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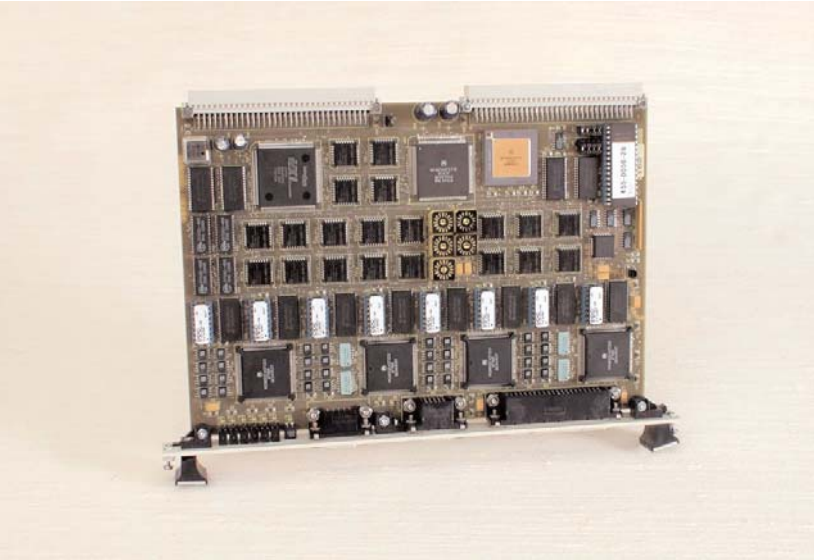
DDC on Board™

DD-42988V0-300
ARINC 429 VME INTERFACE CARD



DESCRIPTION

The DD-42988V0-300 card is available in 6U size to provide a high-performance communications link between a VME host and an ARINC 429 Data Bus. The card's architecture is a multiprocessor design that provides reliable, high-integrity ARINC 429 reception and transmission. Designed for high-performance applications, the card is capable of off-loading tasks from the host computer that could not previously be performed by a single interface card.

The card conforms with the Mark 33 Digital Information Transfer System 429 specifications, and is also capable of parametric testing that handles communications which deviate from the standard specification. This is useful during test and validation phases of Line Replacement Unit (LRU) development, and at repair depots for margin testing to detect "phantom" errors and failures.

The card supports eight configurable parametric channels that can be set as either receivers or transmitters.

In addition to the eight configurable channels, the card also provides eight low-speed receiver channels, for a total of up to 16 independent ARINC 429 channels.

FEATURES

- Eight Programmable Parametric Channels: Receive or Transmit; High, Low, and Variable Speed; Variable Voltage; Variable Bit Gap; and Variable Word Size
- Eight Additional Low-Speed Receivers
- FIFO and Scheduled Transmission Methods
- Label/SDI Receive Data Filtering
- 10 µs Time Stamping Resolution
- Engineering Unit Conversions
- Command/Response FIFOs
- 256 Kilobytes Dual Port RAM for Real-Time Data
- Available in 6U Size
- RS232/RS422 Port
- Bus Master Capability
- Four On-Board 20 MHz Channel Processors
- One Additional 25 MHz Board Processor

DDC® Data Device Corporation

Data Device Corporation
105 Wilbur Place
Bohemia, New York 11716
631-567-5600 Fax: 631-567-7358
www.ddc-web.com

FOR MORE INFORMATION CONTACT:

Technical Support:
1-800-DDC-5757 ext. 7771

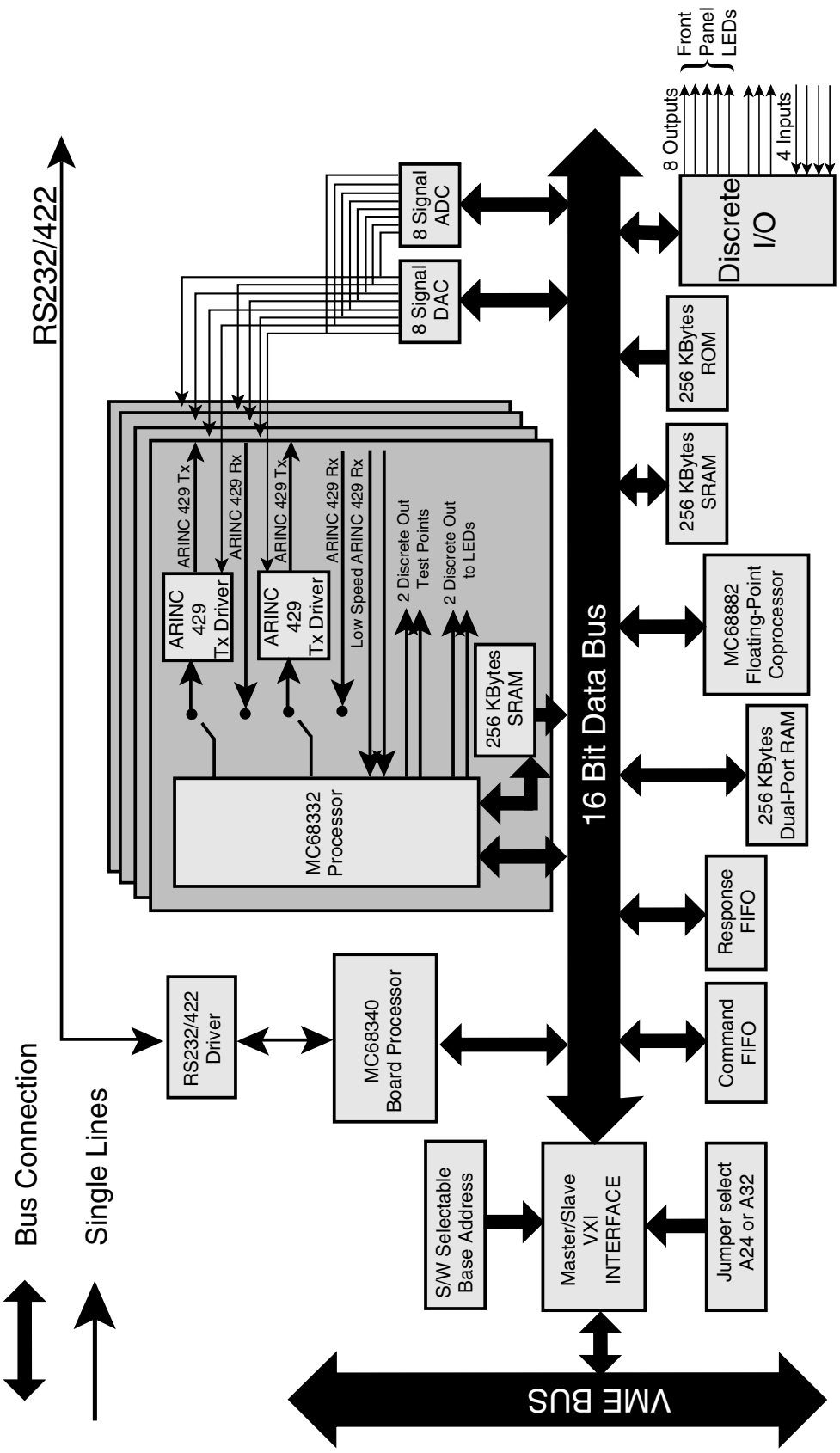


FIGURE 1. DD-42988V0-300 VME CARD FUNCTIONAL BLOCK DIAGRAM

TABLE 1. DD-42988V0-300 GENERAL SPECIFICATIONS	
ELECTRICAL	
Operating Voltage:	+5 VDC and ±12 VDC
Typical Operating Current:	1.4 A at 5 VDC 0.15 A at 12 VDC 0.1 A at -12 VDC
ENVIRONMENTAL	
Operating Temperature:	0 - +40°C at 99% relative humidity noncondensing
Storage Temperature:	-40° - +70°C at 99% relative humidity noncondensing
PHYSICAL CHARACTERISTICS	
Height:	9.2" (23.37 cm)
Width:	0.8" (2.03 cm)
Depth:	6.2" (15.75 cm)
WEIGHT	
Net:	12 oz. (0.34 kg)
Shipping:	28 oz. (0.79 kg)
INTERRUPT LEVEL	
1 - 7, switch selectable	
ADDRESS SPACE	
A16/A32 or A16/A24, D16 Slave/Master Devices Uses 256 Kbytes of A24 or A32 Space	

TECHNICAL OVERVIEW

The DD-42988V0-300 card has five processors. One, called the board processor, maintains host communication and transfers data to the four channel processors. The channel processors manage and control the 429 communication. Each channel processor handles two configurable receive or transmit channels (high or low speed), and two low-speed receive channels.

Since each channel processor can filter received data and schedule transmit data, the performance of the board processor is not dependent on bus loading, but on the amount of received data being transferred to the host, and the amount of transmit data the host generates.

The receivers cannot unknowingly lose data since each of the channel processors can buffer fully loaded buses.

CARD OVERVIEW

The DD-42988V0-300 card contains eight configurable parametric channels that can be configured to be transmitters or receivers. When programmed as transmitters, these channels can be further programmed to output a voltage signal from 0 to 12 volts. Transmitters or receivers can be programmed for variable word sizes (2-32 bits), appropriate parity level (even, odd, or none), variable frequency (100Hz - 120KHz), and variable inter-word gap time.

In addition to the eight configurable channels, the card also contains eight low-speed receive channels. This provides the user with a total of 16 fully independent channels. The card can filter received data based on the label/SDI parameter. The card is capable of transmitting data in both FIFO (First-In First-out) and scheduled modes. The card also contains a floating-point co-processor used to reliably convert data to and from engineering units. This allows the host to directly communicate data to the card in standard engineering units.

RECEPTION

Each receiver channel independently time-stamps and buffers the incoming data. The data is then converted to engineering units (if desired), and sent to the VME host. Received words are automatically checked for parity.

A built-in error counter indicates the number of errors that have occurred during data reception. The card can also filter received words, thereby off-loading the host processor by only collecting data of interest.

The card has firmware installed that allows programmers access to the following card features in a simple, easy to understand format:

Receiving

- "Mailbox" type reception from any channel
- Queued reception from any channel
- Filtering of received label/SDI combinations
- Time stamping of received data

The card is capable of receiving data in two modes: FIFO and mailbox. When FIFO mode is selected through the DefineRxChannel API library routine, a First-In-First-Out queue is created in Dual-Port RAM, from which the host can read the received ARINC 429 data and time stamps in the exact order in which the words were received. The time stamp has a 10 µs resolution. The size of the FIFO is selectable and can be anywhere from 16 to 32,768 32-bit words.

When Mailbox mode is selected through the DefineRxChannel API library routine, a Dual-Port RAM "Mailbox" is created from which the host can read the most current data for a particular label/SDI combination. This mode of reception is extremely useful when the user is only concerned with the latest received data. Both FIFO and mailbox modes can be used simultaneously. The received data words can be filtered by label/SDI combinations or by just the label of the received data words.

TIME STAMPING

The card is capable of time-stamping all received data words with 10 µs of resolution. For applications that use multiple cards, the timer on each card used to time-stamp received words can be synchronized by connecting all the cards via a pin on the external connector.

TABLE 2. EXAMPLES OF STANDARD LIBRARY FUNCTIONS

- ***Configuration***
  ConfigureSerialPort, SetInterruptConditions
- ***Card Control***
  DequeueErrors, ResetClock, RunDiagnostic
- ***Channel Control***
  HaltChannel, StartChannel
- ***Receiving***
  DefineRxFilterWords, ModifyRxChannel
- ***Transmitting***
  DefineTxScheduleTable, ModifyTxChannel
- ***Engineering Units***
  LoadEngineeringConversionTable
- ***Discrete Control***
  ReadInputDiscrete, WriteOutputDiscrete

TRANSMISSION

Each transmitter channel processes scheduled transmissions and transmits buffered sequential words. When the card gets a transmit word from the host, it is converted from engineering units to the ARINC 429 word and proper parity is automatically generated.

The card has firmware installed that allows programmers access to the following card features in a simple, easy to understand format:

Transmitting

- Queued FIFO transmission
- Scheduled major/minor frames transmission
- Scheduled label/SDI rate transmission

If scheduled data is to be transmitted, the user must select scheduled mode through the DefineTxChannel API library routine. There are two ways to schedule a transmission, by table or by rate. The DefineTxScheduleTable API library routine or the DefineTxScheduleRates API library routine is used, respectively, to configure scheduled transmissions.

The DefineTxScheduleTable API library routine allows the host to define a schedule that will continuously be transmitted by the card. The API library routine takes a scheduled table of data and organizes a user-defined number of "minor frames" into a "major frame." The card will transmit each minor frame in sequence until all the minor frames have been transmitted. This cycle of minor frames comprises one major frame. Once the major frame has been transmitted, the card will start over again with the first minor frame.

The DefineTxScheduleRates API library routine allows the host to define a schedule that will continuously be transmitted by the card. The user can assign a rate associated with each label/SDI combination. The word will get transmitted at the interval that the user has specified. If the user wishes to distinguish only by label and not by label and SDI then the SDI field is set to a "don't care" value.

This card is capable of transmitting data in both FIFO and scheduled modes. When both modes are being used the scheduled data will take priority over the FIFO data. The FIFO data will get transmitted in the gaps between scheduled data transmissions without altering the schedule.

INDICATOR LEDS

There is a fail light on the front panel which indicates the pass/fail status of the card's built-in tests. Four more LEDs are used to show detailed diagnostic information. All of these LEDs are connected to output discretes, and therefore are also available on the card’s external connector.

There are eight additional LEDs on the front panel indicating channel activity and channel built-in-test status.

BUILT-IN TESTING

The card's firmware contains built-in tests which are performed on power-up. When these tests are passed, the card indicates to the host that it successfully completed power-up self-testing. If any test fails, this information is passed on to the host, and LEDs on the card's front panel, including the main FAIL light, are illuminated to indicate a failure code.

The following tests are performed during power up: processor tests, memory tests, math coprocessor tests, a ROM checksum test, and channel processor communication tests. In addition, the card contains an Analog-to-Digital Converter (ADC) that allows testing of the Digital-to-Analog Converter (DAC) controlling the variable voltage outputs of the ARINC 429 transmitters.

The host has the ability to perform a complete system test when the user connects an external loopback connector to the card. This connects input discretes to output discretes, and ARINC 429 transmitters to receivers. The host can then send data on the transmitters and verify that the data was received correctly by the ARINC 429 receivers.

HOST COMMUNICATIONS

The cards communicate to the host via 256 KBytes of Dual-Port RAM, a Command FIFO, a Response FIFO, and optional interrupts. The Command and Response FIFOs are used to communicate commands to the card from the host, and responses to

those commands back to the host. The 256 KBytes of Dual-Port RAM is used primarily to communicate large volumes of ARINC 429 real-time data.

DATA MEMORY

The card contains 256 Kilobytes of Dual-Port RAM memory used for data exchange between the host computer and the card. This memory allows for excellent reliability of data transfer between the card and the host computer. The Command and Response FIFOs aid in this reliable transfer of data.

The card also contains 256 Kilobytes of SRAM for each channel processor to use directly. There is a total of 1.25 Megabytes of SRAM on the card. The co-processor contains 256 Kilobytes of Flash Boot ROM that performs a series of power-on-self-tests.

INTERRUPT GENERATION

The robust interrupt generation capability in the card allows these cards to asynchronously signal the host when certain events occur. These events include receive and transmit events, error events, FIFO events, discrete I/O events, and board processor interrupts.

Through program control, any of the interrupts can be selectively enabled or masked. The cards can be configured to interrupt on any one of the seven interrupt lines.

The SetInterruptConditions API library routine allows the host to determine under what conditions the card will generate an interrupt.

DISCRETE I/O

There are two basic commands for handling the card's discrete inputs and outputs. The WriteOutputDiscrete API library routine is used for setting the value of all discrete outputs on the card, and the ReadInputDiscrete API library routine is used for reading the discrete inputs.

There are eight output discretes (TTL compatible) on the card. These are used for a variety of purposes, including triggering, indicating status, and general purpose use. These outputs can sink up to 40 mA of current.

There are four input discretes (TTL and CMOS compatible). Each input discrete accepts any input from 2.4 - 5 volts as a "true" voltage, and from 0 - 0.8 volts as a "false" voltage.

INCLUDED SOFTWARE

CARD LIBRARY

The library, which supports an extensive set of ARINC 429 functions, is supplied with each card. The software is a runtime library that provides the user with a hardware abstraction layer for the card. The library includes routines that dramatically reduce software development time by providing a high-level software interface to the card. The library allows the user to program the card without detailed knowledge of the card's architecture. When transmitting, the host can request that the card send data sequentially from a FIFO queue, or that the card automatically send scheduled data and allow the host to update the data asynchronously. If both FIFO and scheduled modes are selected, the scheduled data always takes priority over the FIFO data, with the FIFO data words filling-in the gaps between scheduled data.

When receiving, the host can get data sequentially from a FIFO, or get the most recent data for any label/Source Destination Indicator (SDI) combination from a mailbox slot. The data placed in the receive FIFO is time-stamped by the card. The FIFO words can be filtered by label/SDI combination.

The host can configure the size of the FIFOs in Dual-Port RAM to be from 16 to 32K 32-bit words. The starting address for each FIFO, therefore, is dependent on how the host configures the card. Each routine that configures a FIFO returns the offset for that FIFO.

The host can download an Engineering Unit Conversion Table to the card that enables conversion between raw ARINC 429 words to engineering units. The format for all ARINC 429 data placed in Dual-Port RAM is determined by this table. If no table has been defined, all words default to raw format.

SUPPORT

Data Device Corporation is committed to providing unsurpassed customer support. All hardware has a two-year limited warranty. All library and driver updates are available free of charge for the life of the product. This does not include application software.

NOTES:

NOTES:

ORDERING INFORMATION

DD-42988V0-300

8 Rx, 8 Tx/Rx (Configurable) VME Interface Card

These products contain tin-lead solder.

STANDARD DDC PROCESSING FOR DISCRETE MODULES/PC BOARD ASSEMBLIES		
TEST	**METHOD(S)**	**CONDITION(S)**
INSPECTION/WORKMANSHIP	IPC-A-610	Class 3
ELECTRICAL TEST	DDC ATP	—

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©Data Device Corporation
105 Wilbur Place, Bohemia, New York, U.S.A. 11716-2426

For Technical Support - 1-800-DDC-5757 ext. 7771

Headquarters, N.Y., U.S.A. - Tel: (631) 567-5600, Fax: (631) 567-7358
Southeast, U.S.A. - Tel: (703) 450-7900, Fax: (703) 450-6610
West Coast, U.S.A. - Tel: (714) 895-9777, Fax: (714) 895-4988
United Kingdom - Tel: +44-(0)1635-811140, Fax: +44-(0)1635-32264
France - Tel: +33-(0)1-41-16-3424, Fax: +33-(0)1-41-16-3425
Germany - Tel: +49-(0)8141-349-087, Fax: +49-(0)8141-349-089
Japan - Tel: +81-(0)3-3814-7688, Fax: +81-(0)3-3814-7689
World Wide Web - http://www.ddc-web.com