



OPERATION MANUAL

429EB ARINC 429 TX/RX

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DATE: 11/10/2006

WARNING: INFORMATION SUBJECT TO EXPORT CONTROL LAWS

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ELECTROSTATIC DISCHARGE GENERAL WARNINGS FOR ALL EQUIPMENT

CAUTION: THIS EQUIPMENT MAY CONTAIN ELECTROSTATIC DISCHARGE (ESD) SENSITIVE COMPONENTS. TO PREVENT ESD SENSITIVE EQUIPMENT FROM POSSIBLE DAMAGE, OBSERVE THE FOLLOWING PRECAUTIONS WHEN HANDLING ANY ESD SENSITIVE COMPONENTS, OR UNITS CONTAINING ESD SENSITIVE COMPONENTS:

- a. Maintenance or service personnel must be grounded through a conductive wrist strap, or a similar grounding device, using a 1 M Ω series resistor for equipment protection against static discharge, and personal protection against electrical shock.
- b. All tools must be grounded (including soldering tools) that may come into contact with the equipment. Hand contact will provide sufficient grounding for tools that are not otherwise grounded, provided the operator is grounded through an acceptable grounding device such as a wrist strap.
- c. Maintenance or service of the unit must be done at a grounded, ESD workstation.
- d. Before maintenance or service of the equipment, disconnect all power sources, signal sources, and loads connected to the unit.
- e. If maintenance or service must be performed with power applied, take precautions against accidental disconnection of equipment components. Specifically, do not remove integrated circuits or printed circuit boards from equipment while the equipment has power applied.
- f. All ESD sensitive components are shipped in protective tubes or electrically conductive foam. The components should be stored using the original container/package when not being used or tested. If the original storage material is not available, use similar or equivalent protective storage material.
- g. When ESD sensitive components are removed from a unit, the components must be placed on a conductive surface, or in an electrically conductive container.
- h. When in storage or not being repaired, all printed circuit boards must be kept in electrically conductive bags, or other electrically conductive containers.
- i. Do not unnecessarily pick up, hold, or directly carry ESD sensitive devices.

Failure to comply with these precautions may cause permanent damage to ESD sensitive devices. This damage can cause devices to fail immediately, or at a later time without apparent cause.

Safety and Regulatory Information

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate this equipment.

WARNING The **WARNING** notice denotes a hazard. It calls attention to a procedure, practice, or the like, that, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

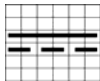
CAUTION The **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.



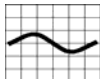
Caution (refer to accompanying documents). Attention – refer to the manual. This symbol indicates that information about usage of a feature is contained in the manual.

Equipment Markings

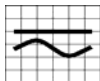
The following markings may appear on this equipment:



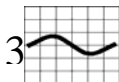
Direct current. This symbol indicates that the equipment requires direct current input.



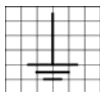
Alternating current. This symbol indicates that the equipment requires alternating current input.



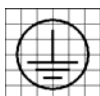
Both direct and alternating current. This symbol indicates that the equipment requires either ac or dc input at the same connector.



Three-phase alternating current. This symbol indicates that the equipment requires 3-phase ac input.



Earth (ground) terminal. This symbol indicates the ground (earth) terminal.



Protective conductor terminal. This symbol indicates the protective ground (earth) terminal.



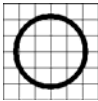
Frame or chassis terminal. This symbol indicates the frame or chassis terminal for connection to ground.



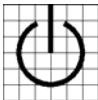
Equipotentiality. This symbol indicates an equipotentiality terminal.



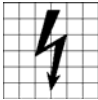
On (Supply). This symbol indicates that the power line switch is ON.



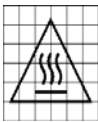
Off (Supply). This symbol indicates that the power line switch is OFF.



Standby. This symbol indicates that the power line switch is in STANDBY.



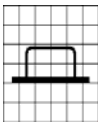
Caution, risk of electric shock. Danger – high voltage.



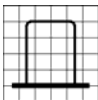
Caution, hot surface. Danger – high temperature surface.



Caution (refer to accompanying documents). Attention – refer to the manual. This symbol indicates that information about usage of a feature is contained in the manual.



In-position of a bistable push control. This symbol indicates the in (on) position of a bistable push control.



Out-position of a bistable push control. This symbol indicates the out (off) position of a bistable push control.



CE Mark. TM of the European Community.



Fuse Symbol. To indicate a fuse.

Warnings

WARNING Do not use the equipment in a manner not specified in this manual!

WARNING Equipment should only be serviced by authorized personnel.

DO NOT OPERATE IN EXPLOSIVE ATMOSPHERES

To avoid explosion, do not operate the equipment in an atmosphere of explosive gas.

WARNING Keep the equipment dry to avoid electrical shock to personnel or damage to the equipment. To prevent damage, never apply solvents to the equipment housing. For cleaning, wipe the equipment with a cloth that is lightly dampened with water, mild detergent, or alcohol. Do not use aromatic hydrocarbons, chlorinated solvents, or methanol-based fluids.

WARNING Equipment has a recharging circuit for rechargeable cells. Use only NiCad size "AA" cells.

WARNING Equipment is not intended for wet locations. Miscellaneous liquids on or in the equipment could cause hazardous conditions.

WARNING TO SERVICE PERSONNEL

Ensure that power is disconnected before removal of any covers.

Declaration of Conformity

DECLARATION OF CONFORMITY

Manufacturer's Name: BFGoodrich Aerospace, JcAIR Test Systems Division

Manufacturer's Address: 400 New Century Parkway
New Century, KS 66031-0009
USA

Declares that the products

Product Name: 429E/429EB/429EX -- ARINC 429 TX/RX

Model Number(s): 01-1001-00/01-1001-10/01-1001-05

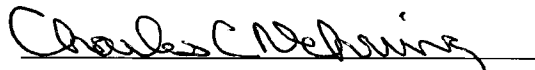
Product Options: All options associated with listed models are covered.

Conform to the following product specifications and carry the CE-marking accordingly.

Low Voltage Directive 73/23/EEC: IEC 61010-1:1990 / EN 61010-1:1993

EMC Directive 89/336/EEC: EN 61326:1998
IEC 61326:1997

Date: 11/8/2000


Chuck Nehring, Director
Quality Assurance/Customer Support

REVISION HISTORY BY DRAWING NUMBER

MANUAL: 429EB ARINC 429 TX/RX OPERATION

REVISION: 0 – November 10, 2006

<u>DRAWING NO.</u>	<u>REV. LEVEL</u>	<u>DRAWING NO.</u>	<u>REV. LEVEL</u>
Table of Contents	00		
Section I	00		
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Section III	00		
Section IV	00		
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**SECTION I
GENERAL INFORMATION**

1.1 INTRODUCTION

This manual provides operational procedures, calibration procedures and maintenance information for the Aeroflex Model 429EB - ARINC 429 Transmitter/Receiver.

1.2 EQUIPMENT DESCRIPTION

The 429EB provides avionics and line maintenance personnel with a convenient, easy to use tool for testing and troubleshooting ARINC 429 avionic systems. The 429EB has unique label definitions designed to facilitate the testing of the Generic Airborne Vibration Monitor (AVM) and the Fuel Quantity Indicating System (FQIS) found on Boeing aircraft as listed in Table 1-1 (also see Appendix A for specific labels used).

BOEING AIRCRAFT	SUB-SYSTEM	BOEING REFERENCE
737,747,757,767	AVM	P/N 332T304
757,767	FQIS, HONEYWELL	P/N S345N001-X

Table 1-1: Boeing Aircraft/Sub-System Applicability

The unit has the capability to transmit up to 10 ARINC 429 labels simultaneously in either Lo (12.5KHz) or Hi Speed (100KHz) from a single transmit port. It can receive and store up to 255 labels.

Special receiver functions include the ability to trap up to 255 words (511 words without label or rate information in the DATA ONLY TRAP Mode). Additionally, the FILTER Mode allows the user to examine only the particular data that matches a predetermined label and bit pattern selected by the operator.

The 429EB is housed in a rugged, compact case with internal, rechargeable NiCad batteries for portable operation. The data is out put via an LCD, Liquid Crystal Display. Selection of data to be transmitted or display of data received, can be in either hexadecimal or engineering format.

Engineering format allows data display using easy-to-understand terminology (miles, degrees etc.) with individual screens for display of word rate. SSM, SDI screens are provided for access to individual label bit positions for frequency or bit management. Hex format is broken down into an 8 bit label field in Octal, bits 32 through 9 in Hex, and a Binary display of SDI (Source Destination Identifier) and SSM (Sign Status Matrix).

1.3 TECHNICAL CHARACTERISTICS

Specification	Characteristic
ENVIRONMENTAL SPECIFICATIONS:	The environmental specifications are as follows.
OPERATING TEMPERATURE:	5 °C to 40 °C.
RELATIVE HUMIDITY:	Maximum of 80% for temperatures up to 31 °C decreasing linearly to 50% at 40 °C.
OPERATING ALTITUDE:	Up to 2 000 m maximum.
IEC OVERVOLTAGE CATEGORY:	II
POLLUTION DEGREE:	1

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SIZE: 18.42 cm H x 11.43 cm W x 6.35 cm D
(7.25" H x 4.5" W x 2.5" D)

MASS (Weight) 1.36 kg (3 lbs.)

CABLES AND WIRES Jumper cable assembly should be fabricated using 2-conductor twisted pair with braided shield. The shield should be folded back onto the insulation and the clamp on the connector should be crimped around the shielding. Also, once the shield is clamped, solder should be added to ensure a stable connection is made between the clamp and wire shield. Refer to figures X and Y.

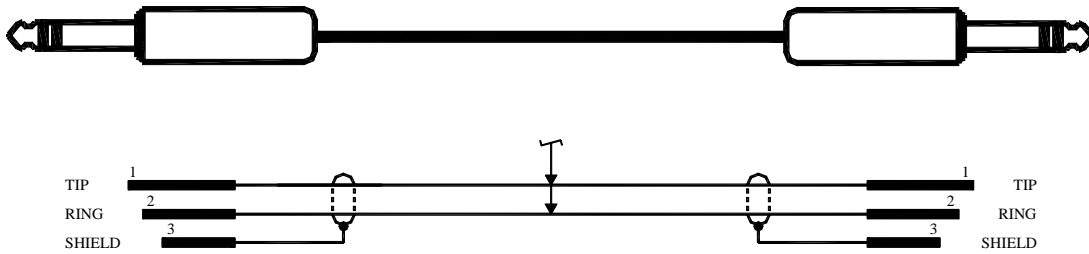


Figure X. Cable Assembly Schematic

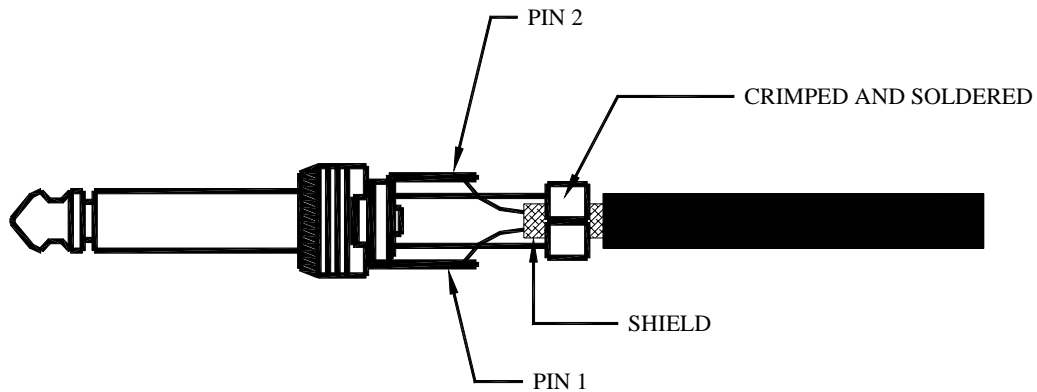



Figure Y. Phone Plug Termination

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EQUIPMENT MEETS THESE LISTED STANDARDS:

EN 61010-1 (IEC 61010-1)
EN 61326 (IEC 61326)
EN 55011 Class A
EN 50082-1

POWER REQUIREMENTS:

110 V/60 Hz/500 mA 

OR

230 V/50 Hz/300 mA 

OR

Six (6) internally mounted AA size rechargeable NiCad cells



ARINC SPECIFICATION:

Conforms to Mark 33 Digital Information Transfer System (DITS) 429-9 unless otherwise noted.

ARINC 429 TRANSMITTER

Pulse Rise/Fall Time:	Low Speed	10.0 ±5.0 μs
	High Speed	1.5 ±0.5 μs
Voltage Levels (Line A to B):	HI	+10.0 ±1.0 V dc
	NULL	0.0 ±0.5 V dc
	LO	-10.0 ±1.0 V dc
Output Impedance:	75 ±5 Ω Line A to B)	
Bit Rate:	Low Speed	12.5 kbps ±0.5%
	High Speed	100.0 kbps ±0.5%
Word Rate:	4 to 59998 ms	
Parity:	ODD or EVEN	

ARINC 429 RECEIVER

Voltage Levels (Line A to B):	HI	+6.5 to +13.0 V dc
	NULL	+2.5 to - 2.5 V dc
	LO	-6.5 to -13.0 V dc
Bit Rate:	Low Speed	8 to 20 kbps
	High Speed	80 to 125 kbps
Word Rate:	±2 ms average	
Input Impedance:	12 kΩ min. (balanced)	

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1.4 UNITS AND ACCESSORIES SUPPLIED

The Aeroflex Model 429EB, JPN: 01-1001-10, is supplied with either a 110 V ac or a 230 V ac battery charger. Two 3-conductor 1/4" phone plugs are included for fabrication of cables to connect to the transmit and receive jacks of the unit. (See Section 1.3 for fabrication instructions.) The accessories provided are as follows:

AEROFLEX P/N	DESCRIPTION
15-0009-00	Battery Charger 110 V ac to 9 V dc 500 mA
OR	
15-0009-01	Battery Charger 230 V ac to 9 V dc 300 mA
AND	
33-1032-00	3-Conductor 1/4" Phone Plugs
06-1001-10	429EB Maintenance/Overhaul Manual

SECTION II INSTALLATION

2.1 GENERAL INFORMATION

This section contains information relating to the unpacking and inspection of the unit. Also included is information concerning charging of the internal batteries and an explanation of the Unit Self Test routine.

2.2 UNPACKING AND INSPECTING EQUIPMENT

Carefully remove the 429EB and accessories from the packing box. Visually inspect the units for any damage incurred during shipment. Should there be damage, save the packing box to show the shipping company when submitting your claim. It is generally a good idea to save the packing box should it become necessary to store or ship the unit.

2.3 EQUIPMENT INSTALLATION

2.3.1 BATTERY CHARGING

The batteries were fully charged when the unit was shipped from the factory. However, if the unit has been stored for an extended period of time, the batteries may have become discharged. Plug the charger into an appropriate voltage outlet (U.S. as well as international voltage chargers are available). A 4 to 5 hour charge should refresh the batteries. The 429EB may be operated while charging or with the charger disconnected. With fully charged batteries, the unit will operate for approximately three to six hours.

***** CAUTION *****

To avoid possible damage to the battery charger, it is recommended that you do NOT have the charger connected to the wall outlet when connecting or disconnecting the charging plug to the 429EB.

2.3.2 CONNECTION TO USER EQUIPMENT

Connect the 429EB TX output jack to the input of the UUT and the 429EB RX jack to the output of the UUT using 3-conductor 1/4 inch phone plugs (see par. 1.4).

2.4 POST INSTALLATION CHECK

2.4.1 UNIT SELF-TEST

The 429EB performs a self-test routine on initial power up. The following tests are performed:

1. Red LED's on the front of the unit will be lit for approximately 0.5 seconds each in the following order: EVEN and ODD Parity, TX and RX. For the remainder of the self-test, unless an error condition exists, the LED's are extinguished. If one of the LED's fails to light, the unit should still function properly, but the LED should be replaced at the earliest opportunity.
2. The EPROM is checked by summing all the memory locations and comparing the result to the know checksum. If the checksums do not match, the unit will signal a checksum error by flashing the RX LED and will attempt to write CHECKSUM ERROR to the display. If the entire EPROM has failed, however, or one of the locations in the checksum subroutine is bad, the program will not be able to execute properly.

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3. The 429EB has RAM in two independent IC's. The unit tests each RAM section separately for data retention and address integrity. It begins by writing the lower 8 bits of the location address to the location. It completely writes to all the locations of the section. It will then read each location and check it's value. If all is OK, it will then repeat this sequence with the exception that it will write the complement of the lower 8 bits of the location address to the location. It performs this sequence for each RAM section.

If the first IC fails this test, the unit will flash the EVEN parity LED and attempt to write NSC RAM ERR to the display. This indicates that U5 has failed its test. If the second IC fails this test, the unit will flash the ODD parity LED and at tempt to write 6116 RAM ERR to the display. This indicates that U3 has failed its test. The unit will then loop indefinitely reading from the failed location.

4. The 429EB has a loop back feature on the digital board to completely test the digital portion of the transmit and receive circuitry. The unit will turn on the loop back circuitry and transmit a word with a label of 000 and a data pattern of AA55AA. After a brief pause, the unit will read its receive buffer and check the data against the transmitted data. If the data is not what is expected, the unit will flash the TX LED and attempt to write LOOP BACK FAILED to the display. No further operations will be possible until the cause of the failure is corrected.

NOTE

The Loop test and Ram tests are not performed if the unit Trap mode is active.

If all tests have been successfully completed, the unit will display SELF TEST OK for approximately 2 seconds and then will enter the operational receive mode and display the number of different labels currently being received.

SECTION III OPERATION

3.1 GENERAL OPERATION DESCRIPTION

The Aeroflex 429EB is a single channel ARINC 429 transmitter and receiver. It can receive and display all ARINC 429 labels (001 - 377). It can simultaneously output up to ten 429 words. Data can be displayed and entered in either hexadecimal or engineering formats.

The transmitter and receiver can operate at either 100kbps (High Speed) or 12.5 kbps (Low Speed). Each mode's speed can be set independently of the other. The parity of the words being transmitted can be set for either ODD or EVEN parity. An LED indicator will show the parity selected for transmitted words (if in the TX mode) or the parity of the currently displayed received word (if in the RX mode).

To minimize battery drain, the 429EB has the capability to sense when there has been no activity (Keypad, TX, RX) for at least 5 minutes. When this happens, the 429EB will shut down some of its circuitry and go to "Sleep". In this state, the 429EB is fully functional, but it is in a low current drain wait state. The LCD screen will blank, but either the TX or RX LED will be lit. Any keypad or RX activity will reawaken the 429EB to its normal operational mode.

3.1.1 HEX MODE

The HEX mode allows entry and display of bits 32 - 9 of the 429 word in hexadecimal format. The characters represent bits 32 through 9, starting with bit 32 (MSB) of the 32 bit word in six 4-bit nibbles. Each 4-bit nibble is derived from the BCD equivalent of the binary value. For example:

Data field in binary - 1001 0010 1111 0001 1010 0101
Equivalent hex value - 9 2 F 1 A 5

The display is structured as follows (reading left to right): The LABEL (bits 1 -8) will be displayed in octal, followed by the SDI (bits 10 - 9) in binary, followed by the DATA field (bits 32 - 9 in six 4-bit nibbles) in hex. On the far right of the display will be the SSM (bits 31 - 30) in binary. The only other screen possible in DATA mode (while in HEX) is the RATE screen, which provides the word repetition time in milliseconds.

3.1.2 ENGINEERING MODE

The ENG mode allows data entry and display in engineering unit formats (Feet, Knots, MHz, etc.). The label definition will determine the number of screens required for display of all possible fields of the word.

3.1.3 TRANSMIT & RECEIVE MODES

There are two distinct display modes of operation; TX (Transmit) and RX (Receive). Selection of these modes and all other display operations are accomplished by keypad or slide switch entry as described in the following sections.

3.1.3.1 TX MODE

The transmitter is capable of outputting up to ten 32-bit words in ARINC 429 or 419 bipolar RZ (Return to Zero) format. The word rate for each of the ten can be set independently. The word rate can be as fast as 4 msec or as slow as 59998 msec, or left to the default value as defined as the minimum word rate in the ARINC 429-9 specifications. The transmitter automatically insures at least a 4 bit time (Low Speed) separation between adjacent words.

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The word output sequence can be synchronized under certain circumstances as described under the ENT (Enter) Key description in the following section. The data for each individual word is easily modified. There is a unique screen for most individual fields of the 429 word. Some words will have more screens than others.

3.1.3.2 RX MODE

The receiver has the capability of receiving and storing up to 255 (511 in DATA ONLY mode) high or low speed 32 bit words in ARINC 429 or 419 RZ (Return to Zero) format. There are three mutually exclusive receiver modes of operation; NORMAL, FILTER and TRAP. Each mode has a screen that shows the count of words received, the label and description, or the data field currently selected.

3.1.3.2.1 NORMAL Mode

NORMAL mode (default) is a dynamic mode that displays all unique labels received. In this mode, the screen is updated 4 times per second with the latest data received.

3.1.3.2.2 FILTER Mode

FILTER mode is identical to normal mode with the exception that words received may be filtered to only have those words which meet certain label/bit patterns, to be displayed. Words may be filtered in 1 of 4 combinations: All Labels/All SDI, Specific Label/All SDI, All Labels/Specific SDI, and Specific Label/Specific SDI (this does not include Label 241). Any words that do not meet the filter parameters will be discarded.

3.1.3.2.3 TRAP Mode

The third and most powerful RX mode is the TRAP mode. This is a static mode of operation which captures and stores the data for detailed analysis. Words are received and stored in the trap buffer in their order of occurrence. They will remain in the buffer until the trap mode is turned off, even if the unit power is turned off. In normal TRAP mode, up to 255 unique words may be stored. In this mode the time that has elapsed since the previous word is stored as the rate. In DATA ONLY TRAP mode, up to 511 words (must be the same label) are stored. The rate is invalid in this mode of operation. The data "Trapped" will remain valid until the TRAP key is pressed again, even if the unit is turned off. Once the trap buffer is full, all subsequent received 429 words will be ignored.

3.2 CONTROL FUNCTIONS

3.2.1 CONTROLS AND INDICATORS (Figure 3-1)

(1) TRAP Mode Key

IN RX MODE. ON/OFF control for the TRAP mode. Pressing the ENT key for any of the prompted parameters will cause a DON'T CARE to be used for that parameter. Data is automatically protected if unit is powered off when TRAP is on.

NON-VOLATILE TRAP MODE MEMORY. The 429EB has the capability of providing nonvolatile storage of data accessed during TRAP mode. Rather than losing all of the information stored in TRAP mode following power off, the 429EB will retain the stored data in non-volatile RAM. Retention of the stored data in TRAP mode simply requires the operator to turn power off, while in TRAP MODE. Any data that was present in the buffers at the time the unit is turned off will be retained. When the unit is turned back ON, the operator can scroll

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through the retained data by pressing either the AUTO or UP/DOWN keys. In order to clear the memory, press the TRAP key.

CAUTION

As stated above, pressing the TRAP key after turning the unit back on will erase the memory contents. Press the TRAP key only when you wish to clear the memory.

Turning the unit OFF and then rapidly back ON may cause power transients which may effect the non-volatile memory storage. It is recommended that a minimum interval of 5-15 seconds be observed between power OFF and power ON.

- | | |
|-------------------------|---|
| (2) AUTO Mode Key | IN RX MODE. ON/OFF key for AUTO scrolling mode. Allows the operator to scroll through labels that have been received by TRAP mode. If in the LABEL mode, steps automatically through the word buffer and displays the number of trapped words as well as the engineering name of the label. If in the DATA mode, the AUTO mode steps to the same data menu for the next trapped word. Scroll keys will allow scanning direction to be selected. |
| (3) TX Parity Switch | IN EDIT MODE. Allows the hexadecimal value "C" to be entered. |
| (4) TX SPEED Switch | Allows operator to select ODD or EVEN transmit word parity. |
| (5) TX Output Jack | Allows operator to select HI (100 kbps) or LO (12.5 kbps) speed transmit bit rate. |
| (6) RX Input Jack | Allows access to transmitter port using standard 3-conductor, 1/4" phone plug. |
| (7) ARROW (Scroll) Keys | Allows access to receiver port using standard 3-conductor, 1/4" phone plug. |
| (8) TX/RX Indicator | Allows operator to scroll through display menus (10 transmitter slots, up to 511 receiver slots, or data menus). Allows selection of the scanning direction in AUTO mode. If editing data of an ISO Alpha label (356 or 357), the SCROLL keys will allow selection of the Alpha character to be entered (SCROLL to the desired character and press ENT to select a character). |
| (9) PARITY Indicator | LED indicates that the system is in either the transmit (TX) or receive (RX) mode of operation for display and entry of data. |
| | IN RX MODE. LED Indicates parity (ODD or EVEN) of word presently displayed. |
| | IN TX MODE. LED Indicates selected transmit parity. |

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- (10) HEX/ENG Switch
Allows operator to select hexadecimal or engineering unit display and entry of data.
- (11) TX/RX Key
Allows operator to select whether the system is in transmit or receive mode of operation for display and entry of data. After selection of the TX/RX key, initial display indicates the number of labels being transmitted or received. SCROLL keys should then be used for manual stepping through transmitter or receiver slots. TX/RX LED indicators above display will indicate current mode of operation.
- (12) RX SPEED Switch
Allows operator to select HI (100 kbps) or LO (12.5 kbps) speed receiver bit rate.
- (13) DATA ENTRY Keys
Allows operator to enter various data in hexadecimal or engineering formats.
- Keys 0 - 9 and the "." and "-" keys are valid while in ENG mode. Keys 0 - F are valid while in HEX mode. Hex mode will be forced regardless of switch position if the label is currently undefined by ARINC 429-9 Attachment 2 specifications or is a label not supported in ENG mode (Discrete data, Maintenance Data, etc.).
- Keys 0 - 7 are valid for LABEL entry since all labels are entered in octal format.
- The 0 and 1 keys allow the turning OFF and ON, respectively, of discrete bit screens (SDI, SSM, RF management labels, frequency discretions and individual bits, etc.) and turning various modes OFF and ON.
- (14) LAB/DAT Key
Allows operator to select either LABEL mode or DATA mode of display. LABEL mode displays octal number and engineering definition of labels being transmitted or received. DATA mode allows viewing of data of the currently selected label being transmitted or received.
- (15) EDIT/DEL Key
Allows operator access to the data entry mode. If in the data entry mode, the DEL (Delete) key allows correction of errors during data entry.
- (16) ON/OFF Key
Turns unit ON and OFF.
- (17) ENT Key
DATA ENTRY MODE. Completes an entry sequence if in the data entry mode. Until the ENT key is pressed, an entry may be edited with the DEL key. If an entry is not allowed for some reason (out of range, illegal key), the old data will be retained.
- TX WORD ORDER SYNCHRONIZATION. If not in the data entry mode and the transmitter is active, pressing the ENT key will reset the counters of each active label to their initial value. This allows the TX labels to be synchronized in their output order if all have the same

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word rate. They will be sent out in descending TX block order (10 through 1). For example, you want to simulate an LRU that transmits 6 labels in bursts of 100 msec apart. You would enter the first label in the group in TX block 10 with a word rate of 100. The second label would go in TX block 9 with a word rate of 100. This would continue for the remaining labels, with the last label of the group being entered in TX block 5. Once all the data has been entered and you are ready to synchronize the labels, the ENT key should be pressed. There will be no visible indication that anything has occurred, but the words will have been synchronized and are being transmitted in bursts of 6, 100 msec apart. If any data is changed later, the ENT key should be pressed again to resynchronize the words.

(18) Battery Charging Jack

Allows the internal AA NiCad batteries to be charged by connecting to the battery charger furnished with the 429EB.

(19) Filter Key

The FILTER MODE has the capability to display only those particular ARINC 429 words on the receiver input bus that the user wishes to examine. Any superfluous words that are present on the bus are "filtered out" to unclutter the displayed receiver data. The user can choose any one particular label or all labels and either any one particular SDI or all SDI's in this mode. To access this feature, the 429EB must first be set to the RX mode. Once in receiver mode, press the "F/FILT" key on the keyboard, which will place the unit in the FILTER mode. The 429EB will display the prompt "LABEL?", at which time the user will enter the desired three digit octal label via the keyboard and press ENTER. Should the user wish to receive and display all labels, simply press the enter key and the display will advance to the prompt "SDI?". At the SDI? prompt, enter the desired two digit binary SDI number and press the ENTER key. If all SDI's are desired, at the SDI? prompt, press the ENTER key again. The unit will now receive and display only the ARINC 429 words that correspond to the label and SDI combinations previously entered.

(20) D.O. Key

IN EDIT MODE. While in the EDIT mode, this key allows the hexadecimal value "D" to be entered.

IN RX MODE. Pressing this key when trap mode is first activated (before entering the Trap Label) will activate the DATA ONLY trap mode. This mode expands the trap capacity to 511 words, however, no label or rate information is stored. This means that the user must enter a trap label when prompted. This mode will be cleared when trap mode is turned off.

(21) Display Contrast Adj.

Allows adjustment of the liquid crystal display for desired viewing angle.

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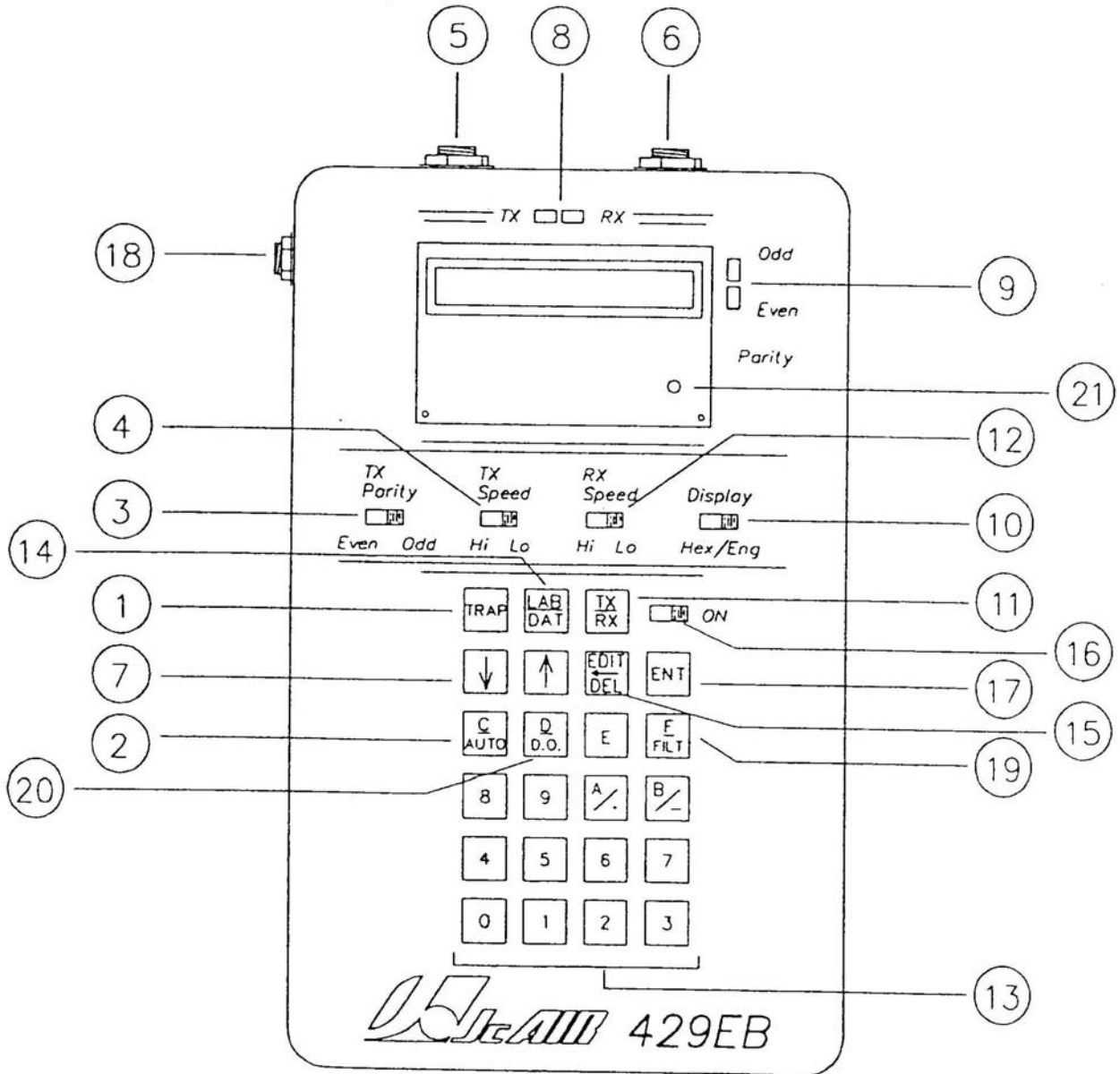


Figure 3-1: Controls and Indicators
(Dwg. No. 40-1001-11, Rev. 0)

SECTION IV THEORY OF OPERATION

4.1 GENERAL CIRCUIT THEORY

The Aeroflex Model 429EB, ARINC 429 single channel transmitter and receiver, consists of three board level subassemblies and a battery pack. The three boards are; 1) Analog Board, JPN: 20-6783-00, 2) Display Board, JPN: 20-6782-20 and 3) Digital Board, JPN: 20-6784-20.

4.1.1 ANALOG BOARD

The Analog board contains the analog circuitry for the 429EB. This circuitry has three major sections; 1) Power Circuits, 2) 429 Receiver and 3) 429 Driver.

4.1.1.1 Power Circuits

The Power circuits supply power to the system from one of two sources. If the battery charger is disconnected, the circuits supply power to the system from the battery pack. The battery voltage is monitored by the power circuits. Should the voltage drop to an insufficient level, it is the power circuits that will indicate this to the Control circuits. An indication of low power will be seen on the display board should the aforementioned conditions exist. If the charger is connected, the power circuits will supply power to the system from the charger and will also trickle charge the NiCad batteries. The power circuits consist of the following components:

- | | |
|---------------------------|------|
| 1) Low Drop Out Regulator | (U5) |
| 2) Voltage converter | (U6) |
| 3) Monitor | (U7) |

4.1.1.2 429 Receiver

The 429 Receiver circuits convert ARINC 429 RZ transmitted signals from 10V levels (line A to B) to TTL level signals for use by the 429 Receiver Buffer on the Digital board. The 429 receiver circuits consist of a Comparator (U4) and a number of discrete components.

4.1.1.3 429 Driver

The 429 driver circuits convert the TTL level signal from the digital board into 10V (line A to B) ARINC 429 compatible signal levels. The 429 Driver circuits consist of the following components:

- | | |
|-----------------|--------------|
| 1) "1" Driver | (U2, Q1, Q2) |
| 2) "0" Driver | (U3, Q3, Q4) |
| 3) Speed Switch | (U1) |

4.1.2 DISPLAY BOARD

The Display board performs the human interface function for the 429EB. It has three major sections of circuitry; 1) Display circuits, 2) Keypad circuits and 3) Slide Switch circuits.

4.1.2.1 Display Circuits

The Display circuits output data in visual form. The display circuit consists of the liquid crystal display (DS1).

4.1.2.2 Keypad Circuits

The Keypad switches allow data to be input to the unit. The keypad circuits consist of 23 momentary contact switches (S1 - S23). The switches are arranged in an X/Y matrix and are decoded by the firmware on the digital board.

4.1.2.3 Slide Switch Circuits

The slide switches allow various I/O information (Parity, TX Baud, etc.) to be changed and to turn the unit ON and OFF. The slide switch circuits consist of 5 SPST slide switches (S24 - S28) and various discrete components (resistors, transistors & capacitors).

4.1.3 DIGITAL BOARD

The Digital board contains the digital circuitry for the 429EB. This circuitry has three major sections; 1) Control circuits, 2) 429 Receive Buffer and 3) 429 Generator.

4.1.3.1 Control Circuits

The Control circuits are the "Heart" of the system that controls and monitors all other circuits in the system. The control circuits consist of the following components:

- | | |
|--------------------|------|
| 1) Microcontroller | (U1) |
| 2) Firmware EPROM | (U2) |
| 3) RAM | (U3) |
| 4) Address Latch | (U4) |
| 5) RAM IO | (U5) |

The control circuits monitor the number of "bits" received and upon completion, will read the receive buffer.

4.1.3.2 429 Receive Buffer

The 429 Receive Buffer stores the 429 bit stream data (converted to TTL levels by the Analog board). The following components make up the 429 Receive Buffer:

- | | |
|--------------------|----------|
| 1) Bit Latch | (1/2 U8) |
| 2) Serial Register | (1/2 U6) |
| 3) Mux | (U14) |

4.1.3.3 429 Generator Circuits

The 429 Generator circuits send TTL level bit stream data to the Analog board, where it is converted to the correct levels for output. The Generator is loaded and started by the Control circuits. The 429 Generator consists of the following components:

- | | |
|---------------------------|----------|
| 1) Digital drivers | (U9) |
| 2) Serial Register | (1/2 U6) |
| 3) Baud Clock/Bit Counter | (U5) |
| 4) Driver Enable | (1/2 U8) |

4.1.4 BATTERY PACK

The battery Pack supplies power to the system and consists of the following components:

- 1) Battery Holder
- 2) Six (6) "AA" NiCad rechargeable batteries.

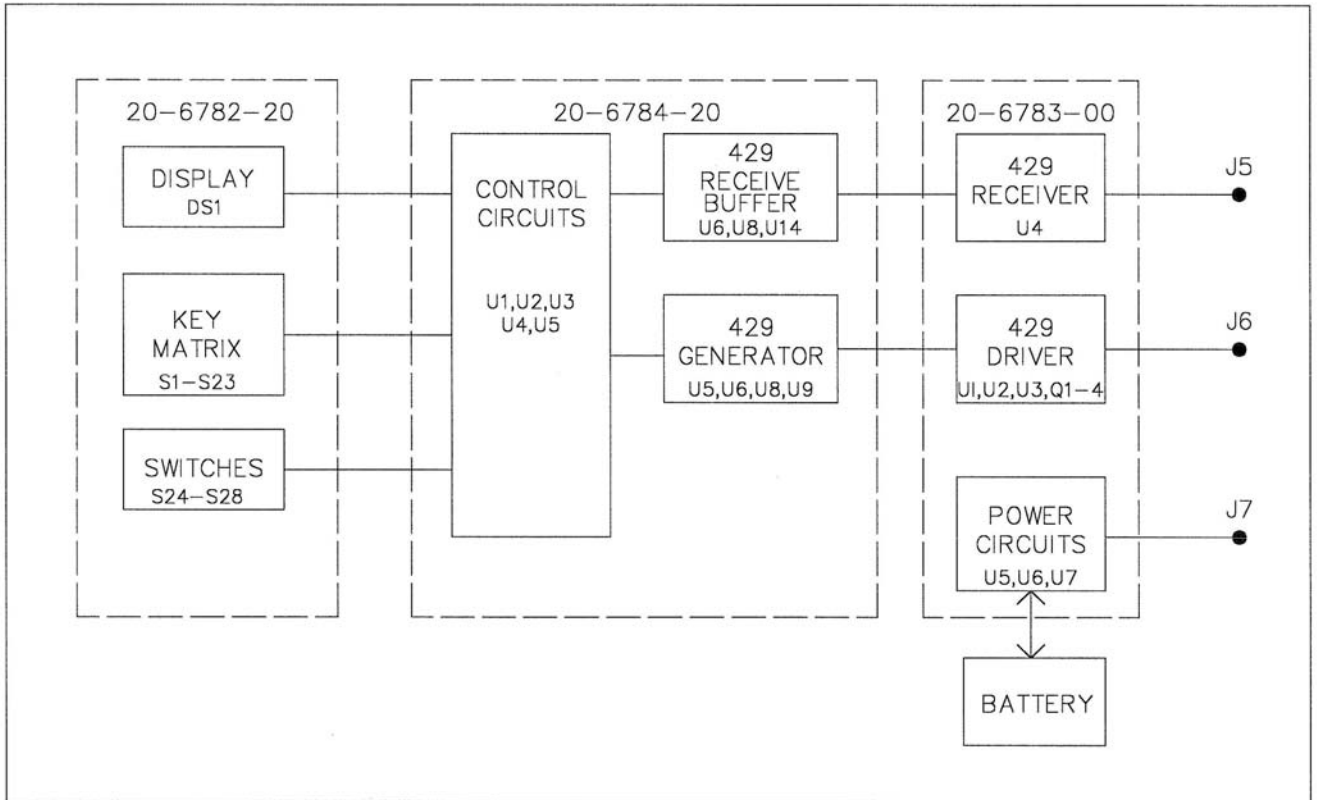


Figure 4-1: 429EB Block Diagram
(Dwg. No. 40-1001-10, Rev. 01)

**SECTION V
MAINTENANCE**

5.1 TEST AND ALIGNMENT

5.1.1 ALIGNMENT AND CALIBRATION PROCEDURE

No alignment or calibration required.

5.2 BILLS OF MATERIAL, ASSEMBLY DRAWINGS, SCHEMATICS & TEST PROCEDURE

To assist in the maintenance of the 429EB, bills of material, assembly drawings, schematics and a test procedure are available in the 429EB Maintenance Manual (P/N 06-1001-10 for hard copy, E6-1001-10 for CD) available separately from Aeroflex.

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APPENDIX A

MODEL 429EB (VERS. 1.0): DEFINED LABELS AND DEFAULT DATA

<u>LAB</u>	<u>DESCRIPTION</u>	<u>RANGE **</u>	<u>UNITS</u>	<u>RATE</u>	<u>ID's</u>
001	`DIST TO GO'	+ 3999.9	NAU MILE	100ms	2
002	`TIME TO GO'	0-399.9	MINUTES	100ms	2
003	`X TRACK DIST'	0-399.9	NAU MILE	100ms	2
004	`RUNWAY DIST'	0-79900	FEET	100ms	1
005	`SPARE LABEL'		HEX	200ms	
006	`SPARE LABEL'		HEX	200ms	
007	`SPARE LABEL'		HEX	200ms	
010	`PRES POS LAT'	180N-180S	DEG:MIN	250ms	2,4
011	`PRES POS LNG'	180E-180W	DEG:MIN	250ms	2,4
012	`GROUND SPEED'	0-7000	KNOTS	250ms	2,4,5,25
013	`TRK ANG TRUE'	0-359.9	DEGREES	250ms	2,4
014	`MAG HEADING'	0-359.9	DEGREES	168ms	4,5
015	`WIND SPEED'	0-799	KNOTS	250ms	2,4,5
016	`WIND DIR TRU'	0-359.9	DEGREES	250ms	4
017	`SEL RNWY HDG'	0-359.9	DEGREES	168ms	10,A0,B0
020	`SEL VERT SPD'	+ 6000	FT/MINUTE	100ms	20,A1
021	`SEL EPR'	0-3		100ms	2
022	`SEL MACH'	0-4	MACH	100ms	20,A1
023	`SEL HEADING'	0-359	DEGREES	100ms	20,A1
024	`SEL COURSE 1'	0-359	DEGREES	168ms	11,20,A1,B1
025	`SEL ALTITUDE'	0-50,000	FEET	100ms	20,A1
026	`SEL AIRSPEED'	30-450	KNOTS	100ms	3,20,A1
027	`SEL COURSE 2'	0-359	DEGREES	168ms	11,20,A1,B1
030	`VHF COM FREQ'	118-135.975	MHz	100ms	20,24,B6
031	`BCN ATC CODE'	0-7777	NUMERIC	100ms	20,B8
032	`ADF FREQ'	190-1750	KHz	100ms	12,20,B2
033	`ILS FREQ'	108-111.95	MHz	168ms	2,10,20,B0
034	`VOR FREQ'	108-117.95	MHz	168ms	2,11,20,B0
035	`DME FREQ'	108-135.95	MHz	100ms	2,9,20,A9
036	`MLS FREQ'		HEX	100ms	
037	`HF COM FREQ'	2.8-24	MHz	100ms	20,B9
040	`SPARE LABEL'		HEX	200ms	
041	`SET LATITUDE'	180N-180S	DEG:MIN	250ms	2,4,20,A4
042	`SET LONGTUDE'	180E-180W	DEG:MIN	250ms	2,4,20,A4
043	`SET MAG HEAD'	0-359	DEGREES	250ms	2,4,20,A4
044	`TRUE HEADING'	0-359.9	DEGREES	250ms	4
045	`MIN AIRSPEED'	0-259.9	KNOTS	64ms	3
046	`ENG SER# LSD'	0999	NUMERIC	500ms	33
047	`ENG SER# MSD'	0999	NUMERIC	500ms	33
050	`SPARE LABEL'		HEX	200ms	
051	`SPARE LABEL'		HEX	200ms	
052	`SPARE LABEL'		HEX	200ms	
053	`TRAK ANG MAG'	0-359	DEGREES	250ms	4,5
054	`SPARE LABEL'		HEX	200ms	
055	`SPARE LABEL'		HEX	200ms	
056	`ETA'	0-2359.9	HOUR:MIN	250ms	2
057	`SPARE LABEL'		HEX	200ms	
060	`LI TIRE PRES'		HEX	50ms	
061	`LO TIRE PRES'		HEX	50ms	
062	`RI TIRE PRES'		HEX	50ms	

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<u>LAB</u>	<u>DESCRIPTION</u>	<u>RANGE **</u>	<u>UNITS</u>	<u>RATE</u>	<u>ID's</u>
063	`RO TIRE PRES'		HEX	50ms	
064	`NOSE TIRE'		HEX	50ms	
065	`GROSS WEIGHT	0-12000	LBS x100	100ms	3
066	`LONG CG'	0-100.00	% MAC	100ms	2
067	`LAT CG'	0-100.00	% MAC	100ms	
070	`AC FREQ ENG'	0-512	Hz	100ms	29
071	`AC FREQ ALT'	0-512	Hz	100ms	29
072	`STAT VAN ANG'	0-360	DEGREES	100ms	1C,2F
073	`OIL QUANTITY'	0-512	CC	100ms	1C
074	`O FUEL WEIGHT'	1,310,720	LBS	100ms	2C
075	`GROSS WEIGHT'	1,310,720	LBS	100ms	2,3,2C,3E
076	`AC VOLT BB'	0-256	VOLTS	100ms	29
077	`AC LOAD ENG'	0-256	PERCENT	100ms	29
100	`SEL COURSE 1'	0-360	DEGREES	168ms	1,2,11,20,A1,B1
101	`SEL HEADING'	0-360	DEGREES	32ms	2,20,A1
102	`SEL ALTITUDE'	0-65536	FEET	100ms	2,20,A1
103	`SEL AIRSPEED'	0-512	KNOTS	100ms	1,2,3,20,A1
104	`SEL VERSPEED'	0-16384	FEET/MIN	100ms	1,2,20,2B,A1
105	`SEL RNWY HDG'	0-360	DEGREES	168ms	2,10,20,A1,B0
106	`SEL MACH'	0-4096	m MACH	32ms	2,A1
107	`FLP/SLAT LEV'	0-360	DEGREES	100ms	1B
110	`SEL COURSE 2'	0-360	DEGREES	168ms	1,2,10,11,20,A1
111	`TEST WORD A'		HEX	200ms	
112	`RNWY LENGTH'	0-20480	FEET	250ms	2
113	`SPARE LABEL'		HEX	200ms	
114	`DESRD TRACK'	0-360	DEGREES	32ms	2
115	`WAYPOINT BRG'	0-360	DEGREES	32ms	2
116	`X TRACK DIST'	0-128	NAU. MILE	32ms	2
117	`VERT DEVIATN'	0-2048	FEET	32ms	2
120	`RANGE TO ALT'	0-512	NAU. MILE	26ms	2
121	`HZ CMD SIGN'	0-360	DEGREES	50ms	2
122	`VER CMD SIGN'	0-360	DEGREES	50ms	2
123	`THROTTLE CMD'	0-256	DEG/SEC	50ms	2
124	`SPARE LABEL'		HEX	200ms	
125	`GMT'	0-2400	HR/MN/SEC	100ms	31
126	`PACK FLOW'		HEX	200ms	
127	`SLAT ANGLE'	0-360	DEGREES	100ms	1B
130	`FAN TTL TEMP'	0-128	DEGREES C	100ms	1A,1C,2F,3F
131	`FAN TTL PRES'	0-32	PSI	100ms	1A,1C,2D,2F,33,35
132	`EXH GAS PRES'	0-32	PSI	100ms	1A,1C
133	`THRUST LEVER'	0-360	DEGREES	100ms	1A,2F,3F
134	`POWER LEVER'	0-360	DEGREES	100ms	1C
135	`ENG VIBRAT 1'	0-8	INCH/SEC	100ms	1C
136	`ENG VIBRAT 2'	0-8	INCH/SEC	100ms	1C
137	`FLAP ANGLE'	0-360	DEGREES	100ms	1B,2A
140	`FLT DIR ROLL'	0-360	DEGREES	50ms	1
141	`FLT DIR PTCH'	0-360	DEGREES	50ms	1
142	`FAST/SLOW'	0-32	KNOTS	32ms	2,3
143	`FLT DIR YAW'	0-360	DEGREES	50ms	1
144	`ALT ERROR'	0-8192	FEET	26ms	2B
145	`DSCR DATA 8'		HEX	200ms	
146	`DSCR DATA 9'		HEX	200ms	
147	`DSCR DATA 10'		HEX	200ms	

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<u>LAB</u>	<u>DESCRIPTION</u>	<u>RANGE **</u>	<u>UNITS</u>	<u>RATE</u>	<u>ID's</u>
150	`GMT'	0-2400	HR/MIN/SEC	200ms	31
151	`LOC BRG TRU'	0-360	DEGREES	168ms	2
152	`MLS ELEVAT 1'		HEX	200ms	
153	`MLS ELEVAT 2'		HEX	200ms	
154	`RNWY HDG TRU'	0-512	NAU. MILE	84ms	2
155	`MAINT DATA 6'		HEX	200ms	
156	`MAINT DATA 7		HEX	200ms	
157	`MAINT DATA 8'		HEX	200ms	
160	`MAINT DATA 9'		HEX	200ms	
161	`MAINT DATA 10'		HEX	200ms	
162	`ADF BEARING'	0-360	DEGREES	32ms	12
163	`SPARE LABEL'		HEX	200ms	
164	`MDA'	0-8192	FEET	500ms	2
165	`RADIO HEIGHT'	+7999.9	FEET	100ms	7
166	`RALT CHPT DV'	0-512	FEET	200ms	7
167	`SPARE LABEL'		HEX	200ms	
170	`DH SEL'	0-7000	FEET	100ms	25
171	`SPARE LABEL'		HEX	200ms	
172	`SPARE LABEL'		HEX	200ms	
173	`LOC DEV'	0-0.4	DDM	34ms	10
174	`GLS DEV'	0-0.8	DDM	34ms	10
175	`ECON SPEED'	0-1024	NAU. MILE	64ms	3
176	`ECON MACH'	0-4096	m MACH	64ms	3
177	`ECON FLT LEV'	0-131072	FEET	32ms	3
200	`DRIFT ANGLE'	+ 180	DEGREES	100ms	4
201	`DME DISTANCE'	-1-399.99	NAU. MILE	84ms	9
202	`DME DISTANCE'	0-512	NAU. MILE	84ms	9
203	`ALTITUDE'	0-131072	FEET	32ms	6
204	`BARD ALT #1'	0-131072	FEET	32ms	6
205	`MACH'	0-4.096	MACH	64ms	6,1A
206	`CMP AIRSPEED'	0-1024	KNOTS	64ms	6
207	`MAX AIRSPEED'	0-1024	KNOTS	64ms	6
210	`TRU AIRSPEED'	0-2048	KNOTS	64ms	6
211	`TTL AIR TEMP'	0-512	DEGREES C	250ms	3,6,1A
212	`ALTITUD RATE'	0-32768	FEET/MIN	32ms	4,5,6
213	`STAT AIR TMP'	0-512	DEGREES C	250ms	6
214	`SPARE LABEL'		HEX	200ms	
215	`IMPACT PRESS'	0-512	MB	64ms	6,1A
216	`SPARE LABEL'		HEX	200ms	
217	`STATIC PRESS'	0-64	INCHES HG	64ms	6
220	`BARO ALT. #2'	0-131072	FEET	32ms	6
221	`ANG ATACK AV'	0-360	DEGREES	32ms	6
222	`VOR BRG'	0-360	DEGREES	50ms	11
223	`ANG ATACK 1R'	0-360	DEGREES	32ms	6
224	`ANG ATACK 2L'	0-360	DEGREES	32ms	6
225	`ANG ATACK 2R'	0-360	DEGREES	32ms	6
226	`SPARE LABEL'		HEX	200ms	
*227	`COMMAND WORD'			1000ms	
230	`TRU AIRSPEED'	100-599	KNOTS	250ms	6
231	`TTL AIR TEMP'	-060-099	DEGREES C	250ms	6
232	`ALTITUD RATE'	+ 20,000	FEET/MIN	32ms	4,5,6
233	`STAT AIR TMP'	099-060	DEGREES C	250ms	6
234	`BARO (MB) #1'	745-1050	MB	64ms	6

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<u>LAB</u>	<u>DESCRIPTION</u>	<u>RANGE **</u>	<u>UNITS</u>	<u>RATE</u>	<u>ID's</u>
235	`BARO (IN) #1'	22-31	INCHES HG	64ms	6
236	`BARO (MB) #2'	745-1050	MB	64ms	6
237	`BARO (IN) #2'	22-31	INCHES HG	64ms	6
240	`SPARE LABEL'		HEX	200ms	
*241	`LABEL'			200ms	
242	`TOTAL PRSUR'	0-2048	MB	64ms	6,1A
243	`SPARE LABEL'		HEX	200ms	
244	`FUEL FLOW ED'	0-32768	LBS/HOUR	100ms	1C
245	`MIN AIRSPEED'	0-256	KNOTS	64ms	3
246	`N1 (ENG DIR)'	0-4096	RPM	100ms	1C
247	`TOTAL FUEL'	0-655,360	POUNDS	500ms	1F
250	`PSEL FUEL QT'	0-655,360	POUNDS	100ms	2C
251	`BARO ALT. #3'	0-131,072	FEET	32ms	6
252	`BARO ALT. #4'	0-131,072	FEET	32ms	6
253	`GO-A EPR LMT'	0-4		100ms	1E
254	`CRUS EPR LMT'	0-4		100ms	1E
255	`CLMB EPR LMT'	0-4		100ms	1E
*256	`FUEL QTY #1'	0-163,840	POUNDS	500ms	
257	`FUEL QTY #2'	0-131,072	POUNDS	500ms	2C,32
260	`DATE/FLT/LEG'	31-12-9	NUMERIC	200ms	2,A2
261	`FLIGHT'	0-999	NUMERIC	200ms	2,A2
262	`FUEL QTY #5'	0-131,072	POUNDS	500ms	2C
263	`FUEL QTY #6'	0-131,072	POUNDS	500ms	2C
264	`FUEL QTY #7'	0-131,072	POUNDS	500ms	2C
265	`FUEL QTY #8'	0-131,072	POUNDS	500ms	2C
266	`TEST WORD B'		HEX	200ms	
267	`THRTL POS CM'	0-360	DEGREES	50ms	2B
*270	`STATUS WORD'			200ms	
271	`DSCR DATA 2'		HEX	200ms	
272	`DSCR DATA 3'		HEX	200ms	
273	`DSCR DATA 4'		HEX	200ms	
274	`DSCR DATA 5'		HEX	200ms	
275	`DSCR DATA 6'		HEX	200ms	
276	`DSCR DATA 7'		HEX	200ms	
277	`GEN TEST WD'		HEX	200ms	
*300	`FLIGHT HIST'			1000ms	
*301	`FAULT HIST'			1000ms	
302	`SPARE LABEL'		HEX	200ms	
303	`SPARE LABEL'		HEX	200ms	
304	`SPARE LABEL'		HEX	200ms	
305	`SPARE LABEL'		HEX	200ms	
306	`SPARE LABEL'		HEX	200ms	
307	`SPARE LABEL'		HEX	200ms	
310	`PRES POS LAT'	180N-180S	DEGREES	100ms	2,4
311	`PRES POS LNG'	180E-180W	DEGREES	100ms	2,4
312	`GROUND SPEED'	0-4096	KNOTS	26ms	2,4,5
313	`TRK ANG TRUE'	0-360	DEGREES	26ms	4
314	`TRUE HEADING'	0-360	DEGREES	26ms	4
315	`WIND SPEED'	0-256	KNOTS	50ms	2,4,5
316	`WIND ANGLE'	0-360	DEGREES	50ms	4
317	`TRK ANG MAG'	0-360	DEGREES	25ms	4,5
320	`MAG HEADING'	0-360	DEGREES	26ms	4,5
321	`DRIFT ANGLE'	0-360	DEGREES	26ms	4,5
322	`FLT PATH ANG'	0-360	DEGREES	26ms	4,5
323	`FLT PATH ACL'	0-4	G	10ms	4,5

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<u>LAB</u>	<u>DESCRIPTION</u>	<u>RANGE **</u>	<u>UNITS</u>	<u>RATE</u>	<u>ID's</u>
324	`PITCH ANGLE'	0-360	DEGREES	10ms	4,5
325	`ROLL ANGLE'	0-360	DEGREES	10ms	4,5
326	`BDY PITCH RT'	0-128	DEG/SEC	10ms	4,5
327	`BDY ROLL RT'	0-128	DEG/SEC	10ms	4,5
330	`BDY YAW RATE'	0-128	DEG/SEC	10ms	4,5
331	`BDY LNG ACCL'	0-4	G	10ms	4,5
332	`BDY LAT ACCL'	0-4	G	10ms	4,5
333	`BDY NRM ACCL'	0-4	G	10ms	4,5
334	`PLTFORM HDNG'	0-360	DEGREES	20ms	4,5
335	`TRK ANG RATE'	0-32	DEG/SEC	10ms	4,5
336	`INRT PTCH RT'	0-128	DEG/SEC	10ms	4,5
337	`INRT ROLL RT'	0-128	DEG/SEC	10ms	4,5
340	`EPR ACTUAL'	0-4		100ms	3,1A,2D,33
341	`EPR COMMAND'	0-4		100ms	3,29
342	`EPR LIMIT'	0-4		100ms	3,29
343	`EPR RATE'	0-4		100ms	3
344	`N2'	0-256	%RPM	50ms	1A,1C,29,33
345	`EGT'	0-2048	DEGREES	100ms	1A,1C,33
346	`N1 ACTUAL'	0-256	%RPM	100ms	3,1A
347	`FUEL FLOW'	0-32768	LBS/HOUR	50ms	29
*350	`MAINT DATA 1'			200ms	
351	`MAINT DATA 2'		HEX	200ms	
352	`MAINT DATA 3'		HEX	200ms	
*353	`HIGHEST VIBR'			200ms	
*354	`LABEL'			200ms	
*355	`LABEL'			200ms	
*356	`LABEL'			200ms	
*357	`LABEL'			200ms	
*360	`LABEL'	0-512	DEGREES	200ms	
*361	`LABEL'	0-512	DEGREES	200ms	
362	`ATRK HZ ACCL'	0-4	G	10ms	4
363	`X TRACK ACCL'	0-4	G	10ms	4
364	`VERT ACCEL'	0-4	G	10ms	4,5
365	`INR VERT VEL'	0-32768	FEET/MIN	20ms	4,5
366	`N-S VELOCITY'	0-4096	KNOTS	50ms	4
367	`E-W VELOCITY'	0-4096	KNOTS	100ms	4
370	`DH SEL (EFI)	0-8192	FEET	100ms	25
371	`SPARE LABEL'		HEX	200ms	
372	`WIND DIR-MAG'	0-360	DEGREES	50ms	5
373	`N-S VEL MAGN'	0-4096	KNOTS	100ms	5
374	`E-W VEL MAGN'	0-4096	KNOTS	100ms	5
375	`A HDG ACCEL'	0-4	G	10ms	5
376	`X HDG ACCEL'	0-4	G	10ms	5
377	`EQUIPMENT ID'		HEX	200ms	

NOTES:

* All defined label and default data is per ARINC 429-9 with the exception of those labels preceded by an asterisk (*), which are specially defined for Boeing testing applications.

** Ranges shown are those specified by ARINC 429-9 and are provided for reference only. The 429EB does not perform range checking to prevent over or under range entries. The user should insure that the ranges entered are within limits when making entries in the TX mode.