DATATRAC 250

REFERENCE

MANUAL

Atlantic Instruments inc

Atlantic Instruments inc
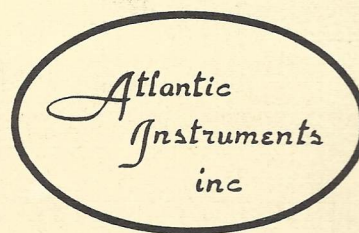
DATATRAC 250

DATABUS RECEIVER, TRANSMITTER, AND RECORDER

REFERENCE MANUAL

Document Version A- June 30, 1988

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SECTION 1

GENERAL INFORMATION

1.1 INTRODUCTION

This document is furnished to customers of Atlantic Instruments Inc. to provide detailed instruction for the operation and maintenance of the DATATRAC 250 unit. It contains all necessary illustrations and information to allow the unit to be interfaced with appropriate electronic equipments and operated in all of its modes: receive, transmit, record, and break. This section provides a general overview of the unit's features and operation. A detailed specification is also provided which describes its application and handling.

1.2 IDENTIFICATION

The unit's model description, DATATRAC 250, appears on the front of the unit and identifies it as a combination Arinc 429 and ASCB bus monitor. A nameplate on the rear of the unit provides serial number and revision status information. This plate must remain attached to the unit and referred to when reporting problems to Atlantic Instruments personnel.

1.3 DESCRIPTION

The DATATRAC 250 is a digital data bus monitor, simulator, and recorder designed to support the development, production test, and field service of avionics equipment. The unit supports interface with either Arinc 429 or ASCB standard data buses. With its internal battery as well as external power provisions, all features valuable for laboratory testing are also available for ramp or in-flight troubleshooting.

The front and rear views of the unit are illustrated in Figures 1-1 and 1-2, respectively. The eight line display allows viewing of many data words simultaneously. It also supports a highly simplified setup of functions through the use of menu screens.

A pot adjustment allows the user to optimize the display contrast and viewing angle.

The upper left switch on the front of the unit is the master power control for the DATATRAC 250, but battery charging circuits remain activated even with this switch off if external power has been connected to the rear of the unit.

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The two slide switches on the front of the unit are used to select between the high and low speed buses of the Arinc 429 transmit/receive functions.

For each of the two data bus standards, the DATATRAC 250 allows four basic modes of operation:

RECEIVE: The user is allowed to select specific labels to receive or to allow the unit to receive all incoming data. Either hexidecimal, decimal, or binary format may be selected for the data display. In addition to displaying the label and data value, the update rate of the transmission is also presented. The user may scroll to place a desired label at the top of the display or view all of the received data.

TRANSMIT: The transmit capability applies to either the digital bus data or analog data outputted via a D/A convertor and driver. In Arinc 429 mode, up to 16 digital words may be transmitted at various rates allowing most LRU's to be completely simulated. In ASCB mode, a single LRU can be simulated by allowing all word sequence positions for a particular equipment address to be transmitted when the appropriate request address is received. Output data is specified in hexidecimal units. A real time update capability allows the user to edit the output data without halting transmission. The D/A output may be setup to output a static value selected from the keyboard, convert received digital data to analog output, or to generate a trigger pulse on selected conditions of a received digital word.

RECORD: The DATATRAC 250 may be used to record and playback received data. The label and desired record rate are specified as a part of the setup procedure. At any time while data is being recorded or after all available memory has been filled, the user may select playback mode and examine the data either in hexidecimal format, as a strip chart like recording in graphics mode, or as analog data on the D/A output line.

BREAKPOINT: This mode is used to halt the DATATRAC 250 when a specified label and data value have been received. After the break condition has been generated, a history of all received data may be examined.

1.4 SPECIFICATION

Table 1-1 provides characteristics and specifications for the DATATRAC 250.

FUNCTION SWITCHES

HEXIDECIMAL NUMBER SWITCHES

RCV	XMT	RCD ←	BRK →	CLR	INC	ENT
			0	1	2	3
			4	5	6	7
			8	9	A	B
			C	D	E	F +−

RECEIVE SPEED SLIDE SWITCH

RCV SPEED — HI / LO

TRANSMITTER SPEED SLIDE SWITCH

XMT SPEED — HI / LO

DISPLAY ADJUSTMENT

POWER SWITCH

POWER — ON / OFF

LCD DISPLAY

DATATRAC 250

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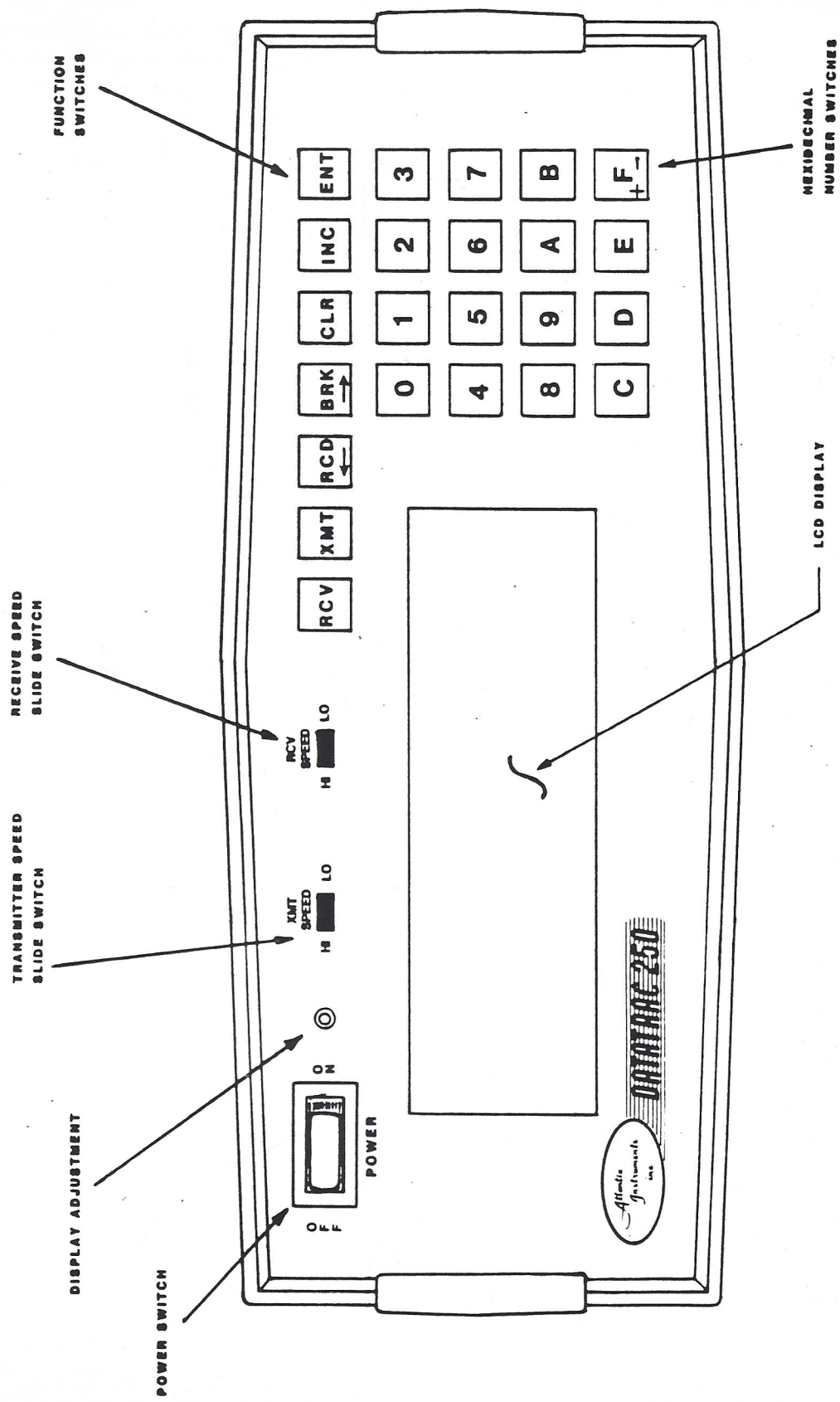
FIGURE 1-1

DATATRAC 250 FRONT VIEW

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NAMEPLATE

AC ADAPTOR JACK

POWER JACKS

+ 28 VDC −

.5 AMP

FUSE HOLDER
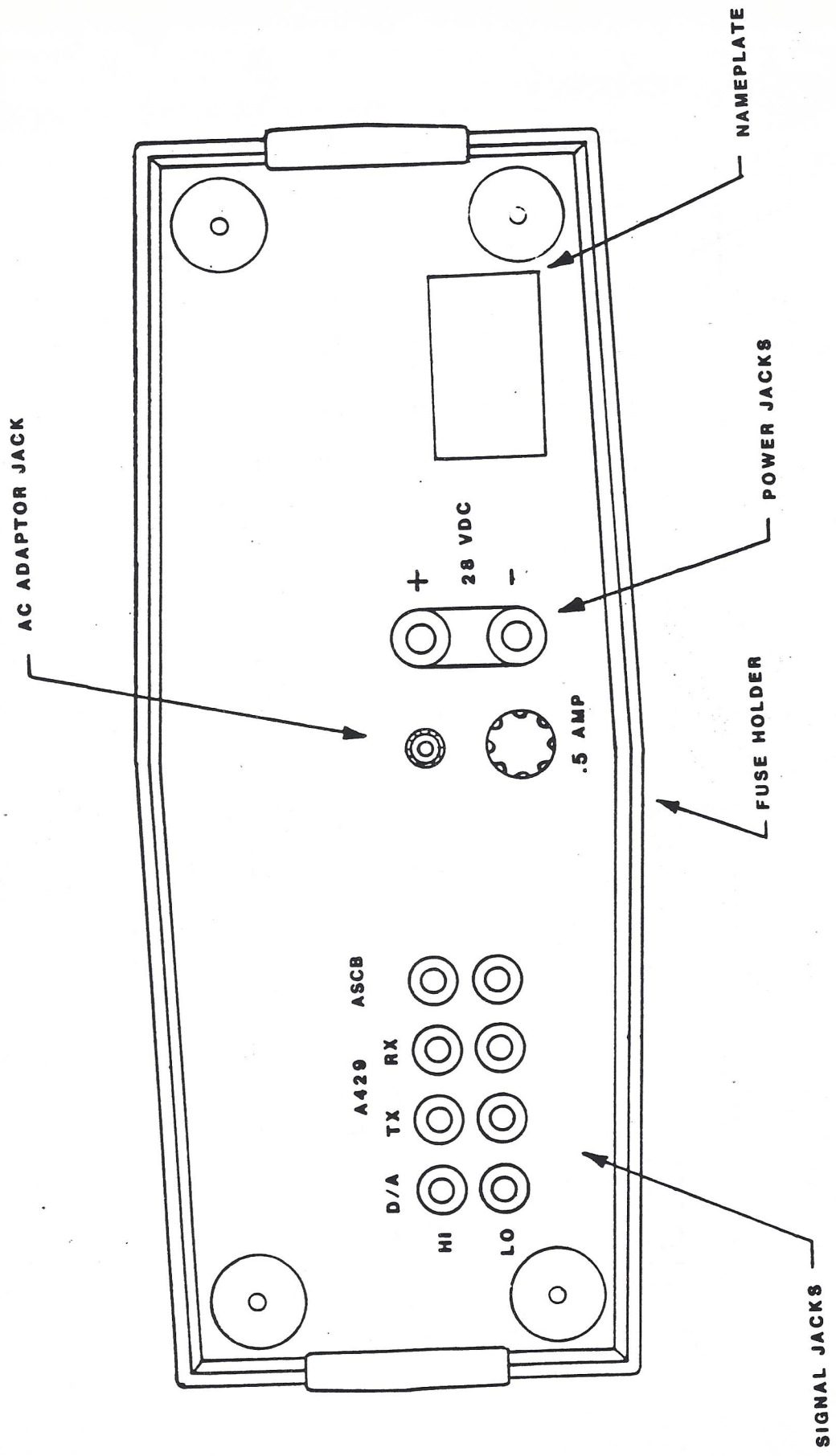
FIGURE 1-2

DATATRAC 250 REAR VIEW

A429   ASCB

D/A   TX   RX

HI

LO

SIGNAL JACKS

TABLE 1-1

DATATRAC 250 SPECIFICATION

ITEM	SPECIFICATION
SIZE	5.0 IN. HEIGHT, 12.5 IN. WIDTH, 11.6 IN. DEPTH
WEIGHT	7.5 LBS.
TEMPERATURE	0 TO 40 DEG C
CASE	BLACK ABS PLASTIC
HANDLING	15 G
DISPLAY	LCD WITH 8 LINE BY 40 CHARACTER MODE OR 64 BY 256 DOT GRAPHICS MODE
POWER	28.0 +/-1.0 VDC AT 8.4 WATTS OR 115 VAC, 60 HZ (AC ADAPTOR) AT 7 WATTS OR 12 VDC INTERNAL BATTERY
BATTERY CAPACITY	1.2 AMP-HR (PROVIDES BETWEEN 2 TO 5 HRS OPERATION DEPENDING ON STATE OF CHARGE, MODE OF OPERATION, ETC.)
DATA BUS	ARINC 429: ELECTRICAL AND DATA FORMAT CHARACTERISTICS PER A429-10. HIGH AND LOW SPEED RECEIVE. HIGH AND LOW SPEED TRANSMIT.
	ASCB: ELECTRICAL AND DATA FORMAT CHARACTERISTIC PER GAMA SPECIFICATION OCT 15, 1988, ASCB VERSION B. BUS FREQUENCY 2/3 MHZ.
D/A OUTPUT	+/-5.0 VDC RANGE. SOURCE IMPEDANCE - 150 OHMS. NOISE LEVEL - 100 MV.

SECTION 2

INSTALLATION AND MAINTENANCE INFORMATION

2.1   INTRODUCTION

This section provides information regarding the handling and maintenance of the DATATRAC 250 as well as interconnection information for various installations. The user is urged to read and follow all recommendations in this section very carefully to achieve many years of trouble free operation with the DATATRAC 250.

2.2   UNPACKING AND INSPECTION

The DATATRAC 250 has been carefully packed to survive all normal shipping and handling conditions. It is important that the customer immediately inspect the received shipment to ensure that all items are present and undamaged.

> Contents: 1. DATATRAC 250 unit
>
> 2. Recoton Model AD 550 AC Adaptor
>
> 3. Reference Manual

Inspect all items thoroughly for physical damage. If no damage is evident, connect the AC adaptor to the unit and plug into a 110 VAC, 60 HZ wall outlet. Turn the power switch on the front of the DATATRAC 250 to ON. The basic Arinc 429 / ASCB setup screen should immediately appear. If a problem is encountered at this point, verify that the 0.5 amp fuse is not open and contact an Atlantic Instruments representative for assistance. DO NOT OPEN THE UNIT AND ATTEMPT REPAIRS.

The internal battery should be in a charged state, but as a precaution it is recommended that the unit be connected to 110 VAC, 60 Hz power through the AC adaptor overnight before attempting to operate from the internal battery. The battery will be charged with the unit's power switch in the on or off position.

2.3   PHYSICAL HANDLING AND STORAGE

While the unit has been designed and manufactured for durability in a field support environment, the user is urged to take all reasonable precautions in the handling, operation, and storage of the DATATRAC 250. Avoid temperature conditions outside the 0 to 40 degree C range. While transporting or shipping protect against vibration or shocks beyond 15 G's.

2.4   POWER AND SIGNAL CONNECTION

The DATATRAC 250 may be powered with its internal battery or with external power. The source of the external power may be the AC adaptor supplied with the unit or some source of 28 VDC power.   IT IS IMPORTANT THAT THE OPERATOR NOT ATTEMPT TO SUBSTITUTE OTHER AC ADAPTORS FOR THE RECOTON AD550 SUPPLIED WITH THE DATATRAC   250.   This adaptor provides the proper voltage and polarity for the DATATRAC 250. Adjustment exist for polarity and voltage levels which have been factory preset to the "+" polarity switch position and the highest voltage setting.   The adaptor switches have been covered by protective   tape to prevent their inadvertent change. The adaptor should be plugged into the jack on the rear of the unit above the fuse.   With the adaptor powered, it may be left connected to the unit indefinitely and will maintain the battery in a fully charged state.

A convenient source of 28 VDC may also be used to power the unit.   Care should be taken to make sure that this power is regulated to within +/- 1 VDC. The 0.5 amp fuse protects the unit from anomalies of either the AC adaptor or 28 VDC power.

Signal connections with the DATATRAC 250 are made through banana jacks on the rear of the unit. Four high and low pairs of jacks allow the following connections:

> A/D Output
> A429 Transmit
> A429 Receive
> ASCB Receive/Transmit Interface

2.5   DISPLAY ADJUSTMENT

The display may be adjusted for contrast and viewing angle with a pot located on the front panel next to the power switch as shown in Figure 1-1.

2.6   BATTERY CHARGING

A sealed lead acid battery contained within the DATATRAC 250 will normally provide problem free operation indefinitely. Fading of the display is an indication of battery discharge, and the unit should not remain powered after the the display becomes difficult to read.

The internal charging circuit provides an ideal charging profile for the 12 volt battery. The first part of the cycle consists of a current limit of 0.25 amps. After the battery charge reduces the input current below 0.25 amps, a constant 14.7 volts is applied to the battery until current drops below approximately 10 milliamps.   At this point a maintenance voltage of 13.5 volts is held on the battery.

Either the AC adaptor or the 28 VDC connection will charge and maintain the internal battery. A 3 to 4 hour period will generally restore 75% charge and an overnight to 24 hour period will ensure a peak charged condition.

2.7   WARRANTY AND SERVICE POLICY

The warranty period extends for 4 months from the date of purchase of the DATATRAC 250 and is identified in the last page of this Reference Manual. During the warranty period failures occuring as a result of normal usage are repaired at no cost by Atlantic Instruments. Shipping costs will also be reimbursed according to prevailing rates for normal ground transportation. The DATATRAC 200 enclosure is sealed at the factory to protect the extensive CMOS circuitry within the unit. Opening of these seals creates the potential for damage to the unit and invalidates the warranty.

Failures after the warranty period will be serviced very promptly by Atlantic Instruments. Parts will be replaced at cost and labor charges will be adjusted to current prevailing rates. Shipping costs are not reimbursed after the warranty period.

For all return shipments the customer is expected to pack the unit adequately to protect against damage and to insure the shipment. Recommended packing is illustrated in Figure 2-1. Atlantic Instruments cannot be held liable for damage incurred through noncompliance with these recommendations.

SHIPPING CONTAINER

FOAM PACKING MATL

3.0 IN.

3.0 IN.

3.0 IN.

3.0 IN.
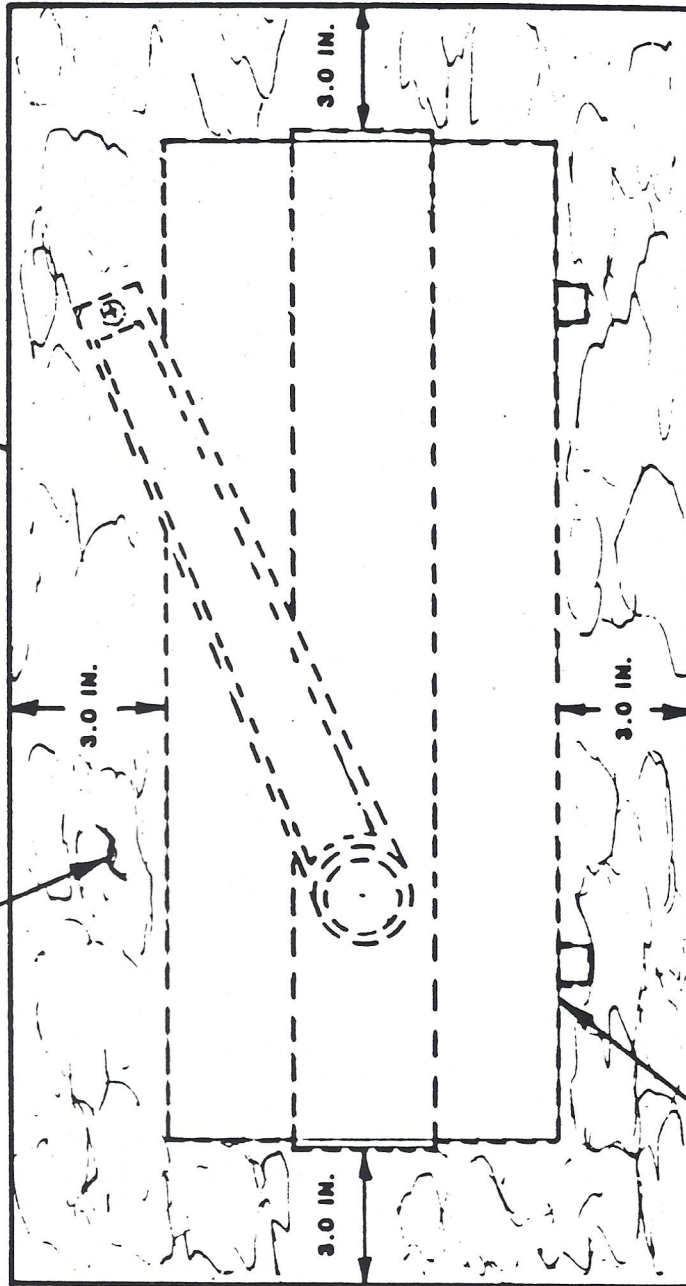
DATATRAC

FIGURE 2-1 RECOMMENDED PACKING PROCEDURE

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SECTION 3

OPERATION

3.1 INTRODUCTION

This section provides detailed instructions for operation of all functions of the DATATRAC 250. Independent subsections are dedicated to the two different bus standards: ARINC 429 and ASCB. A highly consistent format is used in the menu driven setup of all modes. Figures 1-1 and 1-2 containing illustrations of the front and rear views of the unit will be referred to frequently in the text.

3.2 FOUR BASIC MODES

After power on, the following screen will appear on the LCD display. It indicates that the unit is operating normally and first requests the operator to select either 1 for A429 mode or 2 for ASCB mode.

```
*************************************************
*                                               *
*      * THE DATATRAC 250 IS OPERATIONAL *      *
*                                               *
*       SELECT MODE (1=A429, 2=ASCB): 1         *
*       SELECT FUNCTION (RCV=RECEIVE,           *
*          XMT=TRANSMIT, RCD=RECORD): RCV       *
*                                               *
*          PRESS 'ENT' WHEN COMPLETE            *
*************************************************
```

Whether the operator has selected A429 or ASCB, four basic modes or functions are available to aid in the development and testing of the digital systems. These modes are receive, transmit, record, and break and are selected with the first four pushbuttons in the function row (top row of seven buttons shown in Figure 1-1). The user is prompted to select one of three functions, receive, transmit, or record, at this point in the setup. The break function is active only when the receiver has been setup and can not be selected here in the initial setup menu. After the initial selection of a function on this menu, the user may transition between functions by completing the current setup screen and then pushing the desired function button. The theory of operation remains the same for both modes with only slight variations for data format differences between A429 and ASCB.

The remaining three buttons in the function row are clear, increment, and enter. These support setup operations for the four functions. The four by four keypad area contains all of the hexidecimal pushbuttons as well as the +/- pushbutton.

In general, the hexidecimal pushbuttons are used to input setup information, and the 'ENT' key "loads" this data when the setup is complete. The 'CLR' key is used to erase and re-enter information prior to pushing the 'ENT' key.

An 'ENT' after the mode and function selection will lead to a series of setup screens appropriate to the selected mode and function. Transition between A429 and ASCB may only be performed when this menu is present. This menu is displayed if all functions have been turned 'off'.

3.3   ARINC 429 OPERATION

3.3.1   A429 RECEIVE MODE

3.3.1.1 GENERAL RECEIVER SETUP DESCRIPTION

The A429 receiver setup screen is shown below.

```
**************************************************
*                                                *
*              * DATA RECEIVER SETUP *           *
*                                                *
*           SET HI/LO RECEIVER SWITCH: HI        *
*   SELECT FORMAT (1=DEC,2=HEX,3=BIN): DEC       *
*   SELECT LABELS (1=ALL,2=SEL,3=OFF): ALL       *
*                                                *
*           PRESS 'ENT' WHEN COMPLETE            *
**************************************************
```

The receiver speed slide switch is indicated in Figure 1-1 and must be set for either the 100 KHz (HI) or 12.5 KHz (LO) speed of the received bus.

The second setup line prompts the user for a decimal (engineering units), hexidecimal, or binary choice. This selection is made by pressing either the 1, 2, or 3 pushbutton.   The basic presentation formats are hexidecimal or binary, and all data will be intelligently presented in these formats.   For certain data words, however, range and scaling information have been prestored in an internal table so that these labels may be viewed with their information presented as decimal values and discretes.   The list of scaled words is given in Table 3-1 along with their display formats.   Pressing the 'INC' pushbutton gives the next setup line.

The third line allows the user to select 'ALL' to receive all incoming labels (up to 255), 'SEL' to preset only a selected set of labels (up to 16) to be received and displayed, or 'OFF' to turn the receiver off. The 'Select' mode may be desirable to reduce cluttering of the display or to place several desired labels in a particular order for viewing. 'Select' mode must also be setup in order to obtain a history of received data in break mode. This is discussed in more detail in section 3.3.4. When the same label is received in 'ALL' mode with different SDI's, each label/SDI combination is displayed independently.

After making this final selection, press the 'ENT' pushbutton for the label selection screen. Note that if 'ALL' had been selected, the next screen would be the received data itself.

```
**********************************************
*           ENTER UP TO 16 LABELS & SDI:     *
*TYPE 'LBL-S' (LBL=OCTAL, S=0,1,2,3,OR X)    *
*                                            *
*    ___-_  ___-_  ___-_  ___-_  ___-_  ___-_  *
*    ___-_  ___-_  ___-_  ___-_  ___-_  ___-_  *
*                                            *
*                                            *
*          PRESS 'ENT' WHEN COMPLETE         *
**********************************************
```

When defining the select labels, the user is prompted for the
SDI as well as the label. The label should be entered in
octal. A 0, 1, 2, or 3 (BCD representation for bits 10,9)
may be entered and will cause the display of only that
label/SDI combination when received. The user may
alternatively push 'D' for 'don't care' after entering the
label (this will appear as 'X'). In this case, the SDI will
be ignored and only one display of the specified label will
appear. After the initial setup of the select labels or
after operating in 'ALL' mode, the previous setup will be
displayed when this menu is entered again. The labels may be
editted by using the 'INC' key to move the cursor to the
desired label to edit. Labels may be deleted by placing the
cursor on the label to be deleted and pressing the 'CLR' key.

A429 data will be displayed with one of the following
screens.

```
***********************************************
*LBL SI  11-----  DEC RCV    SM  P  MSEC      *
*                                             *
*                                             *
*                                             *
*                                             *
*                                             *
*                                             *
*                                             *
***********************************************


***********************************************
*LBL SI  29-HEX RCV-11       SM  P  MSEC      *
*                                             *
*                                             *
*                                             *
*                                             *
*                                             *
*                                             *
*                                             *
***********************************************
```

```
***********************************************
*LBL SI  29---BIN RCV---11  SM  P  MSEC     *
*                                           *
*                                           *
*                                           *
*                                           *
*                                           *
*                                           *
*                                           *
***********************************************
```

The SDI bit order is bit 10, bit 9 and the SSM order is bit
31, bit 30. A 1 in the parity display column indicates that
odd parity has been received. The data field will contain
either a 4 to 5 digit decimal value, a 5 character
hexidecimal value, or a 19 bit binary value. A set of
enhanced labels are indicated by the asterisks in Table 3-1
and feature a more complete information display described in
a later section. The instantaneous rate accurate to +/- 10%
is displayed in milliseconds. To rotate lines upward,
sequentially press the 'INC' pushbutton. If no data is
present on the digital bus at mode selection, a "NO DATA
RECEIVED" message will appear. When a bus has been active
but ceases to transmit data, the last data displayed will
remain on the screen, but a set of double asterisks will
appear 2 seconds after the bus has been lost.

If the receiver is operating in 'ALL' mode, the data is
displayed in numerical order and may be quickly scrolled to a
particular label by typing in the desired label to be viewed.

At any time while displaying dynamic data, the user may
"freeze" the display by pressing 'ENT'. To return to normal
display operation, press any key. The 'CLR' pushbutton can
be used to clear old information from the display.

TABLE 3-1

DECIMAL MODE SCALING FOR A429

LABEL	BNR/BCD	PARAMETER	SCALE	REFERENCE
001	BCD	DISTANCE TO GO	0-3999.9 NM	A429
002	BCD	TIME TO GO	0-399.9 MIN	A429
003	BCD	CROSS TRACK DIST.	0-399.9 NM	A429
004	BCD	RWY. DIST. TO GO	0-79900. FT	A429
005	----------- HEX FORMAT ONLY ------------------------			
006	----------- HEX FORMAT ONLY ------------------------			
007	----------- HEX FORMAT ONLY ------------------------			
010	BCD	PRES. POS. LAT	N/S 180 DEG	A429
011	BCD	PRES. POS. LONG.	E/W 180 DEG	A429
012	BCD	GROUND SPEED	0-2000. KTS	A429
013	BCD	TRACK ANGLE	0-359.9 DEG	A429
014	BCD	MAG. HEADING	0-359.9 DEG	A429
015	BCD	WIND SPEED	0-799. KTS	A429
016	BCD	WIND DIRECTION	0-359 DEG	A429
017	*	ENHANCED LABEL - SEE SECTION 3.3.1.4		
020	BCD	SEL. VERT. SPD.	+/-6000. FPM	A429
021	BCD	SEL. EPR	0-3	A429
022	BCD	SEL. MACH	0-4	A429
023	BCD	SEL. HEADING	0-359 DEG	A429
024	BCD	SEL. COURSE #1	0-359 DEG	A429
025	BCD	SEL. ALT.	0-50000 FT	A429
026	BCD	SEL. AIRSPD	0-450 KTS	A429
027	BCD	SEL. COURSE #2	0-359 DEG	A429
030	*	ENHANCED LABEL - SEE SECTION 3.3.1.4		
031	*	ENHANCED LABEL - SEE SECTION 3.3.1.4		
032	*	ENHANCED LABEL - SEE SECTION 3.3.1.4		
033	*	ENHANCED LABEL - SEE SECTION 3.3.1.4		
034	*	ENHANCED LABEL - SEE SECTION 3.3.1.4		
035	*	ENHANCED LABEL - SEE SECTION 3.3.1.4		
036	*	ENHANCED LABEL - SEE SECTION 3.3.1.4		
037	*	ENHANCED LABEL - SEE SECTION 3.3.1.4		
040	----------- HEX FORMAT ONLY ------------------------			
041	BCD	SET LATITUDE	N/S 180 DEG	A429
042	BCD	SET LONGITUDE	E/W 180 DEG	A429
043	BCD	SET HEADING	0-359 DEG	A429
044	BCD	TRUE HEADING	0-359.9 DEG	A429
045	BCD	MIN AIRSPEED	0-259.9	A429
046	----------- HEX FORMAT ONLY ------------------------			
047	----------- HEX FORMAT ONLY ------------------------			
050	----------- HEX FORMAT ONLY ------------------------			
051	----------- HEX FORMAT ONLY ------------------------			
052	----------- HEX FORMAT ONLY ------------------------			
053	BCD	TRACK ANGLE - MAG	0-369	A429
054	----------- HEX FORMAT ONLY ------------------------			
055	----------- HEX FORMAT ONLY ------------------------			
056	BCD	WIND DIR - MAG	0-359	A429

057	---------- HEX FORMAT ONLY --------------------------			
060	---------- HEX FORMAT ONLY --------------------------			
061	---------- HEX FORMAT ONLY --------------------------			
062	---------- HEX FORMAT ONLY --------------------------			
063	---------- HEX FORMAT ONLY --------------------------			
064	---------- HEX FORMAT ONLY --------------------------			
065	BCD	GROSS WT	0-12000 100LB	A429
066	BCD	LONG. CG	0-100 %MAC	A429
067	BCD	LAT. CG	0-100 %MAC	A429
070	BNR	AC FREQ	+/- 512 HZ	A429
071	BNR	AC FREQ	+/- 512 HZ	A429
072	BNR	STATOR VANE ANGLE	+/- 180 DEG	A429
073	BNR	V1	+/- 512 KTS	A429
074	BNR	ZERO FUEL WT.	+/-13107 10LB	A429
075	BNR	GROSS WT.	+/-13107 10LB	A429
076	BNR	AC VOLTAGE	+/- 256 VOLTS	A429
077	BNR	TARGET AIRSPEED	+/- 512 KTS	A429
100	BNR	SELECTED COURSE	+/- 180 DEG	A429
101	BNR	SELECTED HEADING	+/- 180 DEG	A429
102	BNR	SELECTED ALTITUDE	0-65536 FT	A429
103	BNR	SELECTED AIRSPEED	0-512 KTS	A429
104	BNR	SELECTED VERT SPD	+/-16384 FPM	A429
105	BNR	SELECTED RWY HDG	+/-180 DEG	A429
106	BNR	SELECTED MACH	+/-4096 mMACH	A429
107	---------- HEX FORMAT ONLY --------------------------			
110	BNR	SELECTED COURSE	+/-180 DEG	A429
111	---------- HEX FORMAT ONLY --------------------------			
112	BNR	RWY LENGTH	0-20480 FT	A429
113	---------- HEX FORMAT ONLY --------------------------			
114	BNR	DESIRED TRACK	+/-180 DEG	A429
115	BNR	WAYPT BEARING	+/-180 DEG	A429
116	BNR	CRS TRK DIST	+/-128 NM	A429
117	BNR	VERT DEV	+/-2048 FT	A429
120	BNR	RANGE TO ALT	+/-512 NM	A429
121	BNR	HORIZ. CMD	+/-180 DEG	A429
122	BNR	VERT. CMD	+/-180 DEG	A429
123	BNR	THROTTLE CMD	+/-256 DEG/SEC	A429
124	---------- HEX FORMAT ONLY --------------------------			
125	---------- HEX FORMAT ONLY --------------------------			
126	---------- HEX FORMAT ONLY --------------------------			
127	BNR	SLAT ANGLE	+/-180 DEG	A429
130	BNR	FAN INLET TOTAL TEMP	+/-128 DEG C	A429
131	BNR	FAN INLET TOT PRES	+/-32 PSIA	A429
132	BNR	EXH GAS TOT PRES	+/-32 PSIA	A429
133	BNR	THRST LEVER ANGLE	+/-180 DEG	A429
134	BNR	PWR LEVER ANGLE	+/-180 DEG	A429
135	BNR	ENG VIBRATION	+/-8 IPS	A429
136	BNR	ENG VIBRATION	+/-8 IPS	A429
137	BNR	FLAP ANGLE	+/-180 DEG	A429
140	BNR	FLT DIR ROLL	+/-180 DEG	A429
141	BNR	FLT DIR PIT	+/-180 DEG	A429
142	BNR	FLT DIR F/S	+/-32 KTS	A429
143	BNR	FLT DIR YAW	+/-180 DEG	A429
144	BNR	ALT ERR	+/-8192 FT	A429

145	----------	HEX FORMAT ONLY	--------------------------------	
146	----------	HEX FORMAT ONLY	--------------------------------	
147	----------	HEX FORMAT ONLY	--------------------------------	
150	----------	HEX FORMAT ONLY	--------------------------------	
151	BNR	LOC BEARING	+/-180 DEG	A429
152	----------	HEX FORMAT ONLY	--------------------------------	
153	----------	HEX FORMAT ONLY	--------------------------------	
154	BNR	RUNWAY	+/-512 NM	A429
155	----------	HEX FORMAT ONLY	--------------------------------	
156	----------	HEX FORMAT ONLY	--------------------------------	
157	----------	HEX FORMAT ONLY	--------------------------------	
160	----------	HEX FORMAT ONLY	--------------------------------	
161	----------	HEX FORMAT ONLY	--------------------------------	
162	BNR	ADF BEARING	+/-180 DEG	A429
163	----------	HEX FORMAT ONLY	--------------------------------	
164	BNR	MIN DESC ALT	+/-8192 FT	A429
165	----------	HEX FORMAT ONLY	--------------------------------	
166	BNR	RALT CHK PT DEV	+/-512 FT	A429
167	----------	HEX FORMAT ONLY	--------------------------------	
170	----------	HEX FORMAT ONLY	--------------------------------	
171	----------	HEX FORMAT ONLY	--------------------------------	
172	----------	HEX FORMAT ONLY	--------------------------------	
173	BNR	LOC DEV	+/-.4 DDM	A429
174	BNR	GS DEV	+/-.8 DDM	A429
175	BNR	ECON SPD	+/-1024 KTS	A429
176	BNR	ECON MACH	+/-4096 mMACH	A429
177	BNR	ECON FLT LEV	+/-131072 FT	A429
200	----------	HEX FORMAT ONLY	--------------------------------	
201	----------	HEX FORMAT ONLY	--------------------------------	
202	BNR	DME DIST	+/-512 NM	A429
203	BNR	ALTITUDE	+/-131072 FT	A429
204	BNR	BARO COR ALT #1	+/-131072 FT	A429
205	BNR	MACH	+/-4.096	A429
206	BNR	COMP AIRSPD	+/-1024 KTS	A429
207	BNR	MAX ALLOW AIRSPD	+/-1024 KTS	A429
210	BNR	TAS	+/-2048 KTS	A429
211	BNR	TAT	+/-512 KTS	A429
212	BNR	ALTITUDE RATE	+/-32768 FPM	A429
213	BNR	SAT	+/-512 DEG C	A429
214	----------	HEX FORMAT ONLY	--------------------------------	
215	BNR	IMPACT PRES	+/-512 MB	A429
216	----------	HEX FORMAT ONLY	--------------------------------	
217	BNR	STATIC PRES	+/-64 IN HG	A429
220	BNR	BARO CORR ALT #2	+/-131072	A429
221	BNR	IND AOA (AVG)	+/-180 DEG	A429
222	BNR	IND AOA (#1 LEFT)	+/-180 DEG	A429
223	BNR	IND AOA (#1 RT)	+/-180 DEG	A429
224	BNR	IND AOA (#2 LFT)	+/-180 DEG	A429
225	BNR	IND AOA (#2 RT)	+/-180 DEG	A429
226	----------	HEX FORMAT ONLY	--------------------------------	
227	----------	HEX FORMAT ONLY	--------------------------------	
230	----------	HEX FORMAT ONLY	--------------------------------	
231	----------	HEX FORMAT ONLY	--------------------------------	
232	----------	HEX FORMAT ONLY	--------------------------------	

233	---------- HEX FORMAT ONLY		-----------------------------	
234	---------- HEX FORMAT ONLY		-----------------------------	
235	---------- HEX FORMAT ONLY		-----------------------------	
236	---------- HEX FORMAT ONLY		-----------------------------	
237	---------- HEX FORMAT ONLY		-----------------------------	
240	---------- HEX FORMAT ONLY		-----------------------------	
241	BNR	CORR AOA	+/-180 DEG	A429
242	BNR	TOT PRESS	+/-2048 MB	A429
243	---------- HEX FORMAT ONLY		-----------------------------	
244	BNR	FUEL FLOW	+/-32768 LB/HR	A429
245	BNR	MIN AIRSPD	+/-256 KTS	A429
246	BNR	AOA ERROR	+/-180 DEG	A429
247	BNR	SPD ERROR	+/-256 KTS	A429
250	BNR	EPR LIMIT	+/-4.	A429
251	BNR	DIST TO GO	+/-4096 NM	A429
252	BNR	TIME TO GO	+/-512 MIN	A429
253	BNR	GO ARND EPR LIMIT	+/-4.	A429
254	BNR	CRUISE EPR LIMIT	+/-4.	A429
255	BNR	CLIMB EPR LIMIT	+/-4.	A429
256	BNR	V STICK SHAKER	+/-512 KTS	A429
257	BNR	FUEL	+/-13107 10LB	A429
260	BNR	FUEL	+/-13107 10LB	A429
261	BNR	FUEL	+/-13107 10LB	A429
262	BNR	PRED AIRSPD VAR	+/-256 KTS	A429
263	BNR	MIN AIRSPD	+/-512 KTS	A429
264	BNR	MIN AIRSPD	+/-512 KTS	A429
265	BNR	MAN AIRSPD	+/-512 KTS	A429
266	---------- HEX FORMAT ONLY		-----------------------------	
267	BNR	PRED MAX MAN AIRSPD	+/-512 KTS	A429
270	---------- HEX FORMAT ONLY		-----------------------------	
271	---------- HEX FORMAT ONLY		-----------------------------	
272	---------- HEX FORMAT ONLY		-----------------------------	
273	---------- HEX FORMAT ONLY		-----------------------------	
274	---------- HEX FORMAT ONLY		-----------------------------	
275	---------- HEX FORMAT ONLY		-----------------------------	
276	---------- HEX FORMAT ONLY		-----------------------------	
277	---------- HEX FORAMT ONLY		-----------------------------	
300	---------- HEX FORMAT ONLY		-----------------------------	
301	---------- HEX FORMAT ONLY		-----------------------------	
302	---------- HEX FORMAT ONLY		-----------------------------	
303	---------- HEX FORMAT ONLY		-----------------------------	
304	---------- HEX FORMAT ONLY		-----------------------------	
305	---------- HEX FORMAT ONLY		-----------------------------	
306	---------- HEX FORMAT ONLY		-----------------------------	
307	---------- HEX FORMAT ONLY		-----------------------------	
310	BNR	LATITUDE	+/-180 DEG	A429
311	BNR	LONGITUDE	+/-180 DEG	A429
312	BNR	GROUND SPEED	+/-4096 KTS	A429
313	BNR	TRACK	+/-180 DEG	A429
314	BNR	HEADING	+/-180 DEG	A429
315	BNR	WIND SPEED	+/-256 KTS	A429
316	BNR	WIND ANGLE	+/-180 DEG	A429
317	BNR	MAG TRACK ANGLE	+/-180 DEG	A429
320	BNR	MAG HEADING	+/-180 DEG	A429

321	BNR	DRIFT ANGLE	+/-180 DEG	A429
322	BNR	FLT PATH ANGLE	+/-180 DEG	A429
323	BNR	FLT PATH ACCEL	+/-4 G	A429
324	BNR	PITCH	+/-180 DEG	A429
325	BNR	ROLL	+/-180 DEG	A429
326	BNR	BODY PITCH RATE	+/-128 DEG/SEC	A429
327	BNR	BODY ROLL RATE	+/-128 DEG/SEC	A429
330	BNR	BODY YAW RATE	+/-128 DEG/SEC	A429
331	BNR	BODY LONG ACCEL	+/-4 G	A429
332	BNR	BODY LAT ACCEL	+/-4 G	A429
333	BNR	BODY NORM ACCEL	+/-4 G	A429
334	BNR	PLATFORM HEADING	+/-180 DEG	A429
335	BNR	TRK ANGLE RATE	+/-32 DEG/SEC	A429
336	BNR	INERTIAL PIT RATE	+/-128 DEG/SEC	A429
337	BNR	INERTIAL ROLL RATE	+/-128 DEG/SEC	A429
340	BNR	ACT EPR	+/-4.	A429
341	BNR	N1 CMD	+/-256%	A429
342	BNR	N1 LIMIT	+/-256%	A429
343	BNR	N1 DERATE	+/-256%	A429
344	BNR	N2	+/-256%	A429
345	BNR	EXH GAS TEMP	+/-2048 DEG C	A429
346	BNR	N1 ACT	+/-256%	A429
347	BNR	FUEL FLOW	+/-32768 LB/HR	A429
350	---------- HEX FORMAT ONLY --------------------------			
351	---------- HEX FORMAT ONLY --------------------------			
352	---------- HEX FORMAT ONLY --------------------------			
353	---------- HEX FORMAT ONLY --------------------------			
354	---------- HEX FORMAT ONLY --------------------------			
355	---------- HEX FORMAT ONLY --------------------------			
356	---------- HEX FORMAT ONLY --------------------------			
357	---------- HEX FORMAT ONLY --------------------------			
360	BNR	POT VERT SPD	+/-32768 FPM	A429
361	BNR	ALTITUDE	+/-13107 10FT	A429
362	BNR	ALG TRK ACCEL	+/-4 G	A429
363	BNR	CRS TRK ACCEL	+/-4 G	A429
364	BNR	VERT ACCEL	+/-4 G	A429
365	BNR	INERTIAL VERT VEL	+/-32768 FPM	A429
366	BNR	N-S VELOCITY	+/-4096 KTS	A429
367	BNR	E-W VELOCITY	+/-4096 KTS	A429
370	BNR	DEC HT SELECTED	+/-8192 FT	A429
371	---------- HEX FORMAT ONLY --------------------------			
372	BNR	WIND DIR - MAG	+/-180 DEG	A429
373	BNR	N-S VELOCITY - MAG	+/-4096 KTS	A429
374	BNR	E-W VELOCITY - MAG	+/-4096 KTS	A429
375	BNR	ALG HDG ACCEL	+/-4 G	A429
376	BNR	CRS HDG ACCEL	+/-4 G	A429
377	---------- HEX FORMAT ONLY--------------------------			

3.3.1.2 HEXIDECIMAL FORMAT DEFINITION

The data field for ARINC-429 type labels is 19 bits organized in a 32 bit word as follows:

```
3 3 3 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0
2 1 0 9 8 7 6 5 4 3 2 1 0 9 8 7 6 5 4 3 2 1 0 9 8 7 6 5 4 3 2 1
P S S M                                       L S S
A S S S---------------DATA---------------S I I ------ADDR-----
R M M B                                       B 2 1
```

In order to display the data field in HEX format, one bit must be added to form a five digit hex data word. This pad bit will be added as described below:

BCD labels 001 through 067:

      A '0' pad bit will be added to the MSB position i.e.

```
        0XXX  XXXX  XXXX  XXXX  XXXX
        P222  22                   1
        A987  65                   1
        D
```

Binary labels 070 through 377:

      A '0' pad bit will be added to the LSB position i.e.

```
        XXXX  XXXX  XXXX  XXXX  XXX0
        222                       1P
        987                       1A
                                  D
```

3.3.1.3 SPLIT SCREEN FORMAT

The previous screens had represented the case of receive mode only selection. If the user wishes to view transmit data while in receive mode, the display is automatically configured for split screen operation. Four lines rather than seven lines of receive data are presented along with two lines of transmit data. The utility functions (ENT-freeze, CLR-clear, INC-increment) can still be used with the receive data but only if cursor control exists in the receive portion of the display. This is indicated by the square marker on the right side of the screen as shown in the following figure.

```
        *************************************************
        *LBL  SI  11-----  DEC RCV  SM  P  MSEC  ▇ *
        *                                            *
        *                                            *
        *                                            *
        *                                            *
        *LBL  SI  11-----  DEC XMT  SM  P  MSEC      *
        *                                            *
        *                                            *
        *************************************************
```

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If control exists in the transmit portion of the screen, it may be transferred to the receive screen by pressing the receive (RCV) button once. The user then has available all the receive data manipulation capabilities discussed for single screen operation. If the receive button is depressed a second time, the receive setup screen will appear.

To transfer cursor control to the transmit portion of the screen, the user must depress the transmit (XMT) button once moving the square to the lower half of the screen. The transmit data can then be rotated for viewing with the 'INC' pushbutton, cleared with the 'CLR' pushbutton, or edited as will be described in a later section.

3.3.1.4 ENHANCED LABEL FORMATS

The enhanced label display formats are shown below. Decimal mode is assumed to be selected in the receiver setup in all of these examples. Appendix A also contains a definition for these labels that has been excerpted from the ARINC 429 Specification. This is included for the user's convenience and contains the definitions for the discrete bits that are contained within each of the labels below (with the exception of 017).

```
****************************************************
*LBL  SI   11-----      DEC RCV   SM  P  MSEC     *
*017  01   1011         170.6     11  1  0100      *
*030  01                128.530   11  1  0100      *
*031  01   1000101      3620      11  1  0100      *
*032  01   100          1057.5    11  1  0100      *
*033  01   1100         109.30    11  1  0100      *
*034  01   0001         114.65    11  1  0100      *
*035  01   1011011      115.65    11  1  0100      *
*037  01   1            23.579    11  1  0100      *
****************************************************
```

Below is a bit by bit definition for each of the above enhanced labels:

017-Selected Runway Heading

	LBL	SDI	Discretes	BCD Degrees	SSM	PAR
Data:	017	0 1	1 0 1 1	1 7 0 . 6	1 1	1
Bit	0 0	1 0	1 1 1 1	2 2 2 1	3 3	3
Def:	1-8	0 9	1 2 3 4	9 6 2 8	1 0	2
					- - - -	
				2 2 1 1	
				7 3 9 5	

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```
030-VHF COM Frequency
        LBL  SDI        BCD Frequency, MHz      SSM   PAR
Data:   030  0 1        1 2 8 . 5 3 0           1 1    1

Bit     0 0  1 0          2 2   2 1 1           3 3    3
Def:    1-8  0 9          9 6   2 8 4           1 0    2
                          - -   - - -
                          2 2   1 1 1
                          7 3   9 5 1


031-Beacon Transformer Code
        LBL  SDI    --Disc. Bits-    Octal Reply   SSM   PAR
                                        Code
Data:   031  0 1    1 0 0 0 1 0 1     3 6 2 0       1 1    1

Bit     0 0  1 0    1 1 1 1 1 1 1     2 2 2         3 3    3
Def:    1-8  0 9    1 2 3 4 5 6 7     9 6 3 0       1 0    2
                                      - - - -
                                      2 2 2 1
                                      7 4 1 8


032-ADF Frequency
        LBL  SDI    Discretes    BCD Freq., KHz    SSM   PAR
Data:   032  0 1    1 0 0        1 0 5 7 . 5       1 1    1

Bit     0 0  1 0    1 1 1        2 2 2 1 1         3 3    3
Def:    1-8  0 9    1 2 3        9 6 2 8 4         1 0    2
                                 - - - -
                                 2 2 1 1
                                 7 3 9 5


033-ILS Frequency
        LBL  SDI    Discretes    BCD Freq., MHz    SSM   PAR
Data:   033  0 1    1 1 0 0      1 0 9 . 3 0       1 1    1

Bit     0 0  1 0    1 1 1 1      2 2   2 1         3 3    3
Def:    1-8  0 9    1 2 3 4      9 6   2 8         1 0    2
                                 - -   -
                                 2 2   1 1
                                 7 3   9 5


034-VOR/ILS Frequency
        LBL  SDI    Discretes    BCD Freq., MHz    SSM   PAR
Data:   034  0 1    0 0 0 1      1 1 4 . 6 5       1 1    1

Bit     0 0  1 0    1 1 1 1      2 2 2   1         3 3    3
Def:    1-8  0 9    1 2 3 4      9 6 2   8         1 0    2
                                 - - -   -
                                 2 2 1   1
                                 7 3 9   5
```

```
035-DME Frequency
        LBL  SDI    --Discretes--   BCD Freq.,MHz   SSM  PAR
Data:   035  0 1    1 0 1 1 0 1 1   1 1 5 . 6 5     1 1   1

Bit     0 0  1 0    1 1 1 1 1 1 1     2 2   2 1     3 3   3
Def:    1-8  0 9    1 2 3 4 5 6 7     9 6   2 8     1 0   2
                                      - -   -
                                      2 2   1
                                      7 3   9


037-HF COM Frequency
        LBL  SDI   Discr.    BCD Freq., MHz         SSM  PAR
Data:   037  0 1     1       2 3 . 5 7 9            1 1   1

Bit     0 0  1 0     1       2 2   2 1 1            3 3   3
Def:    1-8  0 9     1       9 7   3 9 5            1 0   2
                              - -   - - -
                              2 2   2 1 1
                              8 4   0 6 2
```

3.3.2 A429 TRANSMIT MODE

The first transmit setup screen to appear after mode selection
is shown below.

```
***************************************************
*           * A429 TRANSMITTER SETUP *         *
*                                              *
*    TRANSMITTER STATUS (1=ON,2=OFF): ON       *
*    TRANSMITTER MODE (1=DIG,2=D/A): DIG       *
*                                              *
*                                              *
*           PRESS 'ENT' TO CONTINUE            *
*                                              *
***************************************************
```

The first setup line of the screen prompts the user to select
the transmitter to be either on or off. The second line of the
setup prompts the user to select either the digital data
transmitter or the D/A output. If the digital transmitter is
selected, the transmitter speed slide switch that is indicated
in Figure 1-1 must be set to either the 100 kHz (HI) or 12.5
kHz (LO) position at this point in the setup.

3.3.2.1 DIGITAL DATA TRANSMISSION

If the digital data transmitter mode is selected, the following
screen will appear after the 'ENT' key is pressed on the above
setup menu.

```
***************************************************
*LBL  SI  29-HEX XMT-11     SM   P  MSEC      *
*                                              *
*                                              *
*                                              *
*                                              *
*                                              *
*                                              *
*                                              *
***************************************************
```

The user must enter the label in octal, the SDI bits (10
followed by 9), the data in hex format, the SSM bits (31
followed by 30), a parity selection, and the desired
transmission interval. A 1 in the 'P' column causes odd parity
to be used in the transmission. After entering the label a
default entry appears, and the user actually edits these values
by shifting the cursor with the lateral arrow buttons and
writing over the existing entry. After entering one complete
line, the user presses the 'INC' key to initiate transmission
and move the cursor to the next line ready to begin a new
setup.

As many as 16 labels may be entered. These can be reviewed by
pushing the increment button. This allows all current transmit

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data to be rotated for viewing. At any point while the cursor is positioned on a line with data entered, edits may be made using two lateral arrow buttons to move the cursor to the bit to be changed (the 'RCD'(<--) and 'BRK'(-->) keys). (Transmit setup is the only mode in which the lateral arrows are recognized). When edits are complete, pressing the 'INC' button causes the new word to replace the previously transmitted word. To add another output word, press the 'INC' key until it positions the cursor on a blank line and enter the additional transmission data. In addition to editing, an entry line may be deleted by pressing 'CLR' when the cursor has been positioned on the line.

Operation with a split screen was discussed in the previous section. Transmit data is manipulated exactly the same as described above and the only difference is that only two lines are provided for viewing the transmit data.

When defining a hex word for transmission the user should be aware of the BCD vs binary conventions of Section 3.3.1.2 for adding pad zeros. Examples of this have been included in Appendix B of this manual to help the user understand the hex format.

The user is allowed to select different transmission rates but these must be a 1, 2, 4, or 10 multiple of the fastest rate. Incorrect entries will be rounded down to the next lower rate.

In general, the DATATRAC 250 can be operated in receive and transmit modes simultaneously with no inaccuracy or variation of data rate. For the case of both high speed received data and high speed transmitted data, some loss of transmission rate accuracy, etc. may be observable, and this mode of operation is not recommended.

3.3.2.1.1 BURST MODE TRANSMISSION SETUP

The previous section described the procedure for setting up labels for continuous transmission. Certain labels associated with radio transmission may require transmission in "burst mode" in which the word is output a specified number of times and at a specified interval. This mode is set up by pressing the 'B' pushbutton when the cursor is located on the first digit of the rate value. This leads to the default below in which the word will be transmitted every 50 msec a total of 16 times when the user presses the 'ENT' button. The default values may be changed by positioning the cursor appropriately and editing.

```
************************************************
*LBL SI   29-HEX XMT-11     SM  P  MSEC      *
*030 01      2853B          11  1  B16 50    *
*                                            *
************************************************
```

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3.3.2.2 D/A OUTPUT

If the D/A output mode had been selected, the following setup
screen would appear prompting the user to select the desired
operating mode for the D/A.

```
**************************************************
*            * SELECT D/A OUTPUT MODE *          *
*                                                *
*    ENTER:   '0'  FOR D/A OUTPUT OFF            *
*             '1'  FOR TRIGGER ON RCVD DATA      *
*             '2'  FOR RECEIVED DATA             *
*             '3'  FOR KEYBD ENTRY DATA          *
*             YOU HAVE SELECTED: 1               *
*             PRESS 'ENT' TO CONTINUE            *
**************************************************
```

The D/A setup choices are listed on the above screen, and the
user must select a corresponding number and then 'ENT'.

Selection of '0' or D/A OUTPUT OFF causes 0.0 volts to be
output on the D/A output.

Selection of '1' or TRIGGER ON RCVD DATA will lead to the
following screen.

```
****************************************************
*            * TRIGGER PULSE/BRKPT SETUP *         *
*                                                  *
*    LBL SDI            DATA          SSM P         *
*    ___ ___     _____     ___ _         *
*    OCT BIN            BIN            BIN          *
*  >EQ    NE    OR    GT    LT    /GT/   /LT/  *
*                                                  *
*            PRESS 'ENT' TO CONTINUE               *
****************************************************
```

The label is entered as a standard Arinc 429 label in octal.
The SDI, DATA, SSM, and P data fields are all entered as a
binary 0 or 1. The SDI is entered bit 10, bit 9; the DATA is
entered as bits 29 through 11; the SSM is entered bit 31, bit
30; and the P(parity) is bit 32. In addition to the 0 or 1
entry, the user may enter 'D' for 'don't care' (it will appear
as an 'X') in any or all bit positions. After entering the
entire Arinc word, the user must push 'INC' to continue the
setup on the condition line. The selection arrow can be
repeatedly incremented through the various options on this
line. These are:

    EQ   -   D/A output pulse will occur when an exact
               match of the non-'don't care' bits exists.

    NE   -   D/A output pulse will occur when any bit does
               not equal any of the non-'don't care' bits.

```
OR    -    D/A output pulse will occur when a match
           with any of the non-'don't care' bits exists.

GT    -    D/A output pulse will occur when the data
           value in the received word is greater than
           the user defined value.

LT    -    D/A output pulse will occur when the data
           value in the received word is less than the
           user defined value.

/GT/  -    D/A output pulse will occur when the absolute
           data value of the received word is greater
           than the positive user defined value.

/LT/  -    D/A output pulse will occur when the absolute
           data value of the received word is less than
           the positive user defined value.
```

When complete, 'ENT' should be pressed to start the 5.0 +/- 0.5 vdc, 0.50 +/- 0.05 second conditional output pulses.

Selection of '2' or RECEIVED DATA will lead to the following screen.

```
********************************************
*              * D/A OUTPUT WORD SETUP *        *
*                                               *
*                         LABEL: 105            *
*           SCALE FACTOR (1,2,8): 2             *
*           DATA OFFSET (HEX): 1F00             *
*                                               *
*                                               *
*           PRESS 'ENT' TO CONTINUE             *
********************************************
```

A label is entered in octal format followed by an 'INC'. The next line prompts the user to enter a scale factor of either 1, 2 or 8. A '1' means that the contents of the digital word will be output as a +/- 5.0 volt signal, '2' means that one half of the digital word will be represented by the +/- 5.0 volt output range, and an '8' means that one eighth of the digital word will be represented by the +/- 5.0 volts. The data offset is a data value that should be entered in hex and this value is subtracted from the data word before the scale factor is applied. Pressing 'ENT' completes the setup.

Selection of '3' or KEYBD ENTRY DATA will lead to the following
screen.

```
*******************************************
*                                         *
*           * D/A OUTPUT DATA SETUP *      *
*                                         *
*           ENTER DATA: +0.50             *
*                                         *
*                                         *
*           PRESS 'ENT' TO CONTINUE       *
*******************************************
```

This screen allows the user to set up a static value on the D/A
output. A value between +/- 1.00 (+/-1.00 = +/- 5.00 V) is
defined and then entered by the user. The polarity of the data
can be toggled using the 'F' key.

3.3.3 A429 RECORD MODE

The record feature may be used to store 6144 bytes of data. The user may elect to record 2048 values of a single selected label (3 bytes saved per received word), 1365 values each of two selected labels, or 682 values each of three selected labels. The setup screen for record mode is shown below.

```
*********************************************
*          * INITIALIZE DATA RECORDER *     *
*                                           *
*     SET HI/LO RECEIVER SPEED: HI          *
* ENTER RECORD INTERVAL (SEC): 0.50         *
*     ENTER LABEL(S) TO RECORD: 030 105 350 *
*                                           *
*                                           *
*          PRESS 'ENT' TO CONTINUE          *
*********************************************
```

The record interval is entered on the first line as a decimal value between 0.01 sec and 5.00 sec. The labels (1, 2, or 3) are entered on the next line. The 'ENT' pushbutton is then pressed, and the following screen appears.

```
*********************************************
*        * RECORDED DATA - RECORD MODE *    *
*              030      105      350        *
*       03F8   _____  _____  _____       *
*                                           *
*       RECORD INTERVAL= 0.50 SEC           *
*                                           *
*                                           *
*       PRESS 'ENT' TO TOGGLE RECORD/PLAY   *
*********************************************
```

The top line of the display indicates that the unit is in record rather than playback mode. The next line displays the labels that are being recorded followed by a display of the recording index and current values (both in hexidecimal). At any time the user may switch to playback mode by pressing the 'ENT' pushbutton. In all playback modes except the D/A output, the recording of data will continue even while viewing the recorded data. The following screen will then appear requesting the user to select either hexidecimal, graphics, or D/A output mode.

```
**************************************************
*          * RECORDED DATA PLAYBK MODE *        *
*                                                *
*          SELECT PLYBK DISPLAY MODE: 2          *
*          (1=HEX,2=GRAPH,3=D/A OUT)             *
*          SELECT SCALE (1, 2, OR 8): 1          *
*           ENTER DATA OFFSET (HEX): 1F00         *
*                                                *
*          PRESS 'ENT' TO CONTINUE               *
**************************************************
```

Only if the graphics or D/A output modes are selected, will the
scaling information and data offset entered on the next two
lines be recognized.   The three options for scaling are:

    1 - The entire signed digital word will be represented
        by the +/- 32 dots of the graphics display.

    2 - The +/- 32 dots of the graphics display will
        represent +/- 50% of the digital word.

    8 - The +/- 32 dots of the graphics display will
        represent +/- 12.5% of the digital word.

The +/-5.0 volt D/A output is similarly scaled by the 1, 2, 8
code.   The data offset is entered as a hex data word and is
subtracted from the received word before scaling. This feature
allows the user to view data on the X2 or X8 scale that has a
large offset from zero. After this selection is entered, one
of the following three screens will appear.

```
**************************************************
*       * RECORDED DATA - PLAY   MODE *          *
*              030      105      350             *
*        003C _____  _____  _____            *
*        003F _____  _____  _____            *
*        0042 _____  _____  _____            *
*        0045 _____  _____  _____            *
*          PRESS 'INC' FOR MORE DATA             *
*       PRESS 'ENT' TO TOGGLE RECORD/PLAY        *
**************************************************
```

```
**************************************************
*                                                *
*      >>   DUMPING RECORDED DATA TO  <<         *
*           D/A OUTPUT PORT                      *
*                                                *
*                                                *
*                                                *
*                                                *
*                                                *
**************************************************
```

In the first two cases the 'INC' pushbutton is used to sequence
through the data in the chronological sequence that it was
recorded. For the hexidecimal format, an index provides a time
reference for data values. In the graphics presentation, each
dot position in the horizontal direction represents a record
interval point, and 240 dots are presented on each screen. In
the vertical direction, +/- 32 dots represent the full digital
word, one half the digital word, or one eighth of the digital
word depending on the selected scale. Continuing to press
'INC' will allow cycling through the recorded data. A heavy
vertical line indicates the end of recorded data for the
current word. Pressing 'INC' presents the first graphics
screen for the next word. Continuing to press 'INC' will allow·
repeated cycling through the graphics data. Pressing 'ENT'
will recall the record setup screen and allow the user to
record more data or cycle back to playback mode with a new
scale selection. The upper left digit on the graphics screen
indicates the scale that has been selected. The lower left
digit is an index for the 12 screens of graphics data.

The hexidecimal display of recorded data is different than that
discussed earlier for receive mode. Here 6 characters are used
to represent bits 32 through 9 in that order. (For receive
mode, only the data field, bits 29 through 11, were displayed
with the 5 character hexidecimal word.)

To output data via the D/A, the record process should be
allowed to complete. If multiple words have been selected,
they are completely output in the order they have been defined
with no demarcation between data groups. Data words are output
at the same time interval used for their recording. Pressing
the 'ENT' key at any time stops the output.

To exit record mode, cycle to the record screen first and then
press the desired function pushbutton. A warning message will
appear to alert the user that exiting record mode or starting a
new record session will cause the data currently recorded to be
lost. To continue to exit record mode, simply press the
desired function key again. To return to record mode and
retain the current record data, press the 'ENT' key. This
screen is shown below.

```
********************************************
*     ** ALL RECORDED DATA WILL BE LOST **     *
*                                              *
*    YOU MUST REMAIN IN THIS RECORD SETUP      *
*          IN ORDER TO RETAIN DATA             *
*                                              *
*  PRESS 'ENT' TO RETURN TO CURRENT SETUP      *
*                    OR                        *
*       PRESS ANY FUNCTION KEY TO EXIT         *
********************************************
```

3.3.4 A429 BREAK MODE

The select mode of the receive function must always be setup in order to generate a breakpoint and review data history. A break may be generated manually or by programming a label/data condition. Both cases allow the user to perform a detailed examination of current and history data for all labels that have been received. A warning message is displayed on the breakpoint setup screen if 'Select' mode has not been setup. To generate a manual break or to program a breakpoint requires that the user push the 'BRK' pushbutton while the receiver is active, generating the following screen.

```
**********************************************
*     * RECEIVE DATA BREAKPOINT SETUP *      *
*                                            *
*  ENTER: '1' TO SETUP BRKPT CONDITION       *
*         '2' TO REVIEW DATA HISTORY         *
*            YOU HAVE SELECTED: 1            *
*                                            *
*        PRESS 'ENT' WHEN COMPLETE           *
*                                            *
**********************************************
```

At this point, the user may review history data (by entering a 2) or program a break condition (by entering a 1). Entering a 1 leads to the following setup screen.

```
**********************************************
*          * TRIGGER PULSE/BRKPT SETUP *     *
*                                            *
*   LBL SDI          DATA          SSM P     *
*   ___ ___   _____   __ _     *
*   OCT BIN           BIN           BIN      *
*>EQ    NE     OR    GT    LT    /GT/  /LT/   *
*                                            *
*        PRESS 'ENT' WHEN COMPLETE           *
**********************************************
```

The user enters the desired label in octal format and either 1, 0, or D for "don't care" ('X' appears) in the remainder of the field. The order of the SDI entry is bits 10-9, the data is 29-11, and the SSM is 31-30. The increment pushbutton moves the selector arrow through the various break condition codes in the next line. The conditions are defined in section 3.3.2.2. When all conditions have been set up, the user presses 'ENT' and the DATATRAC 250 is ready to generate a breakpoint on incoming data. Until a break condition occurs, a "WAITING ON RCVR DATA BREAKPT" message appears. When a break condition occurs (or the user elects to review data after a manual break), the following screen appears.

33

```
*************************************************
*     BREAK - 'INC' FOR HIST, 'ENT' TO CONT     *
*          LBL SDI  DATA  SSM  P                *
*          ___  __  ____  __  _                 *
*          ___  __  ____  __  _                 *
*          ___  __  ____  __  _                 *
*          ___  __  ____  __  _                 *
*          ___  __  ____  __  _                 *
*          ___  __  ____  __  _                 *
*************************************************
```

The user may now examine up to 85 history words that preceded the break condition by sequentially pressing 'INC'. The history for the selected label is presented first, but the user can then review 85 words of history for all labels that have been received. At any time the user may exit from the present label history and jump to the next label's history field. This is accomplished by pressing 'CLR' and allows the user to very rapidly cycle through a large amount of saved data.

The history information is formatted as follows:

SDI   -   The order of the bits is 10-9.

DATA   -   A five character hexidecimal data
            presentation is used for the data field,
            bits 29 through 11 with a zero pad bit
            added at either the beginning or end of
            the word depending on the label as is
            defined in Section 3.3.1.2.

SSM   -   The order or the bits is 31-30.

When in the data review screen, pressing 'ENT' will cause another break to occur on the currently setup condition. Pressing any function key from this screen will cause an exit from break mode into the selected function.

3.4   ASCB OPERATION

3.4.1   ASCB RECEIVE MODE

3.4.1.1   RECEIVER SETUP DESCRIPTION

The ASCB receiver setup screen is shown below.

```
**********************************************
*              * DATA RECEIVER SETUP *        *
*                                             *
*   SELECT FORMAT (1=DEC,2=HEX,3=BIN): DEC    *
*   SELECT LABELS (1=ALL,2=SEL,3=OFF): ALL    *
*   ENTER EQUIP ADDR (00=DISPLAY ALL): 00     *
*                                             *
*          PRESS 'ENT' TO CONTINUE            *
*                                             *
**********************************************
```

A. Select Format

The first setup line prompts the user to press either a '1' for
decimal format (engineering units), a '2' for hexidecimal
format, or a '3' for binary format. The basic presentation
format is hexidecimal or binary, and all data will be
intelligently presented in either of these two formats. For
certain data words, however, range and scaling information have
been   prestored   in   an internal table so that these data
parameters may be viewed as decimal values.   The list of
decimal scaled words is given in Table 3-2. All equipment
addresses   which   are   currently   undefined   by   the   ASCB
specification and therefore not listed in Table 3-2, can still
be received and will be displayed in the hex format when
decimal format is selected for the receiver. Press the 'INC'
pushbutton for the next setup line.

B. Select Labels

The second line allows the user to select 'ALL', 'SEL' or
'OFF'.

Selecting 'ALL' will cause all the word sequence positions
(WSP) to be displayed in numerical order for the selected
equipment address.

Selecting 'SEL' will allow the user to preset a selected set of
word sequence positions (up to 16) to be displayed (rather than
all incoming data).   This may be desirable to reduce cluttering
of the display or to place several WSP's in a particular order
for viewing.   If 'SEL' is selected, the following menu will be
displayed upon exiting the current setup menu.

Below is the menu for setting up the selected WSP's. WSP's can be entered using the 0-9 keys. The 'CLR' key can be used to clear an incorrect entry.

```
***********************************************
*          * ASCB RECEIVER SELECT SETUP *      *
*    ENTER UP TO 16 WSPs FOR EQUIP ADR = 10    *
*          (ENTER: "001  002  ...")            *
*                                              *
*    001  002  004  010  022  003  _           *
*                                              *
*                                              *
*          PRESS 'ENT' TO CONTINUE             *
***********************************************
```

Selecting 'OFF' will turn the receiver off.

Press 'INC' to move to the next line.

C. Equipment Address

The third setup line requests the hex address for the equipment to be received on the ASCB bus. If '00' is entered, the following screen will appear after exiting the current screen (or after exiting the Select Screen if 'SEL' was selected above). This screen displays the addresses of all the equipments that are being received on the bus.

```
***************************************************
*               * ASCB RECEIVER DATA *             *
*          EQUIPMENT ADDRESSES RECEIVED:           *
*                                                  *
*    10   2B   02   70                             *
*                                                  *
*                                                  *
*                                                  *
*       SELECT EQUIP ADDR TO RECEIVE: __           *
***************************************************
```

A hex address, followed by the 'ENT' key, must be entered to exit this screen.

3.4.1.2 RECEIVER DATA DISPLAY

A. Data Format

When the receiver setup is complete, one of the following three receive data screens will be displayed depending on the data format previously selected. Scaling information for DECIMAL mode is given in Table 3-2. Data that is displayed in scaled units is displayed with a 2 digit hex byte preceding the data. This byte contains discrete bits that have been packed into the 16 bit data word for the particular WSP. Table 3-2 defines

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which bits are contained in this byte. All the bits are LSB justified within the byte when displayed.

DECIMAL:

```
************************************************
*EQ ADR=10 FMCL  * ASCB RCV * RT=0050 MSEC *
*WSP      DECIMAL      WSP      DECIMAL      *
*001         4710      002 1001000011110001 *
*003 1111100000001110 004 0000000000110000 *
*005   01  235.89      006   01   087.56     *
*007      1F88         008   01  1654.4      *
*009   01  345.78      010   01   032.40     *
*011   01  180.00      012   00  127.99      *
************************************************
```

HEX:

```
************************************************
*EQ ADR=10 FMCL  * ASCB RCV * RT=0050 MSEC *
*WSP     15-HEX-0      WSP     15-HEX-0      *
*001      4710         002      90F1         *
*003      F80E         004      0030         *
*005      1783         006      B38C         *
*007      1F88         008      09DA         *
*009      987D         010      A987         *
*011      7855         012      EE4C         *
************************************************
```

BINARY:

```
************************************************
*EQ ADR=10 FMCL  * ASCB RCV * RT=0050 MSEC *
*WSP 15-----BIN-----0 WSP 15-----BIN-----0 *
*001 0100010000010000 002 1010110111001100 *
*003 1001010101010000 004 1111101010001001 *
*005 1111110000001000 006 1111100100010100 *
*007 0000000000001100 008 0000010101010101 *
*009 1110100010100010 010 1010101010101010 *
*011 1000100000000100 012 1110001101001000 *
************************************************
```

B. Equipment Address Mnemonic

On the first line of the data display, a four letter mnemonic is listed next to the equipment address hex number. This mnemonic is to help the user more easily identify the equipment type that corresponds to the data that is being displayed. A definition of these mnemonics is given in Table 3-3.

Below is an example ('FMCL' = FMCS Left):

```
************************************************
*EQ ADR=10 FMCL  * ASCB RCV * RT=0050 MSEC *
*                                           *
```

C.   Receive Rate

The update rate of the data being displayed is computed and
displayed in the right hand corner on the first line of the
display.   This rate is an instantaneous rate displayed in
milliseconds.   The range on this rate is 10 msec to 999 msec.
The accuracy is +/- 5%.

An example is shown below in bolded type:
```
        ********************************************
        *EQ ADR=10 FMCL  * ASCB RCV * RT=0050 MSEC *
        *                                          *
```

D.   Scroll Data

If the number of received WSP's is greater than the display
area, lines may be rotated upward by pressing the 'INC'
pushbutton.

E.   Freeze Data

At any time while displaying dynamic data, the user may
"freeze" the display by pressing 'ENT'. To return to normal
display operation, press any key.

F.   Clear Data

The 'CLR' pushbutton can be used to clear old information from
the display.

TABLE 3-2

DECIMAL MODE SCALING FOR ASCB

EQUIPMENT ADDRESS = 30, 31   AFCS 1.0

WSP	PARAMETER	FORMAT	RANGE	DISCRETES
001	CONTROL/ADDRESS	HEX		
002	AFCS FUNCTIONS STATUS	BINARY		—
003	SENSOR SELECT STATUS	BINARY		
004	MODE ACTIVE IDENT	HEX		
005	GUIDANCE SUB-MODES	HEX		
006	PITCH MODE ARMED	HEX		
007	HEADING ERROR OFFSET	HEX		
008	SPARE	HEX		
009	SELECT HEADING	SEMICIRC	0-360 DEG	0
010	MACH REF SYNC DATA 1	2'S COMP	±2.56 MACH	—
011	IAS REF SYNC DATA 1	2'S COMP	±1024 KNTS	—
012	MACH REF SYNC DATA 2	2'S COMP	±2.56 MACH	—
013	IAS REF SYNC DATA 2	2'S COMP	±1024 KNTS	—
014	REQ TEST DATA 1	HEX		
015	REQ TEST DATA 2	HEX		
016	REQ TEST DATA 3	HEX		
017	REQ TEST DATA 4	HEX		
018	PITCH COMMAND BAR	2'S COMP	±90 DEG	3-0
019	ROLL COMMAND BAR	2'S COMP	±90 DEG	3-0
020	FAST-SLOW COMMAND	HEX		
021	STATUS FLAGS	BINARY		
022	VERT. MODE ANNUN.	BINARY		
023	LATERAL MODE ANNUN.	BINARY		
024	AIR DATA COMMAND	2'S COMP	±25600 FPM	1-0
025	FLAGS TO EFIS & FMCS	BINARY		
026	SPEED INTERVENTION	2'S COMP	±2.0 MACH	0
027	V/S REF SYNC DATA	2'S COMP	±426.67 FPS	—
028	V/S REF SYNC DATA	2'S COMP	±426.67 FPS	—
029	VERTICAL SYNC DATA	2'S COMP	±90	—
030	LATERAL SYNC DATA	2'S COMP	±180	—
031	ALTITUDE SYNC DATA	2'S COMP	±65536 FT	—
032	MAINTENANCE TEST	BINARY		
033	MAINTENANCE DATA	BINARY		
034	MAINTENANCE TEST	BINARY		
035	CROSS SIDE FGC STATUS	BINARY		
036	SELECTED ALTITUDE	2'S COMP	±81920 FT	1-0
037	SENSOR MIS-COMP RESOL.	BINARY		
038	DISC TO FWC FOR EICAS	BINARY		
039	MESSAGES	BINARY		
040	SPARE	HEX		
041	CHECKSUM	HEX		

EQUIPMENT ADDRESS = 06, 07   DADC 1.0

WSP	PARAMETER	FORMAT	RANGE	DISCRETES
001	CONTROL/ADDRESS	HEX		
002	PRESSURE ALTITUDE	2'S COMP	±65536 FT	–
003	BARO ALTITUDE	2'S COMP	±65536 FT	–
004	ALTITUDE RATE	2'S COMP	±32768 FPM	1-0
005	CALIBRATED AIRSPEED	2'S COMP	±1024 KNTS	1-0
006	TRUE AIRSPEED	2'S COMP	±1024 KNTS	1-0
007	MACH	2'S COMP	±2.0 MACH	1-0
008	TOTAL AIR TEMP	2'S COMP	±256 DEG C	2-0
009	STATIC AIR TEMP	2'S COMP	±256 DEG C	2-0
010	PRESELECTED ALTITUDE	2'S COMP	±81920 FT	1-0
011	MAX ALLOWABLE AIRSPEED	2'S COMP	±1024 KNTS	1-0
012	IMPACT PRESSURE	2'S COMP	±64 IN-HG	–
013	TRUE AOA	2'S COMP	±180 DEG	2-0
014	NORMALIZED AOA	2'S COMP	±2.0	3-0
015	SPARE	HEX		
016	SPARE	HEX		
017	SPARE	HEX		
018	SPARE	HEX		
019	SPARE	HEX		
020	TOTAL PRESSURE	2'S COMP	±64 IN-HG	–
021	MAX ALLOWABLE MACH	2'S COMP	±2.0 MACH	1-0
022	BARO SET (IN-HG)	2'S COMP	±32.768 IN-HG	–
023	BARO SET (MILLIBARS)	2'S COMP	±2048 mB	3-0
024	DISCRETES	BINARY		
025	MAINTENANCE TEST WORD	HEX		
026	CHECKSUM	HEX		

EQUIPMENT ADDRESS = 70, 71, 72, 73   DAU 1.0

WSP	PARAMETER	FORMAT	RANGE	DISCRETES
001	CONTROL/ADDRESS	HEX		
002	TURBINE GAS TEMP	INT	0-2047 DEG C	15-11
003	RADIO ALTITUDE	2'S COMP	±2553.6 FT	2-0
004	APU EGT DAU #1	INT	0-1019 DEG C	15-12
005	APU RPM DAU #1	INT	0-122.3 %RPM	15-12
006	STAB POS DAU #1	INT	0-10.23 DEG	15-10
007	A/D CALIBRATION	HEX		
008	FUEL FLOW	INT	0-10485 LB/HR	15
009	LOW PRESSURE TACH	INT	0-163.83 %N1	15-14
010	HIGH PRESSURE TACH	INT	0-163.83 %N2	15-14
011	ENGINE PRESSURE RATIO	BNR	0-2.047 EPR	3-0
012	SPARE	HEX		
013	SPARE	HEX		
014	SPARE	HEX		
015	DISCRETES	BINARY		
016	DISCRETES	BINARY		
017	DISCRETES	BINARY		
018	DISCRETES	BINARY		
019	DISCRETES	BINARY		
020	SPARE	HEX		
021	SPARE	HEX		

ALTERNATE DATA 0:

WSP	PARAMETER	FORMAT	RANGE	DISCRETES
022	ENG OIL TEMP	2'S COMP	±409.6 DEG C	2-0
023	TURB VIB INT - LP	INT	0-5.096 IPS	15-12
024	TURB VIB INT - HP	INT	0-5.096 IPS	15-12
025	FUEL QUANTITY	INT	0-15306.5 LBS	15-12
026	COMB HYD PRESSURE DAU#1	INT	0-4130.1 PSI	15-12
027	UTIL HYD PRESSURE DAU#1	INT	0-4130.1 PSI	15-12
028	ENG BLEED AIR PRESS	INT	0-122.3 PSI	15-12
029	WHEEL BRAKE PRESS	INT	0-4130.1 PSI	15-12
030	COMB HYD QUANT DAU#1	INT	0-102.915 %	15-12
031	BATTERY AMPS	2'S COMP	±409.6 AMPS	3-0
032	BATTERY VOLTS	INT	0-37.367 VDC	15-12
033	AC VOLTS	INT	0-167.527 VAC	15-12
034	ESS AC VOLTS DAU #1	INT	0-167.527 VAC	15-12
035	SPARE	HEX		
036	SPARE	HEX		

EQUIPMENT ADDRESS = 70, 71, 72, 73   DAU 1.0 - CONTINUED

WSP	PARAMETER	FORMAT	RANGE	DISCRETES
ALTERNATE DATA 1:				
022	ENG FUEL TEMP	2'S COMP	±409.6 DEG C	2-0
023	FUEL TANK TEMP	2'S COMP	±409.6 DEG C	2-0
024	ENG OIL PRESSURE	INT	0-76.59 PSI	15-12
025	ESS DC VOLTS DAU #1	INT	0-51.047 VDC	15-12
026	DC VOLTS	INT	0-51.047 VDC	15-12
027	DC LOAD	INT	0-163.066 %	15-12
028	AUX DC LOAD	INT	0-163.066 %	15-12
029	AC LOAD	INT	0-203.478 %	15-12
030	AUX AC LOAD	INT	0-205.727 %	15-12
031	AC FREQUENCY	INT	0-511 HZ	15-9
032	ESS AC FREQ DAU #1	INT	0-511 HZ	15-9
033	DAU BOX TEMP	INT	0-4095 DEG C	15-12
034	SPARE	HEX		
035	SPARE	HEX		
036	SPARE	HEX		
037	CHECKSUM	HEX		

EQUIPMENT ADDRESS = 2B, 2F   DC 1.0

WSP	PARAMETER	FORMAT	RANGE	DISCRETES
001	CONTROL/ADDRESS	HEX		
002	NAV FORMAT SELECT	BINARY		
003	BEARING SELECT	BINARY		
004	TEST MODE	BINARY		
005	SYSTEM MODE	BINARY		
006	SENSOR SELECT	BINARY		
007	ACTIVE NAV SELECT	BINARY		
008	PREVIEW NAV SELECT	BINARY		
009	THRUST REF SYS MODE	BINARY		
010	RSV-REL HEADING SELECT	SEMICIRC	0-360 DEG	3-0
011	REL COURSE #1 SELECT	SEMICIRC	0-360 DEG	3-0
012	REL COURSE #2 SELECT	SEMICIRC	0-360 DEG	3-0
013	V1 SPEED SET (80-250)	BNR	0-511 KNTS	6-0
014	V2 SPEED SET (80-250)	BNR	0-511 KNTS	6-0
015	Vr SPEED SET (80-250)	BNR	0-511 KNTS	6-0
016	Vref SPEED SET (80-250)	BNR	0-511 KNTS	6-0
017	RAD ALT SET (0-2500)	BNR	0-4095 FT	3-0
018	SPARE	HEX		
019	NORM. AOA SET (.2-.59)	2'S COMP	±1.28 DEG	6-0
020	L EPR CMD SET (.85-2)	BNR	0-5.11 EPR	6-0
021	R EPR CMD SET (.85-2)	BNR	0-5.11 EPR	6-0
022	Vse SPEED SET (80-250)	BNR	0-511 KNTS	6-0
023	Vfs SPEED SET (80-250)	BNR	0-511 KNTS	6-0
024	PFD FORMAT SELECT	BINARY		
025	MAINTENANCE TEST WORD	HEX		
026	SPARE	HEX		
027	SPARE	HEX		
028	CHECKSUM	HEX		

EQUIPMENT ADDRESS = 08, 0B, 0C   EFIS 1.0

WSP	PARAMETER	FORMAT	RANGE	DISCRETES
001	CONTROL/ADDRESS	HEX		
002	SOURCE IDENTIFIER	BINARY		
003	SOURCE IDENTIFIER	BINARY		
004	SOURCE IDENTIFIER	BINARY		
005	SOURCE IDENTIFIER	BINARY		
006	EFIS DISPLAY SOURCES	BINARY		
007	COMPARATOR MONITOR STAT	BINARY		
008	HEADING/TRK ERROR	SEMICIRC	0-360 DEG	0
009	DECISION HEIGHT	2'S COMP	±2048 FT	3-0
010	DISPLAYED DISCRETES	BINARY		
011	ARMED LAT DEV	2'S COMP	±299.8 MAMPS	3-0
012	ARMED VERT DEV	2'S COMP	±399.7 MAMPS	3-0
013	SELECT COURSE (SRN)	SEMICIRC	0-360 DEG	3-0
014	VOR BEARING	SEMICIRC	0-360 DEG	3-0
015	DISPLAYED LAT DEV	2'S COMP	±299.8 MAMPS	3-0
016	DISPLAYED VERT DEV	2'S COMP	±399.7 MAMPS	3-0
017	DISPLAYED RADIO ALT	2'S COMP	±2048 FT	3-0
018	DESIGNATOR LAT 1	BCD	0-99.9 MIN	3-0
019	DESIGNATOR LAT 2	BCD	0-999 DEG	3-0
020	DESIGNATOR LONG 1	BCD	0-99.9 MIN	3-0
021	DESIGNATOR LONG 2	BCD	0-999 DEG	3-0
022	DME DISTANCE	BCD	0-399.9	15-14
023	DISPLAYED ROLL	SEMICIRC	0-360 DEG	3-0
024	DISPLAYED PITCH	SEMICIRC	0-360 DEG	3-0
025	COURSE ERROR (SRN)	SEMICIRC	0-360 DEG	3-0
026	DISPLAYED HEADING	SEMICIRC	0-360 DEG	3-0
027	DISPLAYED VERT SPEED	2'S COMP	±65536 FPM	3-0
028	MLS GP ANGLE	BNR	0-51.1 DEG	6-0
029	MLS GROWTH	BNR	0-6300 MTRS	4-0
030	DISPLAYED AIRSPEED	2'S COMP	±1024 KNTS	1-0
031	DISPLAYED BARO ALT	2'S COMP	±65536 FT	0
032	CHECKSUM	HEX		

EQUIPMENT ADDRESS = 10, 14   FMCS - BASIC DATA 1.0

WSP	PARAMETER	FORMAT	RANGE	DISCRETES
001	CONTROL/ADDRESS	HEX		
002	FMCS STATUS	BINARY		
003	SNSOR/RADIO INFORMATION	BINARY		
004	FMCS CONTROL STATUS	BINARY		
005	PPOS LATITUDE	SEMICIRC	0-360 DEG	-
006	PPOS LONGITUDE	SEMICIRC	0-360 DEG	-
007	PPOS LONG (UNSCALED)	HEX		
008	GROUND SPEED	BNR	0-4095 KNTS	0
009	TRACK ANGLE TRUE	SEMICIRC	0-360 DEG	0
010	DRIFT ANGLE	SEMICIRC	0-360 DEG	0
011	WIND DIRECTION	SEMICIRC	0-360 DEG	0
012	WIND SPEED	BNR	0-255 KTS	0
013	X-TRACK DISTANCE	2'S COMP	±128 NM	1-0
014	VERTICAL DEVIATION	2'S COMP	±16384 FT	0
015	DISTANCE TO WAYPT	BNR	0-4095 NM	0
016	BEARING TO WAYPT	SEMICIRC	0-360 DEG	0
017	DUAL NAV FLT PLAN CNTL	HEX		
018	DESIRED COURSE	SEMICIRC	0-360 DEG	0
019	SPARE	HEX		
020	BANK ANGLE COMMAND	2'S COMP	±64 DEG	0
021	MACH TARGET	2'S COMP	±1.28 MACH	0
022	VERTICAL SPEED TARGET	2'S COMP	±16384 FPM	0
023	ALTITUDE TARGET	2'S COMP	±81920 FT	1-0
024	CAS TARGET	2'S COMP	±1024 KNTS	0
025	DISCRETES	BINARY		
026	RADIO CHANNEL NUMBER	INT	0-65536	-
027	MAGNETIC VARIATION	SEMICIRC	0-360 DEG	6-0
028	SPARE	HEX		
029	SPARE	HEX		
030	SPARE	HEX		
031	MAINTENANCE TEST DATA	BINARY		
032	CHECKSUM	HEX		

EQUIPMENT ADDRESS = 12, 16   FMCS - BACKGRND CODE 0001 VER 1.0

WSP	PARAMETER	FORMAT	RANGE	DISCRETES
001	CONTROL/ADDRESS	HEX		
002	HEADER CODE	HEX		
003	RESERVED	HEX		
004	RESERVED	HEX		
005	RESERVED	HEX		
006	RESERVED	HEX		
007	RESERVED	HEX		
008	RESERVED	HEX		
009	RESERVED	HEX		
010	RESERVED	HEX		
011	RESERVED	HEX		
012	RESERVED	HEX		
013	AMBER V SPEED	2'S COMP	±1024 KNTS	1-0
014	BLUE V SPEED	2'S COMP	±1024 KNTS	1-0
015	GREEN V SPEED	2'S COMP	±1024 KNTS	1-0
016	RESERVED	HEX		
017	RESERVED	HEX		
018	RESERVED	HEX		
019	WHITE V SPEED	2'S COMP	±1024 KNTS	1-0
020	GROWTH V SPEED	2'S COMP	±1024 KNTS	1-0
021	GROWTH V SPEED	2'S COMP	±1024 KNTS	1-0
022	GMT	INT	0-65535 MIN	-
023	GMT DATE	HEX		
024	DATE	INT	0-255 DAY	15-9
025	GMT AT WAYPOINT	BNR	0-32767 MIN	0
026	GMT AT DESTINATION	BNR	0-32767 MIN	0
027	SPARE	HEX		
028	SPARE	HEX		
029	SPARE	HEX		
030	TIME TO WAYPOINT	BNR	0-511 MIN	0
031	DISTANCE TO DESTIN.	BNR	0-8192 NM	0
032	MAGNETIC VARIATION	SEMICIRC	0-360 DEG	6-0
033	PARALLEL OFFSET	2'S COMP	±64 NM	5-0
034	PPOS LATITUDE CHECK	HEX		
035	PPOS LONGITUDE CHECK	HEX		
036	SPARE	HEX		
037	SPARE	HEX		
038	SPARE	HEX		
039	SYNC STATUS	BINARY		
040	LEG SEQUENCE COUNT	HEX		
041	ACTIVE VERT LEG POINTER	HEX		
042	CURRENT VERTICAL MODE	BINARY		
043	RESERVED	HEX		
044	SPARE	HEX		
045	SPARE	HEX		
046	SPARE	HEX		

EQUIPMENT ADDR = 12, 16 FMCS - BCKGD CODE 0001 VER 1.0 - CONT.

WSP	PARAMETER	FORMAT	RANGE	DISCRETES
047	LTS #1 SENSOR LATITUDE	SEMICIRC	0-360 DEG	0
048	LTS #1 SENSOR LONG	SEMICIRC	0-360 DEG	8
049	SENSOR LONG (UNSCALED)	HEX		
050	LTS #2 SENSOR LATITUDE	SEMICIRC	0-360 DEG	0
051	LTS #2 SENSOR LONG	SEMICIRC	0-360 DEG	8
052	SENSOR LONG (UNSCALED)	HEX		
053	LTS #3 SENSOR LATITUDE	SEMICIRC	0-360 DEG	0
054	LTS #3 SENSOR LONG	SEMICIRC	0-360 DEG	8
055	SENSOR LONG (UNSCALED)	HEX		
056	SPARE	HEX		
057	SPARE	HEX		
058	SPARE	HEX		
059	NAV OPERATION MODE	HEX		
060	CUSTOM DATA CHECKSUM	HEX		
061	TEMPORARY DATA CHECKSUM	HEX		
062	DISCRETES	BINARY		
063	SPARE	HEX		
064	SPARE	HEX		
065	SPARE	HEX		
066	SPARE	HEX		
067	SPARE	HEX		
068	SPARE	HEX		
069	SPARE	HEX		
070	SPARE	HEX		
071	SPARE	HEX		
072	SPARE	HEX		
073	SPARE	HEX		
074	SPARE	HEX		
075	SPARE	HEX		
076	SPARE	HEX		
077	CHECKSUM	HEX		

EQUIPMENT ADDRESS = 23, 27 FWC 1.0

WSP	PARAMETER	FORMAT
001	CONTROL/ADDRESS	HEX
002	MSG TEXT LINES 1,7,13,19 CNTL WORD	BINARY
003	CHARACTER 2,1	ASCII
004	CHARACTER 4,3	ASCII
005	CHARACTER 6,5	ASCII
006	CHARACTER 8,7	ASCII
007	CHARACTER 10,9	ASCII
008	CHARACTER 12,11	ASCII
009	CHARACTER 14,13	ASCII
010	CHARACTER 16,15	ASCII
011	CHARACTER 18,17	ASCII
012	MSG TEXT LINES 2,8,14,20 CNTL WORD	BINARY
013	CHARACTER 2,1	ASCII
014	CHARACTER 4,3	ASCII
015	CHARACTER 6,5	ASCII
016	CHARACTER 8,7	ASCII
017	CHARACTER 10,9	ASCII
018	CHARACTER 12,11	ASCII
019	CHARACTER 14,13	ASCII
020	CHARACTER 16,15	ASCII
021	CHARACTER 18,17	ASCII
022	MSG TEXT LINES 3,9,15,21 CNTL WORD	BINARY
023	CHARACTER 2,1	ASCII
024	CHARACTER 4,3	ASCII
025	CHARACTER 6,5	ASCII
026	CHARACTER 8,7	ASCII
027	CHARACTER 10,9	ASCII
028	CHARACTER 12,11	ASCII
029	CHARACTER 14,13	ASCII
030	CHARACTER 16,15	ASCII
031	CHARACTER 18,17	ASCII
032	MSG TEXT LINES 4,10,16,22 CNTL WORD	BINARY
033	CHARACTER 2,1	ASCII
034	CHARACTER 4,3	ASCII
035	CHARACTER 6,5	ASCII
036	CHARACTER 8,7	ASCII
037	CHARACTER 10,9	ASCII
038	CHARACTER 12,11	ASCII
039	CHARACTER 14,13	ASCII
040	CHARACTER 16,15	ASCII
041	CHARACTER 18,17	ASCII
042	MSG TEXT LINES 5,11,17,23 CNTL WORD	BINARY
043	CHARACTER 2,1	ASCII
044	CHARACTER 4,3	ASCII
045	CHARACTER 6,5	ASCII
046	CHARACTER 8,7	ASCII
047	CHARACTER 10,9	ASCII
048	CHARACTER 12,11	ASCII
049	CHARACTER 14,13	ASCII
050	CHARACTER 16,15	ASCII
051	CHARACTER 18,17	ASCII

EQUIPMENT ADDRESS = 23, 27   FWC 1.0 - CONTINUED

WSP	PARAMETER	FORMAT
052	MSG TEXT LINES 6,12,18,24 CNTL WORD	BINARY
053	CHARACTER 2,1	ASCII
054	CHARACTER 4,3	ASCII
055	CHARACTER 6,5	ASCII
056	CHARACTER 8,7	ASCII
057	CHARACTER 10,9	ASCII
058	CHARACTER 12,11	ASCII
059	CHARACTER 14,13	ASCII
060	CHARACTER 16,15	ASCII
061	CHARACTER 18,17	ASCII
062	MESSAGE LIST CHECKSUM	HEX
063	MAINTENANCE TEST	HEX
064	MAINTENANCE TEST	HEX
065	INPUT DISCRETES	BINARY
066	BUS CONTROLLER TEST STATUS	BINARY
067	SPARE	HEX
068	SPARE	HEX
069	SPARE	HEX
070	SPARE	HEX
071	SPARE	HEX
072	SPARE	HEX
073	SPARE	HEX
074	CHECKLIST TEST LINE 1 CONTROL WORD	BINARY
075	CHARACTER 2,1	ASCII
076	CHARACTER 4,3	ASCII
077	CHARACTER 6,5	ASCII
078	CHARACTER 8,7	ASCII
079	CHARACTER 10,9	ASCII
080	CHARACTER 12,11	ASCII
081	CHARACTER 14,13	ASCII
082	CHARACTER 16,15	ASCII
083	CHARACTER 18,17	ASCII
084	CHARACTER 20,19	ASCII
085	CHARACTER 22,21	ASCII
086	CHARACTER 24,23	ASCII
087	CHARACTER 26,25	ASCII
088	CHECKLIST TEST LINE 2,5,8,11 CNTL	BINARY
089	CHARACTER 2,1	ASCII
090	CHARACTER 4,3	ASCII
091	CHARACTER 6,5	ASCII
092	CHARACTER 8,7	ASCII
093	CHARACTER 10,9	ASCII
094	CHARACTER 12,11	ASCII
095	CHARACTER 14,13	ASCII
096	CHARACTER 16,15	ASCII
097	CHARACTER 18,17	ASCII
098	CHARACTER 20,19	ASCII
099	CHARACTER 22,21	ASCII
100	CHARACTER 24,23	ASCII
101	CHARACTER 26,25	ASCII

WSP	PARAMETER	FORMAT
102	CHECKLIST TEST LINE 3,6,9,12 CNTL	BINARY
103	CHARACTER 2,1	ASCII
104	CHARACTER 4,3	ASCII
105	CHARACTER 6,5	ASCII
106	CHARACTER 8,7	ASCII
107	CHARACTER 10,9	ASCII
108	CHARACTER 12,11	ASCII
109	CHARACTER 14,13	ASCII
110	CHARACTER 16,15	ASCII
111	CHARACTER 18,17	ASCII
112	CHARACTER 20,19	ASCII
113	CHARACTER 22,21	ASCII
114	CHARACTER 24,23	ASCII
115	CHARACTER 26,25	ASCII
116	CHCKLST CURSOR BOX BEGIN ATTRIBUTES	BINARY
117	CHCKLST CURSOR BOX ENDING ATTRIBUTES	BINARY
118	CHECKSUM	HEX

EQUIPMENT ADDRESS = 19, 1D   PMC AUTOTHROTTLE VER 1.0

WSP	PARAMETER	FORMAT
001	CONTROL/ADDRESS	HEX
002	SPARE	HEX
003	DISCRETES TO AFCS & EFIS	BINARY
004	DISCRETES TO AFCS & EFIS -LIMIT TYPES	BINARY
005	CHECKSUM	HEX

EQUIPMENT ADDRESS = 18, 1C   PMC PERFORMANCE 1.0

WSP	PARAMETER	FORMAT	RANGE	DISCRETES
001	CONTROL/ADDRESS	HEX		
002	GROSS WEIGHT	2'S COMP	±163840 10*LBS	0
003	EPR RATING-TAKEOFF G/A	2'S COMP	±2.56 EPR	3-0
004	EPR RATING-MAX CON	2'S COMP	±2.56 EPR	3-0
005	EPR RATING-CLIMB	2'S COMP	±2.56 EPR	3-0
006	SPARE	HEX		
007	EPR RATING-CRUISE	2'S COMP	±2.56 EPR	3-0
008	V1/V2/VR SPEED	2'S COMP	±512 KNTS	4-0
009	Vse/Vfs/Vref	2'S COMP	±512 KNTS	4-0
010	EPR LIMIT/CMD	2'S COMP	±2.56 EPR	3-0
011	SPARE	HEX		
012	MIN SPEED/FLAP PLACARD	2'S COMP	±512 KNTS	4-0
013	SPARE	HEX		
014	BANK ANGLE BUFFET LIMIT	2'S COMP	±64 DEG	6-0
015	SPARE	HEX		
016	CAS/MACH TARGET	2'S COMP	±2.0 MACH	3-0
017	CHECKSUM	HEX		

EQUIPMENT ADDRESS = 1A, 1E   PMC PERFORMANCE BACKGROUND 1.0

WSP	PARAMETER	FORMAT	RANGE	DISCRETES
001	CONTROL/ADDRESS	HEX		
002	WAYPOINT NUMBER	INT	0-127 WYPT	15-9
003	ALTITUDE	2'S COMP	±65536 FT	-
004	GROUND SPEED CLIMB	2'S COMP	±1024 KNTS	4-0
005	CALIBRATED AIRSPEED	2'S COMP	±512 KNTS	5-0
006	VERTICAL SPEED	2'S COMP	±32768 FPM	4-0
007	WIND SPEED	2'S COMP	±512 KNTS	5-0
008	WIND DIRECTION	2'S COMP	±180 DEG	5-0
009	DELTA ISA TEMPERATURE	2'S COMP	±64 DEC C	6-0
010	FUEL REMAINING	2'S COMP	±65536 LBS	-
011	NEXT WAYPT DATA (11-19)	INT	0-127 WYPT	15-9
012	ALTITUDE	2'S COMP	±65536 FT	-
013	GROUND SPEED CLIMB	2'S COMP	±1024 KNTS	4-0
014	CALIBRATED AIRSPEED	2'S COMP	±512 KNTS	5-0
015	VERTICAL SPEED	2'S COMP	±32768 FPM	4-0
016	WIND SPEED	2'S COMP	±512 KNTS	5-0
017	WIND DIRECTION	2'S COMP	±180 DEG	5-0
018	DELTA ISA TEMPERATURE	2'S COMP	±64 DEC C	6-0
019	FUEL REMAINING	2'S COMP	±65536 LBS	-
020	NEXT WAYPT DATA (20-38)	INT	0-127 WYPT	15-9
021	ALTITUDE	2'S COMP	±65536 FT	-
022	GROUND SPEED CLIMB	2'S COMP	±1024 KNTS	4-0
023	CALIBRATED AIRSPEED	2'S COMP	±512 KNTS	5-0
024	VERTICAL SPEED	2'S COMP	±32768 FPM	4-0
025	WIND SPEED	2'S COMP	±512 KNTS	5-0
026	WIND DIRECTION	2'S COMP	±180 DEG	5-0
027	DELTA ISA TEMPERATURE	2'S COMP	±64 DEC C	6-0
028	FUEL REMAINING	2'S COMP	±65536 LBS	-
029	NEXT WAYPT DATA (29-37)	INT	0-127 WYPT	15-9
030	ALTITUDE	2'S COMP	±65536 FT	-
031	GROUND SPEED CLIMB	2'S COMP	±1024 KNTS	4-0
032	CALIBRATED AIRSPEED	2'S COMP	±512 KNTS	5-0
033	VERTICAL SPEED	2'S COMP	±32768 FPM	4-0
034	WIND SPEED	2'S COMP	±512 KNTS	5-0
035	WIND DIRECTION	2'S COMP	±180 DEG	5-0
036	DELTA ISA TEMPERATURE	2'S COMP	±64 DEC C	6-0
037	FUEL REMAINING	2'S COMP	±65536 LBS	-
038	NEXT WAYPT DATA (38-46)	INT	0-127 WYPT	15-9
039	ALTITUDE	2'S COMP	±65536 FT	-
040	GROUND SPEED CLIMB	2'S COMP	±1024 KNTS	4-0
041	CALIBRATED AIRSPEED	2'S COMP	±512 KNTS	5-0
042	VERTICAL SPEED	2'S COMP	±32768 FPM	4-0
043	WIND SPEED	2'S COMP	±512 KNTS	5-0
044	WIND DIRECTION	2'S COMP	±180 DEG	5-0
045	DELTA ISA TEMPERATURE	2'S COMP	±64 DEC C	6-0
046	FUEL REMAINING	2'S COMP	±65536 LBS	-
047	SPARE	HEX		
048	SPARE	HEX		
049	CHECKSUM	HEX		

EQUIPMENT ADDRESS = 02, 03, 04   SENSOR 1.0

WSP	PARAMETER	FORMAT	RANGE	DISCRETES
001	CONTROL/ADDRESS	HEX		
002	SIN PITCH ANGLE	2'S COMP	±1.0	-
003	COS PITCH ANGLE	2'S COMP	±1.0	-
004	SIN ROLL ANGLE	2'S COMP	±1.0	-
005	COS ROLL ANGLE	2'S COMP	±1.0	-
006	TRUE HEADING	SEMICIRC	0-360 DEG	0
007	INERTIAL ALTITUDE	BNR	0-65536 FT	-
008	PITCH ANGLE	2'S COMP	±90 DEG	0
009	ROLL ANGLE	2'S COMP	±180 DEG	0
010	MAGNETIC HEADING	SEMICIRC	0-360 DEG	0
011	INERTIAL VERT SPEED	2'S COMP	±16384 FPM	0
012	BODY PITCH RATE	2'S COMP	±25 DEG/SEC	3-0
013	BODY ROLL RATE	2'S COMP	±25 DEG/SEC	3-0
014	BODY YAW RATE	2'S COMP	±25 DEG/SEC	3-0
015	LONGITUDINAL ACCEL	2'S COMP	±2.0 G'S	3-0
016	LATERAL ACCEL	2'S COMP	±2.0 G'S	3-0
017	NORMAL ACCEL	2'S COMP	±5.0 G'S	3-0
018	GROUND SPEED	2'S COMP	±1024 KNTS	0
019	TRUE TRACK ANGLE	SEMICIRC	0-360 DEG	0
020	FLIGHT PATH ANGLE	2'S COMP	±90 DEG	3-0
021	VERTICAL ACCEL	2'S COMP	±4.0 G'S	2-0
022	ALONG TRACK ACCEL	2'S COMP	±4.0 G'S	2-0
023	CROSS TRACK ACCEL	2'S COMP	±4.0 G'S	2-0
024	TRACK ANGLE RATE	2'S COMP	±32 DEG/SEC	3-0
025	FLIGHT PATH ACCEL	2'S COMP	±4.0 G'S	2-0
026	PPOS LATITUDE	SEMICIRC	0-360 DEG	0
027	PPOS LONGITUDE	SEMICIRC	0-360 DEG	8
028	PPOS LONG (UNSCALED)	HEX		
029	E-W VELOCITY	2'S COMP	±4096 KNTS	0
030	N-W VELOCITY	2'S COMP	±4096 KNTS	0
031	SPARE	HEX		
032	SPARE	HEX		
033	DISCRETES (IRS)	BINARY		
034	DISCRETES (IRS)	BINARY		
035	MAINTENANCE TEST	BINARY		
036	CHECKSUM	HEX		

TABLE 3-3

EQUIPMENT ADDRESS MNEMONICS

ADDRESS	MNEMONIC	EQUIPMENT
01		UNDEFINED
02	SNSL	SENSOR - LEFT
03	SNSR	SENSOR - RIGHT
04	SNSC	SENSOR - CENTER
05	TCAS	TCAS
06	DADL	DADC - LEFT
07	DADR	DADC - RIGHT
08	EFSL	EFIS - LEFT
09	EFSL	EFIS - LEFT
0A		UNDEFINED
0B	EFSC	EFIS - CENTER
0C	EFSR	EFIS - RIGHT
0D	EFSR	EFIS - RIGHT
0E		UNDEFINED
0F	MFDM	MFD MAILBOX
10	FMCL	FMC BASIC - LEFT
11	FMCL	FMC XLIST - LEFT
12	FMCL	FMC BACKGD - LEFT
13	FMCL	FMC MAILBOX - LEFT
14	FMCR	FMC BASIC - RIGHT
15	FMCR	FMC XLIST - RIGHT
16	FMCR	FMC BACKGD - RIGHT
17	FMCR	FMC MAILBOX - RIGHT
18	PMPL	PMC PERF BASIC - LEFT
19	PMAL	PMC AUTOTHR BASIC -LEFT
1A	PMPL	PMC PERF BACKGD - LEFT
1B	FTIU	FTIU
1C	PMPR	PMC PERF BASIC - RIGHT
1D	PMAR	PMC AUTOTHR BASIC - RIGHT
1E	PMPR	PMC PERF BACKGD - RIGHT
1F	FTIU	FTIU XLIST
20	LRNL	LRNS BASIC - LEFT
21	LRNL	LRNS XLIST - LEFT
22	LRNL	LRNS MAP - LEFT
23	FWCL	FWC - LEFT
24	LRNR	LRNS BASIC - RIGHT
25	LRNR	LRNS XLIST - RIGHT
26	LRNR	LRNS MAP - RIGHT
27	FWCR	FWC - RIGHT

ADDRESS	MNEMONIC	EQUIPMENT
28	INSL	INS BASIC - LEFT
29	INSL	INS XLIST - LEFT
2A	INSL	INS MAP - LEFT
2B	DCL	DC - LEFT
2C	INSR	INS BASIC - RIGHT
2D	INSR	INS XLIST - RIGHT
2E	INSR	INS MAP - RIGHT
2F	DCR	DC - RIGHT
30	AFCL	AFCS - LEFT
31	AFCR	AFCS - RIGHT
32	DMEL	DME - LEFT
33	DMER	DME - RIGHT
34	ADFL	ADF - LEFT
35	ADFR	ADF - RIGHT
36	VHFL	VHF NAV - LEFT
37	VHFR	VHF NAV - RIGHT
38		UNDEFINED
39	DC3	DC - 3
3A-6F		UNDEFINED
70	DAU1	DAU1A
71	DAU1	DAU1B
72	DAU2	DAU2A
73	DAU2	DAU2B
74	DAU3	DAU3A
75	DAU3	DAU3B
76	DAU4	DAU4A
77	DAU4	DAU4B
78-7F		UNDEFINED

3.4.2.2 D/A OUTPUT

If the D/A output mode is selected, the following setup
screen will appear prompting the user to select the desired
operating mode for the D/A.

```
**********************************************
*             * SELECT D/A OUTPUT MODE *        *
*                                               *
*    ENTER:    '0' FOR D/A OUTPUT OFF           *
*              '1' FOR TRIGGER ON RCVD DATA     *
*              '2' FOR RECEIVED DATA            *
*              '3' FOR KEYBD ENTRY DATA         *
*              YOU HAVE SELECTED: 1             *
*              PRESS 'ENT' TO CONTINUE          *
**********************************************
```

The D/A setup choices are listed on the above screen, and the
user must select a corresponding number and then 'ENT'.

A.   D/A Output Off

Selection of '0' or D/A OUTPUT OFF causes 0.0 volts to be
output on the D/A output.

B.   Trigger on Received Data

This feature provides a trigger pulse output on a particular
received data condition for the the equipment address that
has been set up to be received by the receiver function.
Selection of this mode will lead to the following screen.

```
**********************************************
*             * TRIGGER PULSE/BRKPT SETUP *     *
*                                               *
*    EQP   WSP          DATA                    *
*    10    001   00X0 XXXX 0000 XX11            *
*          DEC   .... ...BIN... ....            *
*>EQ   NE     OR    GT    LT    /GT/   /LT/ *
*                                               *
*          PRESS 'ENT' TO CONTINUE              *
**********************************************
```

The WSP is entered as a decimal value between 001 and the max
WSP for the equipment. The data is entered as either 0 or 1
binary values or as a D for don't care (this will appear as
'X'). For the value conditions of GT, LT, /GT/, and /LT/,
the data field is setup primarily to accomodate two's
complement data. After entering the WSP and data, the user
must push 'INC' to continue the setup on the condition line.
The selection arrow can be repeatedly incremented through the
various

options on this line. These are:

EQ   -   D/A output pulse will occur when an exact
           match of the non-'don't care' bits exists.

NE   -   D/A output pulse will occur when any bit does
           not equal any of the non-'don't care' bits.

OR   -   D/A output pulse will occur when a match
           with any of the non-'don't care' bits exists.

GT   -   D/A output pulse will occur when the data
           value in the received word is greater than
           the user defined value.

LT   -   D/A output pulse will occur when the data
           value in the received word is less than the
           user defined value.

/GT/ -   D/A output pulse will occur when the absolute
           data value of the received word is greater
           than the positive user defined value.

/LT/ -   D/A output pulse will occur when the absolute
           data value of the received word is less than
           the positive user defined value.

When complete, 'ENT' should be pressed to start the trigger
pulse outputs. The trigger pulse is a 5.0 +/- 0.5 vdc, 0.50
+/- 0.05 second output pulses.

C.   Received Data Output

This feature allows a specific data parameter to be converted
to a analog signal and output on the D/A output in
real-time. Selection of this mode will lead to the following
screen.

```
******************************************
*           * D/A OUTPUT WORD SETUP *         *
*                                         *
*        WSP # (001,002,...): 001         *
*        SCALE FACTOR (1,2,8): 2          *
*          DATA OFFSET (HEX): 1F00        *
*                                         *
*                                         *
*          PRESS 'ENT' TO CONTINUE        *
******************************************
```

The user is prompted to enter a decimal WSP on the first
line. The second line prompts the user to enter a scale
factor code of either 1, 2 or 8. A '1' means that the
contents of the digital word will be output as a +/- 5.0 volt
signal, '2' means that one half of the digital word will be
represented by the +/- 5.0 volt output range, and an '8'
means that one eighth of the digital word will be represented
by the +/- 5.0 volts. The data offset is a data value that
should be entered in hex and this value is subtracted from
the data word before the scale factor is applied. Pressing
'ENT' completes the setup.

D. Keyboard Data Entry

Selection of '3' or KEYBD ENTRY DATA will lead to the following
screen.

```
*************************************************
*                                               *
*           * D/A OUTPUT DATA SETUP *            *
*                                               *
*             ENTER DATA: +0.50                  *
*                                               *
*                                               *
*           PRESS 'ENT' TO CONTINUE              *
*************************************************
```

This screen allows the user to set up a static value on the D/A
output. A value between +/- 1.00 (+/-1.00 = +/- 5.00 V) is
defined and then entered by the user. The polarity of the data
can be toggled using the 'F' key.

3.4.3   ASCB RECORD MODE

A.   Record Setup

The record feature may be used to store up to 6144 bytes of data.   One, two or three WSP's may be selected to be recorded. The setup screen for record mode is shown below.

```
************************************************
*            * INITIALIZE DATA RECORDER *       *
*                                               *
* ENTER RECORD INTERVAL (SEC): 1.05             *
*   ENTER EQUIP ADDR TO RECORD: 10              *
*      ENTER WSP(S) TO RECORD: 001 004          *
*                                               *
*         PRESS 'ENT' WHEN COMPLETE             *
************************************************
```

The first line requests the desired record interval in seconds.   A decimal value between 0.01 and 5.00 seconds is entered. Pressing the 'INC' moves the cursor to the next line.

The second line requests the equipment address to be recorded. This is entered in hexidecimal, and the 'INC' pushbutton is pressed to move to the next line.

The last line requests the WSP's to record. Up to three may be entered.   If more than one WSP is entered the record memory of 6 Kbytes is shared equally by all WSP's recorded. Each record count uses 2 bytes per WSP recorded.

A change to the setup may be made by pressing the 'CLR' pushbutton or using the 'INC' key to increment to the line to be changed.   Pressing the 'ENT' pushbutton begins the recording process and causes the next screen to be displayed.

B.   Record

```
************************************************
*        * RECORDED DATA - RECORD MODE *        *
* EQP ADR=10    001     002     003             *
*        0001    XXXX    XXXX    XXXX            *
*                                               *
*        RECORD INTERVAL= 1.05 SEC              *
*                                               *
*                                               *
*        PRESS 'ENT' TO TOGGLE RECORD/PLAY      *
************************************************
```

The top line of the display indicates that the record rather than playback mode is active.   The next line displays the equipment address and the WSP's that are being recorded along

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with current received data values. The counter on the left of
the display is the hexidecimal index for the data being
recorded.   At any time the user may switch to playback mode by
pressing the 'ENT' pushbutton.

B.   Playback Mode

When the user has entered playback mode, the following screen
will appear requesting the user to select either hexidecimal,
graphics, or D/A output mode.

```
**********************************************
*              * RECORDED DATA PLAYBK MODE *        *
*                                                   *
*         SELECT PLYBK DISPLAY MODE: 2              *
*          (1=HEX,2=GRAPH,3=D/A OUT)                *
*         SELECT SCALE (1, 2, OR 8): 1              *
*           ENTER DATA OFFSET (HEX): 1F00           *
*                                                   *
*           PRESS 'ENT' TO CONTINUE                 *
**********************************************
```

Only when the graphics or D/A output modes are selected, will
the scaling information and data offset entered on the next two
lines be recognized.   The three options for scaling are:

    1 - The entire signed digital word will be
           represented by the +/- 32 dots of the
           graphics display or the +/- 5.0 volt
           range of the D/A output.

    2 - The +/- 32 dots of the graphics display
           (+/- 5 V D/A output) will represent
           +/- 50% of the digital word.

    8 - The +/- 32 dots of the graphics display
           (+/- 5 V D/A output) will represent
           +/- 12.5% of the digital word.

The data offset word is entered in hex format and is subtracted
from the received data word before the scaling constant is
applied.

After the 'ENT' key is pressed, one of the following three
screens will appear depending on the playback mode selected.

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1) Hex Data Playback

```
**********************************************
*        * RECORDED DATA - PLAY    MODE *        *
* EQP ADR=10    001      002      003           *
*        0000   XXXX     XXXX     XXXX           *
*        0002    .        .        .            *
*        0004    .        .        .            *
*                                               *
*            PRESS 'INC' FOR MORE DATA          *
*        PRESS 'ENT' TO TOGGLE RECORD/PLAY   —*
**********************************************
```

For   the   hexidecimal   format,   an index provides a time
reference for data values. The 'INC' pushbutton is used to step
through the data in the chronological sequence that it was
recorded.

2) Graphic Display Playback
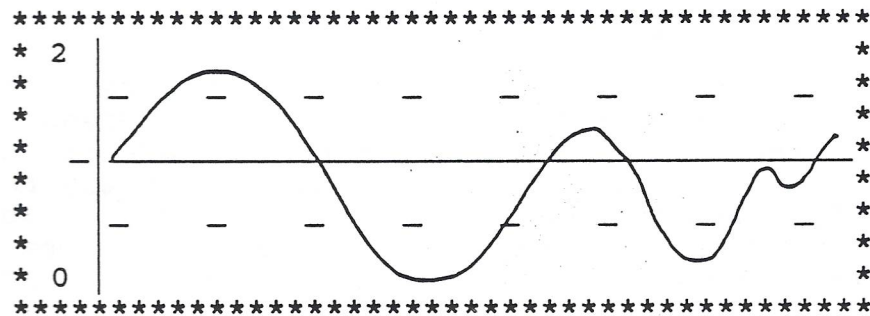
In   the   graphics   presentation,   each dot position in the
horizontal direction represents a record interval point, and
240 dots are presented on each   screen.   In the vertical
direction, +/- 32 dots represent the full digital word, one
half the digital word, or one eighth of the digital word
depending on the selected scale.   Continuing to press 'INC'
will allow cycling through the recorded data. Pressing 'ENT'
will recall the record setup screen and allow the user to
record more data or cycle back to the playback mode with a new
scale selection.   The upper left digit on the graphics screen
indicates the scale that has been selected. The lower left
digit is an index for the current graphic screen. If more than
one WSP has been recorded, the entire data for one WSP is
displayed before beginning the next WSP. The end of one WSP
data field is indicated by a heavy vertical bar on the display.
The data for the next WSP will then begin on the next screen
which can be displayed by pressing the 'INC' key.

3) D/A Data Output

```
*********************************************
*                                           *
*      >>   DUMPING RECORDED DATA TO <<      *
*               D/A OUTPUT PORT              *
*                                           *
*                                           *
*                                           *
*                                           *
*                                           *
*********************************************
```

The record process should be allowed to complete before
initiating a D/A output.   Each recorded word is output an
entire block at a time with no demarcation between labels. The
output is performed using the same time interval employed for
recording the data.   Pressing the 'ENT' key at any time stops
the output.

C.   Record Mode Exit

To exit record mode, cycle to the record screen first and then
press the desired function key. A warning message will appear
to alert the user that exiting record mode or starting a new
record session will cause the data currently recorded to be
lost.   To continue to exit record mode, simply press the
desired function key again.   To return to record mode and
retain the current record data, press the 'ENT' key. This
screen is shown below.

```
*********************************************
*    ** ALL RECORDED DATA WILL BE LOST **   *
*                                           *
*   YOU MUST REMAIN IN THIS RECORD SETUP    *
*           IN ORDER TO RETAIN DATA         *
*                                           *
*  PRESS 'ENT' TO RETURN TO CURRENT SETUP   *
*                     OR                    *
*      PRESS ANY FUNCTION KEY TO EXIT       *
*********************************************
```

3.4.4 ASCB BREAK MODE

A break while in receive mode may be generated manually or by
programming a WSP/data condition. Both cases allow the user to
perform a detailed examination of history data for all WSP's
that have been received. To generate a manual break or to
program a breakpoint requires that the user push the 'BRK'
pushbutton generating the following screen.

```
************************************************
*      * RECEIVE DATA BREAKPOINT SETUP *      *
*                                             *
*  ENTER: '1' TO SETUP BRKPT CONDITION        *
*         '2' TO REVIEW DATA HISTORY          *
*         YOU HAVE SELECTED: 1                *
*                                             *
*         PRESS 'ENT' WHEN COMPLETE           *
*                                             *
************************************************
```

At this point, the user may review history data (by entering a
2) or program a break condition (by entering a 1). Entering a 1
leads to the following setup screen.

A. <u>Programmed Break</u>

```
************************************************
*        * TRIGGER PULSE/BRKPT SETUP *        *
*                                             *
*    EQP  WSP           DATA                  *
*    10   002  00X0 XXXX 0000 XX11            *
*         DEC  .... ...BIN... ....            *
*>EQ   NE    OR    GT    LT   /GT/  /LT/ *
*                                             *
*         PRESS 'ENT' TO CONTINUE             *
************************************************
```

The WSP byte is entered as a decimal value. The data is
entered as either 0 or 1 binary value or as a D for don't care
(displayed as 'X'). For the value conditions GT, LT, /GT/, and
/LT/, the data field is setup primarily to accomodate two's
complement data.

The user then increments to continue the setup on the condition
line. The 'INC' key moves the selector arrow through the
various break condition codes. These conditions were
previously defined in section 3.4.2.2. The user may re-input
his selections at any time by pressing 'CLR'. When the setup
is complete, the user presses 'ENT' and the DATATRAC 250 is
ready to generate a breakpoint on incoming data.

When a breakpoint is generating with the programmed break
condition, a trigger pulse is output on the D/A Output.

B.   Reviewing History Data

When a break is generated either manually or based on
programmed conditions, the user may examine data with the
following screen.

```
**********************************************
*    BREAK - 'INC' FOR HIST, 'ENT' TO CONT  *
*         CNT   EQP   WSP    DATA            *
*         00    10    001    XXXX            *
*         01    10    001    XXXX            *
*         02    10    001    XXXX            *
*                                           *
*                                           *
*                                           *
**********************************************
```

This is accomplished by sequentially pressing 'INC'. The
history for the selected WSP is first presented, but the user
can then review the history for all other WSP data words that
have been received. At any time the user may exit from the
present WSP history and jump to the next WSP's history field.
This is accomplished by pressing 'CLR' and allows the user to
very rapidly cycle through a large amount of saved data.
Between 25 and 256 words of history can be received for a
particular equipment depending on the number of WSP's for that
specific equipment.

The 'ENT' pushbutton can be used to generate another programmed
break based on the same setup conditions or in the case of a
manual break to return to the receive screen. The user may
elect to leave break mode at any time by pressing any of the
other three mode pushbuttons. Pressing 'BRK' allows a new
breakpoint setup.

APPENDIX A

ARINC 429 SPECIFICATION FOR RADIO DATA

VHF/COM — LABEL 030 VHF COM Frequency

Function	PARITY (odd)	SIGN/STATUS MATRIX	10 MHz (2)	1 MHz (8)	0.1 MHz (5)	0.01 MHz (3)	0.001 MHz (0)	RESERVED (SDI)	LABEL
Bit No.	32	31 30	29 28 27	26 25 24 23	22 21 20 19	18 17 16 15	14 13 12 11	10 9	8 7 6 5 4 3 2 1
Example	1	0 0	0 1 0	1 0 0 0	0 1 0 1	0 0 1 1	0 0 0 0	0 0	0 0 0 1 1 0 0 0

ATC TRANSPONDER — LABEL 031 Beacon Transponder Code

Function	PARITY (odd)	SIGN/STATUS MATRIX	Pilot Selected Mode A Reply Code A4 A2 A1 (0-7) (3)	B4 B2 B1 (0-7) (6)	C4 C2 C1 (0-7) (2)	D4 D2 D1 (0-7) (0)	Control Function	Alt. Data Source Select	Ident.	Control Function	Alt. Rep. On/Off	RESERVED (SDI)	LABEL
Bit No.	32	31 30	29 28 27	26 25 24	23 22 21	20 19 18	17	16	15	14 13	12	11	10 9	8 7 6 5 4 3 2 1
Example	1	0 0	0 1 1	1 1 0	1 0 1	0 0 0	0	0	0	0 0	0	0	0 0	1 0 0 1 1 0 0 0
Notes							⟨2⟩	⟨1⟩			⟨2⟩			

⟨1⟩

Bit	Zero	One
11	Altitude Report On	Altitude Reporting Off
13	Ident. OFF	Ident. ON
14	Use #1 Alt. Data Source	Use #2 Alt. Data Source

⟨2⟩ Control Panel Function

Function	BIT 17	16	15	12
DABS ON/ ASAS OFF	0	0	0	1
Reset Aural Warning Signal	0	0	1	0
Remainder are Reserved for future use.				

ADF — LABEL 032 ADF Frequency

Function	PARITY (odd)	SIGN/STATUS MATRIX	1000 kHz (1)	100 kHz (0)	10 kHz (5)	1 kHz (7)	0.5 kHz (0.5)	SPARE	ANT	BFO	RESERVED (SDI)	LABEL
Bit No.	32	31 30	29 28 27	26 25 24 23	22 21 20 19	18 17 16 15	14	13	12	11	10 9	8 7 6 5 4 3 2 1
Example	1	0 0	0 0 1	0 0 0 0	0 1 0 1	0 1 1 1	1	0	0	0	0 0	0 1 0 1 1 0 0 0
Notes							⟨1⟩		⟨2⟩⟨3⟩			

⟨1⟩ When bit no. 14 is "zero", the radio should tune to the whole kilohertz frequency encoded in the word. When bit no. 14 is "one" the radio should tune 0.5kHz above this frequency.

⟨2⟩⟨3⟩

Bit	Zero	One
11	BFO off	BFO on
12	ADF Mode	ANT Mode

ILS

Function	PARITY (odd)	SIGN/STATUS MATRIX		10 MHz (0)			1 MHz (9)				0.1 MHz (3)				0.01 MHz (0)				SPARE	SPARE	ILS CAT.		RESERVED (SDI)		033 LABEL Frequency							
Bit No.	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Example	1	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0

BIT POSITION	12	11
ILS CAT I	0	1
ILS CAT II	1	0
ILS CAT III	1	0
CATEGORY NOT ENCODED	0	0

VOR/ILS

Function	PARITY (odd)	SIGN/STATUS MATRIX		10 MHz (1)			1 MHz (6)				0.1 MHz (6)				0.01 MHz (5)				ILS Mode	SPARE	SPARE	SPARE	RESERVED (SDI)		034 LABEL VOR/ILS Frequency							
Bit No.	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Example	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0
Notes															①																	

① Bit no. 14 should be set to "zero" for VOR frequencies and "one" for ILS frequencies by the tuning information sources.

DME

Function	PARITY (odd)	SIGN/STATUS MATRIX		10 MHz			1 MHz				0.1 MHz				0.00/0.05 MHz	IDENT DISPLAY	MLS FREQ.	ILS FREQ.	DME MODE			SDI		035 LABEL DME Frequency							
Bit No.	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Examples ①	1	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	1	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0
Notes															②	⑦		③		④			⑥									

① Directed Frequency #1, 115.65 MHz, VOR

② Bit 18 is used only for VOR & ILS frequencies and is limited to .00 or .05.

③ Bits 15 & 14 codes: VOR (0,0), ILS (0,1) or MLS (1,0). (1,1) is spare.

④ Refer to table in Section 4.1.2 of ARINC Characteristic 709 for mode codes.

⑤ Although not encoded in the tuning word all VOR & ILS frequencies have 1 as hundreds digit.

⑥ SDI is to be used only on input words. Output frequencies to be coded 0,0.

⑦ Bit 16 when equal to "1" specifies that a displayable BCD output is to be provided for that station, and when bit 17 is a "1", an ident output is to be generated for that station.

HF COM Word#1 Function	PARITY (odd)	SIGN/STATUS MATRIX		10 MHz (2)		1 MHz (3)				0.1 MHz (5)				0.01 MHz (7)				0.001 MHz (9)				USB/LSB MODE	SSM/AM MODE	Word Identifier	037 — LABEL HF COM Frequency							
Bit No.	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Example	0	0	0	1	0	0	0	1	1	0	1	0	1	0	1	1	1	1	0	0	1	0	0	0	1	1	1	1	1	0	0	0
Notes																						①	②									

①   Bit no. 11 should be set to "zero" for LSB operation and "one" for USB operation.

②   Bit no. 10 should be set to "zero" for AM operation and "one" for SSB operation.

HF COM Word#2 Function	PARITY (odd)	SIGN/STATUS MATRIX		.1KHz (5)				NOT USED															RESERVED	Word Identifier	037 — LABEL HF COM Frequency							
Bit No.	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Example	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0

Note: Bit No. 10 is reserved for CW mode select. The CW mode is selected when bit no. 10 is a "1".

When the second word is transmitted, it should immediately follow the first HF word.

APPENDIX B

HEX TRANSMIT DATA EXAMPLES

EXAMPLES FOR HEX MODE TRANSMIT

1.0 BCD data - Labels 001 through 067

1.1 Standard BCD format

These two examples cover the majority of the BCD labels.

a. Label 034

If the user desires to set up label 034 for 114.65 MHz and
to set the ILS Mode discrete bit (bit 14) to 1, the
following setup shows the data to enter on the display:

Note: For the radio data, frequencies above 100 MHz do not
contain the 100 MHz decimal place in the data field, so the
data that is to be setup is 14.65.

```
Bit      3 3 3 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 0
Pos.:    2 1 0 9 8 7 6 5 4 3 2 1 0 9 8 7 6 5 4 3 2 1 0 9
         P S S *---------DATA FIELD----------------* S S
         A S S                                      D D
         R M M                                      I I
```

The data field contains 19 bits; bits 29 through 11.
The 5 digit hex word that is entered corresponds to the
bits shown below:

```
         0 2 2 2   2 2 2 2   2 2 2 1   1 1 1 1   1 1 1 1
         0 9 8 7   6 5 4 3   2 1 0 9   8 7 6 5   4 3 2 1
Hex
digit:      1         2         3         4         5
```

Note that a zero is added to the MSB of the first hex digit
since each hex digit contains 4 bits.

Now to enter the data '14.65', the A429 spec defines which
bits correspond to each digit of the frequency data. This
is: tens of MHz   (1)   -   bits 29-27
              units of MHz   (4)   -   bits 26-23
              tenths of MHz   (6)   -   bits 22-19
              hundredths of MHz (5)   -   bits 18-15

Inserting this data into the data format gives:

```
         0 2 2 2   2 2 2 2   2 2 2 1   1 1 1 1   1 1 1 1
         0 9 8 7   6 5 4 3   2 1 0 9   8 7 6 5   4 3 2 1

         0 0 0 1   0 1 0 0   0 1 1 0   0 1 0 1   1 0 0 0
Hex
digit:      1         2         3         4         5


Hex
Value:      1         4         6         5         8
```

B-2

The last digit contains 3 spare bits (bits 11-13) and the discrete bit 14 which is defined as the ILS mode. The user would enter '14658' in the data field on the transmit screen. The binary to hex conversion table provided in Table B-1 can be used to determine the hex value to enter for transmit data.

b.   Label 025

If the user desires to set up label 025 for 31,295 feet for selected altitude, the following example shows the data to enter on the display:

```
Bit      3 3 3 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 0
Pos.:    2 1 0 9 8 7 6 5 4 3 2 1 0 9 8 7 6 5 4 3 2 1 0 9
         P S S *----------DATA FIELD-----------------* S S
         A S S                                         D D
         R M M                                         I I
```

The data field contains 19 bits; bits 29 through 11.
The 5 digit hex word that is entered corresponds to the bits shown below:

```
        0 2 2 2   2 2 2 2   2 2 2 1   1 1 1 1   1 1 1 1
        0 9 8 7   6 5 4 3   2 1 0 9   8 7 6 5   4 3 2 1
Hex
digit:     1         2         3         4         5
```

Note that a zero is added to the MSB of the first hex digit since each hex digit contains 4 bits.

Now to enter the data '31295', the A429 spec defines which bits correspond to each digit of the frequency data. This is: tens of thousands (3) - bits 29-27
                    thousands (1) - bits 26-23
                    hundreds (2) - bits 22-19
                        tens (9) - bits 18-15
                        ones (5) - bits 14-11

Inserting this data into the data format gives:

```
        0 2 2 2   2 2 2 2   2 2 2 1   1 1 1 1   1 1 1 1
        0 9 8 7   6 5 4 3   2 1 0 9   8 7 6 5   4 3 2 1

        0 0 1 1   0 0 0 1   0 0 1 0   1 0 0 1   0 1 0 1
Hex
digit:     1         2         3         4         5

Hex Value
to enter:  3         1         2         9         5
```

As can be seen from this example, the hex data to enter for transmit is equal to the data itself in engineering units. This is usually the case for most of the BCD labels. The exceptions to this are covered in the examples in 1.2 and 1.3.

1.2 Latitude-Longitude Data; Labels 010, 011, 041, 042

Labels 010, 011, 041, and 042 deviate from the standard BCD
format as shown in the example below.

If the user desires to set up label 041 for 123.42.5
degrees east (or positive), the following setup shows the
data to enter on the display:

```
Bit      3 3 3 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 0
Pos.:    2 1 0 9 8 7 6 5 4 3 2 1 0 9 8 7 6 5 4 3 2 1 0 9
         P S S *---------DATA FIELD----------------* S S
         A S S                                      D D
         R M M                                      I I
```

The usual data field contains 19 bits; bits 29 through 11.
The 5 digit hex word that is entered corresponds to the
bits shown below:

```
         0 2 2 2   2 2 2 2   2 2 2 1   1 1 1 1   1 1 1 1
         0 9 8 7   6 5 4 3   2 1 0 9   8 7 6 5   4 3 2 1
Hex
digit:      1         2         3         4         5
```

Note that a zero is added to the MSB of the first hex digit
since each hex digit contains 4 bits.

For this set of labels, the SDI bits (bits 10 & 9) are used
as part of the data field.   Now to enter the data
'123.42.5', the GAMA 429 data bus spec defines which bits
correspond to each digit of the data.
This is: hundreds of degrees (1) - bit 29
             tens of degrees   (2) - bits 28-25
             units of degrees   (3) - bits 24-21
             tens of minutes   (4) - bits 20-17
             units of minutes   (2) - bits 16-13
             tenths of minutes   (5) - bits 12-09

Inserting this data into the data format gives:

```
     2 2 2 2   2 2 2 2   2 2 2 1   1 1 1 1   1 1 1 1   1 0
     0 9 8 7   6 5 4 3   2 1 0 9   8 7 6 5   4 3 2 1   0 9

     0 1 0 0   1 0 0 0   1 1 0 1   0 0 0 0   1 0 0 1   0 1
Data: 1         2         3         4         2         5

Hex
digit: 1         2         3         4         5

Hex value
to enter: 4       8         D         0         9
```

The data to enter on the transmit screen for the data field
is '48D09' and the SDI field should be entered as '01'. The
sign of the data is entered in the SSM field (bits 31 &

30).   For this example, the SSM should be '00' (see section 2.1.5.1 of the ARINC 429 spec for a complete definition of the SSM).   The binary to hex conversion table provided in Table B-1 can be used to determine the hex value to enter for transmit data.

1.3   HF Com Frequency; Label 037

Label 037 deviates from the standard BCD format as shown in the example below.

If the user desires to set up label 037 for 23.579 MHz, the following setup shows the data to enter on the display:

```
Bit        3 3 3 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 0
Pos.:      2 1 0 9 8 7 6 5 4 3 2 1 0 9 8 7 6 5 4 3 2 1 0 9
           P S S *---------DATA FIELD----------------* S S
           A S S                                       D D
           R M M                                       I I
```

The usual data field contains 19 bits; bits 29 through 11. The 5 digit hex word that is entered corresponds to the bits shown below:

```
           0 2 2 2   2 2 2 2   2 2 2 1   1 1 1 1   1 1 1 1
           0 9 8 7   6 5 4 3   2 1 0 9   8 7 6 5   4 3 2 1
Hex
digit:        1         2         3         4         5
```

Note that a zero is added to the MSB of the first hex digit since each hex digit contains 4 bits.

Now to enter the data '23.579', the ARINC 429 data bus spec defines which bits correspond to each digit of the data.
This is: tens of MHz   (2)   -   bits 29-28
              units of MHz   (3)   -   bits 27-24
              tenths of MHz   (5)   -   bits 23-20
              hundredths of MHz   (7)   -   bits 19-16
              thousandths of MHz (9)   -   bits 15-12

Bit 11 is a discrete data bit defined as USB/LSB MODE. Inserting this data into the data format gives:

```
      2 2 2 2   2 2 2 2   2 2 2 1   1 1 1 1   1 1 1 1
      0 9 8 7   6 5 4 3   2 1 0 9   8 7 6 5   4 3 2 1

      0 1 0 0   0 1 1 0   1 0 1 0   1 1 1 1   0 0 1 1
Data: 2           3         5         7         9
```

```
Hex
digit:    1         2         3         4         5
```

```
Hex value
to enter: 4         6         A         F         3
```

The data to enter on the transmit screen for the data field
is '46AF3'. Note that bit 11 is set to a '1' indicating
that this is the upper significant byte (USB). The binary
to hex conversion table provided in Table B-1 can be used
to determine the hex value to enter for transmit data.

TABLE B-1

BINARY DATA	DECMIMAL DATA	HEX VALUE
0 0 0 0	0	0
0 0 0 1	1	1
0 0 1.0	2	2
0 0 1 1	3	3
0 1 0 0	4	4
0 1 0 1	5	5
0 1 1 0	6	6
0 1 1 1	7	7
1 0 0 0	8	8
1 0 0 1	9	9
1 0 1 0	10	A
1 0 1 1	11	B
1 1 0 0	12	C
1 1 0 1	13	D
1 1 1 0	14	E
1 1 1 1	15	F

2.0   BINARY data - Labels 070 through 377

If the user desires to set up label 210 for 300 knots of
TAS, the following setup shows the data to enter on the
display:

```
Bit      3 3 3 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 0
Pos.:    2 1 0 9 8 7 6 5 4 3 2 1 0 9 8 7 6 5 4 3 2 1 0 9
         P S S *---------DATA FIELD---------------* S S
         A S S                                     D D
         R M M                                     I I
```

The data field contains 19 bits; bits 29 through 11.
The 5 digit hex word that is entered corresponds to the bits
shown below:

```
         2 2 2 2   2 2 2 2   2 2 1 1   1 1 1 1   1 1 1 0
         9 8 7 6   5 4 3 2   1 0 9 8   7 6 5 4   3 2 1 0
Hex
digit:      1         2         3         4         5
```

Note that a zero is added to the LSB of the last hex digit
since each hex digit contains 4 bits.

Now to enter the data '300.0', the A429 spec defines label
210 to be scaled as a 2's complement word with a range of
2048.   The 300 knots must be scaled by the range of 2048 to
compute the proper hex value to enter for transmission.
This is shown below:

$$300/2048 = 0.14648$$

$$0.14648 \times 32768 = 4800$$

4800 is the decimal equivalent of the hex value to be
entered.   A calculator with a decimal to hex conversion is
an good tool to use to convert.

$$4800 \text{ decimal} =   12C0 \text{ hex}$$

If the user does not have any tools available, the
conversion can be performed as follows:

$$4800/4096 = 1 \text{ w/ } 704 \text{ remainder}$$

$$704/256 = 2 \text{ w/ } 192 \text{ remainder}$$

$$192/16 = 12 \text{ w/ } 0 \text{ remainder}$$

For numbers between 10 and 16, use Table B-1 to convert to
a hex digit. The answer using this method is 12C0.

If a negative number is being converted, the number should first be converted and then have a 2's complement performed. In the above example, if -300 was to be entered, after obtaining the 12C0 hex number the 2's complement is computed as shown below:

```
              1         2         C         0
           0 0 0 1   0 0 1 0   1 1 0 0   0 0 0 0
Neg
each       1 1 1 0   1 1 0 1   0 0 1 1   1 1 1 1
bit

Add 1      0 0 0 0   0 0 0 0   0 0 0 0   0 0 0 1

Sum        1 1 1 0   1 1 0 1   0 1 0 0   0 0 0 0

Hex Data      E         D         4         0
```

From the first part, inserting the data 300 knots or 12C0 hex into the data format gives:

```
           0 2 2 2   2 2 2 2   2 2 2 1   1 1 1 1   1 1 1 1
           0 9 8 7   6 5 4 3   2 1 0 9   8 7 6 5   4 3 2 1

           0 0 0 1   0 0 1 0   1 1 0 0   0 0 0 0   0 0 0 0
Hex
digit:        1         2         3         4         5

Hex
Value:        1         2         C         0         0
```

The user should enter '12C00' in the data field on the transmit setup screen.