MODEL 75D3
3U cPCI HIGH-DENSITY I/O

Features
- Discrete, TTL, Serial and MIL-STD-1553
- 12-Port, Unmanaged Ethernet Switch
- Single Slot 3U cPCI with up to 48 I/O Channels
- cPCI Bus and/or Dual Gigabit Ethernet Interfaces
- Automatic Background Built-in-Test (BIT) (module dependent)
- Front and/or Rear I/O Support
- Designed for Commercial and Rugged applications
- Software Support Kit(s) and Driver(s) are available

Description
The 75D3 is a single slot, 3U cPCI low power-high performance and high density I/O board. A high density module slot enables integrators to choose from a variety of high density I/O and communications functions. These functions include Digital I/O (Discrete & TTL), full hand-shaking modem control synchronous/asynchronous RS232/422/485 or MIL-STD-1553. Additionally, a 12-port unmanaged Gigabit Ethernet switch is available. Module slots are standardized with a relatively large footprint and high density channel count, enabling up to 48 channels of high functionality, feature-rich programmable discrete on a single 3U card. The 75D3 allows systems integrators to confidently tailor, manage, monitor and control a host of sensor interfacing and communications requirements using NAI's flexible, leading-edge, fully programmable and continuous background built-in-test (BIT) enabled function modules.

The 75D3 can be used alone or with NAI's 75DP3 Processor, or 75C3 Multi-Function I/O boards in a system to provide a complete low power-high performance, programmable cPCI solution for sensor control/interfacing and communications. This uniquely tailored COTS design offers a broad assortment of signal interfaces, including Digital I/O (Discrete, Differential, TTL/CMOS), Analog I/O (A/D, D/A, RTD, Strain Gage), Motion Control and Sensor Interfaces (Synchrho/Resolver/LVDT/RVDT Measurement and Simulation, Encoder/Counter), and Communications Interfaces (Serial RS-232/422/485, CANBus, MIL-STD-1553 and ARINC 429/575).

All sensor data is available on the cPCI bus or Gigabit Ethernet. API libraries, source code, documentation and test/sample applications are available for direct use or for porting to a variety of operating systems.

Advantages of using the 75D3 for board or system-level solutions include:
- Sensor control/data available for immediate use by an external host system processor via cPCI or Gigabit Ethernet
- High channel density data acquisition and control
## General Board Specifications

**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

<table>
<thead>
<tr>
<th>Discrete I/O</th>
<th>Module</th>
<th>Channels</th>
<th>Input Range</th>
<th>Output Range</th>
<th>Programmable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Operating Temp</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2 – Contact factory regarding availability  
3 – Possible Limited module positions (See P/N in Operations Manual)

<table>
<thead>
<tr>
<th>ILD-STD-1553</th>
<th>Module</th>
<th>Channels</th>
<th>Input Range</th>
<th>Operational Modes</th>
<th>Onboard RAM</th>
<th>Coupled</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ILD-STD-1553</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RS-232/422/485</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Motor Controller</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Additional Notes:
- Encoder/Resolver
- 12 CH synchronous A/D
- 256K word buffer, 4 ISO A/D w/ position trigger set pts.
SOFTWARE SUPPORT

The ENABL 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 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

cPCI Core: 32-Bit/33MHz

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 hours, for options “E” or “H”

(see part number)

Size:

Height – 3.94”/100 mm (3U)

Width – 0.8”/20.3 mm (4HP)

Depth – 6.3”/160mm deep

Weight:

4 oz. (115g) unpopulated

Add weight for each module (typically 1 oz. (29g) each)

Add 2 oz. (57g) for reference supply

Add 2 oz. (57g) for wedgelocks

MIL-STD-1553 (Module N3) – Two Dual/Redundant Channels, Transformer Coupled

Onboard RAM: 128Kbyte per dual redundant channel

Operational Modes: BC/RT or MT

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: 2 oz. (56g)

MIL-STD-1553 (Module N4) – Two Dual/Redundant Channels, Directly Coupled

Onboard RAM: 128Kbyte per dual redundant channel

Operational Modes: BC/RT or MT

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: 2 oz. (56g)
### RS-232/422/485 (Module P4) – Four High Speed RS-232, RS-422, RS-485

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Channels:</td>
<td>Four (4) fully programmable</td>
</tr>
<tr>
<td>Data Rate:</td>
<td>8 Mbits/s per channel in synchronous/HDLC mode</td>
</tr>
<tr>
<td></td>
<td>800kbits/s per channel in asynchronous mode (RS-422 &amp; RS-485)</td>
</tr>
<tr>
<td>Data can be read 4µs after receipt in</td>
<td>UART</td>
</tr>
<tr>
<td></td>
<td>These data rates are verified with all channels running simultaneously</td>
</tr>
<tr>
<td>Receive/Transmit Buffers:</td>
<td>64 Kbytes for each receive and transmit buffer; accessed in 16-bit mode only</td>
</tr>
<tr>
<td>Power:</td>
<td>+5 VDC @ 1A per module (mode dependant: RS232 has lower power req'ts;</td>
</tr>
<tr>
<td></td>
<td>RS422 more)</td>
</tr>
<tr>
<td>Ground:</td>
<td>Ground return is to system ground</td>
</tr>
<tr>
<td>Weight:</td>
<td>2 oz. (56g)</td>
</tr>
</tbody>
</table>

### RS-232/422/485 (Module P5) – Six High Density RS-232, RS-422, RS-485

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Channels:</td>
<td>Six (6) fully programmable</td>
</tr>
<tr>
<td>Data Rate:</td>
<td>4 Mbits/s per channel in synchronous/HDLC mode</td>
</tr>
<tr>
<td></td>
<td>800kbits/s per channel in asynchronous mode (RS-422 &amp; RS-485)</td>
</tr>
<tr>
<td>Data can be read 4µs after receipt in</td>
<td>UART</td>
</tr>
<tr>
<td></td>
<td>These data rates are verified with all channels running simultaneously</td>
</tr>
<tr>
<td>VME Data Transfer:</td>
<td><strong>Data transfers within 300 ns</strong></td>
</tr>
<tr>
<td>Receive/Transmit Buffers:</td>
<td>32 Kbytes for each receive and transmit buffer; accessed in 16-bit mode only</td>
</tr>
<tr>
<td>Power:</td>
<td>+5 VDC @ 1A per module (mode dependant: RS232 has lower power req'ts;</td>
</tr>
<tr>
<td></td>
<td>RS422 more)</td>
</tr>
<tr>
<td>Ground:</td>
<td>Ground return is to system ground</td>
</tr>
<tr>
<td>Weight:</td>
<td>2 oz. (56g)</td>
</tr>
</tbody>
</table>
I/O (Module D6) – Forty-Eight TTL/CMOS, Programmable for Input or Output

**TTL Input**

**Input Levels:**
- TTL and CMOS compatible, single ended inputs
- Each channel incorporates a 100 KΩ pull-down resistor
- \( V_{\text{in L}} \): 0.8 V = 0
- \( V_{\text{in H}} \): 2.0 V = 1
- \( V_{\text{in max.}} \): 5.0 V
- \( I_{\text{IN}} \) = \( \pm 50\mu A \)
- Read Delay: 1.02 \( \mu s \)
- De-bounce: Programmable per bit from 0 to 255 \( \mu s \); LSB = 1 \( \mu s \)

**TTL Output**

**Output Levels:**
- TTL/CMOS, single ended outputs
- Drive Capability:
  - \( V_{\text{out L}} \): -0.5 V max. sink 32 mA max.
  - \( V_{\text{out H}} \): 3.8 V min. source -32 mA max.
- Output Current: Channel will withstand a current of 50mA for 4 \( \mu s \) and will then be turned off
- Rise/Fall Time: 10 ns into a 50pf load
- Write Delay: 1.02 \( \mu s \)

**Signal Power**

- \( V_{cc} \):
  - 8 \( V_{cc} \) input pins per module, each powers an individual 6 channel bank
  - 1.65 volts \( \leq V_{cc} \leq 5 \) volts. Output signal level is equivalent to \( V_{cc} \) input level \( \pm 5\% \)
- Ground:
  - 8 Ground inputs pins per module. All ground inputs are common with ground
- Weight: 2 oz. (56g)
Discrete (Module K9) Forty-Eight (48) Programmable Discrete I/O Channels

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)

Input Characteristics:
- Input Range: 0 to +60 Vdc. Programmable for either voltage or switch closure sensing
- Over-Voltage Surge Protection: 80 Vdc max. (< 50ms)
- 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 12 Vcc banks, each with 4 channels for a total of 48 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 external Vcc source.
- Over-Voltage Surge Protection: 80 Vdc max. (< 50ms)
- Output Current: 0.5A maximum (28V Vcc typical) per channel
  - 2A total per Vcc bank if outputs are through front panel connectors
  - 1A total per Vcc bank if outputs are through rear connectors
  - (total module capacity 8A). 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 output voltage of each channel
  - LSB=100mV; Accuracy: ±3 LSB’s (300 mV) over temp

General Characteristics:
- 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)
- +5 Vdc @ 1400 mA. For contact sensing, add (Vcc x Iset) x4 per bank of 4 channels
- Ground: Twelve (12) ground pins per module (four for each of three bank groups of 16 channels) Grounds are common within bank groups of (3) but isolated from each other and system ground
- Weight: 2 oz. (56g)
Specifications

Ethernet (Module H2) – 12 Port 10/100/1000 Base-T Switch

STANDARDS
- IEEE 802.3ab (1000BASE-T Gigabit Ethernet)
- IEEE 802.3u (100BASE-TX Fast Ethernet)
- IEEE 802.3 (10BASE-T Ethernet)
- IEEE 802.3x (Flow control/full and half duplex)

FEATURES
- Broadcom® 53312S
- Non-blocking Gigabit Ethernet fully integrated switch fabric with 4 Mb packet buffer memory
- Integrated MACs (IEEE 802.x compliant) with support for 9600-byte jumbo frames
- High performance look-up engine with support for up to 8K unicast MAC address entries
- Automatic learning and aging tags
- IPv4 and IPv6 traffic class support
- Up to 12 Ports available for external Ethernet communication/connectivity
- 2 ports (of 12) for motherboard and/or processor communication/connectivity (if supported)
- Port segregating/partitioning options are available (i.e. separate 6/6 ports for 2x independent networks)

BENEFITS
- Allows triple-speed Ethernet 10/100/1000 Mbps operation
- Unmanaged Layer 2+ switch capability
- Low Power
- Wire-speed performance
- Provides true non-blocking switching performance

Layer 2 Support
- Denial of Service Protection
- Rate Control
- Link Aggregation
- Rapid Spanning Tree
- Spanning Tree
- VLAN
- QoS

Layer 3 Support
- Network Address Translation (NAT*)
- Port Forwarding*
- DHCP
- Firewalling
  - MAC Validation
  - IP Validation

Power: +5 VDC @ 1200 mA. (typ. quiescent)
Add 50 mA per active port
(est. typ. full duty cycle)

Ground: Isolated signals
Weight: 2 oz. (56g)

*Contact factory for details.
Specifications

Motor Control (Module M*) Three (3) Axis Motor Control

Features
- Programmable for control of DC brushed, brushless, stepper or PWM motor systems
- Provides complete control and feedback for up to 3-axis (simultaneous) systems
- Integrated motor control feedback for either hall sensor, A-QUAD-B or resolver
- Integrated I/O for motor limits, home, fault and motor enable sense/control
- Programmable AC reference (optional reference input to resolvers or stand-alone AC source)
- Twelve (12) channel A/Ds with (10) CH synchronized/simultaneous FIFO data buffer and triggering option
- Six (6) (3 x 2) D/A or PWM (3 x 4); (A, B, C and DIR) control signal outputs
- Analog Devices Blackfin DSP for user expansion to program additional control algorithms/functions
- Background (automatic/on-line) calibration and built-in-test (BIT)

Module Block Diagram

<table>
<thead>
<tr>
<th>Module Designation</th>
<th>Feedback Option</th>
<th>Output Type Option</th>
<th>Includes 12x A/D; 10 CH with Synchronous Event Trigger, 52K FIFO Buffer, and 3x Isolated A/D</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA</td>
<td>Encoder/Hall</td>
<td>DAC</td>
<td>No</td>
</tr>
<tr>
<td>MB</td>
<td>Encoder/Hall</td>
<td>DAC</td>
<td>Yes</td>
</tr>
<tr>
<td>MC*</td>
<td>Encoder/Hall</td>
<td>PWM</td>
<td>No</td>
</tr>
<tr>
<td>MD*</td>
<td>Encoder/Hall</td>
<td>PWM</td>
<td>Yes</td>
</tr>
<tr>
<td>ME*</td>
<td>Resolver/External REF</td>
<td>DAC</td>
<td>Yes</td>
</tr>
<tr>
<td>MF*</td>
<td>Resolver/External REF</td>
<td>PWM</td>
<td>Yes</td>
</tr>
<tr>
<td>MG*</td>
<td>Resolver/Internal REF</td>
<td>DAC</td>
<td>Yes</td>
</tr>
<tr>
<td>MH*</td>
<td>Resolver/Internal REF</td>
<td>PWM</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Contact factory for availability of option selections
(Module M*) Specifications (Continued)

Motor Controller:
- Channels: 3 (3-axis)
- Servo Loop Timing Range: 10 Hz to 20 KHz (max)
- Minimum Serve Loop Timing: 50 – 75 µsec./axis; based on number of axes
- Profile Modes: S-Curve point-to-point (velocity, acceleration, jerk and position), Trapezoidal point-to-point (velocity, acceleration, deceleration and position), Velocity contouring (velocity, acceleration and deceleration), Electronic gearing (encoder position of one axis used to drive second axis)
- Motor Output Modes: PWM: 10-bit resolution at 20 KHz; pulse and direction up to 5M-pulse/sec or Two 16-bit monotonic DAC outputs/channel (±10 V)

Motor Feedback:
- Feedback Modes/Inputs: 3 channels (one per axis); A+/A-, B+/B-, C+/C- (3 differential RS422 compliant receiver pairs)
- A-QUAD-B Inputs: Either 12, 13, 14, 15, or 16-bit resolution, (programmable) with index marker
- Commutation Inputs: When programmed will interface to the equivalent of the A, B, C outputs from hall effect sensors for 4, 6 or 8 pole motors
- Resolver-to-Digital: 3 channels (one per axis) (optional – see configuration)
- AC Reference Source: 2-28 Vrms / 47 to 10 KHz (programmable) / 100 mA maximum load current
- Harmonic Distortion: 3% max.
- Accuracy: 3% no load absolute magnitude, 5% regulation (no-load to full-load)

A/D Converters:
- Synchronous A/D: 12 Channel, synchronous, single simultaneous sample/trigger (external or internal) (10 CH available for FIFO buffer store)
- Programmed full-scale (FS) ranges of ± 10V, ± 5V, ± 2.5V and ± 1.25V
- Resolution: 16-bit individual A/Ds (maximum sampling 100 KHz / CH)
- Accuracy: ±0.3% FS range
- Input Format: Differential, non-isolated
- Input Impedance: 1 MΩ min.
- FIFO Buffer Trigger Array: 5200 x 16-bit word position/time trigger array (pre-load to determine/set A/D simultaneous measure and store-to-FIFO trigger points)
- Programmable trigger point parameters: External, internal timer (100 nsec. resolution), encoder or resolver position or software
- FIFO Data Buffer: 52K x 16-bit word buffer – upon ‘trigger’, all 10 A/D channels are simultaneously sampled and stored in the FIFO buffer (sequentially)
- Update Rate: 10 µs per channel (min.)
- 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.
- Integral Non-Linearity (INL): ±3 LSB’s max.
- Dynamic Non-Linearity (DNL): ±1 LSB’s max. (monotonic)
Event Array -

Determines event to trigger simultaneous 10 CH A/D Data store in the FIFO

Programmable to trigger from:
Position (from Encoder or R/D) or
Time (from internal timer)

5200 Event Array

- Event 1 (Position or Time)
- Event 2 (Position or Time)
- Event 3 (Position or Time)
- Event 4 (Position or Time)
- Event 5 (Position or Time)
- Event 5195 (Position or Time)
- Event 5196 (Position or Time)
- Event 5197 (Position or Time)
- Event 5198 (Position or Time)
- Event 5199 (Position or Time)
- Event 5200 (Position or Time)

52K word FIFO

Trigger Array 1 – Simultaneous Buffer store of A/D CH1-10 data
(stores 10 elements – 16-bit data from each channel sequentially)
- Word 01 – A/D CH 01
- Word 02 – A/D CH 02
- Word 03 – A/D CH 03
- Word 04 – A/D CH 04
- Word 05 – A/D CH 05
- Word 06 – A/D CH 06
- Word 07 – A/D CH 07
- Word 08 – A/D CH 08
- Word 09 – A/D CH 09
- Word 10 – A/D CH 10

Trigger Array 2 – Simultaneous Buffer store of A/D CH1-10 data
(stores 10 elements – 16-bit data from each channel sequentially)
- Word 01 – A/D CH 01
- Word 02 – A/D CH 02
- Word 03 – A/D CH 03
- Word 04 – A/D CH 04
- Word 05 – A/D CH 05
- Word 06 – A/D CH 06
- Word 07 – A/D CH 07
- Word 08 – A/D CH 08
- Word 09 – A/D CH 09
- Word 10 – A/D CH 10

Trigger Array 5.2K – Simultaneous Buffer store of A/D CH1-10 data
(stores 10 elements – 16-bit data from each channel sequentially)
- Word 01 – A/D CH 01
- Word 02 – A/D CH 02
- Word 03 – A/D CH 03
- Word 04 – A/D CH 04
- Word 05 – A/D CH 05
- Word 06 – A/D CH 06
- Word 07 – A/D CH 07
- Word 08 – A/D CH 08
- Word 09 – A/D CH 09
- Word 10 – A/D CH 10
(Module M*) Specifications (Continued)

Isolated A/Ds: 3 Channels, independently isolated from each other and system/power ground full-scale (FS) range of ±100 mV
(Optional – contact factory)

- Resolution: 12 bit individual SAR A/D converters
- Accuracy: 0.3 % FS range
- Input Format: Differential, isolated
- Input Impedance: 1 MΩ min.
- Update Rate: 10 μs per channel (minimum)
- Common Mode Voltage: 500 V (signal voltage plus common mode voltage not to exceed 500 volts)
- Linearity Error: ±3 LSB’s max.
- Sampling Rate: 100 KHz max per channel, programmable

D/A Outputs:
- Channels: 6 single-ended monotonic outputs
- Output Range: ±10 VDC or 0 to 10 VDC, programmable
- Relative Accuracy (INL): ±2 LSB’s max.
- Differential Non-Linearity: ±1 LSB monotonic
- Offset: <3 mV over temperature
- Gain Error: 0.5% FS range over temperature
- Output Impedance: <1 Ω
- Settling Time: 10 μs typ. (15 μs max.)
- Load: 2 mA/channel max. (source or sink); short circuit protected
- Update Rate: 1μs (1 MHz)

General Characteristics:
- Module power returns (GND) and I/O to system ground: 500 volts (where noted)
- Power: +5 VDC @ 1100 mA (maximum, all functions enabled)
  ±12VDC @ 60 mA (no load) and 160 mA (full load) (applies to AC Reference Source)
- Ground: All I/O is referenced to system (power) ground with the exception of the isolated current measurement A/D channels. The isolated A/D channels each have independent returns with 500V isolation from each other and system ground
- Weight: 3 oz. (84g)
# Part Number Designation

## Module (Slots 1 – 3) Definition

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Module Designation</th>
<th>Channel</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital I/O</td>
<td>D6 Note 1</td>
<td>48</td>
<td>TTL/CMOS, Programmable for Input or Output</td>
</tr>
<tr>
<td>Discrete I/O</td>
<td>K9</td>
<td>48</td>
<td>Discrete (0-80 VDC), Programmable for Input or Output (v3)</td>
</tr>
<tr>
<td>MIL-STD-1553</td>
<td>N3</td>
<td>2</td>
<td>Redundant MIL-STD 1553, Transformer coupled</td>
</tr>
<tr>
<td>MIL-STD-1553</td>
<td>N4</td>
<td>2</td>
<td>Redundant MIL-STD 1553, Direct coupled</td>
</tr>
<tr>
<td>RS-232C/422/485</td>
<td>P4 Note 1</td>
<td>4</td>
<td>High Speed, programmable, Synchronous or Asynchronous</td>
</tr>
<tr>
<td>RS-232C/422/485</td>
<td>P5 Note 1</td>
<td>6</td>
<td>High Density, programmable, Synchronous or Asynchronous</td>
</tr>
<tr>
<td>Ethernet Switch</td>
<td>H2 Note 1</td>
<td>12</td>
<td>10/100/1000-B-T, Multi-Port, Unmanaged</td>
</tr>
<tr>
<td>Motion Controller</td>
<td>MB Note 3</td>
<td>3</td>
<td>3-Axis motor controller (MA–MH)</td>
</tr>
</tbody>
</table>

## Mechanical

- **F** = Front panel I/O only (no P2)
- **B** = Front and rear I/O (with P2)
- **P** = Rear I/O only
- **W** = P with Wedge locks

## Environmental

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

## Dual Ethernet (Motherboard (MB) only) Note 2

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Ethernet</td>
</tr>
<tr>
<td>1</td>
<td>(Reserved)</td>
</tr>
<tr>
<td>2</td>
<td>MB port A to rear I/O connection (1 port)</td>
</tr>
<tr>
<td>3</td>
<td>(Reserved)</td>
</tr>
<tr>
<td>4</td>
<td>MB port A and port B to rear I/O connection (2 ports)</td>
</tr>
</tbody>
</table>

## Special Option Code (or leave blank)

- **Note 1**: Contact factory for availability
- **Note 2**: Ethernet available through rear I/O mechanical options (B,P, or W) only
- **Note 3**: M* Motor controller option designation selector:

<table>
<thead>
<tr>
<th>Module Designation</th>
<th>Feedback Option</th>
<th>Output Type Option</th>
<th>Includes 12x A/D; 10 CH with Synchronous Event Trigger and 52K FIFO Buffer and 3x Isolated A/D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic 3-Axis Motor Controller</td>
<td>Encoder/Hall</td>
<td>DAC</td>
<td>No</td>
</tr>
<tr>
<td>MA</td>
<td>Encoder/Hall</td>
<td>DAC</td>
<td>Yes</td>
</tr>
<tr>
<td>MB</td>
<td>Encoder/Hall</td>
<td>PWM</td>
<td>No</td>
</tr>
<tr>
<td>MC*</td>
<td>Encoder/Hall</td>
<td>PWM</td>
<td>Yes</td>
</tr>
<tr>
<td>MD*</td>
<td>Encoder/Hall</td>
<td>PWM</td>
<td>Yes</td>
</tr>
<tr>
<td>ME*</td>
<td>Resolver / External REF</td>
<td>DAC</td>
<td>Yes</td>
</tr>
<tr>
<td>MF*</td>
<td>Resolver / External REF</td>
<td>PWM</td>
<td>Yes</td>
</tr>
<tr>
<td>MG*</td>
<td>Resolver / Internal REF</td>
<td>DAC</td>
<td>Yes</td>
</tr>
<tr>
<td>MH*</td>
<td>Resolver / Internal REF</td>
<td>PWM</td>
<td>Yes</td>
</tr>
</tbody>
</table>
## REVISION PAGE

<table>
<thead>
<tr>
<th>Revision</th>
<th>Description of Change</th>
<th>Engineer</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-01-05-1004</td>
<td>Document clarifications: 1. 75C3 OpsMans/Specs inclusion 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 header. 6. Clarified KA specification (VCCI/O definition)</td>
<td>LB</td>
<td>01/05/12</td>
</tr>
</tbody>
</table>

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