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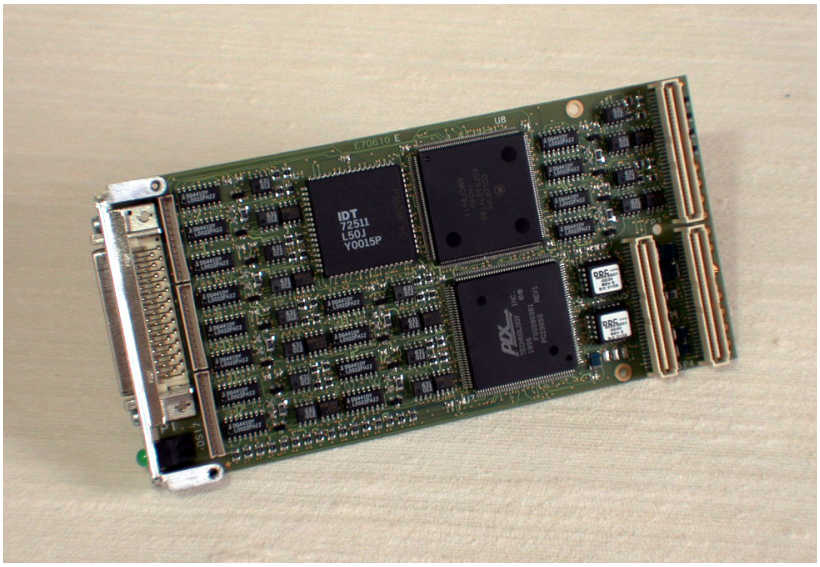
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DD-42916C1-300

ARINC 429 PMC MODULE (PCI MEZZANINE CARD)



DESCRIPTION

The DD-42916C1-300 is a PMC (PCI Mezzanine Card) designed specifically to interface with an ARINC 429 data bus. The card contains both transmitters and receivers, and can be used for analyzing and simulating data on an ARINC 429 data bus. The card provides 16 independently programmable Rx/Tx channels, with High speed/Low speed operation and engineering unit conversion.

This card is well suited for all types of ground support work (development, manufacturing test, etc.), as well as on-board data acquisition. LRU developers find that these cards provide easy access for simulating and/or testing new systems prior to use with actual flight systems. Avionics maintenance and validation teams can perform end-item testing in the laboratory and by using portable PC's can continue testing in an aircraft.

The card has an on-board processor operating at 90 MHz. The card contains 512 Kbytes of dual-port RAM that can be accessed by both the PC and the card. This dual-port RAM is used to reliably transfer ARINC 429 data to and from the card.

Software libraries and drivers for Windows 95/98/2000/XP, Windows NT, LabVIEW, LabWindows/CVI, Linux, and VxWorks are available to assist in software development.

This card also works with DDC's advanced DD-42999S0 Commercial Avionics Utilities Software Suite. This optional software includes an ARINC 429 Data Bus Analyzer, and an ARINC 615 Data Loader.

Make sure the next Card you purchase has...

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FEATURES

- PMC Interface Card
- 16 Programmable High Speed/Low Speed Rx/Tx Channels
- Both Front and Rear ARINC I/O
- Supports High-Speed Data Rates on all Channels Simultaneously
- On-Board Processor Operating at 90 MHz
- 512 Kilobytes Dual Port RAM for Real-Time Data
- 512 Kilobytes Program RAM
- Engineering Unit Conversion
- FIFO and Scheduled Transmission Methods
- Command Response FIFO
- Receive Data Filtering
- Wrap Around Self Test for Each Channel
- Six Discrete Inputs and Four Discrete Outputs
- Programmable Interrupt Support
- 0° to 70°C Operation
- Supports Windows® 95/98/2000/XP, Windows NT®, LabVIEW™, LabWindows™/CVI, Linux, and VxWorks®
- Optional Application Software Available

DDC® Data Device Corporation

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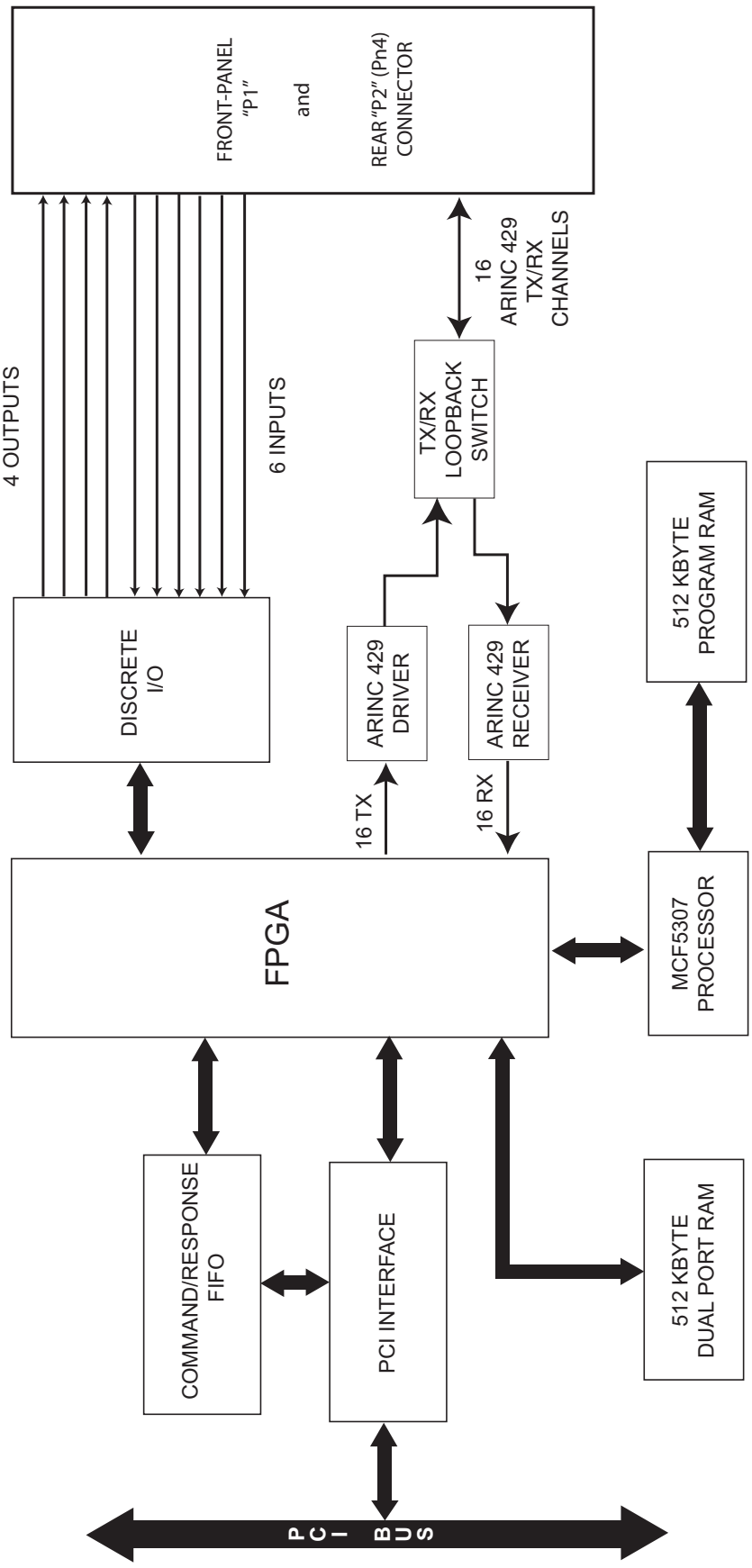


FIGURE 1. DD-42916C1-300 BLOCK DIAGRAM

TABLE 1. DD-42916C1-300 GENERAL SPECIFICATIONS				
PARAMETER	VALUE			UNIT
	MIN	TYP	MAX	
PHYSICAL		**STANDARD SINGLE PMC MODULE**		
Card Size		5.87 x 2.91 (149.1 x 73.9)		in (mm)
Card Weight		3.6 (112)		oz (gms)
ENVIRONMENTAL				
Operating Temperature at no more than 95% relative humidity, non-condensing		0 to +70		°C
Storage Temperature at no more than 99% relative humidity, non-condensing		-40 to +85		°C
ELECTRICAL				
Connectors-50-pin I/O connector is located on the front panel Nominal Data Rate		12.5/100		KHz
Power Supplies		+3.3, +5, and ±12		V DC
PCI Signaling Voltage		+5 only		V
Expected Bus Impedance		75 ±10% with termination at both ends		Ohms
Receiver Input Impedance		1K		Ohm
Time Tag Resolution		1 or 1		µsec msec
ARINC RECEIVER INPUTS				
Differential Input Voltage (See Notes 1 & 2)				
One	6.5	10.0	13.0	V
Zero	-13.0	-10.0	-6.5	V
Null	-2.5	0.0	2.5	V
ARINC TRANSMITTER OUTPUTS				
Differential Output Voltage (See Note 1)				
One	9.0	10.0	11.0	V
Zero	-11.0	-10.0	-9.0	V
Null	-0.5	0.0	0.5	V
ARINC DISCRETE INPUTS				
True	3.5		30.0	V
False	0.0		3.00	V
ARINC DISCRETE OUTPUTS (See Note 1)				
Maximum Output Voltage			30.0	V
Current sinking via Darlington output driver			100.0	mA

Notes:
1. ARINC I/O is NOT lightning-protected per DO-160D.
2. Absolute Maximum Input Voltage rating at ARINC receiver input pins is -29V to +29V.

TECHNICAL OVERVIEW

The DD-42916C1-300 card is user programmable with a Motorola COLDFIRE processor and 512 Kbytes of program RAM. The card also contains 512 Kbytes of dual-port RAM that can be accessed by both the host computer and the on-board processor. This dual-port RAM is used to transfer ARINC 429 data to and from the card. Sixteen ARINC channels can be programmed to be Transmit/Receive channels operating at high or low speed. The card has six input and four output discretes which provide the capability to control external devices or monitor events. On-board Interrupt Mask and Interrupt Status Registers support flexible operation for both interrupt and polling applications.

Application software has the capability to simulate the outputs of various airborne systems, receive inputs from these systems, and provide bus analyzer functions. Included with each card is the advanced, easy-to-use, API (Application Programming Interface) library with example source code that allows users to easily write their own application software for the card.

APPLICABLE DOCUMENTS

Draft Standard Physical and Environmental Layers for PCI Mezzanine Cards: PMC

Draft Standard for Common Mezzanine Card Family: CMC

TABLE 2. DD-42916C1-300 POWER SPECIFICATIONS				
PARAMETER	**POWER SUPPLY (V)**	**CURRENT DRAWN (mA)**	**POWER (W)**	**TOTAL POWER**
Idle	5	273.5	1.37	= 4.56 W
	3.3	409	1.35	
	+12	57.5	0.69	
	-12	96	1.15	
16 Channels Transmitting (Duty Cycle Approx 45%, NO Loads):	5	273.5	1.37	= 4.68 W
	3.3	440	1.45	
	+12	59.2	0.71	
	-12	96	1.15	
16 Channels Transmitting (Duty Cycle Approx 45%, One Channel Loaded with 400 Ohms and 400pF):	5	274.2	1.37	= 4.81 W
	3.3	446-450	1.48	
	+12	63	0.76	
	-12	96	1.20	
16 Channels Transmitting (Duty Cycle Approx 45%, Two Channels Loaded with 400 Ohms and 400pF):	5	272.3	1.36	= 4.89 W
	3.3	460	1.50	
	+12	66	0.79	
	-12	103	1.24	
Extrapolation Estimate of 16 Channels Transmitting (Duty Cycle Approx 45%, 16 Channels Loaded with 400 Ohms and 400pF):	5	274.2	1.37	= 6.38 W
	3.3	600	1.98	
	+12	108	1.30	
	-12	144	1.73	

ARINC 429 Mark 33 Digital Information Transfer Systems (DITS)

RECEIVE/TRANSMIT CHANNELS

Each card has up to 16 programmable ARINC 429 channels. These are general-purpose ARINC 429 channels, and can be set under program control for high or low speed operation, with receive or transmit functionality, and with receiver timestamping of data.

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

TRANSMITTING

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

To transmit scheduled data, 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 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 user to define a schedule that will continuously transmit data words at a fixed rate on any given channel based on label/SDI combinations.

To transmit FIFO data, the user must select FIFO mode through the DefineTxChannel API library routine. FIFO data will get transmitted in the exact order in which the data was input by the host.

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 defined schedule.

RECEIVING

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

The DD-42916C1-300 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 stamping resolution can be selected to be 1msec or 1µsec. 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 is extremely useful if the host is only interested in the most recently received data. Both FIFO and Mailbox modes can be used simultaneously.

BUILT IN TEST

A series of self-tests are run each time the card is powered up or following a ResetCard command. There is a Green self-test LED on the front panel that indicates passing of self-tests. A wrap around test connects receiver and transmitter channels together with an isolated I/O connector.

DIAGNOSTIC LEDS

Diagnostic LED's are provided as a visual aid to indicate proper card initialization and to show channel activity. Once the card is powered up, or following a ResetCard command, the green LED located on the front panel of the card will turn off until the card is initialized. If any Power or Self Tests fail, this green LED will flash five times before turning solid green. If all tests pass this LED will not flash and will immediately switch to green. There are also 16 red miniature LED's located on the upper left side of the printed circuit card. The corresponding LED will illuminate during any transmission or reception of data on a channel.

DATA MEMORY

The DD-42916C1-300 card contains 512 Kilobytes of Dual Port RAM used for the rapid exchange of data between the host computer and the card. This memory allows for excellent reliability of data transfer between the card and the host computer.

The card also contains 512 Kilobytes of Program RAM used by the on-board processor to aid in data processing. This allows the host computer to perform other tasks while the card processes data.

INTERRUPT GENERATION

The DD-42916C1-300 is capable of generating interrupts to the host computer. Interrupts can be generated when an ARINC 429 word is received, receive errors occur, changes in transmit or receive FIFO status, or at the end of a major frame. There is a structure in Dual-Port RAM that allows the host to determine the cause(s) of an interrupt generated by the card.

A user defined interrupt handler function may be used in programming. If a handler function is required, it can be passed to the DLL through the SetIrqHandler API library routine. The ClearIrqHandler API library routine may be called to release the user defined callback function.

DISCRETE I/O

The DD-42916C1-300 contains 6 discrete open/ground inputs and 4 discrete outputs.

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.

The discrete outputs can be used for a variety of things, including triggering events, indicating status, and general-purpose use. The discrete outputs can sink up to 100mA of current at 30V. Each discrete output must be tied to an external voltage source through a pull up resistor. The discrete output can be tied to a 5V source through a 1.5KW pull up resistor. This will provide an output voltage at the output discrete when logic '1' is input to the WriteOutputDiscrete API library routine. The discrete output can be tied directly to any of the 6 discrete inputs located on the card. By default, the discrete inputs drive a 5V output.

The discrete inputs are implemented by use of DDC's DD-03206 six-channel discrete-to-digital interface device with lightning-

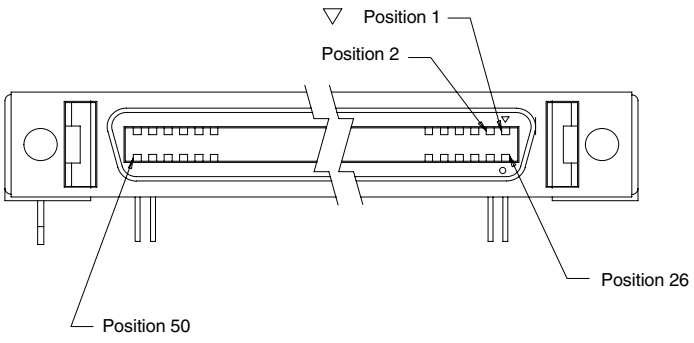


FIGURE 2. DD-42916C1-300 FRONT-PANEL "P1"CONNECTOR

TABLE 3. DD-42916C1-300 FRONT-PANEL "P1" AND REAR "P2" (Pn4) CONNECTOR PINOUT			
1	Channel 1 I/O A	26	Channel 13 I/O B
2	Channel 1 I/O B	27	Channel 14 I/O A
3	Channel 2 I/O A	28	Channel 14 I/O B
4	Channel 2 I/O B	29	Channel 15 I/O A
5	Channel 3 I/O A	30	Channel 15 I/O B
6	Channel 3 I/O B	31	Channel 16 I/O A
7	Channel 4 I/O A	32	Channel 16 I/O B
8	Channel 4 I/O B	33	Ground
9	Channel 5 I/O A	34	Ground
10	Channel 5 I/O B	35	Ground
11	Channel 6 I/O A	36	Ground
12	Channel 6 I/O B	37	Discrete Input 1
13	Channel 7 I/O A	38	Discrete Input 2
14	Channel 7 I/O B	39	Discrete Input 3
15	Channel 8 I/O A	40	Discrete Input 4
16	Channel 8 I/O B	41	Discrete Input 5
17	Channel 9 I/O A	42	Discrete Input 6
18	Channel 9 I/O B	43	Diode 4
19	Channel 10 I/O A	44	Discrete Output 4
20	Channel 10 I/O B	45	Diode 3
21	Channel 11 I/O A	46	Discrete Output 3
22	Channel 11 I/O B	47	Diode 2
23	Channel 12 I/O A	48	Discrete Output 2
24	Channel 12 I/O B	49	Diode 1
25	Channel 13 I/O A	50	Discrete Output 1

Note: Per ARINC-429 specification, "A-Side signal is "+" (positive) with respect to ground, while "B-Side" signal is "-" (negative) with respect to ground.

Note: Rear "P2" (Pn4) Connector is 64-pins. Pins 51 through 64 are not used nor connected.

protected inputs to handle open/ground signals. The logic threshold lies between 3V and 3.5V. The status of the discrete inputs is not guaranteed if the voltage lies within this threshold voltage. The maximum tolerated voltage is 30V DC.

CARD PINOUT

The card has one front-panel connector "P1", a 0.50" Mini-D Type, 50-pin connector. The pinout for this connector is shown in FIGURE 2 and TABLE 3 (see accessory list for mating connector part number).

The card also features a rear I/O connection via connector "P2" (Pn4). This connector is a 64-pin "Mezzanine IEEE 1386 Board-to-Board Plug, Dual Row, SMT Vertical Stacking" (MOLEX P/N 71436-2164). The pinout for this connector is shown in Table 3.

NOTES:

1. All ground returns are connected to the chassis ground.
2. Diode pins are connected to 1N914 diodes, which may be used to suppress transients from inductive loads on the discrete outputs. The anode of the diode is internally connected to the discrete output.

INCLUDED SOFTWARE LIBRARY

The DD-42977S0 software package furnished with the card includes Windows 95/98/2000/XP and Windows NT drivers, and a complete API (Application Programming Interface) software library. This software is used to configure the card for receiving and transmitting data on an ARINC 429 data bus. See TABLE 4 for a listing of Host Commands. This software package also includes support for LabVIEW and LabWindows/CVI.

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. Demo programs are included with this software to demonstrate some of the card's capabilities. Source code is also provided to help you get started with programming your card.

The DD-42977S1 software package includes drivers and a complete API software library for Linux.

The DD-42977S2 software package includes drivers and a complete API software library for VxWorks.

OPTIONAL APPLICATION SOFTWARE

DD-42999S0: Commercial Avionics Utilities Software Suite
ARINC 429 Data Bus Analyzer
ARINC 615 Data Loader

CUSTOMER SUPPORT

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

TABLE 4. HOST COMMANDS	
COMMAND	**DESCRIPTION**
CardInit	Initializes a card for operational use
ClearIrqHandler	Clears a user specified Interrupt Service Routine Callback function
DefineRxChannel	Configures a receive channel
DefineRxFilterWords	Defines the receiver's filter, enabling received ARINC data to be placed in a receive FIFO
DefineRxInterruptFilter	Defines the received SDI/label combination that will generate an interrupt
DefineTxChannel	Configures a transmit channel
DefineTxScheduleRates	Defines a transmit schedule for individual SDI/label combinations according to the desired transmission rate
DefineTxScheduleTable	Defines a transmit schedule table for frames of SDI/label combinations
DequeueErrors	Retrieves any errors that have occurred on a given channel
EnableSSMFilter	Enables and disables the mailbox SSM filtering
FIFO_Loopback	Tests host communications by looping data between the Command and Response FIFOs
FreeCard	This function closes the card and frees up any resources that were being used.
GetCardBaseAddress	Returns the virtual base address of the card specified by the device number
GetClockTime	Reads the current value of the time stamp clock
GetFreeMemory	Returns the amount of any unused Dual-Port RAM
GetInterruptSource	Returns all pending interrupt sources
GetLabelRate	Returns the transmit rate for a given SDI/label, on a given channel
GetMemoryAddresses	Retrieves the starting memory offsets for the configurable FIFOs and mailboxes in Dual-Port RAM
GetNumberFreeTimers	Returns the number of available timers that are used for scheduled transmissions
GetRxFilter	Determines the filter state for a given SDI/label
GetScheduleRates	Returns the schedule table for a given channel
HaltChannel	Stops a channel's operation
LoadEngConverTable	Loads the engineering conversion table
ModifyRxChannel	Modifies the configuration for a receive channel
ModifyTxChannel	Modifies the configuration for a transmit channel
NumberOfElements	Returns the number of 32-bit long elements in the specified queue
ReadInputDiscrete	Reads the discrete inputs
ReadMailbox	Reads received ARINC data from the Mailbox
ReceiveFIFO	Reads received ARINC data from the FIFO
ResetCard	Resets the card to power-up state
ResetClock	Resets the time stamp timer to zero
SetFilterEnabling	Enables or disables a defined filter
SetInterruptConditions	Configures the conditions that will generate host interrupts
SetIrqHandler	Defines a user specified Interrupt Service Routine Callback function to be called whenever a hardware interrupt occurs
SetPreciseTxTimerMode	Changes the default timer used in scheduled transmissions from 1 msec to 100 µsec
SizeOfFIFO	Returns the current size of the requested queue
SoftwareVersion	Retrieves the current card firmware version
StartChannel	Starts a channel operating
StateOfFIFO	Returns the current FIFO state of a given channel
TransmitFIFO	Transmits an array of data through the FIFOs
TransmitScheduled	Transmits data in the scheduled queue
TxRxLoopback	Allows the card to loopback a data word internally
UpdateFlash	Updates the firmware on the DD-42916C1-300 board. A valid S19 file must be provided.
UpdateTxScheduleRates	Allows the host to update a previously defined transmission schedule
WhatIsChannel	Returns the specified channel's type
WriteOutputDiscrete	Writes to the discrete outputs

ORDERING INFORMATION:

DD-42916C1-300

ARINC 429 PMC Card
16 Programmable Receive/Transmit Channels
6 Discrete Inputs, 4 Discrete Outputs

Note: The above products contain tin-lead solder.

INCLUDED SOFTWARE:

DD-42977SO

API Library and drivers for Windows 95/98/2000/XP, Windows NT, LabVIEW and LabWindows/CVI

DD-42977S1

API Library and drivers for Linux

DD-42977S2

API Library and drivers for VxWorks

All of the above software is available free of charge on our web site at www.ddc-web.com

ACCESSORIES:

Mating Connector 3M P/N 10150-3000VE

OPTIONAL APPLICATION SOFTWARE ORDERING INFORMATION:

DD-42999S0

Commercial Avionics Utilities Software Suite

Includes: ARINC 429 Data Bus Analyzer

ARINC 615 Data Loader

BU-6940XX

*data*MARS/*data*SIMS Advanced Graphical Monitoring and Simulation Software for Windows 95/98/2000/XP, Windows NT

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TEST	METHOD(S)	CONDITION(S)
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ELECTRICAL TEST	DDC ATP	—

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