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DAS-429P104/Mx

Multi-Channel ARINC-429
Test and Simulation Board
for PC/104 Computers

User's Manual



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1 Introduction

Chapter 1 provides an overview of the DAS-429P104/Mx avionics communication board. The following topics are covered:

- "Overview," page 1-1
- "Installation," page 1-5
- "General Memory Map," page 1-6
- "Global Registers," page 1-7
- "Technical Support," page 1-8

1.1 Overview

The DAS-429P104/Mx is a modular ARINC-429 memory-mapped, 12 channel test, simulation, and monitor card for PC/104 systems. The DAS-429P104/Mx provides a total solution for developing and testing ARINC-429 interfaces and for performing system simulation of the ARINC-429 bus, both in the lab and in the field.

The DAS-429P104/Mx is based on the latest Surface Mount Technology, which substantially reduces the area required. The card occupies 32K bytes of the host computer's memory map. The DAS-429P104/Mx comes configured with 2(x) transmit and 4(x) receive channels (where x = number of modules ordered). The channels are organized in two independent modules (P/N: M429R4T2), each configured with 4 receive and 2 transmit channels. Each module contains an on board hi-speed controller and 16K x 16 true dual-port RAM. Each module is accessed through a banking mechanism and operates independently. You can set up each module to generate interrupts to the host in a variety of circumstances through an extensive interrupt structure. Both transmit and receive channels may be programmed for Hi (100Khz) or Lo (12.5Khz) speed bit rates. In addition, either odd or even parity may be programmed for transmit channels.

All control registers and data blocks can be accessed directly in real time. The card supports filtering of receive data and multiple data storage modes. Status and Time tag information are appended to each word. The transmit channels operate via a transmitter "instruction" stack which allows scheduling of data transmissions and reduces the need for host computer intervention. The DAS-429P104/Mx comes complete with C-driver software libraries, including source code.

The DAS-429P104/Mx is ideally suited for developing, simulating, testing and monitoring ARINC-429 interfaces for multi-channel applications requiring a single PC/104 card.

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For industrial environment applications the DAS-429P104/Mx is available in an extended temperature (-40° to +85°C) version. See “Ordering Information,” page 6-1 for the exact part numbers.

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DAS-429P104/Mx Card Features:

- Up to 8 Receive and 4 Transmit channels on a PC/104 card
- Organized in 2 modules, each containing:
  - 4 Receive channels
  - 2 Transmit channels
  - 16k x16 true dual-port RAM
  - On board 32 bit processor
- 12.5k bit and 100k bit data rates
- Selectable even/odd parity
- Programmable interword gap
- Transmission modes:
  - One-shot
  - Loop
  - "N"- times
- Two Receive/Monitor modes:
  - Sequential
  - Look-up table
- 32 bit Time tagging per word
- "Merge mode" stores data from multiple receive channels in one buffer
- Label filtering
- Start triggers
- Receive count interval triggers
- Interrupt and polling modes of operation
- PC/104 compliance:
  - Occupies 32K (1/2 segment) of the memory map
  - All interrupt lines selectable
- Real time operation
- Extended temperature (-40° to +85° C) version available

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Figure 1-1 below illustrates the DAS-429P104/Mx's block diagram.

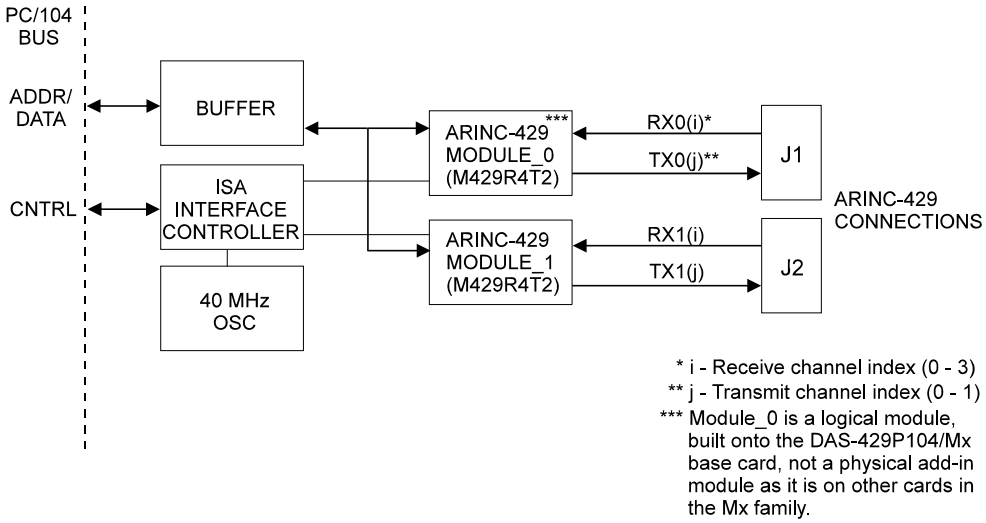


Figure 1-1. DAS-429P104/Mx Block Diagram

Figure 1-2 below illustrates the block diagram of a single M429R4T2 module.

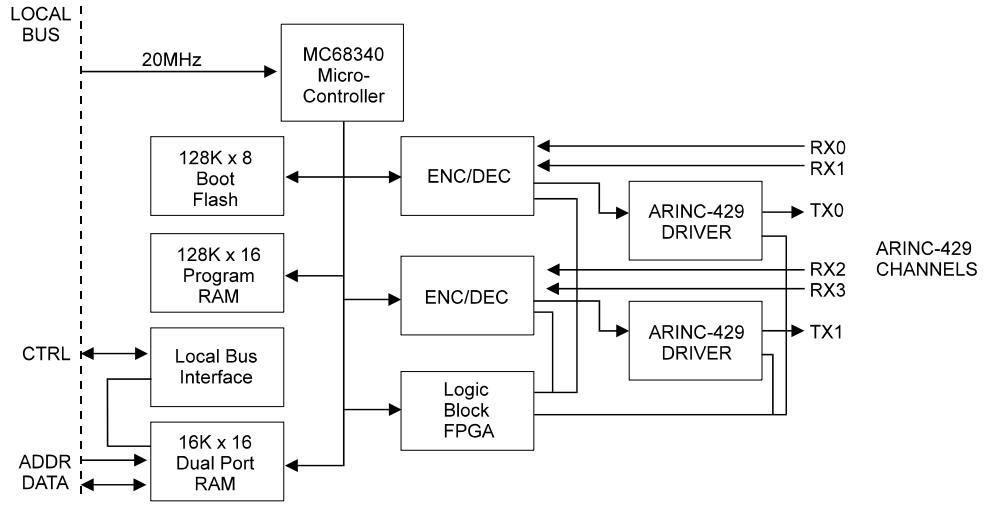


Figure 1-2. M429R4T2 Module Block Diagram

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1.2 Installation

Before installing the card, it is very important to determine which half-segment of memory is available. Programs such as Symantec Corporation's SYSINFO.EXE or Microsoft Corporation's MSD.EXE may be used to determine which memory segments are in use by the BIOS and any other adapter cards already installed on your computer.

WARNING *If a segment is already in use and it is also used for DAS-429P104/Mx, the card will exhibit unpredictable behavior. It may work in some modes, but not others; it may seem to work fine yet exhibit intermittent errors; it may not function at all.*

Once a free segment is found, the Base Address Select jumpers (JP12-JP16) should be set accordingly. The Interrupt Select jumpers (JP17-JP27) should be set to the required interrupt line, if using interrupts.

Once all the jumpers are correctly set, **make certain the computer power source is disconnected.** While using a suitably grounded electrostatic discharge wrist strap, install the DAS-429P104/Mx card on top of the other cards in your system.

Once the card is installed, the mating 16-pin header socket—wired with the ARINC-429 connections—should be attached to the card.

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1.3 General Memory Map

The DAS-429P104/Mx occupies 32K bytes of the host computer's memory map. This is divided into two sections: Module Memory Area and four Global Registers. The Module Memory Area contains 64Kb of dual-port RAM divided into 2 banks of 32Kb each. You can change banks via the Global Bank Select Register defined below. The Global Registers are independent of the selected bank, and include appropriate control bits for all the banks (Modules).

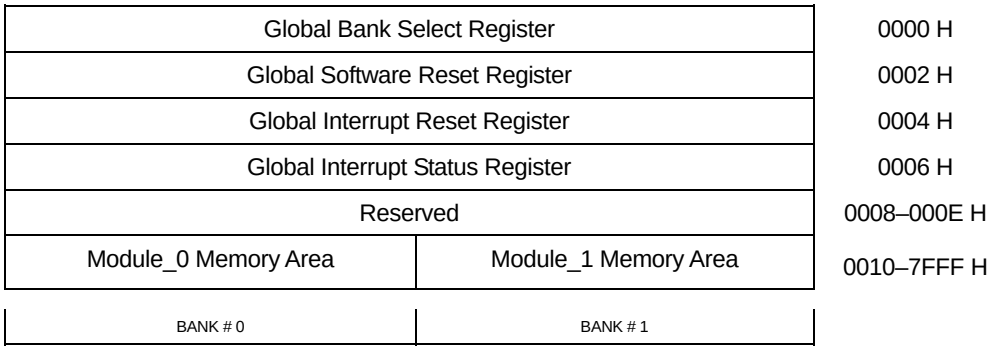


Figure 1-3. General Memory Map

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1.4 Global Registers

1.4.1 Global Bank Select Register

Address: 0000 (H) READ/WRITE

The Global Bank Select register sets the Bank Select for the desired Module access. Writing a zero will give the host access to bank 0, and 1 to bank 1. This register is set to 0 at power-up.

WRITE DEFINITION

Bit	Bit Name	Description
01-15	X - Don't Care	
00	**BS0**	
	0	Bank 0 (Module_0)
	1	Bank 1 (Module_1)

READ DEFINITION

Bit	Bit Name
01-15	X - Don't Care
00	BS0

Global Bank Select Register

1.4.2 Global Software Reset Register

Address: 0002 (H) WRITE

The Global Software Reset register is used to reset the card. Writing a value of 1 to the appropriate bit will reset the corresponding Module. Writing a value of 0 has no effect.

WARNING *Reset erases all memory locations in the dual-port RAM. The Module Status, Firmware Revision, Module ID and Channel x RCV Look-Up Table Start Address registers are written by the card after reset operation has been completed.*

Bit	Description
02-15	X - Don't Care
01	Module_1 Software Reset
00	Module_0 Software Reset

Global Software Reset Register

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1.4.3 Global Interrupt Reset Register

Address: 0004 (H) WRITE

The Global Interrupt Reset register is used to reset the card interrupt request. Writing a value of 1 to the appropriate bit will reset the corresponding Module interrupt request. Writing a value of 0 has no effect.

Bit	Description
02-15	X - Don't Care
01	Module_1 Interrupt Reset
00	Module_0 Interrupt Reset

Global Interrupt Reset Register

1.4.4 Global Interrupt Status Register

Address: 0006 (H) READ

The Global Interrupt Status register indicates the card pending interrupts status. A value of 1 at the appropriate bit indicates a corresponding Module active interrupt. A value of 0 indicates no interrupt has been generated.

Bit	Description
02-15	X - Don't Care
01	Module_1 Interrupt Status
00	Module_0 Interrupt Status

Global Interrupt Status Register

1.5 Technical Support

Excalibur Systems is ready to assist you with any technical questions you may have. For technical support, see the Technical Support section of our website: www.mil-1553.com. You can also contact us by phone. To find the location nearest you, see the Contact section of our website.

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2 Module Operation

Chapter 2 describes the general principle of module operation, the module memory map, and the module control registers. The following topics are covered:

- "Module General Operation," page 2-1
- "Module Memory Map," page 2-3
- "Module Control Registers," page 2-4
- "Receiver Merge Mode Control Registers," page 2-9

Each bank (Module) handles 4 receive and 2 transmit channels, is controlled by its own processor and works independently of the other banks. All 12 channels may be run simultaneously although you may only access one bank (six channels) at a time. The manual describes the functionality of a single bank; all banks work in an identical manner.

Perform the following procedure after every time you power up or reset the software.

To determine whether a module is installed and ready to operate:

1. Check the Module ID register (test for value = E429 H).
2. Check the Module Status Register (see "Module Status Register," Note 1, page 2-6).

The module is installed and ready when both registers contain the correct values (as written above). For software reset operations, set these values to 0 immediately prior to writing to the Card Software Reset register.

2.1 Module General Operation

The M429R4T2 module operation makes extensive use of pointers for setting up the size and location of both receiver and transmitter data blocks, transmitter instruction stacks, and receiver look-up tables. Pointers on the card represent **byte offsets** into the memory area of the card. Each channel has its own pointer registers so that unique memory areas may be allocated for each channel. It is also possible for multiple channels to share memory areas. For example, more than one receiver channel may point to and use the same Label Look-Up Table, which controls which labels will be stored by the card.

After power-up or reset the module is initialized in a "wait" loop—looking for a Start command from the host computer. This command, issued by writing to the Module Start Register, instructs the module to begin operation on the active channel(s).

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The transmitter and receiver operations necessary to operate the card are described below in general terms. See “Transmit Mode,” page 3-1, and “Receive/Monitor Mode,” page 4-1, for details.

Perform these steps after power-on:

1. Set and verify the Module Control registers.
   - You can check the results of the power-on self-test by reading the Module Status register.
2. Set the Transmitter-related Channel Control registers.
   - Program the Channel Configuration registers (bit rate, rise time, etc.).
   - Update the Transmit Instruction Stack pointer for each channel.
   - Update the Transmit Instruction counter.
3. Set the Tx Instruction blocks.
   - Update the Instruction Blocks with information relating to each ARINC TX data block (i.e., parity, pointer to the Tx Data blocks, delay between data blocks). See “Transmit Instruction Stack,” page 3-5, for details.
4. Write the Tx Data blocks.
   - Write the ARINC words into the on-board memory at locations pointed to by the instruction stack’s TX Data pointers.
5. Set up the Receiver-related Channel Control registers.
   - Program the Channel Configuration registers (bit rate, etc.).
   - Update the [receive data] Start and End pointers.
   - Update the “Look-Up Table” Start Address register (if using this mode).
   - Update the Filter Table Start Address register.
   - Update the Label Trigger register (if using a Label to start storage).
   - Update Counter Trigger registers (not required).
6. Start.
   - Write to the [Module] Start Register setting the appropriate channel(s) “start” bits. Each channel can be “started” individually at different times. (See “Start/Stop Register,” page 2-4.)
7. Read the Receive Status registers (i.e. Word Counter).
   - Read the Receiver Status registers to know how many words have been received.
8. Read the Rcv Data block.
   - Read the ARINC words (and RCV Status and Time tag words) from the on-board memory.

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2.2 Module Memory Map

Figure 2-1 illustrates the module memory usage.

Module Control Registers	0010–007E H
Channel Control Register Block 0	0080–00AE H
Channel Control Register Block 1	00B0–00DE H
Channel Control Register Block 2	00E0–010E H
Channel Control Register Block 3	0110–013E H
Channel Control Register Block 4	0140–016E H
Channel Control Register Block 5	0170–019E H
Area Used For: TX Instruction Stacks TX Data Blocks RCV Data Blocks RCV Look-up Tables	01A0–7FFE H

Figure 2-1. Module M429R4T2 Memory Map

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2.3 Module Control Registers

Start Register	0010 H
Module Status Register	0012 H
Firmware Revision Register	0014 H
Channel Interrupt Register	0016 H
Receiver Data Storage Mode Register	0018 H
Interrupt Status Busy Register	001A H
Reset Time Tag Register	001C H
Module ID Register	001E H
Receiver Merge Start Pointer *	0020 H
Receiver Merge End Pointer *	0022 H
Receiver Merge Current Pointer *	0024 H
Receiver Merge Filter Table Start Address *	0026 H
Receiver Merge Word Counter *	0028 H
Receiver Merge Buffer Wraparound Register *	002A H
Receiver Merge Word Count Trigger Register *	002C H
Receiver Merge Interval Count Trigger *	002E H
Reserved	0030 H
Receiver Merge Label Trigger Register *	0032 H
Receiver Merge Configuration Register *	0034 H
Receiver Merge Interrupt Condition Register *	0036 H
Receiver Merge Status Register *	0038 H
Reserved	003A–007E H

Figure 2-2. Module Control Registers Map

NOTE * For an explanation of these registers, see “Receiver Merge Mode Control Registers,” page 2-9.

2.3.1 Start/Stop Register

Address: 0010 (H) READ/WRITE

The Start/Stop register starts and stops channel operation. You can start one or more channels at the same time. Writing a 1 to bit 00 starts channel #0 operation, writing a 1 to the next location starts channel #1, etc. Writing a 0 to the bit location will stop that channel’s operation. You should wait a minimum of 350 µsec. between writes to the Start/Stop register.

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Bit	Bit Name
06-15	0
05	Channel 5 Start Bit
04	Channel 4 Start Bit
03	Channel 3 Start Bit
02	Channel 2 Start Bit
01	Channel 1 Start Bit
00	Channel 0 Start Bit

Start/Stop Register

NOTE 1. A change in a channel's Configuration register or in the Receiver Data Storage Mode register is acted upon by the firmware only after the Start/Stop register contains a 0 for at least 1 msec.

2. When a transmit channel (channels 2 or 5) has completely finished transmitting all of its data, its start bit is automatically cleared.

2.3.2 Module Status Register

Address: 0012 (H) READ

The Module Status register indicates the result of the self-test of the module.

Bit	Bit Name	Description
15	**Internal Error**	1 = Error 0 = OK
07-14	**Reserved**	
06	**Memory**	1 = OK 0 = Memory Test Fail
05	**Channel 5 Status Bit**	1 = Self Test OK 0 = Self Test Fail
04	**Channel 4 Status Bit**	1 = Self Test OK 0 = Self Test Fail
03	**Channel 3 Status Bit**	1 = Self Test OK 0 = Self Test Fail
02	**Channel 2 Status Bit**	1 = Self Test OK 0 = Self Test Fail
01	**Channel 1 Status Bit**	1 = Self Test OK 0 = Self Test Fail
00	**Channel 0 Status Bit**	1 = Self Test OK 0 = Self Test Fail

Module Status Register

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NOTE 1. Module status should be tested by checking all non-reserved bits for current value. For example, statreg & 0x807F == 0x007F.

2. The "Self Test Fail" is set when the channel self-test fails or when the channel is not present on the module.

3. The module will continue to operate on condition of Channel Self-Test Failures, but will not continue to operate on condition of a Memory failure.

4. The memory and channel self tests are performed once, immediately after the module is reset. On the other hand, Internal Error status is monitored continuously. If the module detects an illegal condition during normal module operation, this register will be cleared, except for the Internal Error bit, which will be set. An example of an illegal condition would be setting a pointer register to a byte boundary address (odd address).

2.3.3 Firmware Revision Register

Address: 0014 (H) READ

The Firmware Revision register indicates the revision level of the firmware. For example, 0100 (H) = Rev 1.00.

2.3.4 Channel Interrupt Register

Address: 0016 (H) READ/WRITE

The Channel Interrupt register indicates which channel issued the interrupt (1 = Active). You can reset the status bits by writing to this register or to the reset register.

Bit	Bit Name
06-15	Reserved
05	Channel 5 Interrupt Bit
04	Channel 4 Interrupt Bit
03	Channel 3 Interrupt Bit
02	Channel 2 Interrupt Bit
01	Channel 1 Interrupt Bit
00	Channel 0 Interrupt Bit

Channel Interrupt Register

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2.3.5 Receiver Data Storage Mode Register — Address: 0018 (H) WRITE

The Receiver Data Storage Mode register is used to select the Receiver Data Storage Mode and the Merge Mode option. ARINC-429 data words can be stored with Time tag and Status words appended to the data block or they can be stored without these additional words. Set bit 00 to a logic 0 to select the standard mode which appends both Time tag and Status Words to each ARINC-429 word stored in memory. Set register bit 00 to a logic 1 to select **Data Only mode**.

Bit 01 controls the Receiver Merge Mode selection. A logic 0 selects the standard independent mode which utilizes different receive buffer areas for each receive channel. A logic 1 selects the **Merge Mode** which utilizes a single receiver buffer for all channels. Each Receive Status Word, in this case, is tagged with Channel Code information. The Merge Module Control registers are used only when the Merge Mode option is selected. See "Receiver Merge Mode Control Registers," page 2-9.

Bit	Description
02-15	0
01	Merge Mode Option 0 = Independent Mode 1 = Merge Mode
00	Receive Data Storage Mode 0 = Standard Mode 1 = Store Only Data

Receiver Data Storage Mode Register

NOTE 1. If Data Only Storage Mode is selected (bit 00 set to 1), storage will be per independent channel regardless of the state of bit 01.

2. Data Only Storage Mode is not available in Lookup Table Mode.

3. The Receiver Data Storage Mode register can only be changed when all channels are turned off (Start/Stop register = 0).

4. Merge mode merges the 4 receive channels in each bank.

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2.3.6 Interrupt Status Busy Register

Address: 001A (H) READ

The Interrupt Status Busy register indicates whether you can access a particular channel's interrupt status register. A 1 in the appropriate bit position indicates that the channel's interrupt status register is busy and you should not access it. A 0 in the appropriate bit position indicates that the contents of interrupt status register are valid and you may access it. Bit 06 corresponds to whether the (Receiver) Merge Mode Interrupt Status register is busy.

Bit	Bit Name
07-15	Reserved
06	Merge Mode Busy Bit
05	Channel 5 Busy Bit
04	Channel 4 Busy Bit
03	Channel 3 Busy Bit
02	Channel 2 Busy Bit
01	Channel 1 Busy Bit
00	Channel 0 Busy Bit

Interrupt Status Busy Register

2.3.7 Reset Time Tag Register

Address: 001C (H) WRITE

Writing any non-zero value to the Reset Time Tag register resets the Time tag to 0.

2.3.8 Module ID Register

Address: 001E (H) READ

The module will write the value E429 (H) into the Module ID register when it has finished its initialization sequence and is ready to be accessed by the Host.

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2.4 Receiver Merge Mode Control Registers

You can select the Merge Mode option via bit 01 in the Receiver Data Storage Mode register (see page 2-7). This section describes the Merge Mode Control registers, which are used only when the Merge Mode option is selected.

2.4.1 Receiver Merge Start Pointer

Address: 0020 (H) WRITE

The Receiver Merge Start pointer sets the start address of the Receive Data buffer. The address must be on a word boundary within the Rcv Data Blocks area. For example, to cause the Merge buffer to begin at byte offset 1A0(H), write a 1A0(H) to this register.

2.4.2 Receiver Merge End Pointer

Address: 0022 (H) WRITE

The Receiver Merge End pointer sets the End Address of the Receive Data buffer. The data will wrap around or stop when the buffer is full, (when the end address is reached), depending upon the contents of the Receiver Wrap Around bit Receiver Merge Configuration Register.

2.4.3 Receiver Merge Current Pointer

The Receiver Merge Current pointer indicates the current address where the next ARINC receive word is to be placed in the Receiver buffer. This pointer value is incremented after the entire receiver block (ARINC word, Time tag, and status) is written into memory.

2.4.4 Receiver Merge Filter Table Start Address

Address: 0026 (H) WRITE

The Receiver Merge Filter Table Start address sets the start address of the (256 x 8) Label Filter Table as described in the Sequential storage mode. See “Rcv Sequential Mode Filter Table Diagram,” on page 4-5. The address must be on a word boundary.

2.4.5 Receiver Merge Word Counter

Address: 0028 (H) READ/WRITE

The Receiver Merge Word counter indicates the number of ARINC words received (0 - 65535). This register wraps around to 0 after it reaches 65535. You can reset it only when the channel is stopped.

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2.4.6 Receiver Merge Buffer Wraparound Register Address: 002A (H) READ/WRITE

The Receiver Merge Buffer Wraparound register contains 2 bits for synchronization with the host. If bit 14 is set to 1, the receive buffer has wrapped around once since the last time this register was cleared. If bit 15 is set to 1, there have been multiple wraparounds. You are expected to clear bit 14 each time the first word of the buffer is read. When the module wraps around it checks bit 14. If bit 14 is not set the module sets it, otherwise the module sets bit 15.

NOTE Excalibur C drivers handle these bits. If you use these drivers, you don't need to deal with them.

Bit	Description
15	Multiple Wraparound - Data Lost
14	Single Wraparound
00-13	0

Receiver Merge Buffer Wraparound Register

2.4.7 Receiver Merge Word Count Trigger Register Address: 002C (H) WRITE

The Receiver Merge Word Count Trigger register lets you generate an interrupt and set a flag which indicates when a specific number of words have been received (1 - 65535). If you want to generate an interrupt, you must also set the appropriate bit in the Receiver Merge Interrupt Condition Register. See "Receiver Merge Interrupt Condition Register," page 2-12.

NOTE This trigger is set when the value in the Receiver Merge Word Counter matches the value set in this register.

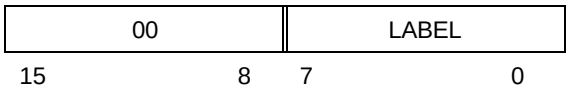
2.4.8 Receiver Merge Interval Count Trigger Register Address: 002E (H) WRITE

The Receiver Merge Interval Count Trigger register (a 16-bit value) lets you generate an interrupt and set a flag upon reception of every "n" number of words, where "n" is the value written to this register. For example, to request an interrupt after every 5 ARINC words, write 05 to this register. If you want to generate an interrupt, you must also set the appropriate bit in the Receiver Merge Interrupt Condition Register. See "Receiver Merge Interrupt Condition Register," page 2-12.

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2.4.9 Receiver Merge Label Trigger Register — Address: 0032 (H) WRITE

The Receiver Merge Label Trigger register is used in conjunction with the Receiver Label Trigger bit in the Receiver Merge Configuration Register to begin the reception and storage of data upon receipt of a unique ARINC-429 label. All ARINC words received prior to the first instance of this label will not be stored by the board.



Receiver Merge Label Trigger Register

2.4.10 Receiver Merge Configuration Register — Address: 0034 (H) WRITE

The Receiver Merge Configuration register sets up various run parameters for Merge Mode.

Bit	Bit Name	Description
10-15	**Reserved**	0
09	**Enable Receive Filter Table**	1 = Enable filter table. (Stores Labels per table) 0 = Disables table. Stores all Labels.
08	**Reserved**	0
07	**Receive Label Trigger**	1 = Start data storage upon receipt of Label xx. 0 = Receiver stores data without Start Label Trigger.
06	**Receiver Wrap Around**	1 = Data storage is halted when the buffer is full. 0 = Receiver wraps around the data in the block.
00-05	**Reserved**	0

Receiver Merge Configuration Register

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2.4.11 Receiver Merge Interrupt Condition Register — Address: 0036 (H) WRITE

The Receiver Merge Interrupt Condition register selects which conditions will cause an interrupt to be generated. Bits 02-06 are the Interrupt Condition bits.

Bit	Description - Interrupt Conditions
07-15	0
06	Stopped on Buffer Full (see bit 06 in "Receiver Merge Configuration Register," page 2-11).
05	Error Word Received
04	Data Word Count Trigger
03	Interval Count Trigger
02	Label Received (see Figure 4-5, page 4-5).
00-01	Reserved

Receiver Merge Interrupt Condition Register

NOTE 1. The Label Received interrupt only occurs upon reception of a label which has been marked for interrupt in the filter table.

2. To activate the Interval Count Trigger interrupt, you must also set the Receiver Merge Interval Count Trigger register. See "Receiver Merge Interval Count Trigger Register," page 2-10.

3. In order to activate the Data Word Count Trigger interrupt, you must also set the Receiver Merge Word Count Trigger register. See "Receiver Merge Word Count Trigger Register," page 2-10.

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2.4.12 Receiver Merge Status Register

Address: 0038 (H) READ/WRITE

The Receiver Merge Status register indicates the operational status of the Merge Mode receive buffer. You can use this register to poll the status of the channel or it can be used with interrupts. When used in conjunction with interrupts the register indicates the condition(s) which caused the interrupt. A logic 1 indicates an active bit. You can reset status bits by writing a 0 to this register.

Bit	Description
07-15	Reserved
06	Stopped on Buffer Full
05	Error Word Received
04	Data Word Count Trigger
03	Interval Count Trigger
02	Label Received
00-01	Reserved

Receiver Merge Status Register

NOTE The Label Received Status bit is set upon receipt of any label for which an interrupt has been requested via the filter table.

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3 Transmit Mode

Chapter 3 describes transmitter operation. The following topics are covered:

- "Transmit Channel Control Register Block Maps," page 3-1
- "Transmit Channel Control Registers," page 3-2
- "Transmit Instruction Stack," page 3-5
- "Transmit Data Block Format," page 3-7

Perform the following procedure to implement the transmit mode:

1. Create an instruction stack for the transmitter channel.
2. Write the data into the dual-port RAM.
3. Start transmission by writing to the Start register found in the Module Control Register area.

The sequence of writes to memory is not important except that writing to the Module Start Register, step 3 above, must be performed last.

3.1 Transmit Channel Control Register Block Maps

3.1.1 Channel 2 Control Register Block Map

Channel 2 Configuration Register	00E0 H
Reserved	00E2–00FA H
Channel 2 TX Instruction Stack Pointer	00FC H
Channel 2 TX Instruction Counter	00FE H
Channel 2 TX Loop Counter	0100 H
Channel 2 TX Current Word Register	0102 H
Channel 2 TX Current Loop Register	0104 H
Channel 2 Interrupt Condition Register	0106 H
Channel 2 Status Register	0108 H
Reserved	010A–010E H

Figure 3-1. Channel 2 Control Register Block Map

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3.1.2 Channel 5 Control Register Block Map

Channel 5 Configuration Register	0170 H
Reserved	0172–018A H
Channel 5 TX Instruction Stack Pointer	018C H
Channel 5 TX Instruction Counter	018E H
Channel 5 TX Loop Counter	0190 H
Channel 5 TX Current Word Register	0192 H
Channel 5 TX Current Loop Register	0194 H
Channel 5 Interrupt Condition Register	0196 H
Channel 5 Status Register	0198 H
Reserved	019A–019E H

Figure 3-2. Channel 5 Control Register Block Map

3.2 Transmit Channel Control Registers

3.2.1 Channel x Configuration Register

The Channel x Configuration register sets up various run parameters for both the receive and transmit channels (see "Channel x Configuration Register — Receive Mode," in "Receive/Monitor Mode," page 4-13). The module ignores unused bits (e.g., receiver-related bits for a transmitter channel).

Bit	Bit Name	Description
10–15	**0**	
09	**Receiver Enable Filter Table**	Not used in Transmit mode
08	**0**	
07	**Receiver Label Trigger**	Not used in Transmit mode
06	**Receiver Wrap Around**	Not used in Transmit mode
05	**Receiver Storage Mode**	Not used in Transmit mode
03-04	**0**	
02	**Transmit Rise/Fall Time**	1 = Low Speed (10 ± 5 μsec.) 0 = High Speed (1.5 ± 0.5 μsec.)
01	**0**	
00	**Bit Rate**	1 = 12.5 KHz (Lo speed) 0 = 100KHz (Hi speed)

Channel x Configuration Register — Transmit Mode

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NOTE 1. It is recommended that you set up **all** [active channel] Configuration Registers before programming any other parameters.

2. You can only write to this register when **all** channels are turned **off** (via the Start Register).

3. You should "start" the module (via the Start Register) only after a minimum of 500 µsec from the time that the contents of this register have been modified.

3.2.2 Channel x Tx Instruction Stack Pointer — WRITE

The Channel x Transmit Instruction Stack pointer sets the starting address of the TX Instruction Stack. The address must be a word boundary within the Tx Instruction Stack area. For example, to place the Transmit Instruction stack at location 300 (H), write a 300 (H) to this register.

3.2.3 Channel x Tx Instruction Counter — WRITE

The Channel x Transmit Instruction counter sets the number of TX Instruction blocks to process. These instruction blocks taken together comprise a **frame**.

3.2.4 Channel x Tx Loop Counter — WRITE

The Channel x Transmit Loop counter sets the number of times to execute the TX instruction blocks (the frame); 'N' Times or Continuous Loop. If the continuous value is selected, the channel's operation can be terminated by setting the related channel bit in the Module Start/Stop register to a 0.

Value	
0000	= Continuous
0001	= One Time
0002	= Two Times
	•
	•
	•
FFFF	= 65535 Times

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3.2.5 Channel x Tx Current Word Register READ

The Channel x Transmit Current Word register contains the number of words that have already been sent in the current loop. This allows you to determine which word is currently being sent out.

The register is updated as the last bit of the word is transmitted. After the first word in a loop goes out the register will be incremented to 1. After the final word in a loop goes out, the register will be updated to 0.

3.2.6 Channel x Tx Current Loop Register READ

The Channel x Transmit Current Loop register contains the number of times the TX instruction blocks have been executed (i.e. the number of loops completed).

NOTE The TX Current Word register is cleared before the TX Current Loop register is incremented.

3.2.7 Channel x Interrupt Condition Register WRITE

The Channel x Interrupt Condition register sets which conditions cause interrupts to be generated by the module. Only the two least significant bits are used for transmit channels and only bits 02 through 06 are used for receive channels. See “Channel x Interrupt Condition Register,” in “Receive/Monitor Mode,” page 4-17.

Bit	Description - Interrupt Conditions
07-15	0
02-06	Not used in Transmit mode
01	Transmitter - End of Frame. See Note 2 below.
00	Transmitter - End of Block. See Note 1 below.

Channel x Interrupt Condition Register — Transmit Mode

NOTE 1. The End of Block interrupt will occur at the completion of transmission of *each* Instruction Block.

2. The End of Frame interrupt will occur at the completion of transmission of the *final* Instruction Block (or in loop mode, at the end of each loop cycle).

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3.2.8 Channel x Status Register READ/WRITE

The Channel x Status register indicates the operational status of the channel. You can use this register to poll the status of the channel or it can be used with interrupts. When used in conjunction with interrupts, the register indicates the condition(s) which caused the interrupt. A logic 1 indicates an active bit. You must reset the status bits. Only the two least significant bits are used for transmit channels and only bits 02 through 06 are used for receive channels. See “Channel x Status Register,” in “Receive/Monitor Mode,” page 4-18.

Bit	Description - Interrupt Conditions
07-15	0
02-06	Not used in Transmit mode
01	Transmitter - End of Frame
00	Transmitter - End of Block

Channel x Status Register — Transmit Mode

3.3 Transmit Instruction Stack

The Transmit Instruction Stack is divided into Instruction Blocks, each containing 8 words. Each Instruction Block is associated with a Data Buffer. A data buffer contains one or more ARINC-429 words that you want to transmit with the same amount of delay time between each word.

The first word in each instruction block is the Control Word which contains error injection parameters (i.e. parity type). The second word is the Word Count which instructs the module as to the number of ARINC words in a data buffer to transmit. The third word, the Interword Delay, determines the delay time between words from the same data buffer. The fourth word contains a 16-bit, user-supplied, data pointer. This TX Data Pointer is a 16-bit address (byte offset into the module) which points to the beginning of the data words in the memory. The remaining four words are reserved.

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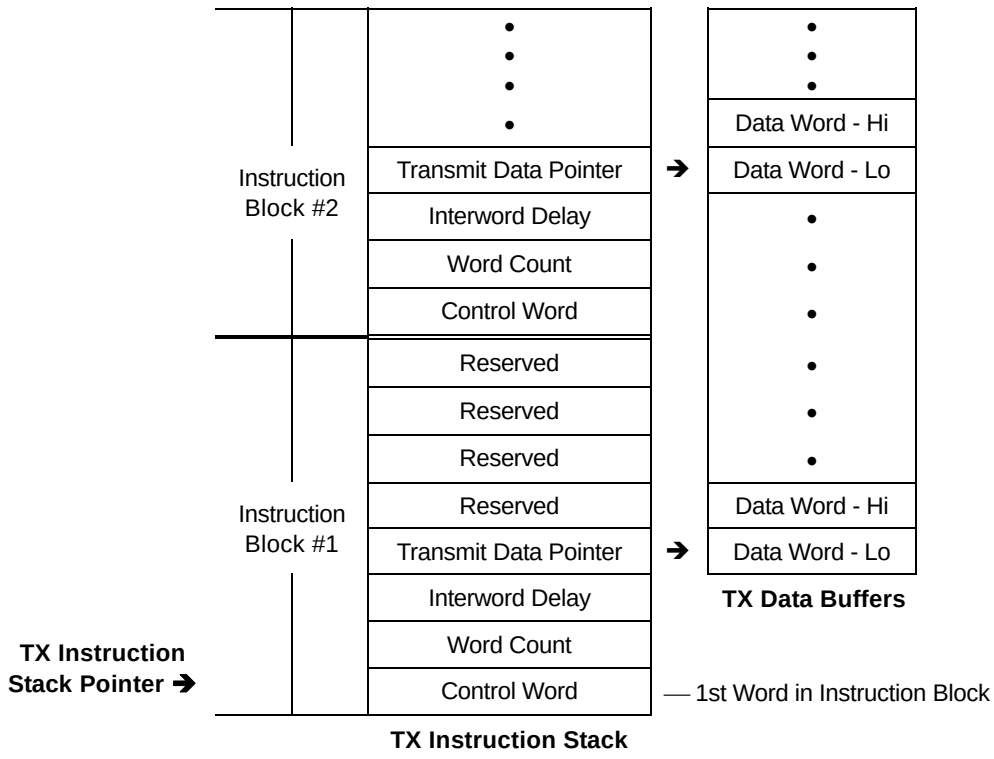


Figure 3-3. Tx Instruction Stack Structure

3.3.1 Control Word Definition (1st word in Instruction Block)

Bit	Bit Name	Description
01-15	**Reserved**	0
00	**Parity Error**	0 = Normal Odd Parity (Standard ARINC-429 parity) 1 = Even Parity (Error Injection)

Control Word Definition

3.3.2 Word Count

The Word Count is used to specify the number of 32 bit ARINC-429 data words in this instruction block (1 - 65535).

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3.3.3 Interword Delay

The Interword delay is used to set the delay (4 - 65504) between words in the block and between the final word in this block and the first word in the following block. Its resolution is 1 bit time. For high speed this gives it a range of 40 microseconds (interword value 4) to just over 655 milliseconds (interword value 65504). For low speed the range is 320 microseconds (interword value 4) to over 5 seconds (interword value 65504).

NOTE The ARINC-429 specification does not allow interword times less than 4 bit times, so interword delay values of less than 4 will be interpreted as the minimum legal interword time.

3.3.4 Tx Data Pointer

The Transmit Data Pointer register is used to set the start address of the transmit data buffer. The address must be a word boundary. The size of the buffer is determined by the Word Count value.

3.4 Transmit Data Block Format

Figure 3-4 below illustrates the format of the TX data words in the memory.

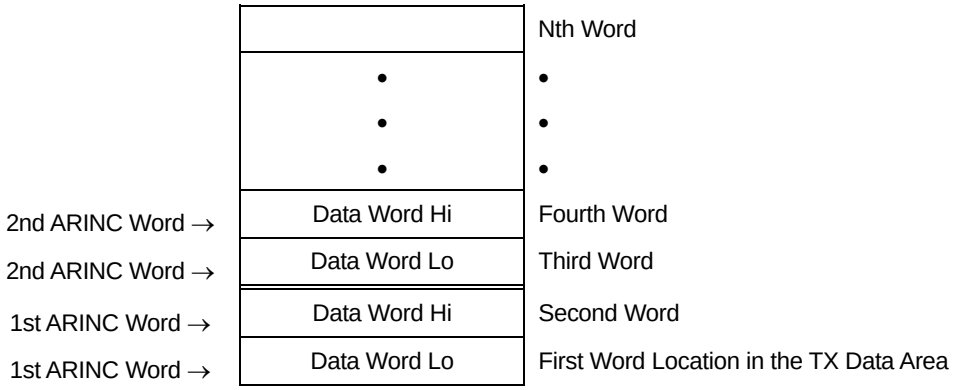


Figure 3-4. Transmit Data Words Memory Format

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Figure 3-5 below defines the locations and bit definitions of the data bytes in the memory. The numbers shown in the four bytes represent the ARINC-429 bit locations in the 32-bit word.

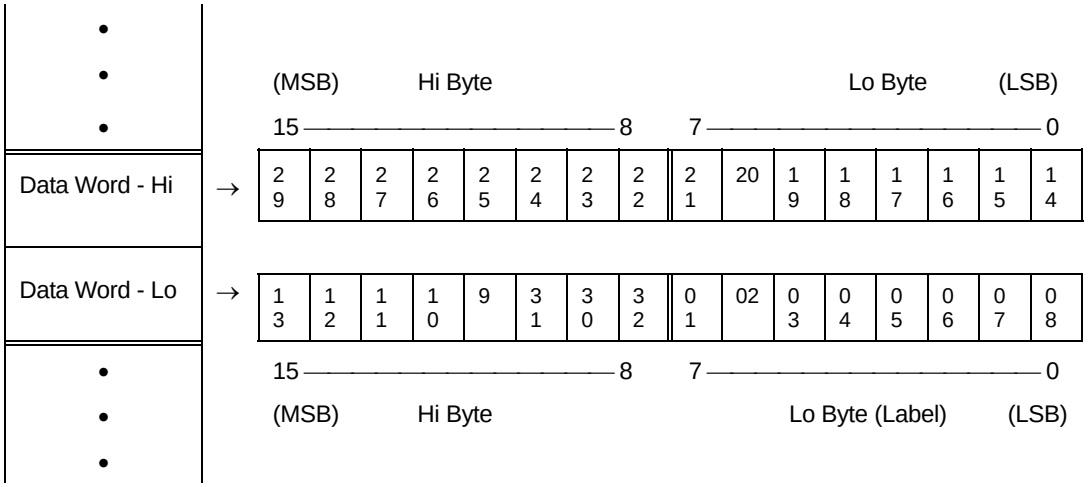
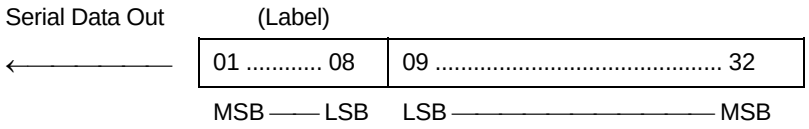


Figure 3-5. Data Bytes in Memory

NOTE 1. The data in ARINC-429 bit 32 is ignored and instead a value calculated using the selected parity is transmitted over the bus.

2. The ARINC word bits are transmitted in the following order:



3. Bits 09 through 29 are ordered from LSB to MSB (opposite from the Label field which is organized MSB to LSB). It is for this reason that the data block is built the way it is.

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4 Receive/Monitor Mode

Chapter 4 describes receiver/monitor operation. The following topics are covered:

- "General Information," page 4-1
- "Sequential/Merge Mode Operation," page 4-2
- "Look-Up Table Mode Operation," page 4-7
- "Receive Channel Control Register Block Maps," page 4-9
- "Receive Channel Control Registers," page 4-12

4.1 General Information

You can set up each receiver channel's mode of operation by writing to the various Channel Control Registers (one per channel). Each receiver channel has three basic modes of operation:

- **Sequential mode** — Stores data in sequential locations in the receive data area.
- **Look-up table mode** — Lets you store words in specific locations of memory according to the Label.
- **Merge Mode** — Siphons **all** receiver channel data into **one** receiver buffer area.

In all modes, the data words are stored with a 16-bit Receiver Status Word and a 32-bit Time tag value. In the Merge Mode, the channel code information (indicating on which channel the data was received) is contained in the Receiver Status Word. The Sequential mode also has a data only option which will not write the status and Time tag along with each data word.

4.1.1 Sequential Mode Overview

The sequential mode has a software-selectable feature which filters the storage of specific, user-defined Labels or stores all Labels into a buffer. The data buffer's size and location in the memory is programmed via a Start and End pointer. Each received ARINC data word is tagged with a Status word indicating the status of the receive word and a 32-bit Time tag value.

The ARINC data word, Time tag, and Status word make up a single receive data block. Alternatively, the sequential mode offers you the capability of storing just the ARINC-429 data without the Time tag and Status Words via the Receiver Data Storage Mode Register described in "Module Control Registers," page 2-4. Interrupts and pollable status registers allow for numerous types of event recognition and are described in "Receive Channel Control Registers," page 4-12.

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4.1.2 Look-Up Table Mode Overview

In the Look-up table mode, the word's **label** is used by the module as an offset to a 256-word look-up table. You can program the table with address pointers indicating where to write the Receiver Data Block. Each block contains the 32-bit ARINC word, 32-bit Time tag word, and status word. The 256-word table can be placed anywhere in the memory via Receiver Look-up Table Pointer which you can program.

You can poll the operational status of each channel and generate interrupts in various circumstances (see "Channel x Interrupt Condition Register," page 4-17).

4.1.3 Merge Mode Overview

The Merge Mode operates in the same manner as the Sequential Mode except that all receive channels are merged into one data buffer area. The control registers for the Merge Mode are located and defined in "Module Control Registers" page 2-4. In this mode the receive data blocks are stored in sequential order and each Status Word received is tagged with a Channel code, indicating on which channel the data was received. Each data block contains a Time tag word as in the standard Sequential Mode of operation.

4.2 Sequential/Merge Mode Operation

4.2.1 Receive Buffer Storage Sequence

Figure 4-1 below illustrates the way in which the receive data blocks are stored in the dual-port RAM while in the sequential mode of operation. The Start and End pointers set up the buffer size. The receive data storage will stop when the end pointer is reached or will wrap around to the beginning of the buffer, depending upon the condition of the Receiver Wrap Around bit in the Channel Configuration Register. The Time tag resolution is 10 μsec/bit. The contents of the Receiver Status Word are described in this section in "Receive Sequential Mode Status Word," page 4-6, and "Receive Merge Mode Status Word," page 4-6.

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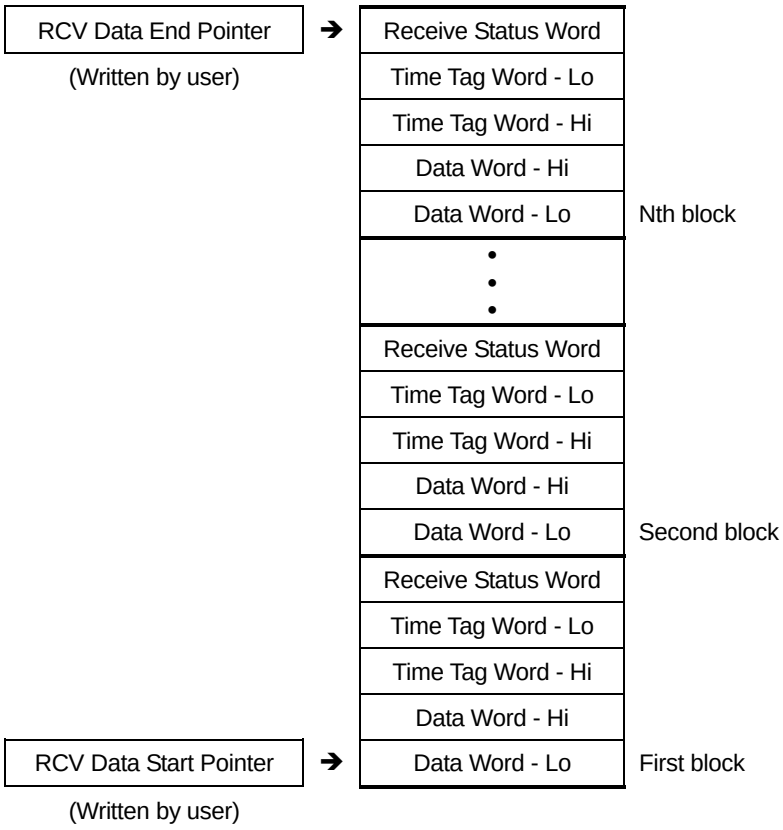
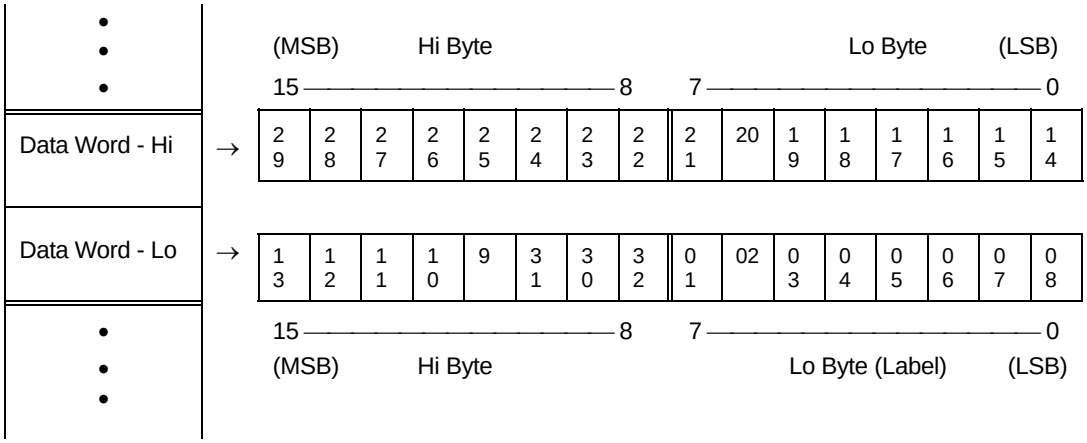


Figure 4-1. Rcv Sequential Mode Buffer Structure

4.2.2 Rcv Data Word Format

The received 32-bit ARINC-429 word is stored as two 16-bit words in the memory (Lo-Word followed by Hi-Word). The numbers shown in the two words represent the ARINC-429 bit locations in the 32-bit word.

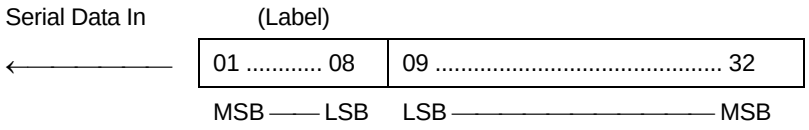


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Figure 4-2. Rcv Data Word Format

NOTE 1. The data in ARINC-429 bit 32 is **not** a parity bit, but a parity status bit. 0 denotes odd parity received, while 1 denotes even parity received.

2. The ARINC word bits are received in the following order:



3. Bits 09 through 29 are ordered from LSB to MSB (opposite from the Label field which is organized MSB to LSB). It is for this reason that the data block is built the way it is.

4.2.3 Time Tag Word Description

The Time tag is a 32-bit word made up of two 16-bit words; Time Tag-Hi and Time Tag-Lo. The resolution of the Time tag is 10 μsec/bit.

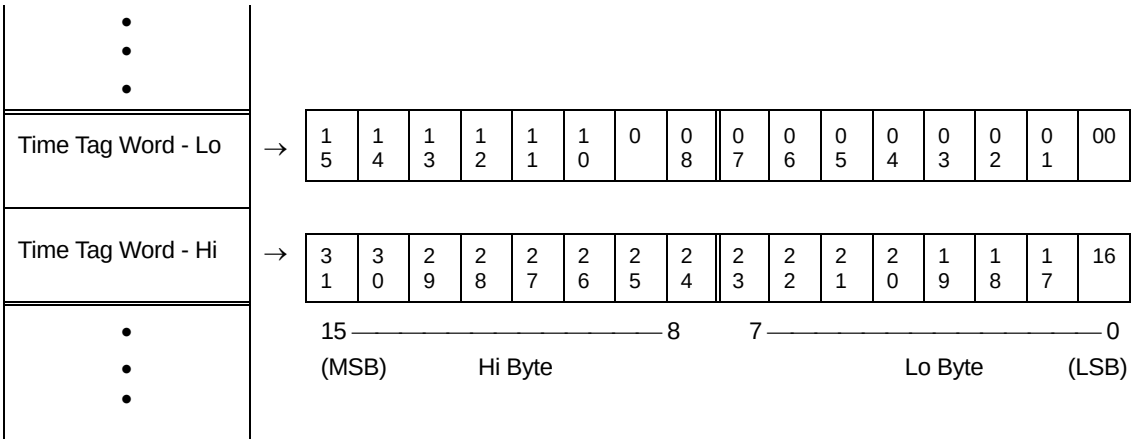


Figure 4-3. Time Tag Word Description

NOTE There is a latency between the time a word is received on the bus and the time that word is recorded in dual-port RAM. This latency is affected by the number of channels and data rate of these channels. The Time tag reflects the time the word is written to dual-port RAM rather than the time the word is received over the bus. In no event shall this latency exceed a single hi-speed word time i.e., 360 microseconds.

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4.2.4 Rcv Sequential Mode Filter Table Diagram

Figure 4-4 below illustrates the structure of the filter table.

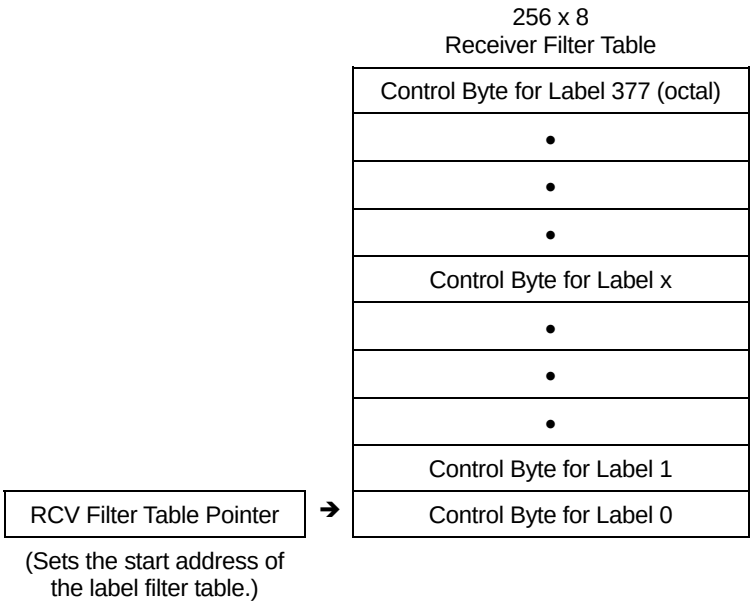


Figure 4-4. Rcv Sequential Mode Filter Table

Bit	Description
02-07	Reserved
01	1 = Interrupt 0 = Don't Interrupt
00	1 = Store Word 0 = Don't Store

Figure 4-5. Label Control Byte Structure (WRITE)

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4.2.5 Receive Sequential Mode Status Word READ

Bit	Bit Name	Description
08-15	Reserved	
07	Valid Word	Global Bit. Indicates that the received ARINC-429 word was valid in all respects.
04-06	Reserved	
03	Parity Error	Indicates that a parity error was detected in the ARINC-429 word.
01-02	Reserved	
00	Word Received	A logic 1. This bit is cleared while data is in the process of being updated. When the bit is set, valid data is in memory.

Receive Sequential Mode Status Word (READ)

4.2.6 Receive Merge Mode Status Word READ

Bit	Bit Name	Description
11-15	Reserved	
08-11	Merge Channel Code	100 - Data received over channel 4 011 - Data received over channel 3 001 - Data received over channel 1 000 - Data received over channel 0
07	Valid Word	Global Bit. Indicates that the received ARINC-429 word was valid in all respects.
04-06	Reserved	
03	Parity Error	Indicates that a parity error was detected in the ARINC-429 word.
01-02	Reserved	
00	Word Received	A logic 1. This bit is cleared while data is in the process of being updated. When the bit is set, valid data is in memory.

Receive Merge Mode Status Word

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4.3 Look-Up Table Mode Operation

4.3.1 Receive Look-Up Table Storage Sequence

In the Look-up table mode, the word's **label** is used by the module as an offset to a 256-word look-up table. You can program the table with address pointers indicating where to write the Receiver Data Block. Each block contains the 32-bit ARINC word, 32-bit Time tag, and status word. The 256-word table can be placed anywhere in the memory via a Receiver Look-up Table Pointer that you can program.

You can poll the operational status of each channel and generate interrupts in various circumstances.

4.3.2 Rcv Look-Up Table Mode Diagram

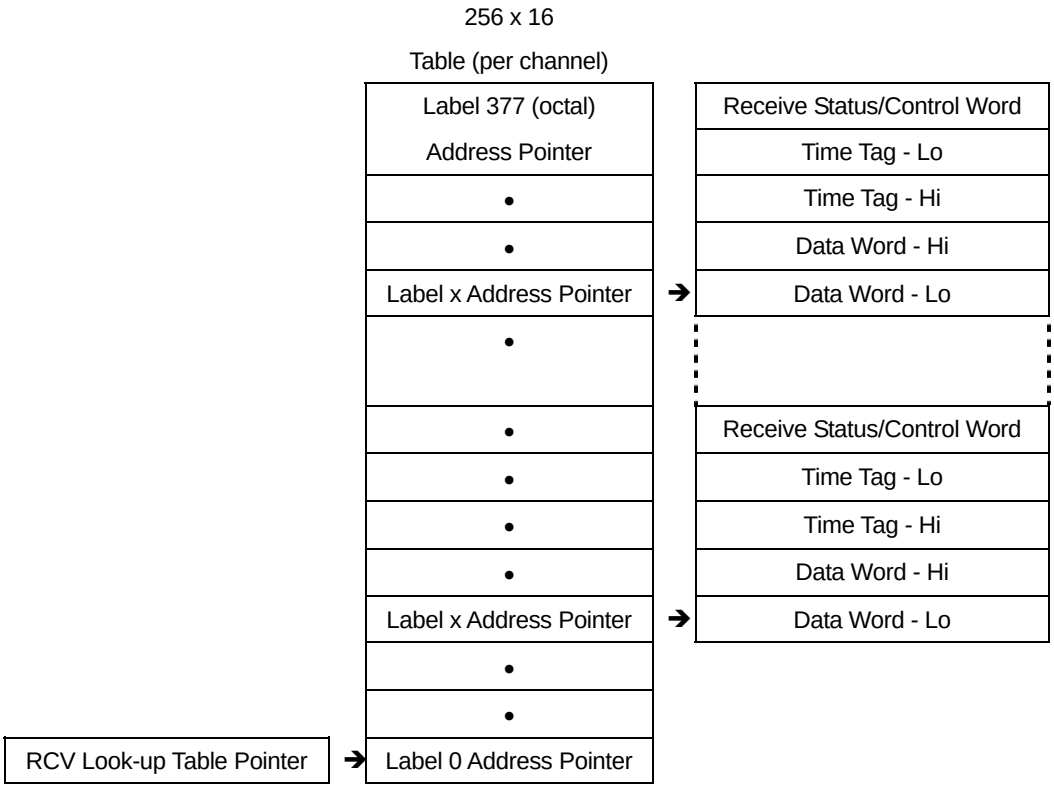


Figure 4-6. Rcv Look-Up Table Mode Structure

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4.3.3 Receive Look-Up Table Status/Control Word

READ/WRITE

Bit	Bit Name	Description
15	**Enable Label Interrupt**	Enables the “interrupt on label received” capability. This bit is used in conjunction with the interrupt Condition Register.
08-14	**Reserved**	
07	**Valid Word**	Global Bit. Indicates that the received ARINC-429 word was valid in all respects.
04-06	**Reserved**	
03	**Parity Error**	Indicates that an even parity error was detected in the ARINC-429 word.
01-02	**Reserved**	
00	**Word Received**	A logic 1. This bit is cleared while data is in the process of being updated. When the bit is set, valid data is in memory.

Receive Look-Up Table Status/Control Word

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4.4 Receive Channel Control Register Block Maps

4.4.1 Channel 0 Control Register Block Map

Channel 0 Configuration Register	0080 H
Reserved	0082 H
Channel 0 RCV Data Start Pointer	0084 H
Channel 0 RCV Data End Pointer	0086 H
Channel 0 RCV Data Current Pointer	0088 H
Channel 0 RCV Look-up Table Start Address	008A H
Channel 0 RCV Filter Table Start Address	008C H
Channel 0 RCV Data Word Count Register	008E H
Channel 0 RCV Buffer Wraparound Register	0090 H
Channel 0 RCV Word Counter Trigger	0092 H
Reserved	0094 H
Channel 0 RCV Interval Counter Trigger	0096 H
Reserved	0098 H
Channel 0 RCV Label Trigger Register	009A H
Reserved	009C H
Reserved	009E H
Reserved	00A0 H
Reserved	00A2 H
Reserved	00A4 H
Channel 0 Interrupt Condition Register	00A6 H
Channel 0 Status Register	00A8 H
Reserved	00AA H
Reserved	00AC H
Reserved	00AE H

Figure 4-7. Channel 0 Control Register Block Map

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4.4.2 Channel 1 Control Register Block Map

Channel 1 Configuration Register	00B0 H
Reserved	00B2 H
Channel 1 RCV Data Start Pointer	00B4 H
Channel 1 RCV Data End Pointer	00B6 H
Channel 1 RCV Data Current Pointer	00B8 H
Channel 1 RCV Look-up Table Start Address	00BA H
Channel 1 RCV Filter Table Start Address	00BC H
Channel 1 RCV Data Word Count Register	00BE H
Channel 1 RCV Buffer Wraparound Register	00C0 H
Channel 1 RCV Word Counter Trigger	00C2 H
Reserved	00C4 H
Channel 1 RCV Interval Counter Trigger	00C6 H
Reserved	00C8 H
Channel 1 RCV Label Trigger Register	00CA H
Reserved	00CC H
Reserved	00CE H
Reserved	00D0 H
Reserved	00D2 H
Reserved	00D4 H
Channel 1 Interrupt Condition Register	00D6 H
Channel 1 Status Register	00D8 H
Reserved	00DA H
Reserved	00DC H
Reserved	00DE H

Figure 4-8. Channel 1 Control Register Block Map

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4.4.3 Channel 3 Control Register Block Map

Channel 3 Configuration Register	0110 H
Reserved	0112 H
Channel 3 RCV Data Start Pointer	0114 H
Channel 3 RCV Data End Pointer	0116 H
Channel 3 RCV Data Current Pointer	0118 H
Channel 3 RCV Look-up Table Start Address	011A H
Channel 3 RCV Filter Table Start Address	011C H
Channel 3 RCV Data Word Count Register	011E H
Channel 3 RCV Buffer Wraparound Register	0120 H
Channel 3 RCV Word Counter Trigger	0122 H
Reserved	0124 H
Channel 3 RCV Interval Counter Trigger	0126 H
Reserved	0128 H
Channel 3 RCV Label Trigger Register	012A H
Reserved	012C H
Reserved	012E H
Reserved	0130 H
Reserved	0132 H
Reserved	0134 H
Channel 3 Interrupt Condition Register	0136 H
Channel 3 Status Register	0138 H
Reserved	013A H
Reserved	013C H
Reserved	013E H

Figure 4-9. Channel 3 Control Register Block Map

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4.4.4 Channel 4 Control Register Block Map

Channel 4 Configuration Register	0140 H
Reserved	0142 H
Channel 4 RCV Data Start Pointer	0144 H
Channel 4 RCV Data End Pointer	0146 H
Channel 4 RCV Data Current Pointer	0148 H
Channel 4 RCV Look-up Table Start Address	014A H
Channel 4 RCV Filter Table Start Address	014C H
Channel 4 RCV Data Word Count Register	014E H
Channel 4 RCV Buffer Wraparound Register	0150 H
Channel 4 RCV Word Counter Trigger	0152 H
Reserved	0154 H
Channel 4 RCV Interval Counter Trigger	0156 H
Reserved	0158 H
Channel 4 RCV Label Trigger Register	015A H
Reserved	015C H
Reserved	015E H
Reserved	0160 H
Reserved	0162 H
Reserved	0164 H
Channel 4 Interrupt Condition Register	0166 H
Channel 4 Status Register	0168 H
Reserved	016A H
Reserved	016C H
Reserved	016E H

Figure 4-10.Channel 4 Control Register Block Map

4.5 Receive Channel Control Registers

4.5.1 Channel x Configuration Register

The Channel x Configuration register sets up various run parameters for both the receive and transmit channels (see “Channel x Configuration Register,” in “Transmit Mode,” page 3-2). Bits which are unused (e.g., transmit-related bits for a receiver channel) are ignored by the module.

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Bit	Bit Name	Description
10–15	**0**	
09	**Receiver Enable Filter Table**	1 = Enable Filter Table (Stores labels per table) 0 = Disables table. Stores all labels.
08	**0**	
07	**Receiver Label Trigger**	1 = Start data storage upon receipt of Label xx. 0 = Receiver stores data without Start Label Trigger (see Note 4 below).
06	**Receiver Wrap Around**	1 = Data storage is halted when the buffer is full. 0 = Receiver wraps around the data in the block. (This bit is used in the Sequential Storage Mode only. See "Sequential/Merge Mode Operation," page 4-2.)
05	**Receiver Storage Mode**	1 = Sequential Storage Mode 0 = Look-up Table Mode (see "Channel x Receive Look-Up Table Start Address," page 4-14).
03-04	**0**	
02	**Transmit Rise/Fall Time**	Not used in Receive mode
01	**0**	
00	**Bit Rate**	1 = 12.5 KHz (Lo speed) 0 = 100 KHz (Hi speed) Available for channels 0 and 3 only (see Note 5 below).

Channel x Configuration Register — Receive Mode

NOTE 1. It is recommended that you set up **all** [active channel] Configuration Registers before programming any other parameters.

2. You can only write to this register when **all** channels are turned **off** (via the Start Register).

3. You should "start" the module (via the Start Register) only after a minimum of 500 µsec from the time that the contents of this register have been modified.

4. Receiver Label Trigger. See "Channel x Rcv Label Trigger Register," page 4-16.

5. The selected speed for channels 0 and 1 must be the same. Similarly, the selected speed for channels 3 and 4 must be the same. Therefore, bit 00 of the Channel Configuration Register is not used for channels 1 and 4.

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4.5.2 Channel x Receive Data Start Pointer — WRITE

The Channel x Receive Data Start pointer register sets the start address of the Receive Data buffer. The address must be a word boundary within the Rcv Data Blocks area. For example, to cause the Receive Data buffer to begin at byte offset 1A0 (H), write a 1A0 (H) to this register. This register is used in the sequential mode of operation.

4.5.3 Channel x Receive Data End Pointer — WRITE

The Channel x Receive Data End pointer sets the End Address of the Receiver Data buffer. This is used in the sequential mode of operation. The data will wrap around or stop when the buffer is full, (when the end address is reached), depending upon the contents of the Receiver Wrap Around control bit in the Configuration Register.

4.5.4 Channel x Receive Data Current Pointer — READ

The Channel x Receive Data Current pointer indicates the current address where the next ARINC receive word is to be placed in the buffer. This pointer value is incremented after the entire receiver block (ARINC word, Time tag, and status) is written into memory.

4.5.5 Channel x Receive Look-Up Table Start Address — WRITE

LOOK-UP TABLE MODE

The Channel x Receive Look-Up Table Start address sets the start address of the [256 x 16] Receiver Look-Up Table (see bit 05 in “Channel x Configuration Register — Receive Mode,” page 4-13). This address represents the byte offset into the modules memory of the first location of the look-up table. The module will store one ARINC-429 data block for each Label received. The data block contains: 32-bit ARINC-429 word, 32-bit Time tag, and the 16 bit Receive Status word. The 429 data block will be overwritten by the subsequent reception and storage of another ARINC-429 word with the same ARINC Label. The address must be a word boundary (see Figure 4-6).

NOTE After reset, the Channel x Receive Look-Up Table Start Address register is loaded with a default value of 7E00 (H).

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4.5.6 Channel x Receive Filter Table Start Address WRITE

SEQUENTIAL MODE

The Channel x Receive Filter Table Start address sets the start address of the (256 x 8) Label Filter Table as described in "Sequential/Merge Mode Operation," page 4-2. The address must be a word boundary. It is valid for several channels to use the same filter table. This table is only valid if the Configuration Register Receiver Enable Filter Table bit is set (see bit 09 in "Channel x Configuration Register — Receive Mode," page 4-13).

4.5.7 Channel x Rcv Data Word Count Register READ/WRITE

SEQUENTIAL MODE

The Channel x Rcv Data Word Count register indicates the number of ARINC words received (0 - 65535). This register wraps around to 0 after it reaches 65535. You can reset it only when the channel is stopped.

4.5.8 Channel x Rcv Buffer Wraparound Register READ/WRITE

The Channel x Rcv Buffer Wraparound register contains 2 bits for synchronization with the host. If bit 14 is set to 1, the receive buffer has wrapped around once since the last time this register was cleared. If bit 15 is set to 1, there have been multiple wraparounds. You are expected to clear bit 14 each time the first word of the buffer is read. When the module wraps around it checks bit 14. If bit 14 is not set, the module sets it; otherwise the module sets bit 15.

NOTE Excalibur C drivers handle these bits. If you use these drivers, you don't need to deal with them.

Bit	Description
15	Multiple Wraparound - Data Lost
14	Single Wraparound
00-13	0

Channel x Rcv Buffer Wraparound Register

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4.5.9 Channel x Rcv Data Word Counter Trigger Register WRITE

SEQUENTIAL MODE

The Channel x Rcv Data Word Counter Trigger register lets you generate an interrupt and set a flag which indicates when a specific number of words have been received (1 - 65535). If you want to generate an interrupt, you must also set the appropriate bit in the Channel x Interrupt Condition Register. See “Channel x Interrupt Condition Register,” page 4-17.

NOTE This trigger is set when the value in the Channel x Receive Data Word Counter matches the value set in this register.

4.5.10 Channel x Rcv Interval Counter Trigger Register WRITE

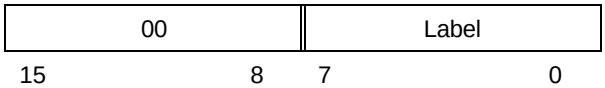
SEQUENTIAL MODE

The Channel x Rcv Interval Counter Trigger register lets you generate an interrupt and set a flag upon reception of every “n” number of words, where “n” is the value written to this register. For example, to request an interrupt after every 5 ARINC words, write 05 to this register. If you want to generate an interrupt, you must also set the appropriate bit in the Channel x Interrupt Condition Register. See “Channel x Interrupt Condition Register,” page 4-17.

4.5.11 Channel x Rcv Label Trigger Register WRITE

SEQUENTIAL MODE

The Channel x Rcv Label Trigger register is used in conjunction with the Receiver Label Trigger bit in the Channel x Configuration Register (see “Channel x Configuration Register,” in “Transmit Mode,” page 3-2 and “Channel x Configuration Register — Receive Mode,” page 4-13). This register enables the reception and storage of data upon receipt of a unique ARINC-429 label. All ARINC words received prior to the first instance of this label will not be stored by the board.



Channel x Rcv Label Trigger Register

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4.5.12 Channel x Interrupt Condition Register WRITE

The Channel x Interrupt Condition register selects which conditions will cause an interrupt to be generated. Only the two least significant bits are used for transmit channels and only bits 02 through 06 are used for receive channels. See "Channel x Interrupt Condition Register," in "Transmit Mode," page 3-4.

Bit	Description - Interrupt Conditions
07-15	0
06	Receiver - Stopped on Buffer Full
05	Receiver - Error Word Received
04	Receiver - Data Word Count Trigger (see Note 3 below).
03	Receiver - Interval Count Trigger (see Note 2 below).
02	Receiver - Label Received (see Note 1 below).
01	Not used in Receiver mode
00	Not used in Receiver mode

Channel x Interrupt Condition Register — Receive Mode

NOTE 1. The Label Received interrupt only occurs upon reception of a label which has been marked for interrupt in a filter table or lookup table.

2. To activate the Interval Count Trigger interrupt, you must also set the Channel x Rcv Interval Counter Trigger Register. See "Channel x Rcv Interval Counter Trigger Register," page 4-16.

3. To activate the Data Word Count Trigger interrupt, you must also set the Channel x Rcv Word Counter Trigger Register. See "Channel x Rcv Data Word Counter Trigger Register," page 4-16.

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4.5.13 Channel x Status Register

READ/WRITE

The Channel x Status register indicates the operational status of the channel. You can use this register to poll the status of the channel or it can be used with interrupts. When used in conjunction with interrupts, the register indicates the condition(s) which caused the interrupt. A logic 1 indicates an active bit. You must reset the status bits by writing a 0 to this register. Only the two least significant bits are used for transmit channels and only bits 02 through 06 are used for receive channels. See "Channel x Status Register," in "Transmit Mode," page 3-5.

Bit	Description - Interrupt Condition
07-15	0
06	Receiver - Stopped on Buffer Full
05	Receiver - Error Word Received
04	Receiver - Data Word Count Trigger
03	Receiver - Interval Count Trigger
02	Receiver - Label Received
00-01	Not used in Receive mode

Channel x Status Register — Receive Mode

In Look Up Mode, the Label Received Status bit is set upon receipt of any label for which an interrupt has been requested via the label's Control byte. In Sequential Mode, it is set upon receipt of any label for which an interrupt has been requested via the filter table.

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5 Mechanical and Electrical Specifications

Chapter 5 describes the mechanical and electrical specifications of the DAS-429P104/Mx card. The following topics are discussed:

- "Card Layout," page 5-1
- "Jumpers," page 5-2
- "Connectors," page 5-4
- "Power Requirements," page 5-7

5.1 Card Layout

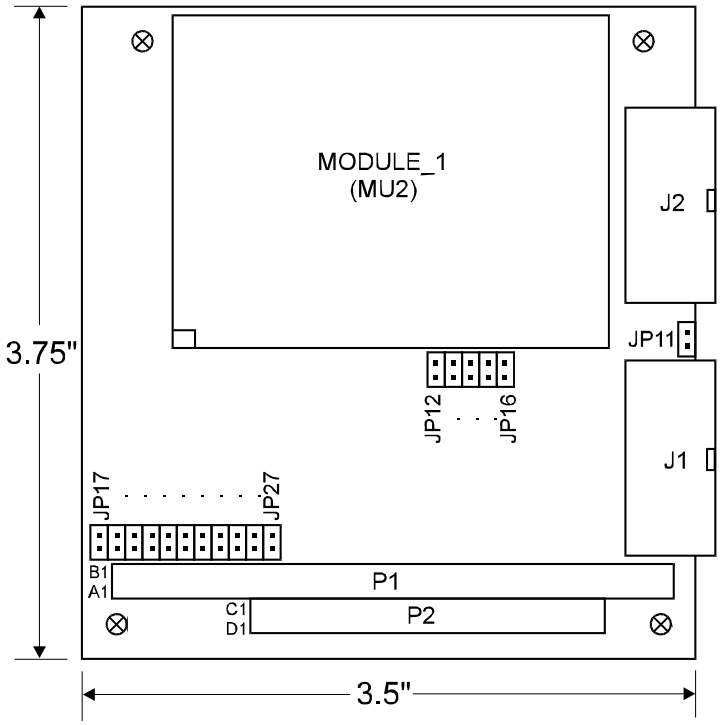


Figure 5-1. Card Layout

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5.2 Jumpers

Jumpers are provided on the card for various functions. These jumpers are occupied with jumper headers and are shorted with shorting blocks at default places. See “Factory Default Jumpers Settings,” page 5-3. Jumpers not appearing on Card Layout are factory set and should not be used.

5.2.1 Shield Signal Jumper [JP11]

The Shield Signal jumper allows you to short the Shield signal on connectors J1 and J2 to Digital Ground. Use this option **only** if connection at the mechanical pads cannot be provided.

5.2.2 Base Address Select Jumpers [JP12 - JP16]

The Base Address Select jumper group selects the Card Base Address. Each jumper selects one address line as shown in Figure 5-2 below:

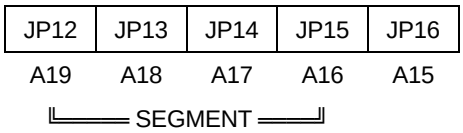


Figure 5-2. Base Address Select Jumpers

NOTE 1. Jumper **short** equates to a 0.

2. Jumper **open** equates to a 1.

3. Jumpers JP12 through JP15 refer to the required segment (64K) in the DOS environment. Jumper JP16 lets you select in which half segment to locate the card.

Example To place the card at Seg. D800:

JP12 OPEN
JP13 OPEN
JP14 SHORT
JP15 OPEN
JP16 OPEN

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5.2.3 Interrupt Select Jumpers [JP17 - JP27]

The Interrupt Select jumper group is used to select the desired PC/104 Interrupt line in case when interrupt mode is used. Each jumper selects one interrupt line as shown in Table 5-1 below:

Jumper	Interrupt Line	Jumper	Interrupt Line
JP17	IRQ2/9	**JP23**	IRQ10
JP18	IRQ3	**JP24**	IRQ11
JP19	IRQ4	**JP25**	IRQ12
JP20	IRQ5	**JP26**	IRQ14
JP21	IRQ6	**JP27**	IRQ15
JP22	IRQ7		

Table 5-1. Interrupt Select Jumpers

NOTE 1. When using interrupt mode: Only one jumper should be shorted at one time.

2. When **not** using interrupts: All the jumpers should be left open.

Example To select the IRQ7 interrupt line:

JP22	SHORT
JP17-21, JP23-27	OPEN

5.2.4 Factory Default Jumpers Settings

JP17 - JP27	OPEN	No interrupts
JP12	OPEN	
JP13	OPEN	
JP14	SHORT	Base address @ D000H
JP15	OPEN	
JP16	SHORT	
JP11	OPEN	No digital ground connection to shield signals

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5.3 Connectors

The DAS-429P104/Mx card contains all communication I/O signals on two Box Header connectors (J1,J2). Mating connectors including crimp pins are supplied. The connectors pinouts and signals description are described in the following sections.

5.3.1 Connectors J1,J2 Pinout

The 16-pin connectors layout (front view) is illustrated in Figure 5-3 below.

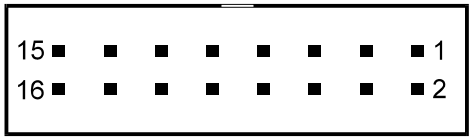


Figure 5-3. Connectors J1,J2 Layout (Front View)

Each module's six channels are grouped similarly and each module is assigned a dedicated connector. Tables 5-2 and 5-3 list the pin assignment and signals description.

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CONNECTOR J1			
1	RXH00	**2**	RXL00
3	RXH01	**4**	RXL01
5	SHIELD	**6**	SHIELD
7	RXH02	**8**	RXL02
9	RXH03	**10**	RXL03
11	SHIELD	**12**	SHIELD
13	TXH00	**14**	TXL00
15	TXH01	**16**	TXL01

CONNECTOR J2			
1	RXH10	**2**	RXL10
3	RXH11	**4**	RXL11
5	SHIELD	**6**	SHIELD
7	RXH12	**8**	RXL12
9	RXH13	**10**	RXL13
11	SHIELD	**12**	SHIELD
13	TXH10	**14**	TXL10
15	TXH11	**16**	TXL11

Table 5-2. Connectors J1,J2 Pin Assignments

RXH00-03	Module_0 Receive channels 0-3 Hi connection
RXL00-03	Module_0 Receive channels 0-3 Lo connection
TXH00-01	Module_0 Transmit channels 0-1 Hi connection
TXL00-01	Module_0 Transmit channels 0-1 Lo connection
RXH10-13	Module_1 Receive channels 0-3 Hi connection
RXL10-13	Module_1 Receive channels 0-3 Lo connection
TXH10-11	Module_1 Transmit channels 0-1 Hi connection
TXL10-11	Module_1 Transmit channels 0-1 Lo connection
SHIELD	Provided for cable shield connection, this signal is connected on the card to the mechanical pads (see “Shield Signal Jumper,” page 5-2). If used, you should provide a connection between the pads and the computer mainframe.

Table 5-3. J1,J2 Signals Description

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5.3.2 PC/104 Bus Connectors Pinout

The following PC/104 signals are used by the DAS-429P104/Mx.

CONNECTOR P1			
Pin	**Signal**	**Pin**	**Signal**
A1		B1	GND
A2	D7	B2	RESET
A3	D6	B3	+5V
A4	D5	B4	IRQ2(9)
A5	D4	B5	
A6	D3	B6	
A7	D2	B7	-12V
A8	D1	B8	
A9	D0	B9	+12V
A10	I/OCHRDY	B10	<<KEY>>
A11		B11	MEMW-
A12	A19	B12	MEMR-
A13	A18	B13	
A14	A17	B14	
A15	A16	B15	
A16	A15	B16	
A17	A14	B17	
A18	A13	B18	
A19	A12	B19	
A20	A11	B20	
A21	A10	B21	IRQ7
A22	A9	B22	IRQ6
A23	A8	B23	IRQ5
A24	A7	B24	IRQ4
A25	A6	B25	IRQ3
A26	A5	B26	
A27	A4	B27	
A28	A3	B28	ALE
A29	A2	B29	+5V
A30	A1	B30	
A31	A0	B31	GND
A32	GND	B32	GND

CONNECTOR P2			
Pin	**Signal**	**Pin**	**Signal**
C0		D0	
C1		D1	
C2		D2	
C3		D3	IRQ10
C4		D4	IRQ11
C5		D5	IRQ12
C6		D6	IRQ15
C7		D7	IRQ14
C8		D8	
C9		D9	
C10		D10	
C11		D11	
C12		D12	
C13		D13	
C14		D14	
C15		D15	
C16		D16	+5V
C17		D17	
C18		D18	GND
C19	<<KEY>>	D19	GND

Table 5-4. Connectors PC/104 Bus Pinout

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5.4 Power Requirements

The card's maximum power supply requirements are defined below:

DAS-429P104/M1	DAS-429P104/M2
+5V @ 500mA	+5V @ 800mA
+12V @ 50mA (see Note)	+12V @ 100mA (see Note)
-12V @ 50mA (see Note)	-12V @100mA (see Note)

NOTE Conditions: Both transmit channels at full speed and full load.

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6 Ordering Information

Chapter 6 explains how to indicate which options you want when ordering a DAS-429P104/Mx card.

The "x" indicates the number of modules required (up to 2).

The suffix "-E" can be added to the name of the card (DAS-429P104/Mx) to indicate the extended temperature option.

PART NUMBER	DESCRIPTION
DAS-429P104/Mx	ARINC-429 interface card for PC/104 systems. Supports 4x Receive and 2x Transmit channels.
DAS-429P104/Mx-E	As above, with extended temperature operation (-40° to +85° C).
x	Number of modules required (up to 2, minimum 1) (Each module is configured as R4T2)
M429R4T2	Additional Mx modules.

Ordering examples:

DAS-429P104/M2	ARINC-429 interface card for PC/104 systems, with 2 modules. Supports 8 Receive and 4 Transmit channels.
DAS-429P104/M1-E	ARINC-429 interface card for PC/104 systems, with 1 module and extended temperature operation. Supports 4 Receive and 2 Transmit channels at -40° to +85° C temperature ranges.

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Appendix A
ARINC 429 Basic Word Formats

All data sent over the ARINC bus is composed of 32-bit words. A number of different formats can be used, as the following diagrams show:

Format 1

P	SSM	DATA	SDI	LABEL
32	31 30	29.....11	10 9	8.....1
		MSB ..... LSB		LSB.....MSB

Format 2

P	SSM	DATA	SDI	LABEL
32	31 30 29	28.....11	10 9	8.....1
		MSB ..... LSB		LSB.....MSB

Format 3

P	SSM	DATA	LABEL
32	31 30	29.....9	8.....1
		MSB ..... LSB	LSB.....MSB

Figure A-1. ARINC 429 Basic Word Formats

Key:

Field	Description
LABEL	Information identifier
SDI	Source/Destination Identifier bits
DATA	Information data: may be presented in one of the following formats
	BNR (Binary)
	BCD (Binary Coded Decimal)
	Discrete
	Maintenance and Acknowledgment
	Alpha Numeric (ISO Alphabet no.5)
SSM	Sign/Status Matrix bits
P	Parity bit (Odd parity)
LSB	Least Significant bit
MSB	Most Significant bit

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Bits are transmitted starting with bit 1, the final bit transmitted is the parity bit, bit 32. The label is transmitted with the most significant bit first while the data is transmitted least significant bit first.

The **LABEL** is a value from 1 to 255 representing a particular type of data. Most labels are defined in the specification though some are reserved for future needs. Many labels are multiply defined in the specification based on the type of equipment being used.

The **SDI** field is used when a transmitter is connected to multiple receivers but not all data is meant to be used by all the receivers. In this case each receiver will be assigned an SDI value and will look only at labels that match its SDI value. While the specification calls for SDI 00 to be universally accepted a good deal of equipment appears to disregard this requirement.

The **DATA** field contains the actual data to be sent. A number of data formats are defined in the specification. Binary Coded Decimal (BCD) format uses each four bits to contain a single decimal digit. BNR data is a binary coding. For both data types the specification calls out the units, the resolution, the range, the number of bits used and how frequently the label should be sent. A discrete type has multiple single bit fields defined within a single label. A number of other formats are described in the specification.

SSM, which is sometime 3 bits long, is used for information which helps interpret the numeric value in the data field. Examples of SSM values might be Plus, North, East, Right, To or Above.

P is the parity bit. ARINC 429 calls for odd parity. The parity bit is the last bit sent over the bus.

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Appendix B
ARINC 429 Connection Precautions

Appendix B describes connection precautions for ARINC 429 cards:

1. Verify the ARINC-429 line is not overloaded beyond the spec:

   Rload > 400 ohm

   Cload < 30,000 pF
2. Use shielded twisted pair wires with typical impedance of 60 to 80 Ohms.
3. Ensure that there is common ground between the connected systems in order to avoid potential differences.
4. Connect/Disconnect cables while the card is powered OFF or *not* transmitting at least.
5. Special care needs to be taken while applying probes of measuring instruments to avoid shorting out signals.

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