93

MAIN OUTPUT - V1 SPECIFICATION

SYMBOL	PARAMETER	CONDITIONS	MIN	NOM	MAX	UNITS
V_o	Output Voltage			5		V
I_o	Output Current	At 50 ° C ambient			6	A
P_o	Output Power	At 50 ° C ambient			30	Watts
T_A	Ambient Temp Range		0		50	°C
V_o initial	Initial Voltage Setting	Factory Set	5.0		5.2	V
V_o adj	Output voltage Adj		4.75		5.5	V
$\frac{\Delta V_o}{V_o \Delta T_A}$	Temperature Coefficient	0 to 50° C. After initial 1 hour warm-up.			.02	%/ °C
ΔV_o	Long Term Voltage Drift	1000 hours		0.3		%
Reg_{line}	Line Regulation	Over input operating range			0.2	%
Reg_{load}	Load Regulation	.5 to 6A			2	%
Reg_{cross}	Cross Regulation	Current Step From Min I_o to Max I_o on V_2, V_1 @3.8A		0.1		%
I_{omin}	Minimum Load Current		.5			A
I_{omax}	Peak Load Current	30 Second Duration max duty ratio 10%			8	A
I_{osc}	Short Circuit Current	I_o during restart period See Fig 1			23	A
V_{ovp}	Overvoltage Protection	Trip voltage	5.6		6.8	V
e_n	Noise and Ripple	20 MHz BW (5 min warmup)			50	mVpp
t_t	Transient Response Time	50% to 100% step, max overshoot ±500 mV. Recovering to within 1% of regulation band. See Fig 3			0.5	ms
$t_{d\ on}$	Turn-on Delay	Main Output after AC power (cold)			5.0	sec
t_r	Rise Time	5% to 95% of V_o, 5@ 6A See Fig 4		7		ms
t_{os}	Overshoot	Overshoot as a % of V_o - Startup			0	%

Typical Transient Response

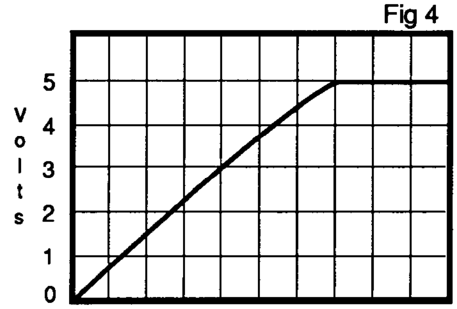
Fig 3



Time: .5ms/DIV

Typical Rise Time

Fig 4



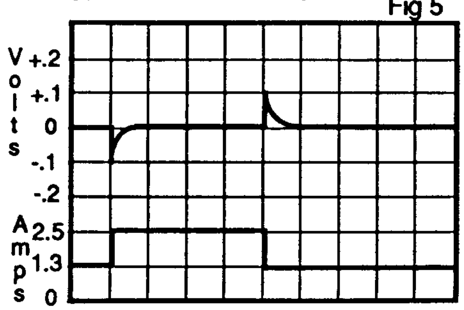
Time: 1ms/DIV

OUTPUT - V2 SPECIFICATION

SYMBOL	PARAMETER	CONDITIONS	MIN	NOM	MAX	UNITS
V_o	Output Voltage			15		V
I_o	Output Current	At 50°C ambient			2.5	A
P_o	Output Power	At 50°C ambient			37.5	Watts
T_A	Ambient Temp Range		0		50	°C
V_o initial	Initial Voltage Setting		14.50		15.40	V
$\frac{\Delta V_o}{V_o \Delta T_A}$	Temperature Coefficient	0 to 50°C. After initial 1 hour warm-up.			.02	%/°C
ΔV_o	Long Term Voltage Drift	1000 hours		.3		%
Reg_{line}	Line Regulation	Over input operating range, V_1 = 5.2V @ 0.5A			0.2	%
Reg_{load}	Load Regulation	0 - 2.5 Amp, V_1 = 5.2V @ 0.5A			2	%
Reg_{cross}	Cross Regulation	Current step from Min I_o to Max I_o on V_1, V_2 @ 1.7 A		0.1		%
I_{omin}	Minimum Load Current		0			A
I_{omax}	Peak Load Current	1 minute duration			3.5	A
I_{osc}	Short Circuit Current	I_o during timeout period See Fig 1			11	A
e_n	Noise and Ripple	20 MHz BW (5 min warm-up)			150	mVpp
t_t	Transient Response Time	50% to 100% step, 5V @ 5A Recovering to within 1% of regulation band. See Fig 5			0.5	ms
$t_{d\ on}$	Turn-on Delay	After AC power is applied (cold)			5.0	sec
t_r	Rise Time	5% to 95% of V_o See Fig 6		7		ms
t_{os}	Overshoot	Overshoot as a % of V_o - Startup			0	%

Typical Transient Response

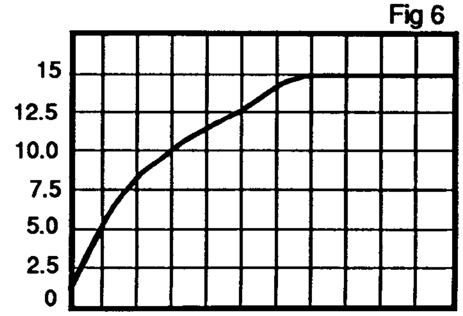
Fig 5



Time: 1ms/DIV

Typical Rise Time

Fig 6



Time: 1ms/DIV

OUTPUT V3 SPECIFICATION

SYMBOL	PARAMETER	CONDITIONS	MIN	NOM	MAX	UNITS
V_o	Output Voltage			-5		V
I_o	Output Current *	At 50 ° C ambient	0		.5	A
P_o	Output Power	At 50 ° C ambient		2.5		Watts
T_A	Ambient Temp Range		0		50	°C
$V_{o\ initial}$	Initial Voltage Setting		-4.8		-5.2	V
$\frac{\Delta V_o}{\Delta T_A}$	Temperature Coefficient	0 to 50 ° C. After initial 1 hour warm-up.		1.5		mV/ °C
Reg_{line}	Line Regulation	Over input operating range, V_1 5.2V @ 0.5A			0.5	%
Reg_{load}	Load Regulation	$I_{o\ min} - I_{o\ max}$, V_1 =5.2V @ 0.5A			2	%
I_{omin}	Minimum Load Current		0			A
I_{osc}	Short Circuit Current				3	A
e_n	Noise and Ripple	20 MHz BW			50	mVpp
t_t	Transient Response Time	50% to 100% step Recovering to within 1% of regulation band.		50		µs

OUTPUT V4 SPECIFICATION

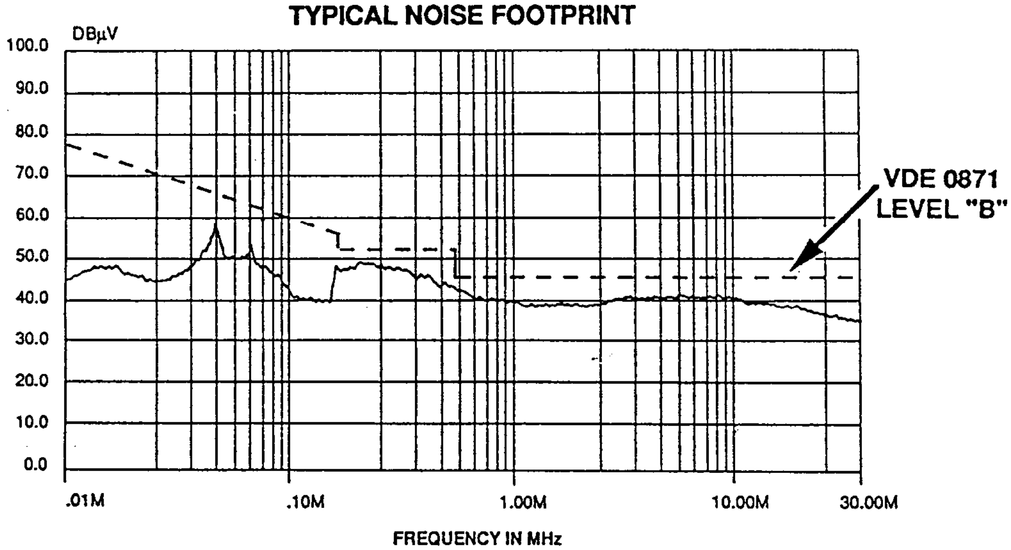
SYMBOL	PARAMETER	CONDITIONS	MIN	NOM	MAX	UNITS
V_o	Output Voltage			-15		V
I_o	Output Current *	At 50 ° C ambient	0		.5	A
P_o	Output Power	At 50 ° C ambient		7.5		Watts
T_A	Ambient Temp Range		0		50	°C
$V_{o\ initial}$	Initial Voltage Setting		-14.50		-15.50	V
$\frac{\Delta V_o}{\Delta T_A}$	Temperature Coefficient	0 to 50 ° C After initial 1 hour warm-up		1.5		mV/°C
Reg_{line}	Line Regulation	Over input operating range, V_1 = 5.2V @ 0.5A			0.5	%
Reg_{load}	Load Regulation	$I_{o\ min} - I_{o\ max}$, V_1 5.2V @ 0.5A			2	%
I_{omin}	Minimum Load Current		0			A
I_{osc}	Short Circuit Current				3	A
e_n	Noise and Ripple	20 MHz BW			150	mVpp
t_t	Transient Response Time	50% to 100% step Recovering to within 1% of regulation band.		50		µs

* Max load on V3 or V4 can be increased to 1A if either V4 or V3 is unloaded.

SAFETY & EMI

SYMBOL	PARAMETER	CONDITIONS	MIN	NOM	MAX	UNITS
	Agency Approvals	Class I, SELV STANDARDS UL1950 (D3) IEC 950 (TUV) VDE 0805 (TUV) CSA 1402 (C). EN60950 (TUV)				
	Dielectric Withstand	Input to Output Input to Chassis Output to Chassis	1500 1500 500			Vrms/1 min Vrms/1 min Vrms/1 min
	Insulation Resistance	Input to Output Input to Chassis Output to Chassis	7 2 2			meg Ohm meg Ohm meg Ohm
	Leakage Current				500	µ Amps
	EMI Conducted	VDE 0871 (at 230VAC level B) FCC 47 CFR Part 15 (115/230VAC, level B)				

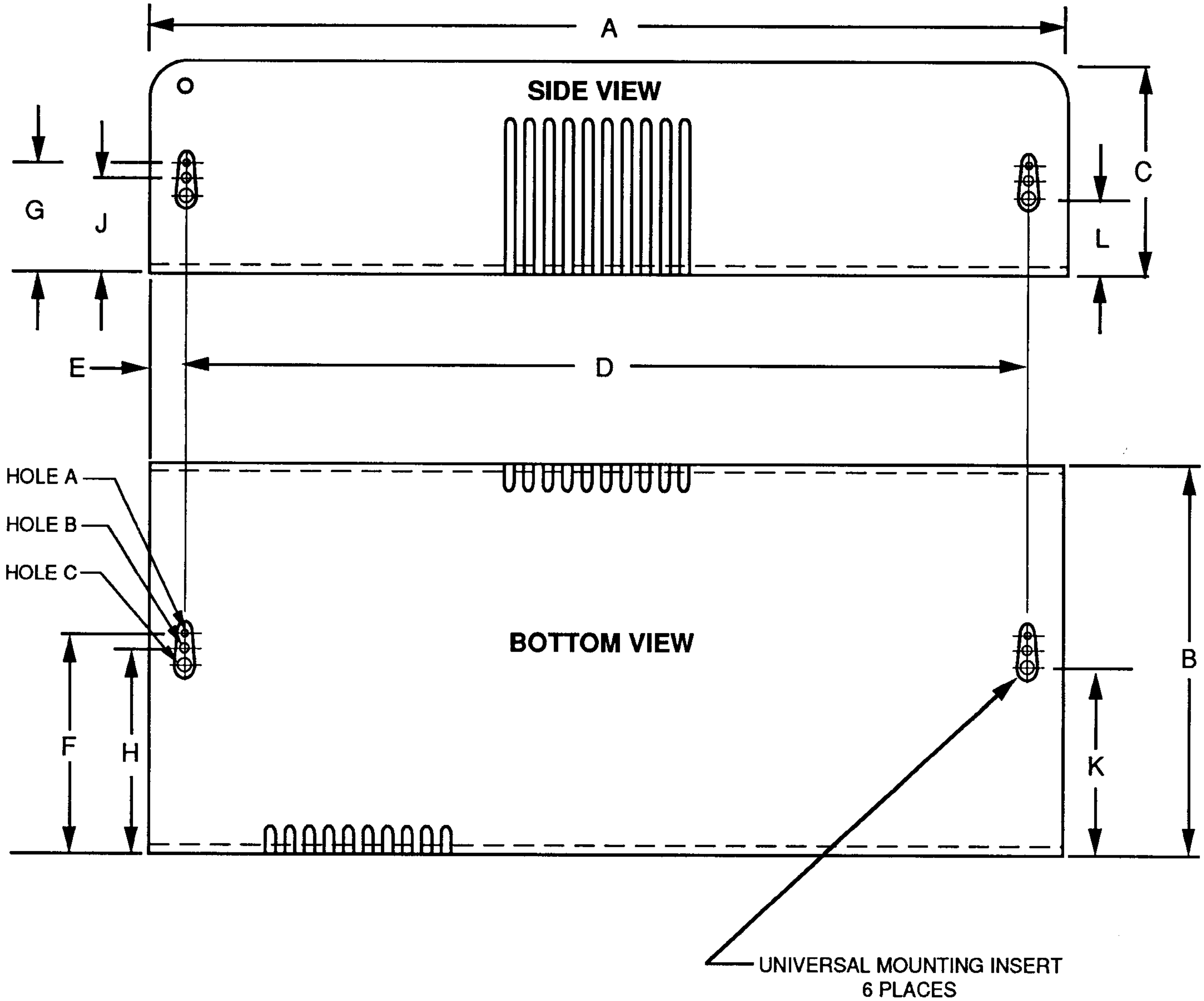
TYPICAL NOISE FOOTPRINT



ENVIRONMENTAL

SYMBOL	PARAMETER	CONDITIONS	MIN	NOM	MAX	UNITS
	Altitude	Operating Non-operating			10000 40000	Feet
	Temperature	Operating Non-operating	0 -40		+50 +85	°C
	Relative Humidity	Non-condensing	5		95	%
	Vibration	Per Mil. Std. 810D Methods 514.3 - 4 and 514.3-6				
	Weight				1.2	lbs.

MECHANICAL DIMENSIONS



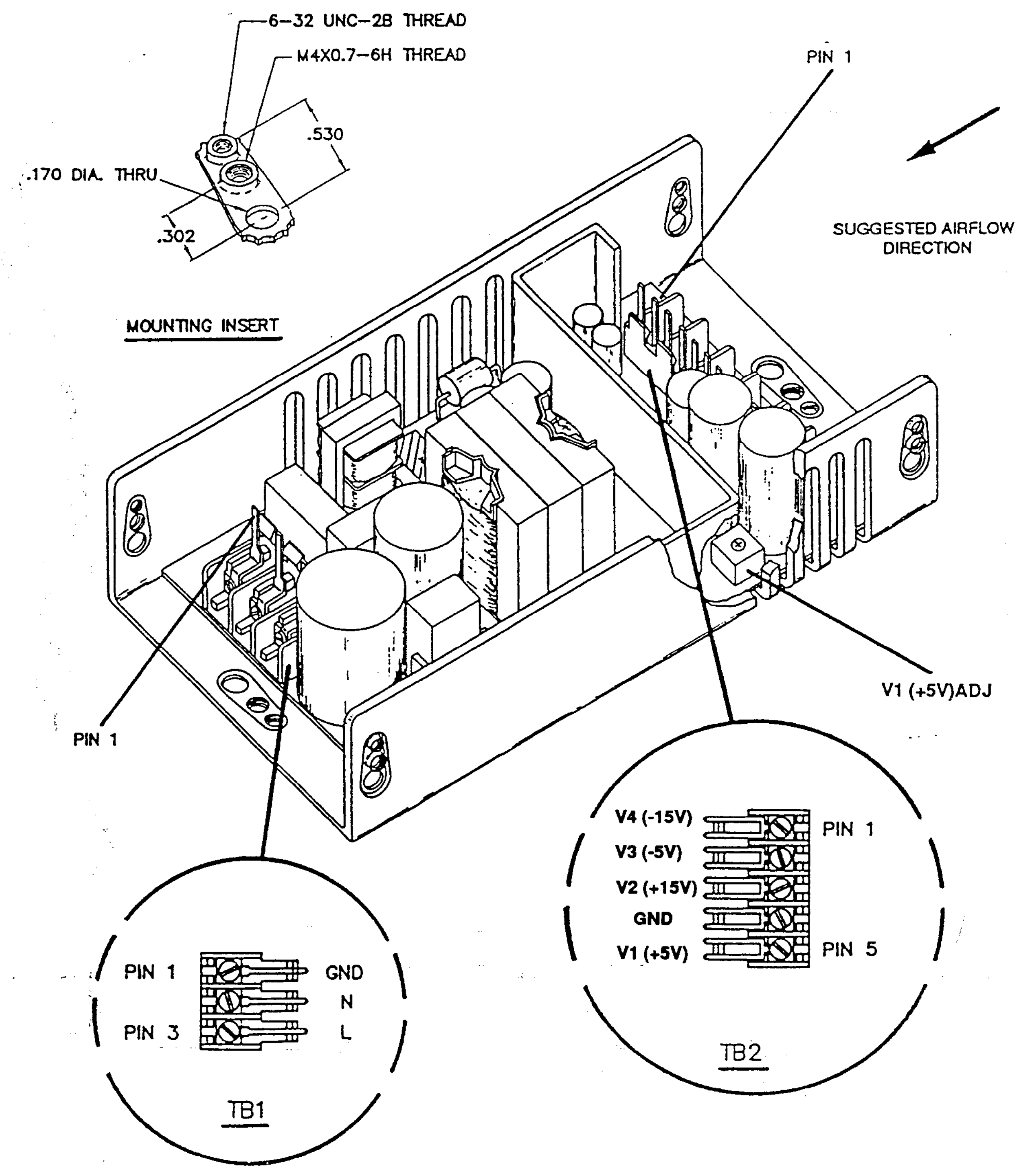
OVERALL SIZE: 6.00" X 3.270" X 1.60"
TOLERANCES: .XXX± . 010 (.254mm)
.XX ±.03 (.76mm)
WEIGHT: 1.21 LB., .549 KG.

DIM	IN	mm
A	6.000	152.400
B	3.270	83.058
C	1.600	40.640
D	5.500	139.700
E	.250	6.350

MOUNTING APPLICATION								
6-32 THREAD HOLE "A"			M4 THREAD HOLE "B"			.170 $^{+.003}_{-.000}$ DIA THRU HOLE "C"		
DIM	IN.	mm	DIM	IN.	mm	DIM	IN.	mm
F	1.900	48.260	H	1.672	42.469	K	1.370	34.798
G	1.065	27.051	J	0.837	21.260	L	0.535	13.589

GENERAL

- TB1/TB2 MATES WITH MOLEX (Series 2139) .156" CENTER CRIMP TERMINAL HOUSING OR EQUIVALENT. ALSO ACCEPTS A SPADE TONGUE TERMINAL WITH A MAX WIDTH OF .255 FOR A NO. 6 STUD
- TORQUE RANGE FOR CUSTOM MOUNTING INSERT IS 7.5-8.5 INCH LBS.



8 APPENDIX A PARAMETER SETTINGS

CONFIGURATION PARAMETERS

FIELD NAME	DEFAULT SETTING	CURRENT SETTING
PORT 1 - BAUD	4800	
PORT 1 - PARITY	ODD	
PORT 2 – BAUD	4800	
PORT 2 – PARITY	ODD	
FREQ	950.000 MHz	
CONTROL	REMOTE	
IF BANDWIDTH	4.0 Khz	
SIGNAL LEVEL OFFSET	0	
VCO CONT	AUTO	
AUTO SWP	120 kHz	
MANUAL VCO STEP	10.0 kHz	
CONFIGURATION	STEPTRACK	