

## MULTI-FUNCTION I/O CARD



Convection Cooled

### Features

- Multiple functions on a single slot 3U cPCI card
- User can specify three different function modules
- Control via either cPCI Bus or Gigabit Ethernet
- Automatic background BIT testing continually checks and reports the health of each channel.
- Connections via front panel, rear panel, or both
- Designed for both commercial and MIL applications
- Conduction or convection-cooled versions
- Software support kit and drivers provided

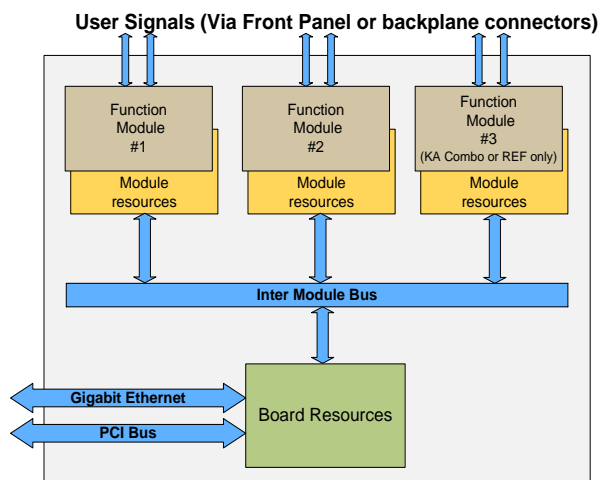


Conduction Cooled

### Description

The 75C3 is a 3U cPCI multifunction I/O and communications card. The motherboard contains 3 independent module slots, two of which can be populated with a function specific module and the third with either a combination module featuring 4 multiplexed A/D channels and 28 Discrete I/O programmable channels, or with a reference supply. The enhanced motherboard, using multiple DSP, allows for higher processing power and dedicated control for each module. This unique design eliminates the need for multiple, specialized single function cards by providing a single board solution for a broad assortment of I/O, Synchro/Resolver, LVDT and other signal interface functions that can be controlled either via the cPCI Bus or 10/100/1000BaseT Ethernet. The available functions are listed on the following page. Additionally, the 75C3 incorporates serial communications modules such as RS232/422/485, MIL-STD-1553, CANBus and ARINC 429. Our approach increases packaging density, saves enclosure slots, reduces power consumption and adds continuous background BIT testing. A Software Support Kit (SSK) is provided.

Automatic background BIT testing, an important feature, is always enabled and continually checks the health of each channel. There is no need to guess or make assumptions about system performance. A fault is immediately reported and the specific channel is identified. This capability is of tremendous benefit because it identifies and reports a failure, without the need to shut down the equipment for troubleshooting. Testing is totally transparent to the user, requires no external programming and has no effect on the standard operation of the card. (See Operations Manual for more detailed information).



## General Board Specification

- **Power:** +5VDC
- **Operating Temp:** 0° C to 70° C or -40° C to 85° C
- **Size:** 100mm x 20mm x 160mm (3U)

## Available Function Modules

**Note 1** – Indicates wide selection (See part number in Operations Manual)

**Note 2** – Contact factory for availability

A/D Converter	Module	Channels	Input Scaling	Resolution	Accuracy (±)	Sampling (programmable)	
	C1	10	± 1.25,2.5,5 or 10 VDC	16-Bit	0.05% FS	200 KHz Max	
	C2	10	±5,10,20 or 40 VDC	16-Bit	0.1% FS	200 KHz Max	
	C3	10	0-25 mA	16-Bit	0.1% FS	200 KHz Max	
	C4	10	±6.25,12.5,25 or 50 VDC	16-Bit	0.1% FS	200 KHz Max	
	CA	10	(Channels 1-6 are C2 type and Channels 7-10 are C3 type)				
D/A Converter	Module	Channels	Output Range	Resolution	Accuracy (±)	Settling time	
	F1	10	±10 or 0-10 VDC	16-Bit	0.05% FS	15µs Max	
	F3	10	±5 or 0-5 VDC	16-Bit	0.05% FS	10µs Max	
	F5	4	±25 or 0-25 VDC	16-Bit	0.05% FS	10µs Max	
	J3	10	±1.25 or 0-1.25 VDC	16-Bit	0.05% FS	10µs Max	
	J5	10	±2.5 or 0-2.5 VDC	16-Bit	0.05% FS	10µs Max	
J8	4	±20 to ±100 VDC	16-Bit	0.15% FS	350µs Max		
D/S	Module 6 <sup>1</sup>	Channels 3	Frequency 47 Hz – 10 KHz	Resolution 16-Bit	Accuracy (±) 0.1°	Power 0.25 VA/Channel	
DLV	Module 5 <sup>1</sup>	Channels 3	Frequency 47 Hz – 10 KHz	Resolution 16-Bit	Accuracy (±) 0.2% FS	Power 0.1 VA/Channel	
Discrete I/O	Module K6 (v4)	Channels 16	Input Range 0 – 60 VDC	Output Range 0 – 60 VDC	Programmable Input or Output	Individual Isolated Switch	
	K7 <sup>2</sup>	16	0 – 60 VDC	0 – 60 VDC	Input or Output		
TTL	Module D7	Channels 16	Input Range 0 – 5.5 V	Output level TTL/CMOS	Programmable Input or Output		
Differential Transceiver	Module D8	Channels 11	Input Range (422) -10V to +10V	Input Range (485) -7V to +12V	Output Range (422/485) -0.25V to +5V		
Encoder	Module E7	Channels 4	Signal Voltage 24 VDC	Resolution 32-Bit	Counter Modes SSI, Encoder, Quadrature		
LVDT	Module L <sup>1</sup>	Channels 4	Frequency 360 Hz to 20 KHz	Resolution 16-Bit	Accuracy (±) 0.025% FS	Interface 2 or 3/4 Wire	
S/D	Module S <sup>1</sup>	Channels 4	Frequency 50 Hz to 20 KHz	Resolution 16-Bit	Accuracy (±) 1 arc-min	Tracking Rate 190 RPS	
RTD	Module G4	Channels 6	Update rate 16.7 Hz/Channel	Resolution 16-Bit	Accuracy (±) 0.05% FS	Interface 2, 3 or 4 Wire	
Strain Gage	Module G5	Channels 4	Update rate 2.3 Hz – 2.4 KHz	Resolution 16-Bit	Accuracy (±) 0.1% FS	Interface Conventional 4-Arm Bridge	
ARINC 429/575	Module A4	Channels 6	Frequency 100 KHz or 12.5 KHz	Input/output RX/TX	Message Buffer 256 word Tx/Rx		
MIL-STD-1553	Module N7	Channels 2	Operational Modes BC,RT, BM, BM/RT	Onboard RAM 128Kbyte per Ch.	Coupled Transformer		
	N8	2	BC,RT, BM, BM/RT	128Kbyte per Ch.	Direct		
CANBus	Module P6, PA	Channels 4	CAN protocol CAN 2.0 A/B, J1939	Message Buffer 16K RX/TX	Data rate (Prog) 1 Mb/s Max.	Notes Bosch® IP Core	
RS-232/422/485	Module P8	Channels 4	Communication Async / Sync	Data rate (Sync) 4 Mbits/s per Ch.	Data rate (Async) 1 Mbit/s per Ch.	Tx/Rx Buffer 32 KB	Notes Part Modem
Reference	Module W <sup>1</sup>	Channels 1	Frequency 47 Hz – 20 KHz	Accuracy +/- 3%	Voltage 2 – 115 VRMS	Power 6 VA	
DC Power Supply	Module V1, V2	Channels 1, 2	Voltage Output +/- 15V	Maximum Current +/- 450 mA	Regulation +/- 1%		
A/D & Discrete I/O (Slot 3 only)	Module KA	A/D Channels 4(multiplexed)	Input Scaling ±10 VDC	Resolution 14-Bit	Accuracy 0.1% FS	Sampling 3 KHz Max	
		I/O Channels 28	Input Range 0 – 50 VDC	Output Range 0 – 50 VDC	Format 12 In/12 Out/4 Prog.	Resolution 12-bit	
Reference <sup>(v9)</sup> (Slot 3 only)	Module W6	Channels 1	Frequency 47 Hz – 20 KHz	Accuracy +/- 2%	Voltage 2 – 28 Vrms	Power 5 VA	
	W7	1	47 Hz – 2 KHz	+/- 5%	115 Vrms	5 VA	

## SOFTWARE SUPPORT

The ENA/BL Software Support Kit (SSK) is supplied with all system platform based board level products. This platform's SSK contents include html format help documentation which defines board specific library functions and their respective parameter requirements. A board specific library and its source code is provided (module level 'C' and header files) to facilitate function implementation independent of user operating system (O/S). Portability files are provided to identify Board Support Package (BSP) dependent functions and help port code to other common system BSPs. With the use of the provided help documentation, these libraries are easily ported to any 32-bit O/S such as RTOS or Linux.

The latest version of a board specific SSK can be downloaded from our website [www.naii.com](http://www.naii.com) in the software downloads section. A Quick-Start Software Manual is also available for download where the SSK contents are detailed, Quick-Start Instructions provided and GUI applications are described therein. For other operating system support, contact factory.

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## SPECIFICATIONS

### General – for the Motherboard

Signal Logic Level:	Automatically supports either 5V or 3.3V CPCI bus
Power (Motherboard):	+5 VDC @ 750mA ±12V @ 15mA Then add power for each individual module
Temperature, Operating:	"C" =0°C to +70°C, "E" =-40°C to +85°C (see part number)
Storage Temperature:	-55°C to +105°C
Temperature Cycling:	Each board is cycled from -40°C to +85°C for 24 hrs for options "E" or "H"
Size:	Height - 3.94" / 100 mm (3U) Width - 0.8" / 20.3 mm (4HP) Depth - 6.3" / 160 mm deep
Weight:	4 oz. (115g) unpopulated add weight for each module (typically 1 oz. each) add 2 oz. (57g) for wedgelocks

### ARINC 429/575 (Module A4) – Six RX/TX Channels, Configurable

Input/Output Format:	6 channels can be programmed for either RX or TX per channel
Frequency:	100 KHz or 12.5 KHz operation
Buffers:	RX/TX FIFO buffering Label/SDI filtering
Self-Test:	Loop back test
Format:	AR429 or 575 programmable/channel
Power:	+5V @ 850 mA (nominal) ±12 V @ 55 mA (nominal)
Ground:	Ground return is to system ground
Weight:	1 oz. (28g)

### MIL-STD-1553 (Module N7) – Two Dual/Redundant Channels, Transformer Coupled

Onboard RAM:	128 KB per dual-redundant channel
Operational Modes:	BC, RT, BM, or BC/RT
Output Signal	28 Vp-p, as per 1553 standard
Power:	+5 VDC @ 1.6 A max at 100% duty cycle (2 channels)
Ground:	Bus signals isolated from system ground
Weight:	1 oz. (28g)

## MIL-STD-1553 (Module N8) – Two Dual/Redundant Channels, Directly Coupled

Onboard RAM:	128 KB per dual-redundant channel
Operational Modes:	BC, RT, BM, or BC/RT
Output Signal:	28 Vp-p, as per 1553 standard
Power:	+5 VDC @ 1.6 A max at 100% duty cycle (2 channels)
Ground:	Bus signals isolated from system ground
Weight:	1 oz. (28g)

## CANBus (Module P6, PA) – Four CANBus Interfaces

Channels:	Four independent isolated RX and TX
CAN Protocol:	P6 = CANBus Version 2.0 A & B protocol support PA = CANBus Version J1939 protocol support Standard (11-bit) and Extended (29-bit) (identifier) Data Frames Integrated BOSCH® CANBus IP Core
Data Rate:	Up to 1 Mbps per channel
Data Length:	0-250 bytes
Power:	210 mA @ 5V / CH; (1.05 W / CH) (typ.)
Ground:	Isolated; Galvanic (500V) isolation from channel-to-channel and system ground
Weight:	1 oz. (28g)

## RS-232/422/485 (Module P8) – Four, High Speed, RS-232, RS-422, RS-485

Number of Channels:	Four (4) fully programmable Note: Due to pin count constraints, extended 'handshaking' capability not available (see pin-outs)
Data Rate:	4 Mbits/s per channel in Synchronous/HDLC mode 1 Mbits/s per channel in Asynchronous mode (RS-422 & RS-485) Data rate will be within 1% of commanded rate. Data can be read 4μs after receipt in UART. These data rates are verified with all channels running simultaneously
Data Transfer:	<b>Data transfers within 300 ns, no latency issues</b>
Receive/Transmit Buffers:	32 KB for each Receive and Transmit buffer. Accessed in 16 bit mode only
Power:	+5 VDC @ 0.2 A per module (typical/average – all channels operating)
Ground:	Ground return is to system ground
Weight:	1 oz. (28g)

## **A/D (Module C1) – Ten A/D Channels (1.25 to 10.0 VDC FS) Uni or Bipolar**

Resolution:	16-bit A/D converters. One per channel
Input format:	Differential (may be used as single ended by grounding one input)
Input scaling:	Ten (10) bipolar or unipolar channels. Programmable, per channel, as Full Scale (FS) range inputs of 10.00, 5.00, 2.50, or 1.25 volts where range is -FS to +FS, or 0 to FS VDC. The ability to set lower voltages for FS assures the utilization of the full resolution.
Over-voltage protection:	No damage up to $\pm 12$ V continuous; $\pm 30$ V momentary
Open input sense:	This module will sense and report unconnected Inputs
Input impedance:	1 M $\Omega$ min.
Accuracy:	0.05 % FS range over temperature. (no missing codes to 16 bits)
Linearity error:	$\pm 1.25$ LSB's max. over temperature
Sampling rate:	200 KHz max per channel, programmable
Data buffering/triggering:	See Operations Manual for details
Bandwidth:	20 KHz per channel
Group delay:	30 $\mu$ s (time for data sample to propagate to data register)
Programmable filter:	Each channel incorporates a fixed second order anti-aliasing filter and a post filter that has a digitally adjustable break point (programmable from 10 Hz to 10 KHz in 10 Hz steps).
Common mode rejection:	70 dB min. at 60 Hz. Roll off to 50 dB min. at 10 KHz
Common mode voltage:	Signal voltage plus Common mode voltage is 10.5 volts Note: A/D differential inputs must not "float". Input source must have return path to ground.
Output logic:	Bipolar output in two's complement. 7FFF is max. positive, 8000 is max. negative Unipolar output range from 0 to FFFF full scale
ESD protection:	Designed to meet the testing requirements of IEC 801-2 Level 2. (4KV transient with a peak current of 7.5A and a time constant of approximately 60 ns).
Power:	+5 VDC @ 500mA typical, 750mA max.
Ground:	Channel inputs are differential, but referenced to system ground.
Weight:	1 oz. (28g)



## **A/D (Module C2) – Ten A/D Channels (5.0 to 40.0 VDC FS) Uni or Bipolar**

Resolution:	16-bit A/D converters. One per channel
Input format:	Differential (may be used as single ended by grounding one input)
Input scaling:	Ten (10) bipolar or unipolar channels. Programmable, per channel, as Full Scale (FS) range inputs of 40.00, 20.00, 10.00, or 5.00 volts where range is -FS to +FS, or 0 to FS VDC. The ability to set lower voltages for Full Scale Input assures the utilization of the full resolution. This module will not sense open Inputs.
Over-voltage protection:	±100 Volts
Input impedance:	500 K $\Omega$ min. (Differential)/ 250 K $\Omega$ min. (Single ended)
Accuracy:	0.1 % FS range over temperature. (no missing codes to 16 bits)
Linearity error:	±1.25 LSB's max. over temperature
Sampling rate:	200 KHz max per channel, programmable
Data buffering/triggering:	See Operations Manual for details
Bandwidth:	20 KHz per channel
Group delay:	30 $\mu$ s (Time for data sample to propagate to data register)
Programmable filter:	Each channel incorporates a fixed second order anti-aliasing filter and a post filter that has a digitally adjustable break point (programmable from 10 Hz to 10 KHz in 10 Hz steps).
Common mode rejection:	70 dB min. at 60 Hz. Roll off to 50 dB min. at 10 KHz
Output logic:	Bipolar output in two's complement. 7FFF is max positive, 8000 is max negative Unipolar output range from 0 to FFFF full scale
Common mode voltage:	Signal voltage plus Common mode voltage is 80 volts. Note: A/D differential inputs must not "float". Input source must have return path to ground.
ESD protection:	Designed to meet the testing requirements of IEC 801-2 Level 2. (4KV transient with a peak current of 7.5A and a time constant of approximately 60 ns)
Power:	+5 VDC @ 500mA typical, 750mA max.
Ground:	Channel inputs are differential, but referenced to system ground.
Weight:	1 oz. (28g)

## A/D (Module C3) – Ten A/D Channels (4-25mA)

Resolution:	16-bit A/D converters. One per channel
Input format:	Differential (may be used as single ended by grounding one input, 0-25ma)
Input scaling:	Ten (10) unipolar channels, 0-25ma Full Scale (FS). This module will not sense open Inputs
Input voltage:	Not to exceed $\pm 3$ volts
Input impedance:	100 $\Omega$ min.
Accuracy:	0.1 % FS range over temperature. (no missing codes to 16 bits)
Linearity error:	$\pm 8$ LSB's max. over temperature
Sampling rate:	200 KHz max per channel, programmable
Data buffering/triggering:	See Operations Manual for details
Bandwidth:	20 KHz per channel
Group delay:	30 $\mu$ s (Time for data sample to propagate to data register)
Programmable filter:	Each channel incorporates a fixed second order anti-aliasing filter and a post filter that has a digitally adjustable break point (programmable from 10 Hz to 10 KHz in 10 Hz steps).
Common mode rejection:	70 dB min. at 60 Hz. Roll off to 50 dB min. at 10 KHz.
Common mode voltage:	Signal voltage plus Common mode voltage is 80 volts. Note: A/D differential inputs must not "float". Input source must have return path to ground.
Output logic:	Unipolar output range from 0 to FFFF full scale
ESD protection:	Designed to meet the testing requirements of IEC 801-2 Level 2. (4KV transient with a peak current of 7.5A and a time constant of approximately 60 ns)
Power:	+5 VDC @ 500mA typical, 750mA max.
Ground:	Channel inputs are differential, but referenced to system ground.
Weight:	1 oz. (28g)

## A/D (Module C4) – Ten A/D Channels (6.25 to 50.0 VDC FS) Uni or Bipolar

Resolution:	16-bit A/D converters. One per channel
Input format:	Differential (may be used as single ended by grounding one input)
Input scaling:	Ten (10) bipolar or unipolar channels. Programmable, per channel, as Full Scale (FS) range inputs of 50.00, 25.00, 12.50, or 6.25 volts where range is -FS to +FS, or 0 to FS VDC. The ability to set lower voltages for Full Scale Input assures the utilization of the full resolution. This module will not sense open inputs.
Over-voltage protection:	±100 Volts
Input Impedance:	500 K $\Omega$ min. (Differential)/ 250 K $\Omega$ min. (Single ended)
Accuracy:	0.1 % FS range over temperature. (no missing codes to 16 bits)
Linearity error:	±1.25 LSB's max. over temperature
Sampling rate:	200 KHz max per channel, programmable
Data buffering/triggering:	See Operations Manual for details
Bandwidth:	20 KHz per channel
Group delay:	30 $\mu$ s (Time for data sample to propagate to data register)
Programmable filter:	Each channel incorporates a fixed second order anti-aliasing filter and a post filter that has a digitally adjustable break point (programmable from 10 Hz to 10 KHz in 10 Hz steps).
Common mode rejection:	70 dB min. at 60 Hz. Roll off to 50 dB min. at 10 KHz.
Common mode voltage:	Signal voltage plus Common mode voltage is 80 volts. Note: A/D differential inputs must not "float". Input source must have return path to ground.
Output logic:	Bipolar output in two's complement. 7FFF is max. positive, 8000 is max. negative Unipolar output range from 0 to FFFF full scale ESD protection Designed to meet the testing requirements of IEC 801-2 Level 2. (4KV transient with a peak current of 7.5A and a time constant of approximately 60 ns)
Power:	+5 VDC @ 500mA typical, 750mA max.
Ground:	Channel inputs are differential, but referenced to system ground.
Weight:	1 oz. (28g)

## A/D Combo (Module CA) – Six Channels ( $\pm 40\text{VDC}$ ) & Four Channels (4-25mA)

### Specifications applicable to channels 1-6 (40 VDC A/D)

Input format:	Differential (may be used as single ended by grounding one input)
Input scaling:	Ten (10) bipolar or unipolar channels. Programmable, per channel, as Full Scale (FS) inputs of: 40.00, 20.00, 10.00, or 5.00 volts where range is -FS to +FS, or 0 to FS VDC. The ability to set lower voltages for Full Scale Input assures the utilization of the full resolution. This module will not sense open Inputs.
Over-voltage protection:	$\pm 100$ Volts
Input impedance:	500 K $\Omega$ min. (Differential)/ 250 K $\Omega$ min. (Single ended)
Accuracy:	0.1 % FS range over temperature. (no missing codes to 16 bits)
Linearity error:	$\pm 1.25$ LSB's max. over temperature
Output logic:	Bipolar output (two's complement). 7FFF is max. positive, 8000 is max. negative Unipolar output range from 0 to FFFF full scale

### Specifications applicable to channels 7-10 (4-25mA A/D)

Input format:	Differential (may be used as single ended by grounding one input, 0-25ma)
Input scaling:	Ten (10) unipolar channels, 0-25ma Full Scale (FS). This module will not sense open inputs
Input voltage:	Not to exceed $\pm 3$ volts
Input impedance:	100 $\Omega$ min.
Accuracy:	0.1 % FS range over temperature. (no missing codes to 16 bits)
Linearity error:	$\pm 8$ LSB's max. over temperature
Sampling rate:	200 KHz max per channel, programmable 200 KHz per channel
Data buffering/triggering:	See Operations Manual for details)
Bandwidth:	20 KHz per channel
Group delay:	30 $\mu\text{s}$ (Time for data sample to propagate to data register)
Programmable filter:	Each channel incorporates a fixed second order anti-aliasing filter and a post filter that has a digitally adjustable break point (programmable from 10 Hz to 10 KHz in 10 Hz steps).
Output logic:	Unipolar output range from 0 to FFFF full scale

### Specifications applicable to ALL channels:

Resolution:	16-bit A/D converters. One per channel
Sampling rate:	200 KHz max per channel, programmable
Data buffering/triggering:	26 KB FIFO/CH; See Operations Manual for details
Bandwidth:	20 KHz per channel
Group delay:	30 $\mu\text{s}$ (Time for data sample to propagate to data register)
Programmable filter:	Each channel incorporates a fixed second order anti-aliasing filter and a post filter that has a digitally adjustable break point (programmable from 10 Hz to 10 KHz in 10 Hz steps).
Common mode rejection:	70 dB min. at 60 Hz. Roll off to 50 dB min. at 10 KHz.
Common mode voltage:	Signal voltage plus Common mode voltage is 80 volts. Note: A/D differential inputs must not "float". Input source must have return path to ground.
ESD protection:	Designed to meet the testing requirements of IEC 801-2 Level 2. (4KV transient with a peak current of 7.5A and a time constant of approximately 60 ns)
Power:	+5 VDC @ 500 mA typical, 750mA max.
Ground:	Channel inputs are differential, but referenced to system ground.
Weight:	1 oz. (28g)

## I/O (Module D7) – Sixteen TTL Channels— Programmable for I/O

### TTL Input

<b>Input levels:</b>	TTL and CMOS compatible, single ended inputs Each channel incorporates a 100 K $\Omega$ pull-down resistor
V in L:	0.8 V = "0"
V in H:	2.0 V = "1"
V in Max.:	5.5 V
I IN:	$\pm 50\mu\text{A}$
Read Delay:	300 ns
De-bounce:	Programmable per bit from 0 to 343 s. LSB= programmable

### TTL Output

<b>Output levels:</b>	TTL/CMOS, single ended outputs
Drive Capability:	V out L: +0.55 V max. Low level output current: 24 mA (sink) V out H: 2.4 V min. High level output current 24 mA (source)
Rise/Fall Time:	10 ns into a 50pf load
Write Delay:	300 ns
Power:	+5 VDC @ 75 mA unloaded (@ 460 mA max if all ch. max source)
Ground:	All grounds are common and connected to system ground
Weight:	1 oz. (28g)

## I/O (Module D8) – Eleven Differential Multi-Mode Transceiver Channels

Mode of Operation:	<b>422 (Differential)</b>	<b>485 (Differential)</b>
<b>Differential Input</b>		
Receiver Input Levels:	-10V to +10V	-7V to +12V
Receiver Input Sensitivity:	$\pm 200\text{mV}$	$\pm 200\text{mV}$
Receiver Input Resistance:	120 $\Omega$	>12k $\Omega$
	(Each channel incorporates a 120 $\Omega$ termination resistor that can be programmed on a channel by channel basis)	
Read Delay:	300 ns	
De-Bounce:	Programmable per bit from 0 to 343 s. LSB= programmable	

### Differential Output

Driver Output Voltage:	-0.25V to +5V max.	
Driver Output Signal Level: (Loaded Minimum)	$\pm 2\text{V}$	$\pm 1.5\text{V}$
Driver Output signal Level: (Unloaded Maximum)	$\pm 5\text{V}$	$\pm 5\text{V}$
Driver Load Impedance:	100 $\Omega$	54 $\Omega$
Max. Driver Current In Hi Z State (Power ON):	N/A	$\pm 100\mu\text{A}$
Max. Driver current In Hi Z State (Power OFF):	$\pm 10\mu\text{A}$	$\pm 10\mu\text{A}$
Write Delay:	300 ns	300 ns
Protection:	Short circuit protected, thermal shutdown, built-in current limiting	
Rise/Fall Time:	31 ns into a 50pf load	
Power (Per 11 Channel Module):	+5VDC @ 200 mA, 360 mA fully loaded (54 $\Omega$ load per channel)	
Ground:	All grounds are common and connected to system ground	
Weight:	1 oz. (28g)	

## D/A (Module F1) – Ten D/A Outputs ( $\pm 10$ VDC)

Resolution:	16 bits/channel for either output range
Output Format:	Single ended
Output Range:	$\pm 10$ VDC or 0 to 10 VDC, programmable
Output Impedance:	$< 1 \Omega$
System Protection:	Output is set to 0 at reset or Power-on
Accuracy:	$\pm 0.05\%$ FS range
Offset:	$< 1$ mV over temperature
Non-Linearity:	$\pm 0.01\%$ FS range over temperature
Gain Error:	$\pm 0.02\%$ over temperature
Settling Time:	10 $\mu$ s typ. (15 $\mu$ s max.)
Data Buffer:	See Operations Manual for details
Load:	Can drive a capacitive load of 0.1 mfd. 20 mA/channel max. (Source or Sink) short circuit protected. When current exceeds 20 mA for any channel, for $> 50$ ms, that channel is set to zero and a flag is set. All channels can be reset by either an automatic retry or by a control port command
Update Rate:	5 $\mu$ s per channel
ESD Protection:	Designed to meet the testing requirements of IEC 801-2 Level 2. (4KV transient with a peak current of 7.5A and a time constant of approximately 60 ns)
Power:	+5 VDC @ 300 mA typical; add 2 mA per 1 mA load per channel
Ground:	All grounds are common, but are isolated from system ground
Weight:	1 oz. (28g)

## D/A (Module F3) – Ten D/A Outputs ( $\pm 5$ VDC)

Resolution:	16 bits/channel for either output range
Output Format:	Single ended
Output Range:	$\pm 5$ VDC or 0 to 5 VDC, programmable
Output Impedance:	$< 1 \Omega$
System Protection:	Output is set to 0 at reset or Power-on
Accuracy:	$\pm 0.05\%$ FS range
Offset:	$< 1$ mV over temperature
Non-Linearity:	$\pm 0.01\%$ FS over temperature
Gain Error:	$\pm 0.02\%$ over temperature
Settling Time:	10 $\mu$ s max
Data Buffer:	See Operations Manual for details
Load:	Can drive a capacitive load of 0.1 mfd. 20 mA/channel max. (Source or Sink) short circuit protected. When current exceeds 20 mA for any channel, for $> 50$ ms, that channel is set to zero and a flag is set. All channels can be reset by either an automatic retry or by a control port command
Update Rate:	5 $\mu$ s per channel
ESD Protection:	Designed to meet the testing requirements of IEC 801-2 Level 2. (4KV transient with a peak current of 7.5A and a time constant of approximately 60 ns)
Power:	+5 VDC @ 300 mA typical; add 2 mA per 1 mA load per channel
Ground:	All grounds are common, but are isolated from system ground
Weight:	1 oz. (28g)

## D/A (Module F5) – Four D/A High Current Outputs ( $\pm 20$ VDC at 100 mA)

Resolution:	16 bits/channel for either output range
Output Format:	Single ended
Output Range:	$\pm 20$ VDC or 0 to 20 VDC, programmable
Output Impedance:	$< 1 \Omega$
System Protection:	Output is set to 0 at reset or Power-on
Accuracy:	0.05% FS range
Offset:	$< 1$ mV over temperature
Non-Linearity:	$\pm 0.01\%$ FS range over temperature
Gain Error:	$\pm 0.02\%$ over temperature
Settling Time:	10 $\mu$ s max
Data Buffer:	See Operations Manual for details
Load:	Can drive a capacitive load of 0.1 mfd. 100 mA/channel max. (Source or Sink) short circuit protected. When current exceeds 110 mA for any channel, for $> 50$ ms, that channel is set to zero and a flag is set. All channels can be reset by either an automatic retry or by a control port command
Update Rate:	5 $\mu$ s per channel
ESD Protection:	Designed to meet the testing requirements of IEC 801-2 Level 2. (4KV transient with a peak current of 7.5A and a time constant of approximately 60 ns)
Power:	+5 VDC @ 400 mA max. $\pm 12$ VDC @ 250 mA max.
Ground:	All grounds are common, but are isolated from system ground
Weight:	1 oz. (28g)

## D/A (Module J3) – Ten D/A Outputs ( $\pm 1.25$ VDC)

Resolution:	16 bits/channel for either output range
Output Format:	Single ended
Output Range:	$\pm 1.25$ VDC or 0 to $+1.25$ VDC, programmable
Output Impedance:	$< 1 \Omega$
System Protection:	Output is set to 0 at reset or Power-on
Accuracy:	$\pm 0.05\%$ FS range
Offset:	$< 1$ mV over temperature
Settling Time:	10 $\mu$ s max.
Data Buffer:	See Operations Manual for details
Load:	Can drive a capacitive load of 0.1 mfd. 20 mA/channel max. (Source or Sink) short circuit protected. When current exceeds 20 mA for any channel, for $> 50$ ms, that channel is set to zero and a flag is set. All channels can be reset by either an automatic retry or by a control port command
Update Rate:	5 $\mu$ s per channel
ESD Protection:	Designed to meet the testing requirements of IEC 801-2 Level 2. (4KV transient with a peak current of 7.5A and a time constant of approximately 60 ns)
Power:	+5 VDC @ 300 mA typical; add 2 mA per 1 mA load per channel
Ground:	All grounds are common, but are isolated from system ground
Weight:	1 oz. (28g)



## D/A (Module J5) – Ten D/A Outputs ( $\pm 2.5$ VDC)

Resolution:	16 bits/channel for either output range
Output Format:	Single ended
Output Range:	$\pm 2.5$ VDC or 0 to +2.5 VDC, programmable. For other ranges contact factory
Output Impedance:	$<1 \Omega$
System Protection:	Output is set to 0 at reset or Power-on
Accuracy:	$\pm 0.05\%$ FS range
Offset:	$<1$ mV over temperature
Settling Time:	350 $\mu$ s max
Data Buffer:	See Operations Manual for details
Load:	Can drive a capacitive load of 0.1 mfd. 20 mA/channel max. (Source or Sink). Short circuit protected. When current exceeds 20 mA for any channel, for $>50$ ms, that channel is set to zero and a flag is set. Card is programmable to allow all channels to be reset by either an automatic retry or by a control port command
Update Rate:	5 $\mu$ s per channel
ESD Protection:	Designed to meet the testing requirements of IEC 801-2 Level 2. (4KV transient with a peak current of 7.5A and a time constant of approximately 60 ns)
Ground:	All grounds are common, but are isolated from system ground
Power:	+5 VDC @ 300 mA typical; add 2 mA per 1 mA load per channel
Weight:	1 oz. (28g)

## D/A (Module J8) – Four D/A High Voltage Outputs ( $\pm 20$ to $\pm 100$ VDC)

Resolution:	16 bits/channel
Output Range:	$\pm 20$ to $\pm 100$ VDC Full Scale (FS) range. The ranges are programmable in pairs (i.e. one register controls the range for channels 1 and 2 and another register controls the range for channels 3 and 4)
Output Impedance:	$<1 \Omega$
System Protection:	Output is set to 0 at reset or Power-on
Accuracy:	0.15% FS
Settling Time:	350 $\mu$ s
Data Buffer:	See Operations Manual for details
Load:	10 ma/channel max. (Source or Sink up to 100 VDC). Short circuit protected
Update Rate:	5 $\mu$ s per channel
Output Control:	Via software Enable/Disable of DC/DC converter for Output Amp Stage
Power:	+5 VDC @ 400 mA max. $\pm 12$ VDC @ 250 mA max.
Ground:	Each D/A channel has a separate return (ground) pin. Channel 1 and 2 share a common return. Channel 3 and 4 share a common return. The returns for all four channels are isolated from system ground
Weight:	1 oz. (28g)



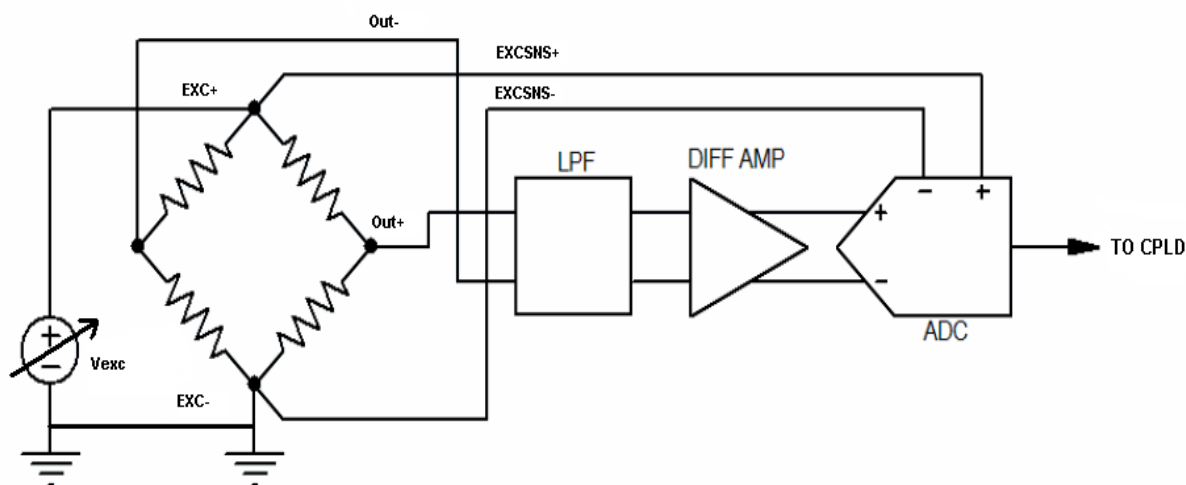
## **RTD (Module G4) – Six Channel RTD Measurement**

Resolution:	16 bits/channel
RTD Interface:	4, 3, or 2-wire RTD interface capability. Specifically designed for use with 100Ω 200Ω, 500Ω, 1000Ω, and 2000Ω RTD's, or any RTD whose maximum operating resistance is less than 6500Ω
Open Line Detection:	Ability to detect an open in any line or RTD in all wire modes
Excitation:	210 μA per channel
Accuracy:	0.05% of full-scale value
Update Rate:	Each channel is updated at 16.7Hz
Output Format:	Resistance
ESD Protection:	Designed to meet the testing requirements of IEC 801-2 Level 2. (4KV transient with a peak current of 7.5A and a time constant of approximately 60 ns
Power:	+5 VDC @ 100 mA typical
Ground:	All channel returns are common but are isolated from system ground
Weight:	1 oz. (28g)

## Load/Strain (Module G5) – Four Channel, Load Cell / Strain Gage Module

Number of Channels:	Four differential Input channels for load cell measurement
Input Interface:	Conventional 4-arm Wheatstone bridge, 4 or six wire interface
A/D Converter:	24 bit Sigma-Delta
Output Resolution:	24 or 16-bit
Accuracy:	± 0.1% Full-Scale (FS) range
Digital Output:	Percent of Full Scale (Ratio (Vin/Vexc))
Gain Settings:	1, 8, 16, 32, 64, and 128 (programmable)
Input Impedance:	> 10 M-ohm
Input Coupling:	DC
Bridge Excitation Voltage:	Dual Independent Sources, Programmable 0 – 4.85 V DC (source 1 for CH1,CH2; source 2 for CH3, CH4)
Output Current (Maximum):	210 mA / source (maximum current is cumulative between channel pairs)
Remote Voltage Sensing:	Yes
Output Data Rate:	4.7 Hz to 4.8 KHz (dependent on programmable filter settings)
BIT (Built-in test):	Continuous background 'on-line' accuracy, OPEN detection capability
ESD Protection:	Designed to meet the testing requirements of IEC 801-2 Level 2. (4 KV transient with a peak current of 7.5A and a time constant of approximately 60 ns)
Power:	+5 VDC @ 210 mA typical (est.)
Ground:	Channels isolated from each other and system ground
Weight:	1 oz. (28g)

Channel Block Diagram Overview



## DISCRETE (Module K6) (ver. 4) – Sixteen (16) Programmable Discrete I/O Channel

### Features:

- Programmable for Input (voltage or contact sensing) or Output (current source, sink or push-pull) per channel/bank
- Continuous Background BIT Testing (during normal operation, status provided for channel health and operation feedback)
- Ability to sense broken input connection and if input is shorted to +V or to ground
- Ability to read I/O voltage and output current for improved diagnostics (indicates if load is connected)
- Ability to current share, by connecting multiple outputs in parallel, to sink/source up to 2A per channel/bank
- Ability to handle high inrush current loads (e.g. two #327 incandescent lamps in parallel)
- Supports 'dual turn-on' (series channel output) applications (e.g. dual series 'key' missile launch control)
- Software compatible with previous versions – additional functions provided via supplementary memory register locations

### Input Characteristics:

Input Range:	0 to +60 VDC. Programmable for either voltage or switch closure sensing
Over-Voltage Surge Protection:	80 VDC max. (< 50ms); 100 VDC max. (< 1μs)
Voltage/Contact Sensing:	Software selectable per bank. When the input channel is utilized for direct voltage sense, Vcc is not required. When input is used to detect switch closures, Vcc is required to provide a current source (pull-up). Vcc per channel bank must be between 5 VDC min. and 60 VDC max. A module has 4 Vcc banks, each with 4 channels for a total of 16 channels/ module.
Input Pulse Detection:	A pulse, of 20.48μs minimum width, will be sensed and reported by the appropriate High-Low or Low-High transition status/interrupt
Input Impedance:	1MΩ (with or without power applied to module)
Switching Threshold:	Four levels (High, Low, Short to +V, Short to ground) are programmable from 0 to 60 VDC with 10-bit resolution
Voltage Measurement:	User can read input voltage of each channel LSB=100mV; Accuracy: ±3 LSB's (300 mV) over temp.
HIGH/LOW Differential (Hysteresis):	0.25 V min. recommended; Programmable by using Upper & Lower thresholds
De-bounce:	Programmable per channel from 0 to 1.34 seconds (LSB= 20.48 μs; 16-bit resolution)
Update Rate:	Each channel is updated every 20.48 μs

### Output Characteristics:

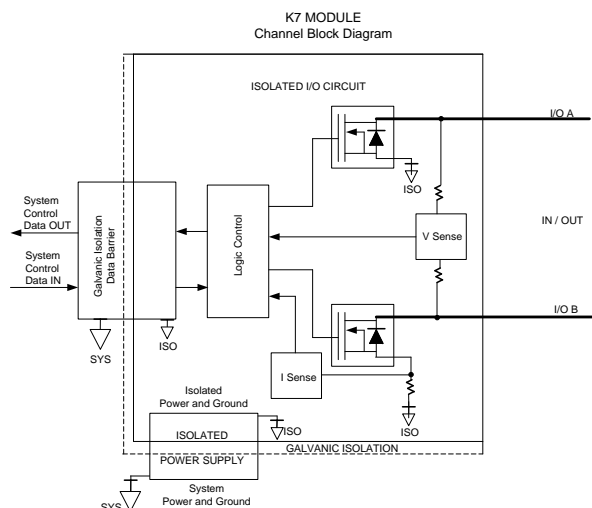
Output Formats:	Low-Side (I sink), High-Side (I source) or Push-Pull (I source-sink); programmable per channel
Output Voltage Range:	0 to +60 VDC. (Output voltage is defined by the user provided Vcc applied to channel bank). Low-side drive does not require Vcc. High-side and push-pull drive requires Vcc.
Over-Voltage Surge Protection:	80 VDC max. (< 50ms) 100 VDC max. (<1μs)
Output Current:	0.5A maximum (28V Vcc typical) per channel. 2A total per Vcc bank if outputs are through front panel connectors (total Module capacity 8A). 1A total per Vcc bank if outputs are through rear connectors (total Module capacity is then 4A). Short circuit protected.
Current Share Applications:	Outputs may be connected in parallel to provide up to 2A source/sink per Vcc bank (See programming details)
Over-Current Protection:	Individual channel will shut down when an over-current (0.75 A) is sensed for @ 20 μs.
Output Load:	Directly drives inductive loads (relays); Reverse current diode is incorporated Can handle high inrush current lamp loads (e.g. two #327 lamps in parallel)
Output Impedance:	Lo-side drive: 0.25 Ω typical; Hi-side drive: 0.5 Ω typical;
Write Delay:	20.48 μs
Update Rate:	Each channel is updated every 20.48 μs
Current Measurement:	User can read output current of each channel LSB=3mA; Accuracy: The greater of ±10% of Signal or ±20 mA over temp.
Voltage Measurement:	User can read voltage of each channel LSB=100mV; Accuracy: ±3 LSB's (300 mV) over temp.

### General Characteristics:

Isolation:	Module power returns (GND) and I/O to System Ground: 500 volts; Proper polarity for Vcc/GND and I/O must be preserved (GND ≤ I/O ≤ Ext. VCC)
Power:	5 VDC @ 400 mA. For contact sensing, add (Vcc x Iset) x4 per bank of 4 channels
Ground:	Four (4) ground pins per module (one for each bank of 4 channels). All grounds are common within the module but are isolated from system ground
Weight:	1 oz. (28g)

## Discrete (Module K7) - Sixteen (16) I/O Channels Individually Isolated Programmable for Input and Bi-Directional Switch

Input	
Channels/Module:	16 Channels via front panel connector(s) (Rear I/O channel count may be limited to 12 channels on certain platforms; check pin-out)
Input Range:	0 to $\pm 80 V_{DC}$
Input Pulse Detection:	A pulse, of $40\mu s$ min. width, will be sensed and indicated by the appropriate Hi-Lo or Lo-Hi Transition Interrupt
Input Impedance:	$2 M\Omega$
Switching Threshold:	Levels are programmable from 0 to $80 V_{rms}$ with 10-bit resolution (0.98% FS) On/Off
Accuracy of Set Point:	The greater of 5% signal value or 0.25 V
ON/OFF Differential:	0.50 V minimum recommended
De-bounce:	Programmable per bit from 0 to 2.62s LSB = $40\mu s$
Update Rate:	Each channel is updated every $5\mu s$
Over-Voltage Protection:	Input clamped at $\pm 80 V_{DC}$ or external source voltage applied to 'VCC' pin (whichever is smaller; see pinout)
Voltage Measurement:	User can read output voltage of each channel (isolated 10-bit A/D) LSB = 163mV; Accuracy: $\pm 3$ LSB's (498 mV) over temperature
Bi-Directional Switch	
Switch Format:	Isolated bi-directional (AC/DC) MOSFET switch
Switch Current:	0-600mA per channel
Switch Impedance Open:	$2 M\Omega$
Switch Impedance Closed:	$0.5\Omega$ typical, $1\Omega$ max
Current Measurement:	User can read AC/DC current through switch, independently for each channel LSB = 3mA; Accuracy: The greater of $\pm 10\%$ of Signal, or $\pm 20mA$ over temperature
Measurement Update Rate:	Each channel is updated every $5\mu s$
Isolation	
Isolation:	500 V (between channels and each channel to system GND)
Power (Per 12-Channel Module):	$+5V_{DC}$ / 340 mA (est. typ.)
Weight:	1 oz. (28g)



## LVDT (Module L\*) – Four Isolated LVDT Measurement Channels (2, 3 or 4 Wire)

**\*See P/N**

Resolution:	16 bit
Input Format:	LVDT or RVDT
Input Voltage:	Auto ranging from 2.0 to 28 VRMS
Excitation Voltage:	2-28 Vrms; Required for computation of 2-wire digital measurement output, 3 or 4 wire out-of-phase signal/noise rejection and for excitation loss status
Input Impedance:	60 K $\Omega$
Accuracy:	$\pm 0.025\%$ FS range
Bandwidth (BW):	Default factory setting is 10% of excitation to 100 Hz max. However, BW is programmable on a per channel basis. User has to program all parameters for each boot up or parameter will be set to the default value
Frequency:	Specify between 360 Hz to 20 KHz, (See Part Number)
Phase Shift:	Automatically compensates for phase shifts between the transducer excitation and output up to $\pm 60^\circ$ (3, 4-wire units ignore phase shift)
Wrap Around Self-Test:	Three powerful test methods are described in the Programming Instructions
Power:	+ 5 VDC @ 400mA
Ground:	Isolated signal and excitation. Channels individually isolated from each other and from system ground
Weight:	1 oz. (28g)

## S/D (Module S\*) – Four Isolated Synchro/Resolver Measurement Channels

**\*See P/N**

Resolution:	16 bits (up to 24 bits for two-speed configuration)
Input Format:	Synchro/Resolver programmable. Default will be Synchro.
Input Voltage:	See P/N
Input Impedance:	60 K $\Omega$ min. at 26VL-L; 260 K $\Omega$ min. at 90VL-L
Accuracy:	$\pm 1$ arc-minute for single speed inputs $\pm 1$ arc-minute divided by the gear ratio for two-speed inputs
Tracking Rate:	190 RPS (Referred to the Fine input for two-speed configuration)
Bandwidth:	Default set at factory but per channel field programmable
Frequency Input:	50 Hz to 20 KHz (See part number)
Phase Shift:	The synthetic reference circuit automatically compensates for phase shifts between the transducer excitation and output up to $\pm 60^\circ$
Wrap Around Self Test:	The three different powerful test methods are detailed in the Description section and further described in the Programming Instructions
Reference Input:	See P/N
Reference Zin:	100 K $\Omega$ min.
Angle Change Alert:	Each channel can be set to a different angle differential. When that differential is exceeded, an interrupt (if enabled) is triggered. Default: "Ch. Disabled". MSB=180°; Min. differential is 0.05°. Max differential that can be programmed is 179.9°
Velocity, Digital:	16-bit resolution; Linearity: 0.1%. Scalable to 0.1°/sec resolution
Power:	+ 5 VDC @ 400 mA
Ground:	Isolated signal and reference. Channels individually isolated from each other and from system ground
Weight:	1 oz. (28g)

## **D/S (Module 6\*) –Three Isolated Digital-to-SYN/RSL Ch, 0.25 VA Power Output**

**\*See P/N**

	(Applies to each channel unless noted otherwise)
Number of Channels:	Three
Resolution:	16 bits (.0055°)
Accuracy:	± 0.1°
Output Format:	Synchro or Resolver, galvanic isolation (see part number)
Output Load:	0.25 VA @ 90 VL-L, 26 VL-L and 11.8 VL-L (Power reduces linearly as output voltage is reduced) Short circuit protected
Output Control:	Module outputs can be turned ON/OFF
Regulation (VL-L):	5% max. (No load to Full load)
Ratio:	Dual speed, Programmable, Set any ratio between 2 and 255 (CH 1 and 2)
Rotation:	Continuous rotation or programmable Start and Stop angles. 0 to ±13.6 RPS with a resolution of 0.015°/sec. Step size is 16 bits (0.0055°) up to 1.5 RPS, then linearly increases to 12 bits (0.088°) at 13.6 RPS
Reference Input Voltage:	Galvanic isolation. Uses 1 ma max/Channel (See part number)
Reference Frequency:	47 Hz to 10 KHz (See part number)
Phase Shift:	0.5° max. (Between output and reference)
Settling Time:	Less than 100 microseconds
Module Power:	+5VDC @ 30 mA ±12VDC @ 190 mA (no-load) (Add 13mA of ±12VDC for every 0.1 VA of output load per channel)
Ground:	Isolated signal and reference. Channels individually isolated from each other and from system ground
Weight:	1 oz. (28g)

## DLV (Module 5\*) – Three Isolated DLV Stimulus Channels, LVDT or RVDT Outputs

**\*See P/N**

	(Applies to each channel unless noted otherwise)
	Programmable 3/4 or 2-Wire
Number of Channels:	3 (2-wire or 3/4 - wire)
Resolution:	16 bits (.001526% FS)
Linearity:	0.1% FS
Output Gain:	0.1%
Output Format:	Configurable for either 3/4-wire or 2-wire. Galvanically isolated. Output voltage is programmable fixed or ratio-metric
Output Voltage:	Programmable (See code table and part number)
Output Load:	0.1 VA max @ 11.8 Vrms or 28 Vrms (de-rates linearly as voltage is decreased) (See code table)
Regulation (VL-L):	5% max. No load to Full load
Excitation Input Voltage:	(See part number), Galvanic isolated. Uses 1 mA max/Channel
Excitation Frequency:	47 Hz to 10 KHz (See part number)
Phase Shift (A/B):	0.5° max. (Between output and reference) (Programmable phase shift)
Settling Time:	Less than 100 microseconds
Module Power:	+5 VDC @ 30 mA ±12 VDC @ 190 mA (no-load) (Add 0.013 A of ±12 VDC for every 0.1 VA of output load per channel)
Ground:	Isolated signal and excitation. Channels individually isolated from each other and from system ground
Weight:	1 oz. (28g)

## Encoder (Module E7) – Four (4) Isolated SSI / Encoder /Quadrature Counter

Channels/Module: 4 channels; individually isolated;  
Independently programmable for selected operation mode

### SSI Mode

I/O Voltage Range: TTL/RS422/485 (single-ended or differential)  
Operational Modes: Each channel, programmable for either “Standard Controller” or “Listen Only”  
SSI “Listen / Standard” Mode: SSI Data Word Length (up to 32 bit programmable)  
Data Word Encoding: Binary or Gray Code (programmable)  
Parity: Odd, Even, None with “0-bit” (programmable)  
Interrupt Generation: Programmable event(s)  
SSI “Standard” Mode: SSI clock rate: 1  $\mu$ s to 32  $\mu$ s (1  $\mu$ s resolution programmable)  
SSI clock transition: Rising / Falling edge (programmable)  
SSI clock watchdog: Preload (up to 32-bit programmable)

### Incremental Quadrature Encoder / Counter Mode

Programmable Type: Quadrature (Differential; A, B, INDEX), UP, DOWN, PRE-LOAD, MODULUS-N  
Pre-Load / Compare Registers: 32 bit  
Resolution: Programmable 1x, 2x or 4x resolution multiplier  
De-Bounce (Filter): Programmable per bit from 0 to 3.2768 ms (16-bit resolution). LSB= 50 ns  
Timer: Programmable internal interval timer with 32-bit pre-scaler  
Count Rate: 25 MHz (max)

### General

Maximum Signal Voltage: 24 VDC  
Isolation: 500 V (between channels and each channel to system GND)  
Power (Per 4 Channel Module): +5 VDC @ 1 A (max)  
Weight: 1 oz. (28g)



### Power Supply (Module V\*) - Isolated $\pm 15\text{V}$ DC/DC converter

The V\* module provides either one (V1) or two (V2) fully isolated bipolar  $\pm 15\text{VDC}$  DC/DC converters. Each DC/DC converter can source and/or sink up to 450mA. Each converter can be used independently and features current output and voltage output monitoring, and a programmable current limit. Both converters are isolated and may be tied in series for applications requiring higher output voltages. For clarity, the two converters are referenced as channel 1 & 2.

**V\* - Module Type Designator**

Module Designation	Channels
V1	Single Channel, Isolated
V2	Dual Channel, Isolated

## Input

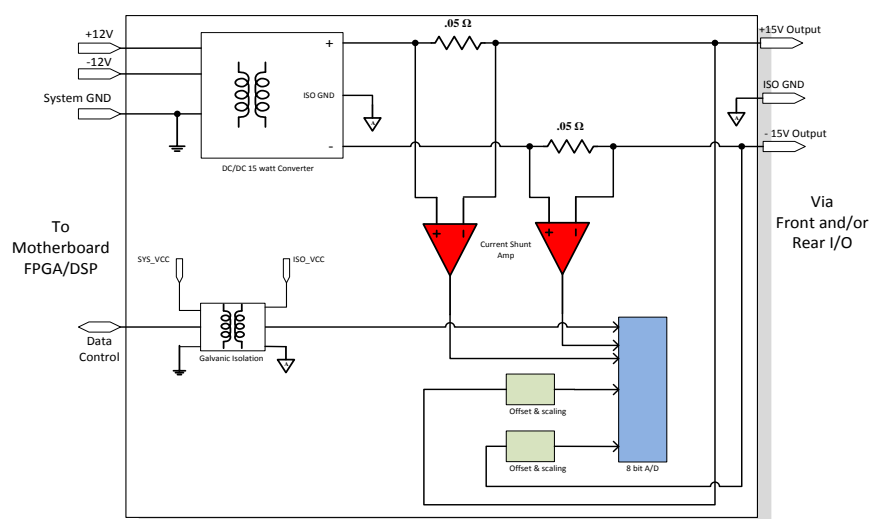
Input Voltage:	$\pm 12V_{DC}$
Input Voltage tolerance	$\pm 20\%$

## Output

Output Voltage:	$\pm 15V_{DC}$
Output Regulation	$\pm 1\%$
Output Current (maximum):	$\pm 450\text{ mA}$
Output Voltage Measurement:	Output voltage, 1mV; Accuracy: $\pm 1\text{ LSB}$
Output Current Measurement:	Output voltage, 1mA; Accuracy: $\pm 1\text{ LSB}$
Output Overload protection:	Programmable from 1mA to 450mA
Efficiency:	$> 80\%$

## Power Input

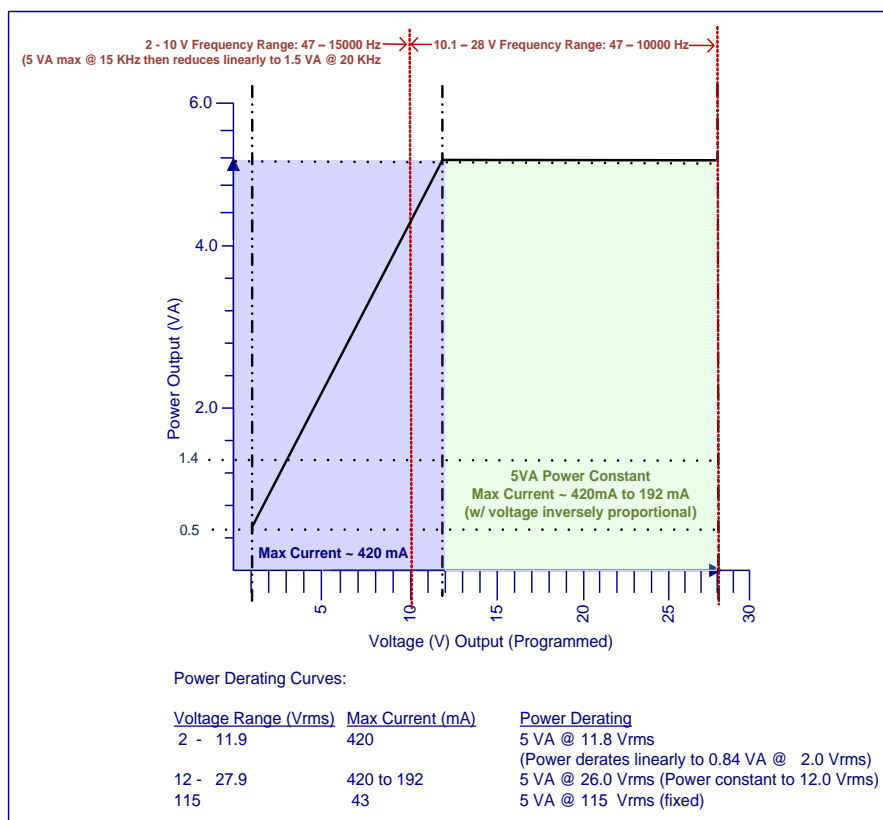
Power +5V:	+5V <sub>DC</sub> / 210 mA (max)
Power ±12V <sub>DC</sub> :	±12V <sub>DC</sub> / 650 mA (max)
Ground:	Each channel isolated from each other and system/power GND.
Weight:	1 oz. (28g)



Block diagram: (1) Channel example

## Reference (Module W6, W7)– Optional, Isolated, Onboard Reference Supply

Voltage Output:	<p><b>Note: Identify voltage output option in P/N option selection</b> (Improved version to 5 VA introduced DOM 6/11)</p> <p><b>Vrms to 28 Vrms, Programmable with a resolution of 0.1 V</b></p> <ul style="list-style-type: none"> <li>• 2.0 to 10.0 Vrms / 47 Hz to 20 KHz frequency range</li> <li>• 10.1 to 28.0 Vrms / 47 Hz to 10 KHz frequency range</li> </ul> <p>or</p> <p><b>115 Vrms fixed</b></p> <ul style="list-style-type: none"> <li>• 115.0 Vrms / 47 Hz to 2.0 KHz frequency range</li> </ul>
Accuracy (No Load):	<p>±2% of setting ≤ 10 KHz</p> <p>±5% of setting &gt; 10 KHz</p>
Regulation:	±10% (No Load to Full Load)
Output Drive:	<p>5 VA maximum ≤ 15 KHz</p> <p>5 VA – 1.5 VA (decreased linearly from 15 KHz to 20 KHz)</p> <p>(See detailed description of Output Drive)</p>
Output Protection:	Over-current (10x automatic retry; @ 1.3 sec int.; afterwards, shutdown w/ manual reset)
Frequency:	47 Hz to 20 KHz Programmable with 0.1 Hz steps
Frequency Accuracy:	0.1% of programmed frequency or 1 Hz (whichever is greater)
THD:	2% (maximum)
Reference Output Drive:	(See detailed characterization)
Power:	<p>+5 VDC @ 10 mA</p> <p>±12 VDC @ 120 mA (Quiescent, no load, max)</p> <p>Add ±12 VDC @ 40 mA for every 1 VA Load</p>
Ground:	Output isolated from system ground
Weight:	1 oz. (28g)



## Combo (Module KA) 4 A/D Channels, 28 Discrete I/O Channels

**Note: Can be specified for Slot 3 only**

### A/D Channels

Number of Channels:	4 A/D Channels
Input Voltage:	Four multiplexed $\pm 10$ VDC
Resolution:	14 bits.
Input Format:	Single ended
Over Voltage:	No damage up to $\pm 12$ V continuous; $\pm 30$ V momentary
Input Impedance:	100 K $\Omega$ min.
Accuracy:	0.1% FS over temperature.
Sampling Rate:	3 KHz per channel
Band Width:	10 KHz
Group Delay:	327.68 $\mu$ s max. (time for data sample to propagate to data register)

### Discrete Channels

### 28 I/O Channels total, (12 In, 12 Out, 4 programmable In/Out)

#### Input Characteristics:

Input Range:	0 to +50 VDC
Input Impedance:	100 K $\Omega$ , with or without power applied to module (50 K $\Omega$ for programmable channel set as input with power applied)
Switching Threshold:	Four levels are programmable from 0 to 40 VDC with 12-bit resolution (0.98% FS) On, Off. Short to +V, Short to ground
Accuracy of Set Point:	The greater of 5% signal value or 0.25 volts
ON/OFF Differential:	0.25 V minimum recommended
Debounce:	Programmable per bit from 0 to 0.671 seconds. (LSB= 81.92 $\mu$ s)
Update Rate:	Each channel is updated every 81.92 $\mu$ s
Over Voltage Protection:	50 VDC max.
Protective Circuits:	Protective circuits are incorporated that avoid damage should an Input Signal be applied when card is not powered. DT-VCC-IO pin supplied for clamping transients to external VCC source (not utilized for 'pull-up'). (See pin-out for channel type designation)

#### Output Characteristics:

Output Range:	0 to +40 VDC. Output logic is defined by the user provided I/O pin voltage that is connected to the card – Low side current drive only; external pull-up to max range.
Output Current:	0.200 A max. per channel short circuit protected; Channel will withstand a current of 0.75A for 20ms and will then be turned off
Output Load:	Directly drive inductive loads (relays); Reverse current protection diode is incorporated
Output Impedance:	1.5 ohms
Output Format:	Low-side switched
Write Delay:	10.24 $\mu$ s
Update Rate:	Each channel is updated every 81.92 $\mu$ s
Over Voltage Protection:	50 VDC max.
Power:	+5 VDC @ 225 mA max. $\pm 12$ VDC @ 80 mA max.

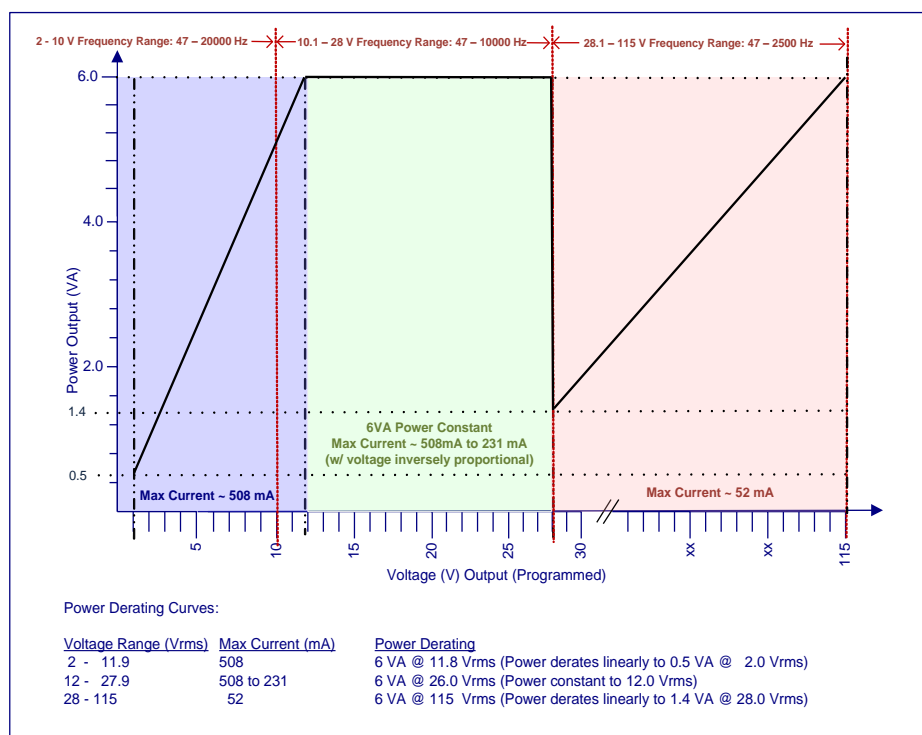
#### General Characteristics:

Power:	+5 VDC @ 225 mA max. $\pm 12$ VDC @ 80 mA max.
GND:	All signals (A/D and Discrete) are referenced to system (power) GND
Weight:	0.85 oz. (24 g.)

## Reference (Module W\*) – AC Source, Isolated, Programmable

\*See P/N

Voltage Output:	2 Vrms to 115 Vrms, Programmable with a resolution of 0.1V 2.0 to 10.0 Vrms / 47 Hz to 20 KHz frequency range 10.1 to 28.0 Vrms / 47 Hz to 10 KHz frequency range 28.1 to 115.0 Vrms / 47 Hz to 2.5 KHz frequency range
Accuracy (No Load):	±3% of setting < 15 KHz ±6% of setting ≥ 15 KHz
Regulation:	±5% (No Load to Full Load)
Output Drive:	6 VA maximum (See detailed description of Output Drive)
Output Protection:	Over-current (10x automatic retry; @ 1.3 sec int.; afterwards, shutdown w/ manual reset)
Frequency:	47 Hz to 20 KHz Programmable with 0.1 Hz steps
Frequency Accuracy:	0.1% of programmed frequency or 1 Hz (whichever is greater)
THD:	3% (maximum)
Reference Output Drive:	(See detailed characterization)
Power:	+5 VDC @ 10 mA ±12 VDC @ 150 mA (Quiescent, no load) Add ±12 VDC @ 46 mA for every 1 VA Load
Ground:	Isolated from system ground
Weight:	1 oz. (28g)



## PART NUMBER DESIGNATION

75C3 - XX XX XX X X X X -XX  
Slot # 1 2 3

### MODULE (SLOT) 1&2 DEFINITION

Enter Module (designation) for each one of Slots 1 & 2. Enter 'Z0' if slot is **not** populated

Module Type	Designation	Channel	Description
ARINC 429/575	A4	6	TX/RX
A/D	C1	10	A/D (1.25 VDC to 10.0 VDC FS) Uni or bipolar
A/D	C2	10	A/D (40VDC) Uni or bipolar
A/D	C3	10	4 – 20ma Current Measurement Module
A/D	C4	10	A/D (50VDC) Uni or bipolar
CANBus	P6, PA	4	CANBus Interface (P6= Standard CAN A/B, PA= CAN J1939)
D/A	F1	10	D/A, $\pm 10$ VDC
D/A	F3	10	D/A, $\pm 5$ VDC
D/A	F5	4	D/A, $\pm 20$ VDC at 100 mA/channel max, Isolated (High current)
D/A	J3	10	D/A, $\pm 1.25$ VDC
D/A	J5	10	D/A, $\pm 2.5$ VDC
D/A	J8	4	D/A, $\pm 20$ to $\pm 80$ VDC (High voltage)
D/S <b>Note 7</b>	6*	3	Digital-to-Synchro/Resolver simulation
DLV <b>Note 7</b>	5*	3	Digital-to-LVDT simulation
Encoder	E7	4	Encoder/Counter – SSI, Incremental A-Quad-B / UP, Down Counter
I/O TTL/CMOS	D7	16	TTL/CMOS, Programmable for Input or Output
I/O Differential	D8	16	Differential Multi-Mode Transceivers
I/O, Discrete	K6	16	Discrete (0-60V), Programmable for Input or Output
I/O, Discrete, ISO	K7	16	Discrete (0-60V), Individual Isolated Switch-type
LVDT <b>Note 2</b>	L*	4	LVDT or RVDT-to-digital
MIL-STD-1553	N7	2	Dual/Redundant MIL-STD-1553 Ch, Transformer Coupled
MIL-STD-1553	N8	2	Dual/Redundant MIL-STD-1553 Ch, Directly Coupled
Reference <b>Note 6</b>	W*	1	2.2 VA Programmable 2-115 Vrms, 50 HZ-10 KHz
RTD	G4	6	Four-wire Platinum RTD
Strain Gage	G5	4	Conventional 4-arm Bridge-type measurement
RS-422/488/232	P8	4	High Speed, Programmable, Synchronous or Asynchronous
S/D <b>Note 1</b>	S*	4	Synchro/Resolver, programmable
Power Supply	V1, V2	1, 2	+/- 15V Power Supply (V1 = 1 Channel, V2 = 2 Channel)

### MODULE (SLOT) 3 DEFINITION **Note 3**

Enter Module (designation) for Slot 3. Enter "Z0" if slot is **not** to be populated.

Module Type	Designation	Description
Combo	KA	4 A/D channels, 28 Discrete I/O channels
Onboard Ref Supply (OSC)	W6	2-28Vrms, 360-10kHz, Programmable
Onboard Ref Supply (OSC)	W7	115Vrms Fixed, 360-10kHz, Programmable

### MECHANICAL

F = Front Panel (J3 & J4) I/O only. B = Front Panel (J3 & J4) and Rear (J1 & J2) I/O. **Note 4**  
P = Rear (J1 & J2) I/O only **Note 4** W= P Conduction Cooled (with Wedgelocks)

### ENVIRONMENTAL

C = 0 TO 70°C K = C with conformal coating  
E = -40 TO +85°C H = E with conformal coating

### ETHERNET

0 = No Ethernet  
2 = Rear I/O Ethernet Connection **Note 5**

### ENCODER OUTPUTS FOR SYNCHRO / RESOLVER MODULES

0 = No Encoder outputs  
1 = Encoders included for each specified Synchro/Resolver module. Cannot specify if Slot 3 is populated.

### SPECIAL OPTION CODE (OR LEAVE BLANK)

## Part Number Notes

### **Note 1:** Synchro/resolver four channel measurement module selection:

(For ranges other than those listed contact factory. Customer should indicate the actual frequency applicable to his design to assure that the correct default band width is set at the factory. Frequency band tolerance +/- 20%.

Module Code	Input Voltage	Reference Voltage	Frequency Band	Remarks
SA:	2-28 VL-L	2-115 Vrms	50 Hz - 400 Hz	All Input and Reference voltages are auto ranging
SB	2-28 VL-L	2-115 Vrms	400 Hz - 1 KHz	All Input and Reference voltages are auto ranging
SC	2-28 VL-L	2-115 Vrms	1 KHz - 3 KHz	All Input and Reference voltages are auto ranging
SD	2-28 VL-L	2-115 Vrms	3 KHz - 5 KHz	All Input and Reference voltages are auto ranging
SE	2-28 VL-L	2-115 Vrms	5 KHz - 7 KHz	All Input and Reference voltages are auto ranging
SF	2-28 VL-L	2-115 Vrms	7 KHz - 10 KHz	All Input and Reference voltages are auto ranging
SG*	2-28 VL-L	2-115 Vrms	10 KHz - 20 KHz	All Input and Reference voltages are auto ranging
SH	90 VL-L	115 Vrms	50 Hz - 400 Hz	
SJ	90 VL-L	115 Vrms	400 Hz - 1 KHz	
SX	x	x	x	Special configurations, contact factory

\*Consult factory for availability

### **Note 2:** LVDT/RVDT four channel measurement module selection:

(For ranges other than those listed contact factory. Customer should indicate the actual frequency applicable to his design to assure that the correct default band width is set at the factory. Frequency band tolerance +/- 20%.

Module Code	Input Voltage	Reference Voltage	Frequency Band	Remarks
LB	2-28 VL-L	2-28 Vrms	400 Hz - 1 KHz	All Input and Reference voltages are auto ranging
LC	2-28 VL-L	2-28 Vrms	1 KHz - 3 KHz	All Input and Reference voltages are auto ranging
LD	2-28 VL-L	2-28 Vrms	3 KHz - 5 KHz	All Input and Reference voltages are auto ranging
LE	2-28 VL-L	2-28 Vrms	5 KHz - 7 KHz	All Input and Reference voltages are auto ranging
LF	2-28 VL-L	2-28 Vrms	7 KHz - 10 KHz	All Input and Reference voltages are auto ranging
LG	2-28 VL-L	2-28 Vrms	10 KHz - 20 KHz	All Input and Reference voltages are auto ranging
LX	x	x	x	Special configurations, contact factory

\*Consult factory for availability

**Note 3:** Can only specify either the KA combo module or the onboard reference supply in Slot 3.

**Note 4:** When Rear I/O is specified (mechanical configuration P, W or B) unit cannot be utilized in a PXI chassis.

**Note 5:** Rear I/O Ethernet connection used in conjunction with mechanical options P, W, or B only

### **Note 6:**

Module Code	Output VL-L	Frequency Band
W1	2-115 Vrms	47 Hz - 10 KHz
W2	2-28 Vrms	47 Hz - 10 KHz
W3	28-115 Vrms	47 Hz - 10 KHz

**Note:** W1 only utilizes a mechanical relay for range switching. May not be suitable for some embedded system applications.

### 3 Channel D/S Module Code Table

Code	Format	Output ( $V_{L-L}$ ) ( $V_{RMS}$ )	Ref ( $V_{REF}$ )*1 ( $V_{RMS}$ )	Frequency*1 (Hz)	Max Load (VA)
60	SYN	2 - 11.8	2 – 115	360 – 1.1K	0.25
61	RSL	2 - 11.8	2 – 115	360 – 1.1K	0.25
62*	RSL	2 - 28	2 – 115	360 – 1.1K	0.25
63*	SYN	90	2 – 115	360 – 1.1K	0.25
64*	RSL	90	2 – 115	360 – 1.1K	0.25
65	SYN	11.8	2 – 115	47 - 440	0.25
66	RSL	2 - 11.8	2 – 115	47 - 440	0.25
67*	RSL	2 - 28	2 – 115	47 - 440	0.25
68*	SYN	90	2 – 115	47 - 440	0.25
69*	RSL	90	2 – 115	47 - 440	0.25
6A	RSL	2 - 11.8	2 – 115	1K – 3K	0.25
6B	RSL	2 - 11.8	2 – 115	3K – 5K	0.25
6C	RSL	2 - 11.8	2 – 115	5K – 7K	0.25
6D	RSL	2 - 11.8	2 – 115	7K – 10K	0.25
6E*	RSL	2 – 28	2 – 115	1K – 3K	0.25
6F*	RSL	2 – 28	2 – 115	3K – 5K	0.25
6G*	RSL	2 – 28	2 – 115	5K – 7K	0.25
6H*	RSL	2 – 28	2 – 115	7K – 10K	0.25
6J	SYN	2 - 11.8	2 – 115	1K – 3K	0.25
6K	SYN	2 - 11.8	2 – 115	3K – 5K	0.25
6L	SYN	2 - 11.8	2 – 115	5K – 7K	0.25
6M	SYN	2 - 11.8	2 – 115	7K – 10K	0.25
6N*	SYN	2 – 28	2 – 115	1K – 3K	0.25
6P*	SYN	2 – 28	2 – 115	3K – 5K	0.25
6Q*	SYN	2 – 28	2 – 115	5K – 7K	0.25
6R*	SYN	2 – 28	2 – 115	7K – 10K	0.25

\*Consult factory for availability

\*1 There is a +10% tolerance on the upper limit, 0% on the lower limit (i.e. 115V +10%)

### 3 Channel DLV Module Code Table

Code	Format	Output ( $V_{L-L}$ ) ( $V_{RMS}$ )	Ref ( $V_{REF}$ ) ( $V_{RMS}$ )	Frequency (Hz)	Max Load (VA)
5A*	DLV	2 – 28	2-115	360 – 1.1K	0.1
5B*	DLV	2 – 28	2-115	47 - 440	0.1
5C*	DLV	2 – 28	2-115	1K – 3K	0.1
5D*	DLV	2 – 28	2-115	3K – 5K	0.1
5E*	DLV	2 – 28	2-115	5K – 7K	0.1
5F*	DLV	2 – 28	2-115	7K – 10K	0.1
5G	DLV	2 - 11.8	2-115	360 – 1.1K	0.1
5H	DLV	2 - 11.8	2-115	47 - 440	0.1
5J	DLV	2 - 11.8	2-115	1K – 3K	0.1
5K	DLV	2 - 11.8	2-115	3K – 5K	0.1
5L	DLV	2 - 11.8	2-115	5K – 7K	0.1
5M	DLV	2 - 11.8	2-115	7K – 10K	0.1

\* Consult factory for availability. (Tol: -0%, +10%)



## REVISION PAGE

Revision	Description of Change	Engineer	Date
2012-08-22-1541	1) 64EP3; Data Sheet / P/N Designation: Redefined/swapped Ethernet option (B) MB and U3 locations. 2) SIU6; HW Manual: Redefined/swapped Ethernet option (4) MB and U3 locations. 3) 76C2 Conn I/O Pinout - no content changes (Agile link only). 4) 67C3 Data Sheet/Spec/Manual: Added mech. option J and K; 67C3/68C3 P/N High Voltage operating warning note (P/N designation). 5) KA module correct/re-define discrete voltage thresholds from 100mV to 10mV lsb. Discrete I/O and A/D signal return references clarified (Description and Conn I/O Pinout sub-docs). 6) "C*" module VME memory map - added missing CH8 FIFO Buffer-Lo Threshold register. 7) P8-PC module description; removed reference to VME specific register reference, Interface Levels (Description sub-doc). 8) 75C3 - Added E7 to P/N Designation subdoc. 9) 44PA1 - Added mechanical options B4, B5. 10) C* module description paragraph restructured.	LB	08/22/12
2012-07-06-1134	1. Clarify MFIO card Ethernet protocol description 2. 64DP3 part number designation expanded for combination U3 and H2 Ethernet port configurations (manual, spec, datasheet) 3. CANBus (P6) module bit rate register programming example added (description section). 4. Corrected minor margin format mis-registrations (module specifications (C*, D7, F/J, K6). 5. RTD (G4) correct typo BIT INT enable register from E0 to E8 (VME, PCI x 2). 6. SIU6 HW manual, correct typo, debug/download mating connector from KMDLX-8P to KMDLAX-8P. 7. Corrected typo 75C3 connector/pin-out section Front Panel BIT LED call-out function.	AS	07/06/12
2012-01-04-1345	Document clarifications:1. 75C3 OpsMans/Specs incluision of G5, K7, V1/V2; associated documentation, pinouts - where applicable.2. Clarified available (Aw/E) modules as/where applicable.3. Clarified L* register/descriptions where applicable.4. CANBus P6/PA split/clarifications.5. 79C3 I/O Conn updated for inboard J3 power header6. Clarified KA specification (VCCI/O definition) 68C3: UPDATE DOCUMENTATION FOR DOCUMENT BUILDER 64E3: NEW RELEASE	AS	01/04/12
2011-09-28-1440	64C2, 64C3, 78C2:CLERICAL CHANGES, UPDATE FORMATTING OF DOCUMENTS 75C3: REFORMATTING OF ALL DOCUMENTS 75C2: REFORMATTING OF ALL DOCUMENTS 76C2: REFORMATTING OF ALL DOCUMENTS 79C3: REFORMATTING OF ALL DOCUMENTS 67C3: REFORMATTING OF ALL DOCUMENTS	GL	09/28/11
A4	Revise P/N to include Encoder option	AS	02/22/10
A3	Added E7 Module, corrected Ethernet option on Part Number	AS	01/21/10
A2	Added N8 & P6 Modules	FH	04/13/09
A1	Added N7, W6 & W7 Modules	FH	01/29/09
A	Initial Release	FH	10/06/08

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