53A-420 PRESORTING ARINC-429 RECEIVER CARD

OPERATING MANUAL

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DESCRIPTION

The 53A-420 Presorting ARINC-429 Receiver Card is a printed circuit board assembly for use in a CDS 53/63 Series System. It is used to receive data from the Mark 33 DITS (Digital Information Transfer System) found on civil aircraft. The 53/63 System will reformat the data received into 8-bit bytes and re-transmit it to the system controller.

The presorting feature is provided on the Receiver Card to solve the data rate problem imposed on the system controller by the DITS bus. This problem can be stated as follows: the DITS bus can have a data rate of up to 100,000 bits per second, but some labels may appear only once every ½ second. Without presorting, to find the most current message of a particular label may require that the system controller sift through a continuous stream of 50,000 bits of data.

With presorting, the DITS data is sorted and stored in RAM located on the Receiver Card, thus allowing immediate access by the system controller to the DITS data associated with a particular label. The presorting can operate in one of two modes:

ALL LABEL Mode - In this mode, the Receiver Card has 256 RAM storage registers, one for each possible DITS word label. The Receiver Card will constantly monitor the incoming data and refresh the appropriate register, therefore, insuring that the most current DITS word, for all labels, is always available to the system controller.

SINGLE LABEL Mode - In this mode, the system controller sets a "trigger label". The Receiver Card then monitors the incoming data for that single trigger label, and when found will store the associated DITS word in RAM. This feature allows the Receiver Card to sequentially store up to 256 DITS words from a single label.

In both of these modes, the system controller can read "in progress" (read without interrupting the loading of new data) a specified DITS word from RAM. This feature is provided to prevent the RAM from missing a new update while being read by the system controller.

CONTROLS AND INDICATORS

The following controls and indicators are provided to select and display the functions of the 53A-420 Card's operating environment.

Address-Select Switch

The 53A-420 Card has a miniature 10-position switch labeled "ADDRESS" that selects the 53A-420 Card's address (0-9) in the 53/63 Series System. The switch's cover opens to allow the address to be reselected. A screwdriver with a narrow, flat blade should be used to turn the cam-action wiper to the desired address position.

Power LED

The Power LED provides a valuable diagnostic tool by giving the system programmer a visual indication of the action which the system is currently taking. Whenever the 53A-420 Card is addressed by the system controller, the Power LED goes out. The LED remains out until another function card is addressed. Since only one function card can be addressed at a time, an unlit Power LED indicates the function card with which the system controller is currently communicating. The Power LED being lit not only indicates that the 53A-420 Card is unaddressed, but that all required dc power (5V dc, ±15V dc) is being supplied.

Fuses

There are three fuses (5V, -15V and +15V) which protect the system from overload conditions. If any fuse has blown, the Power LED will not light.

Function LEDS and Switches

LEDs

The following LEDs are provided at the top front edge of the 53A-420 Card to indicate the status of the card's operation:

Data Detect (DDT) LED

The Data Detect LED will be lit whenever data is being transmitted over the Mark 33 DITS bus to the Receiver Card.

Fast/Slow (F/S) Bit Rate LED

The bit rate is set for fast (100 K b/s) or slow (10-14 K b/s) by the I command. If the Receiver card is set for a slow bit rate the LED will be out. The LED will be out on power-up.

Receiver Data Error (RDE) LED

Located below the DDT LED is the Receiver Data Error LED. This LED will be lit whenever the Receiver Card has received an invalid DITS word. The data error could be caused by:

1. A parity error.
2. DITS word length shorter or longer than the specified 32 bits.
3. Incorrect word synchronization - i.e., there wasn't a gap of four bit times between the periods of word transmission, as specified in 2.4.4 of the ARINC 429 Specification.

   The 53A-420 Receiver card will tolerate word gap spacings less than the minimum specified in the ARINC 429 Specification. (See Specification Section, Minimum Spacing Between ARINC Words.)

   NOTE: If this LED isn't lit, it doesn't guarantee that the data wasn't in violation of the ARINC specification.

Mode (A/B) LED

The Mode LED will be lit if the Receiver Card is in the ALL LABEL Mode and out if in the SINGLE LABEL Mode. This LED is turned on and off by the A and B commands. On power-up this LED will be lit.

LED ASSIGNMENTS

DDT Data Detect	lit when data is detected.
F/S Fast/Slow	lit is card is set for fast bit rate.
RDE Receiver Data Error	lit when receiver detects a data error.
A/B Mode	lit when system is in "A" (ALL LABEL Mode).

Switches

The following switches are provided to select the proper functions for the 53A-420 Card's operating environment:

Data Error Clear Switch

Located near the front edge connector is a momentary push button switch. This switch is used to clear the data error latch that is being displayed by the Data Error LED. The Data Error LED and Clear switch are useful when you are trying to isolate a problem in a system that is transmitting words with data errors.

Interrupt Switch

The Receiver Card has a single slide switch that is used to turn on or off interrupts. When the switch is ON, the card will generate a vectored priority interrupt when a data error is detected. (See Receiver Data Error LED)

SPECIFICATIONS

Configuration:	Single receiver.
Receiver Amplifiers:	LH0002 Current Amplifier.
Coupling:	Connects direct to ARINC-429 data bus. Required bus terminations provided.
ARINC Data Rate: (programmable)	100 K b/s or 10 to 14 K b/s.
Operating Modes: (programmable)	ALL LABEL Mode - Single RAM register for DITS word associated with each of the 256 labels. SINGLE LABEL Mode - 256 RAM registers assigned for DITS words that have a single specified label. The specified label is programmable.
Parity:	ALL LABEL Mode - The Receiver Card will test for odd parity. If parity is valid the DITS word will be loaded into RAM. If invalid the RDE LED will be lit, the word will be discarded and if the interrupt is enabled an interrupt will be generated. SINGLE LABEL Mode - If parity is valid or invalid the DITS word will be loaded into RAM. The RDE LED will be lit if parity is invalid, and if the interrupt is enabled an interrupt will be generated.
Minimum Spacing Between ARINC Words:	High Speed (100 K b/s Data Rate) - 23 μs nominal. Low Speed (10 to 14 K b/s) - 150 μs nominal.
Vectored Priority Interrupts:	The Receiver Card will send a vectored priority interrupt to the system controller whenever it detects a data error. See Receiver Data Error LED.
Word Format:	Twenty-four bits (DITS word less 8-bit label) of the thirty-two bit DITS word will be input by the system controller. These twenty-four bits will be input as three 8-bit bytes with the most significant bit first.
RAM:	24 X 256. Read in progress.
Data Rate:	The system controller can input data from the Receiver Card at a data rate of 200,000 bytes per second. This will produce a bit rate of 200,000 X 8 = 1,600,000 bits per second (16 times faster than the bit rate of the DITS bus).

Power-up:	Within 5 ms after the power is turned on, the Receiver Card will start loading data into RAM. The data in RAM will be all 1's until it is written over by received data. The LEDs will have the following states on power-up. Power LED - lit. DDT LED - lit when data is detected. F/S LED - out. RDE LED - out. A/B LED - lit.
Power Requirements:	5V and ±15V dc power is provided by the internal Power Supply in the 53/63 Series Card Cage.
Voltage (5-volt Supply):	4.75 V dc to 5.25 V dc.
Current (5-volt Supply):	1.5 A, maximum quiescent. 1.5 A, peak.
Voltage (±15-volt Supplies):	+14.5 V dc to +15.5 V dc. -14.5 V dc to -15.5 V dc.
Current (±15-volt Supplies):	0.46 A, maximum quiescent. 0.46 A, peak.
Cooling:	Provided by the fan in the 53/63 Card Cage.
Temperature:	-10 °C to +65 °C, operating (assumes ambient temperature of 55 ° and airflow to assure less than 10 °C temperature rise). -40 °C to +85 °C, storage.
Humidity:	Less than 95% R.H. noncondensing, -10 °C to +30 °C. Less than 75% R.H. non-condensing, +31 °C to +40 °C. Less than 45% R.H. non-condensing, +41 °C to +55 °C.
Dimensions:	197 mm high, 220 mm deep, 13 mm wide (7.75" X 8.66" X 0.5")
Dimensions, Shipping:	When ordered with a 53/63 Card Cage, the card is installed in one of the card cage's function-card slots. When ordered alone, the card's shipping dimensions are: 254 mm X 254 mm X 127 mm (10" X 10" X 5")
Weight:	0.23 kg. (0.5 lbs.)
Weight, Shipping:	When ordered with a 53/63 Card Cage, the card is installed in one of the card cage's function-card slots. When ordered alone the shipping weight is: 0.64 kg. (1.4 lbs.)

Mounting Position:	Any orientation.
Mounting Location:	Installs in any function-card slot of the 53/63 Series Card Cage.
Input Connections:	A 48-pin printed circuit type hooded connector (53A-780) provides a connection for all front edge input and output signals.
Required Equipment:	53A-780 Hooded Connector.
Equipment Supplied:	53A-420 Receiver Card Spare fuse (Part #42202-52001) Spare fuse (Part #42202-52003) Operating Manual (Part #00000-14200) Service Manual (Part #00000-24200)

OPERATION

Overview

In this manual, as in other CDS manuals, the terms "input data" and "output data" are always referenced to the system controller (calculator or computer). Input data means data being input by the system controller.

Transmission Order

The system controller will input data as three 8-bit bytes for each 32-bit serial word received from the Mark 33 DITS bus. The LABEL will not be input by the system controller since the system controller previously output to the Receiver Card LABELS corresponding to the data words to be received. If the system controller was to input the LABEL as well as the data (bits 9 through 32), it would be receiving redundant information which would serve only to slow down the data through-put.

Only bits 9 through 32 of the DITS word will be returned to the system controller, but in what order? The order of the bits, when translating from 32-bit serial data to three parallel bytes, provides an excellent format for confusion and disagreement. For this reason an attempt will be made to not only explain the order, but why this particular order was chosen.

First let's review ARINC specification 429 (2.3.2). "The Least Significant Bit (LSB) and Least Significant Character (LSC) of each word should be transmitted first. It may be noted that the Least Significant Bit of the word is the Most Significant Bit of the label and that the label is transmitted ahead of the data in each case. This reversed label characteristic is a legacy from past systems in which the octal coding of the label field was, apparently, of no significance."

From the above it can be seen that the Receiver Card will receive the DITS word with the Least Significant Bit first. The problem is that system controllers prefer to receive data with the Most Significant Bit first. For this reason, the Receiver Card reverses the data and inputs it to the system controller with the MSB first. This will save the programmer some software, plus, the Receiver Card can reverse the bits much faster in hardware than the system controller can in software.

Data Errors (ALL LABEL Mode)

When the Receiver Card is in the "ALL LABEL Mode" and receives a parity or word length data error (See: Receiver Data Error LED), it discards the word. Keep in mind that if the word received has an error, the label may also be in error. If the word was put into RAM it could result in randomly loading bad data on top of good data.

When the Receiver Card detects a word gap error (See: Receiver Data Error LED), it discards both the word immediately proceeding and the word immediately after the gap error.

On power-up the RAM will be loaded with all 1's. Following power-up, only received valid data will be loaded into RAM. When the system controller inputs the DITS word from the Receiver Card, bit 32 will have the following meaning:

1. A "1" indicates there has been a data error since last time the data error latch was cleared. The latch can be cleared by a "C" command, the "Data Error Clear

Switch", or by an "R" command. A "1" does not mean that the word being read is in error.

2. A "0" indicates that there hasn't been a data error since the last time the data error latch was cleared.

When the Receiver Card detects a data error it will generate a vectored priority interrupt to the system controller, if interrupts are enabled (See: Interrupt Switch).

Data Errors (SINGLE LABEL Mode)

When the Receiver Card is in the "SINGLE LABEL Mode" and receives a parity or word length data error it will store the word in RAM if the received label matches the label that was programmed by the "Sb,K" command. As in the ALL LABEL Mode, a vectored priority interrupt will be generated, if interrupts are enabled (See: Interrupt Switch).

When the Receiver Card detects a word gap error (See: Receiver Data Error LED), it discards both the word immediately proceeding and the word immediately after the gap error.

Bit 32 will be sent to the system controller as it was received on the DITS bus.

ASCII Characters

Since ASCII characters are defined by 7 bits, they can be thought of as a subset of an 8-bit byte. Words sent from the Receiver Card to the system controller will be in bytes. However, it is easier to think in terms of ASCII characters when sending control characters to the 53A system. Whenever an ASCII character is used, the most significant bit (bit 7) can be either a 1 or 0. The 53A System will ignore this bit.

The following table will help you go from 8-bit bytes to 7-bit ASCII.

From ARINC Specification 429

CODE NO (octal)	Transmission Order Bit Position 1	2	3	4	5	6	7	8	ASCII Character
0 6 0	0	0	1	1	0	0	0	0	
0 6 1	0	0	1	1	0	0	0	1	1
0 6 2	0	0	1	1	0	0	1	0	2
0 6 3	0	0	1	1	0	0	1	1	3
0 6 4	0	0	1	1	0	1	0	0	4
0 6 5	0	0	1	1	0	1	0	1	5
0 6 6	0	0	1	1	0	1	1	0	6
0 6 7	0	0	1	1	0	1	1	1	7
0 7 0	0	0	1	1	1	0	0	0	8
0 7 1	0	0	1	1	1	0	0	1	9
1 0 0	0	1	0	0	0	0	0	0	@
1 0 1	0	1	0	0	0	0	0	1	A
1 0 2	0	1	0	0	0	0	1	0	B
1 0 3	0	1	0	0	0	0	1	1	C
1 1 1	0	1	0	0	1	0	0	1	I
1 1 3	0	1	0	0	1	0	1	1	K
1 2 2	0	1	0	1	0	0	1	0	R
1 2 3	0	1	0	1	0	0	1	1	S

7	6	5	4	3	2	1
M						
S						
B						

Bit order as labeled on CDS backplane.

Programming

The 53A-420 Card is programmed by ASCII characters issued from the system controller to the 53/63 System's communications card. The 53A-420 Card is interfaced to the communications card through the 53 Series or 63 Series Card Cage's backplane.

To address a function card for the first time, the system command @XY must be issued. X is the card cage address (0-9) selected on the 53A-171 Control Card in the addressed card cage; Y is the 53A-420 Card's address (0-9) within the addressed card cage. The 53A-420 Card's address is selected using the card's Address-select switch. Once a function card is addressed, it remains addressed until the system receives another @ character. Appendix A fully discusses the @XY command and the other 53/63 Series System commands. After the 53A-420 Card is addressed, the commands listed below may be issued until another function card is addressed.

In all the examples it is assumed that the Receiver Card has address 7 and is located in a Mainframe with address 0.

Labels

The labels, of the messages that will later be input by the system controller, are first output by the system controller to the Receiver Card. Each label is output as a single byte of data.

Label ARINC - 429

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

Octal 222 which is VOR Omnibearing.
Bit 7 is the most significant bit of each byte. The numbers 0 through 7 represent the bits as they are labeled on the CDS Backplane.

Data

ARINC-429 bits 9 through 32 are input by the system controller from the Receiver Card. The ARINC data is returned as three data bytes followed by carriage-return and line-feed characters <CR-LF>. Three typical data bytes are shown below.

Bits 9 through 32 of the DITS word.

32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10
1	0	1	1	0	0	0	1	0	1	0	0	1	1	1	1	1	1	1	0	0	1	1
M			261								117								347			
S																						
B	First Input Byte							Second Input Byte								Third Input Byte						

NOTE: The interpretation of bit 32 will depend on the mode to which the Receiver Card is programmed (SINGLE or ALL LABEL Mode).

See: Data Errors.

Summary

An overview of the commands, listed alphabetically, is as follows:

A	This command is used to program the Receiver Card to the "ALL LABEL Mode" of operation.
B	This command is used to program the Receiver Card to the "SINGLE LABEL Mode" of operation.
C	This command will Clear the RDE LED and latch.
I	This command is used to set the receiver card for either a fast or slow bit rate.
R	This command Resets all RAM locations to the preset condition of all 1's.
S	This command is used to set a specific RAM address whose data will be returned the next time the system controller goes to input and requests data.
Sb_1K	This command is used in the "SINGLE LABEL Mode" to allow the system controller to set a trigger label.

Card Commands

Detailed descriptions of the 53A-420 Card's commands, in the same order as listed above, are as follows:

Command	Description
A	This command is used to program the Receiver Card to the "ALL LABEL Mode" of operation.

Example
The command sequence @07A would put the card in the "ALL LABEL Mode."

Status:

Power LED - out.
DDT LED - lit if card is receiving data.
F/S LED - lit if card is set for fast bit rate.
RDE LED - lit if there has been an error.
A/B LED - lit.

Command	Description
B	This command is used to program the Receiver Card to the "SINGLE LABEL Mode" of operation.

Example
The command sequence @07B would put the card in the "SINGLE LABEL Mode."

Status:

Power LED - out.
DDT LED - lit if card is receiving data.
F/S LED - lit if card is set for fast bit rate.
RDE LED - lit if there has been an error.
A/B LED - out.

Command	Description
C	This command will Clear the RDE LED and latch. See Data Errors in the Operation Section of this manual.

Example
The command sequence @07C would clear the data error latch.

Status:

Power LED	- out.
DDT LED	- lit if card is receiving data.
F/S LED	- lit if card is set for fast bit rate.
RDE LED	- out.
A/B LED	- lit if system is in "A" mode.

Command	Description
I	This command is used to set the receiver card for either a fast or slow bit rate.

Syntax: zI

z is an ASCII character 0 or 1 that has the following meaning:

- 0 Sets a slow bit rate (10 to 14 K b/s). This is the power-up condition.
- 1 Sets the fast bit rate (100 K b/s). The ASCII character "I" sets the bit rate.

Example

The command sequence @071I would set the Receiver Card for the fast bit rate.

Status:

Power LED - out.
DDT LED - lit if card is receiving data.
F/S LED - lit if card is set for fast bit rate.
RDE LED - lit if there has been an error.
A/B LED - lit if system is in "A" mode.

Command	Description
R	This command Resets all RAM locations to the preset condition of all 1's. In the "ALL LABEL Mode" this command is issued anytime the user wishes to reset RAM to a known starting condition. In the "SINGLE LABEL Mode" this command also resets the RAM storage location counter to 000. The first DITS word that is stored will go to location 000 the second to 001 the third to 002 and etc. Example The command sequence @07R would Reset the Receiver Card. Status: Power LED - out. DDT LED - lit if card is receiving data. F/S LED - lit if card is set for fast bit rate. RDE LED - lit if there has been an error. A/B LED - lit if system is in "A" mode.

Command	Description
S	The Set command is used to set a specific RAM address whose data will be returned the next time the system controller goes to input and requests data.

Syntax: Sb_1

b_1 is a single 8-bit binary label. This label is taken from ARINC Specification 429. For example, b_1 could be octal 125 which is the label for "Greenwich Mean Time".

The RAM locations are numbered from 000 to 377 octal, the same as the labels are numbered in ARINC Specification 429.

NOTE: Octal 125 would actually be output from the system controller as one 8-bit byte.

In the "ALL LABEL Mode", RAM locations correspond to individual labels.

In the "SINGLE LABEL Mode", RAM locations correspond to the sequence in which DITS words are loaded into RAM - i.e., 000 is the first word loaded, 001 the second, 002 the third, and etc.

See Data Errors for a discussion of the DITS Bit-32 returned to the system controller.

Example
This example assumes the Receiver Card is in the "ALL LABEL Mode." If the byte b_1 represents an octal 23, the command sequence @07Sb_1 would load data associated with the Receiver Card RAM label 023 (ADF Frequency) into the card's input buffer.

Status:

Power LED - out.
DDT LED - lit if card is receiving data.
F/S LED - lit if card is set for fast bit rate.
RDE LED - lit if there has been an error.
A/B LED - lit.

After issuing the S command, the system controller will normally request data from the 53A-420 card. The data returned will consist of three 8-bit binary bytes of ARINC-429 data, followed by Carriage-Return and Line-Feed characters. All five bytes must be input by the system controller. The format of the returned ARINC-429 data is described at the beginning of the Operation Section.

Command	Description

SK

This command is used in the "SINGLE LABEL Mode" to allow the system controller to set a trigger label. The Receiver Card will scan incoming DITS words for the trigger label and when found, will sequentially store the associated data in RAM. The storage will start at address 000 and end at 377 octal.

Syntax: Sb_1K

The S in the command sequence is the Set command. Upon being received, the Receiver Card will load the trigger label associated with b_1 into the Receiver Card.

b_1 is a single 8-bit binary label. This label is taken from ARINC Specification 429. For example, b_1 could be octal 125 which is the label for "Greenwich Mean Time". Note: Octal 125 would actually be output from the system controller as one 8-bit byte.

The K loads b_1 as the trigger label. The label may be changed at any time, but it will be used by the Receiver Card to determine if a received DITS word is to be stored only when the card is in the "SINGLE LABEL Mode."

Example
If the byte b_1 represents an octal 23, the command sequence $@07Sb_1K$ would load the trigger label 023 (ADF Frequency) into the Receiver Card. This and the following example assumes the Receiver Card is in the "SINGLE LABEL Mode."

Status:

Power LED - out.
DDT LED - lit if card is receiving data.
F/S LED - lit if card is set for fast bit rate.
RDE LED - lit if there has been an error.
A/B LED - out.

Example
If the byte b_1 represents an octal 3, the system controller could now issue the command sequence $@07Sb_1$ to load the contents of the fourth RAM location into the Receiver Card's data input buffer. The system controller would then go to input and receive the contents of the fourth RAM location.

Status:

Power LED - out.
DDT LED - lit if card is receiving data.
F/S LED - lit if card is set for fast bit rate.
RDE LED - lit if there has been an error.
A/B LED - out.

INSTALLATION

The 53A-420 Card is a function card; therefore, it may be plugged into any blue card slot. Setting the Address Select switch defines the card's programming address. To avoid confusion, it is recommended that the slot number and the programming address be the same.

CAUTION:

To avoid plugging the card in backwards, observe the following:

a. Match the keyed slot on the card to the key in the backplane connector. The component side should be to the right for a 53 Series Chassis and to the top for a 63 Series Chassis.

b. There are two ejectors on the card. Make sure the ejector marked "53A-420" is at the top for a 53 Series Chassis and to the left for a 63 Series Chassis.

CAUTION:

The 53A-420 Card is a piece of electronic equipment and therefore has some susceptibility to electrostatic damage (ESD). ESD precautions must be taken whenever the module is handled.

APPENDIX A

53/63 SERIES SYSTEM COMMANDS

Command	Description
@XY	The @XY (Address) command addresses a function card in the 53/63 Series System. @ is a delimiter used by the 53/63 Series System. X is a card cage address (0-9) defined by the Address Select switch on the 53A-171 Control Card in the addressed card cage. Y is a function-card address (0-9) defined by the Address Select switch on the function card. Once a card cage/function-card combination is addressed, it remains addressed until the 53/63 Series System detects a new @ character.
@XS	The @XS (Status) command provides the interrupt status of all function cards within the card cage defined by X. The interrupt status of all function cards in the addressed card cage is latched into the 53A-171 Control Card when the @XS command is issued. All function cards in all card cages become unaddressed after the @XS command is issued. The @XS command allows the interrupt status of the 53A-420 Card to be read as programmed by the I (Interrupt) command (see the Card Commands subsection in the OPERATION section of this manual for details of the I command). The 53A-171 Control Card Operating Manual describes the @XS command in detail.
@XH	The @XH (Halt) command halts all function cards within the card cage defined by X. This command does not affect function cards in other card cages. How a function card reacts to the @XH command depends on the particular card. In all cases, an addressed function card (Power LED out) becomes unaddressed (Power LED lit).
STOP	The STOP command is not a string of ASCII characters. This command is hard-wired from the system controller to the 53/63 System's communications card in each card cage. When the system controller issues a STOP command, each function card (including the 53A-420 Card) reacts as if it had received the @XH command described above. How the system controller executes a STOP command depends on the communications card used. For example, when using the 53A-128 IEEE-488 Communications Card, a STOP command is executed whenever the system controller asserts the IEEE-488 bus line IFC (Interface Clear) true.

APPENDIX B

INPUT/OUTPUT CONNECTIONS

The Mark 33 DITS bus is connected to the Receiver Card by a 53A-780 Hooded Connector. The signal assignments are listed below:

SIGNAL	53A-780 Pin Number/Letter
+5 Volts	1,A
DITS Signal Input, Line A	22
DITS Signal Input, Line B	23
Reconstructed bus data out, TTL, NRZ, serial	2
Reconstructed clock out, TTL	5
Sync Signal out, TTL	4
Data error pulse, TTL	3
Word Spacing error, TTL	6
Parity error, TTL	7
Word length error, TTL	8
Signal Ground	B through BB

APPENDIX C

SAMPLE BASIC PROGRAM FOR THE 53A-420

In this program listing, lines which are indented and not preceded by a line number are not part of the BASIC program. They are inserted here as comments to explain what the program is doing at each numbered line.

Example 1 (ALL LABEL Mode)

The following program written in BASIC programs the Receiver Card to the "ALL LABEL Mode" and then requests input from labels 222 (VOR Omnibearing) and 023 (ADF Frequency).

```
110 PRINT#2;"@07ACR1I"
```

Line 110 of code is a statement to output to logical unit 2 the data contained in quotation marks. It is assumed that the 53A System has been connected to logical unit 2 of the computer. The quotation marks " are part of the required PRINT syntax and are not sent to the 53A System.

@07 - The @ character is a delimiter used by the 53A System. The two characters following the @ are mainframe and Receiver Card address respectively. Once the Receiver Card is addressed it will remain addressed until the 53A System detects a new @ character.

The address of the mainframe 0 was selected by the ten-position Address Select switch on the Control Card.

The address of the Receiver Card 7 was selected by the ten-position Address Select switch on the Receiver Card.

A - Sets the Receiver Card in the "ALL LABEL Mode."

C - Clears the RDE LED and latch.

R - Resets the RAM locations to the preset condition of all 1's.

1I - Sets Receiver Card for fast bit rate.

DDT LED - lit if card is receiving data.
F/S LED - lit.
RDE LED - out.
A/B LED - lit.

```
120 LET A=DEC(222)
```

Store the decimal value of the octal label "222" in the variable A.

```
130 PRINT#2;"S";
```

Send the S command to the Receiver Card. The Receiver Card now expects the very next character to be an 8-bit byte that represents the label of the DITS word to be input. For

this reason this command is followed by semicolon ; which suppresses the Carriage-Return and Line-Feed characters.

140 PUT#2;A

This statement allows the program to output the value of the variable A as a single 8-bit byte to the Receiver Card.

150 GET#2;X1
160 GET#2,X2
and 170 0ET#2,X3
180 0ET#2,X4
in 190 GET#2;X5

The computer will input from the Receiver Card 160 three bytes of data followed by Carriage-Return Line-Feed characters. The data will represent bits 32 through 9 of the VOR Omnibearing. See: DATA in 19 the OPERATION Section of this Manual for an explanation of this DITS word.

NOTE: The data was not read into a string variable since the three data bytes may have contained the characters CR or LF.

200 LET B=DEC(023)

Store in the variable B the decimal value of the octal label "023".

210 PRINT#2;"S";

Same function as Line 130.

220 PUT#2;B

Same function as Line 140.

230 GET#2;Y1
240 GET#2;Y2
250 GET#2;Y3
260 GET#2;Y4
270 GET#2;Y5

The computer will input from the Receiver Card three bytes of data followed by Carriage-Return and Line-Feed characters. This data will represent bits 32 through 9 of the ADF Frequency.

Example 2 (SINGLE LABEL Mode)

This program sets a trigger label (octal 125) in the "SINGLE LABEL Mode. The program then halts the loading of new DITS words into RAM after 200 words have been loaded, and then starts reading the first 128 words into the system controller.

50 DIM A(50),B(150,C(150)

Define arrays for inputing ARINC-429 data.

60 PRINT#2;"@07BC1I"

Line 60 of code is a statement to output to logical unit 2 the data contained in quotation marks. It is assumed that the 53/63 System has been connected to logical unit 2 of the system controller.

The quotation marks " are part of the required PRINT syntax and are not sent to the 53A System.

@07 - The @ character is a delimiter used by the 53A System. The two characters following the @ are mainframe and Receiver Card address respectively. Once the Receiver Card is addressed it will remain addressed until the 53A System detects a new @ character.

The address of the mainframe 0 was selected by the ten-position "Address Select Switch" on the Control Card.

The address of the Receiver Card 7 was selected by the ten-position Address Select switch on the Receiver Card.

A - Sets the Receiver Card in the "ALL LABEL Mode."

C - Clears the RDE LED and latch.

R - Resets the RAM locations to the preset condition of all 1's.

1I - Sets Receiver Card for fast bit rate.

Power LED - out.
DDT LED - lit if card is receiving data.
F/S LED - lit.
RDE LED - out.
A/B LED - out.

70 LET G=DEC(125)
Stores the decimal value of the octal label "125" (Greenwich Mean Time) in variable G.

80 PRINT#2;"S";
Send the S command to the Receiver Card. The Receiver Card now expects the very next character to be an 8-bit byte that represents the label of a DITS word. For this reason this command is followed by a semicolon ; which suppresses the Carriage-Return and Line-Feed characters.

90 PUT#2;G
This command outputs the decimal value of variable "G" as a single 8-bit byte to the Receiver Card.

100 PRINT#2; "KR"
The K command loads the value of variable "G" as a trigger label.

The R command Resets all RAM locations to the reset condition of all 1's and starts the Receiver Card loading DITS words at location 000.

110 PRINT#2; "S"
Send the S command to the Receiver Card. The command is followed by a semicolon ; which suppresses the carriage-return and linefeed characters.

120 PUT#2; 127

This command outputs the decimal value of 127 as a single 8-bit byte to the Receiver Card and loads the contents of RAM location 127 into the card's input buffer.

The program will step through and continuously read RAM location 127 (decimal). When RAM location 127 no longer contains octal 377,377,377 (the value set by the R command in Line 100) 128 words have been loaded into RAM.

The program will then set the trigger word to octal 000 to stop the loading of more DITS into RAM. Then the program will start reading DITS words from RAM.

130 GET#2;A

Input the first byte of data contained in RAM location 127.

140 GET#2;B

Input the second byte of data contained in RAM location 127.

150 GET#2;C

Input the third byte of data contained in RAM location 127.

160 GET#2,D

Input Carriage-Return.

170 GET#2;E

Input Line-Feed.

180 IF A <>255 THEN GO TO 220

If A is not equal to decimal 255 (octal 377, all 1's) then go to Line 220.

190 IF B <>255 THEN GO TO 220

If B is not equal to decimal 255 go to Line 220.

200 IF C <>255 THEN GO TO 220

If C is not equal to decimal 255 go to Line 220.

210 GO TO 110

The program reached this point because RAM location 127 is still all 1's. The program will return to Line 110 and read three more bytes of data.

220 PRINT#2;"S";

The program reached this point because RAM location 127 isn't all 1's. A DITS word has been loaded into RAM location 127. The "S" (Set) command is issued because the computer is going to set a new trigger label. This will be an unused label (000) and the Receiver Card will, therefore, stop loading data from the DITS bus.

NOTE: Failure to stop the loading of RAM would allow the receiver to load to octal 377 and then start again at 000 writing over old data.

230 PUT#2;0

The computer outputs decimal 0, which is octal 000 to the Receiver Card.

240 PRINT#2;"K"
The computer outputs the ASCII character K to the Receiver Card, which loads the byte output in Line 230 as a trigger label. The Receiver Card has now stopped loading data into RAM.

250 FOR I=0 TO 127
Set up loop counter so that the first 128 RAM registers can be read.

260 LET N=I+1
Set up indexing of numeric array from 1 through 128.

270 PRINT#2;"@07S";
Address the Receiver Card and issues the Set command. The ; prevents the computer from sending CR/LF to the Receiver Card.

280 PUT#2;I
Address the RAM register defined by "I".

290 GET#2;A(N)
Reads first byte into A(N). Note: This couldn't be read as INPUT#2; A$(N) since one of the three data bytes may have been the equivalent of ASCII CR or LF.

300 GET#2;B(N)
Read second byte into B(N).

310 GET#2;C(N)
Read third byte into C(N).

320 GET#2;D
Input Carriage-Return.

330 GET#2;E
Input Line-Feed.

340 NEXT I