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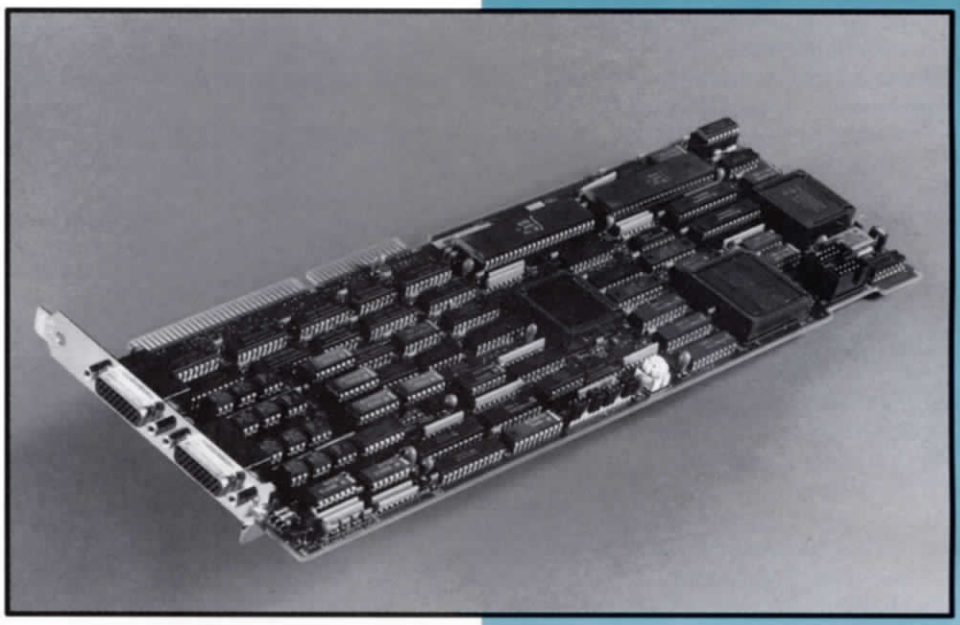
# ORMEC
# DSP Axis Modules & Adapters



## DSP Axis Modules:

The Generation III family of products offers two DSP Axis Modules for high performance control: a dual axis unit and a single axis unit with an auxiliary pacer encoder interface.

These DSP modules are full-height, PC/AT style printed circuit boards which plug conveniently into the backplane of the Generation III controller, and use a 40 Mhz Texas Instruments digital signal processor (DSP) to provide axis control algorithms.



*ORMEC's DSP Axis Modules: dual axis or single axis with remote "pacer encoder" interface*

### Strengths of the DSP Module

**Multi-Processor Architecture:** The DSP is interfaced to the main processor through a shared memory interface for maximum speed and flexibility.

This multi-processor architecture, combined with the overall power of the digital signal processor, enables Generation III to operate effectively at very high sampling rates and provide accurate, precise positioning via robust motion control algorithms. It virtually eliminates the need for all analog components including analog tachometers.

**MotionDATA™:** For multi-axis tightly synchronized motion control applications, MotionDATA™ provides a direct DSP to DSP communications link to share motion reference information at loop update rates. This synchronous data communications channel operates at 613 K bits per second and utilizes user-transparent error correction techniques. MotionDATA™ speed and flexibility allows large systems to be precisely electronically geared to a single *electronic lineshaft* or multiple sub-lineshafts in a cascaded control configuration.

**High Speed Sensors:** In addition to the zero-reference inputs from the two axis encoders, each DSP Axis Module provides interfaces for two high speed sensors. The DSP can capture real-time axis position for either or both axes within *one microsecond* of assertion of its encoder reference pulse as well as both of the high speed sensors. It can also initiate axis motion on the next position loop update to occur 10-20 microseconds after an input is received.

**Electronic Limit Switches:** Each axis of Generation III provides three TTL-level electronic limit switch outputs which respond at the position update rate. In addition, the operation of these switches is fully integrated into MotionBASIC® by the use of pre-defined variables.

*Hardware Overtravel Limits*: Each axis provides two hardware overtravel limits in addition to selectable software overtravel limits for use when motor travel is limited such as in ballscrew applications.

*Analog Inputs*: The analog input option provides four 12-bit analog inputs.

### ORDERING GUIDE

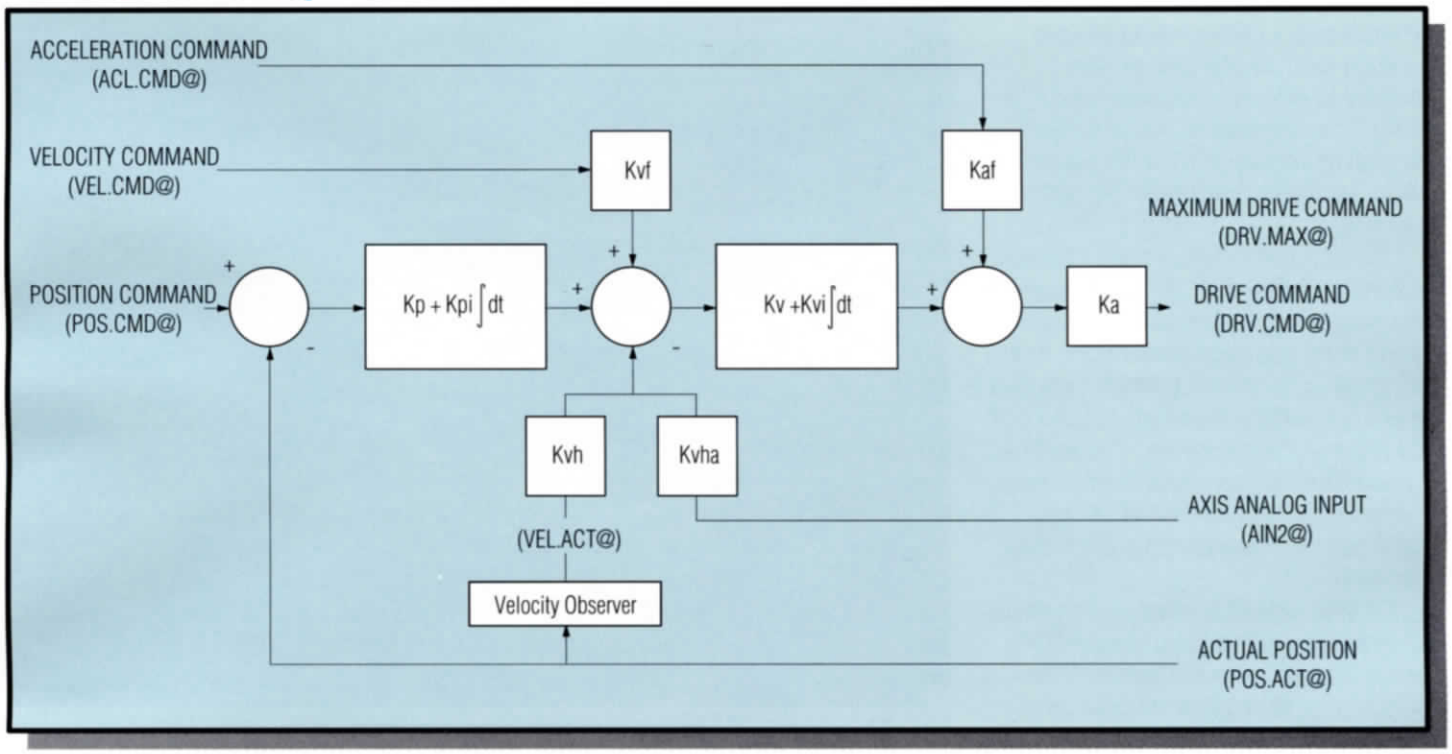
*Generation III Backplane Modules & Accessories*

| | |
|---|---|
| GN3-DSP-AQ | Single Axis DSP Module, with Pacer Encoder Interface |
| GN3-DSP-A2 | Dual Axis DSP Servo Module |

*To add four channels of 12-bit Analog to Digital Converter, append /A to the model numbers above.*

| | |
|---|---|
| CBL-AE/X | Axis Interface Cable, DSP Axis Module to E-Series Servodrive, 1-25 ft |
| CBL-AS/X | Axis Interface Cable, DSP Axis Module to S-Series Servodrive, 1-25 ft |
| CBL-AT/X | Axis Interface Cable to Terminal Block, 1-25 ft |
| TBC-D25 | Axis Interface Terminal Block |
| CBL-AET/X | Axis Interface Cable from Terminal Block to E-Series Servodrive, 1-25 ft |
| CBL-AST/X | Axis Interface Cable from Terminal Block to S-Series Servodrive, 1-25 ft |
| CBL-QE25/X | Axis Interface Cable, DSP Axis Module to EDR-25 Series Encoder, 5-150 ft |
| CBL-DSP-IO/X | DSP I/O Cable and Terminal Block, 1-9 ft |
| CON-2Q | GN3-DSP Axis Interface Connector, crimp type |
| GN3-VDA | Video Display Adapter, EGA, Mono or VGA |
| GN3-VDA/M | Video Display Adapter, Data Highway/Plus™ and Modbus/S908™ compatible |
| CBL-EGAX/X | Video EGA/keyboard Interface Extender, 10-150 ft |
| CBL-MONX/X | Video Mono/keyboard Interface Extender, 10-150 ft |
| GN3-232 | RS-232 Serial Communications Adapter with main and auxiliary ports |
| GN3-422 | Dual RS-422/232 Serial Communications Adapter |

## DSP Axis Module Loop Architecture




*The DSP Axis Module loop architecture is illustrated above. At the left of the diagram is the loop command vector generated by the DSP from information provided in the shared memory by MotionBASIC® motion statements. The loop command vector includes acceleration (ACL.CMD@), velocity (VEL.CMD@) and position (POS.CMD@) command information for maximum loop response and accuracy.*

*The drive command (DRV.CMD@) control output is shown along with a parameter which establishes its maximum output value (DRV.MAX@). With the preferred torque mode servodrives, the value of this parameter is proportional to the torque being commanded by the motion controller. Also shown is the actual position (POS.ACT@) from the axis position transducer. The "actual velocity" (VEL.ACT@) is generated from position information by the DSP velocity observer algorithm. Velocity feedback from the axis analog input can be blended with the output of the velocity observer for distributed feedback systems.*

*The settings for the loop gains determine the loop characteristics for each axis in the system from real-world parameters such as motor-torque gain, system inertia and velocity loop time constant. Loop parameters such as integrator gains are set as factors which are automatically scaled when the basic velocity loop operation is changed.*

*MotionPRO™ allows the user to initialize a number of the axis parameters from a file of motor data. MotionPRO™ also includes a semi-automatic tuning program called SETUP for interactively fine tuning the system after the load is attached to the motor. The SETUP program, with the factory adjusted gains for the motors purchased with the system, is loaded into the non-volatile memory of each standard motion controller as it's shipped from the factory.*

### DSP Axis Module Overview

#### Multi-Processor Architecture

- ❒ Texas Instruments TMS-320C25 DSP operating at 40 Mhz
- ❒ Proprietary MotionDATA™ communications direct from DSP to DSP provides tightly coordinated multi-axis electronic gearing
- ❒ Shared memory interface to main processor
- ❒ Writable control store for DSP program storage is loaded from the main processor at power-up

#### Feedback & Control

- ❒ Direct digital control with update rates to 5 kHz provide wide bandwidth for high positioning accuracy & response
- ❒ Quadrature feedback 4x decoding with positioning rates to 1 MBit per second
- ❒ Position, velocity or torque mode control
- ❒ Full 32-bit absolute or modulo position operation with user-defined units
- ❒ Virtual elimination of analog errors and extremely quiet loop operation using direct digital processing of both position and velocity loops with 32 bit intermediate calculation accuracy
- ❒ Software controlled position, speed, and current limits
- ❒ Velocity and acceleration feedforward for minimum tracking errors and response times

#### Servodrive Interface

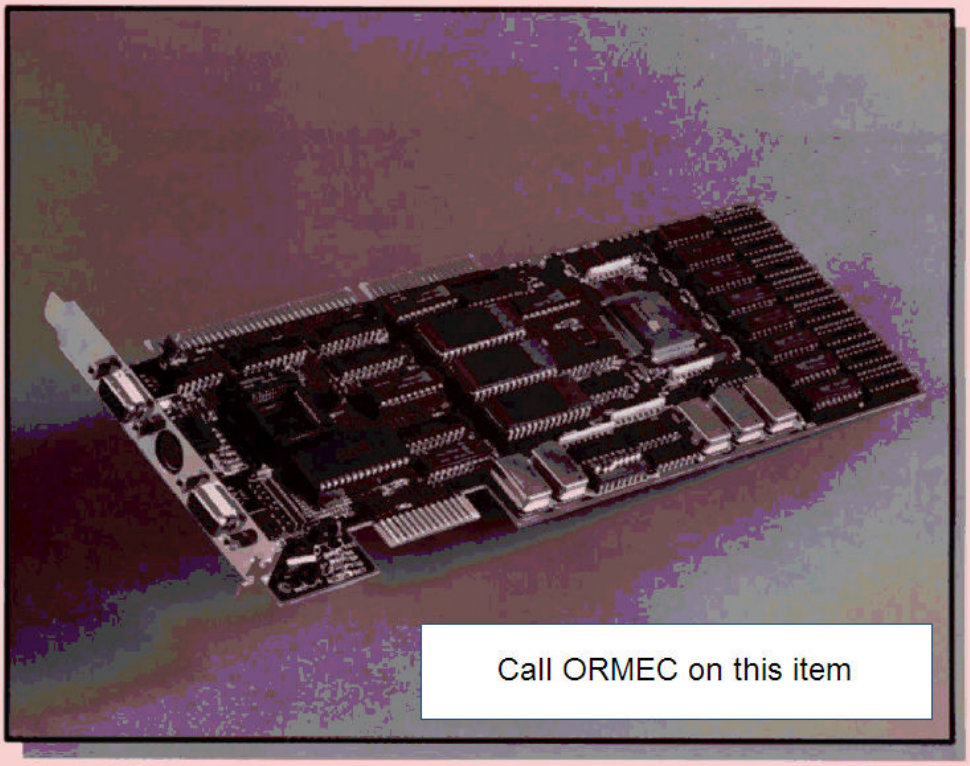
- ❒ Compatible with velocity mode drives as well as the preferred torque mode servodrives through individual axis interface connectors
- ❒ Pacer encoders for electronic gearing can be interfaced through any standard axis interface connector
- ❒ Servodrive remote enable and reset functions are provided by optically coupled outputs
- ❒ Open wire detection provided on all differential quadrature feedback inputs
- ❒ Failsafe servodrive alarm detection using optically isolated input
- ❒ Servodrive alarm decoding is provided by three optically isolated inputs

## Video Display Adapter:

Generation III's video display adapter interface module provides a video interface to IBM-PC compatible color or monochrome monitors. Color follows the high resolution EGA or VGA standards. Monochrome follows the MDA standard.

The optional interface takes one slot in the Generation III PC/AT style expansion bus, and is compatible with a wide variety of PC compatible monitors. For industrial applications, ORMEC provides Operator Interface Terminals in both EGA and monochrome versions. The keyboard of these Operator Interface Terminals is interfaced through an IBM-PC/AT keyboard interface connector on the motion controller.

ORMEC Operator Interface Terminals come with six foot cables, however they can be located up to 150 feet from the motion controller using optional interface extenders.




*Video Display Adapter: EGA, Mono or VGA video interface to operator interface terminal*

## Serial Communications Interface Adapters:

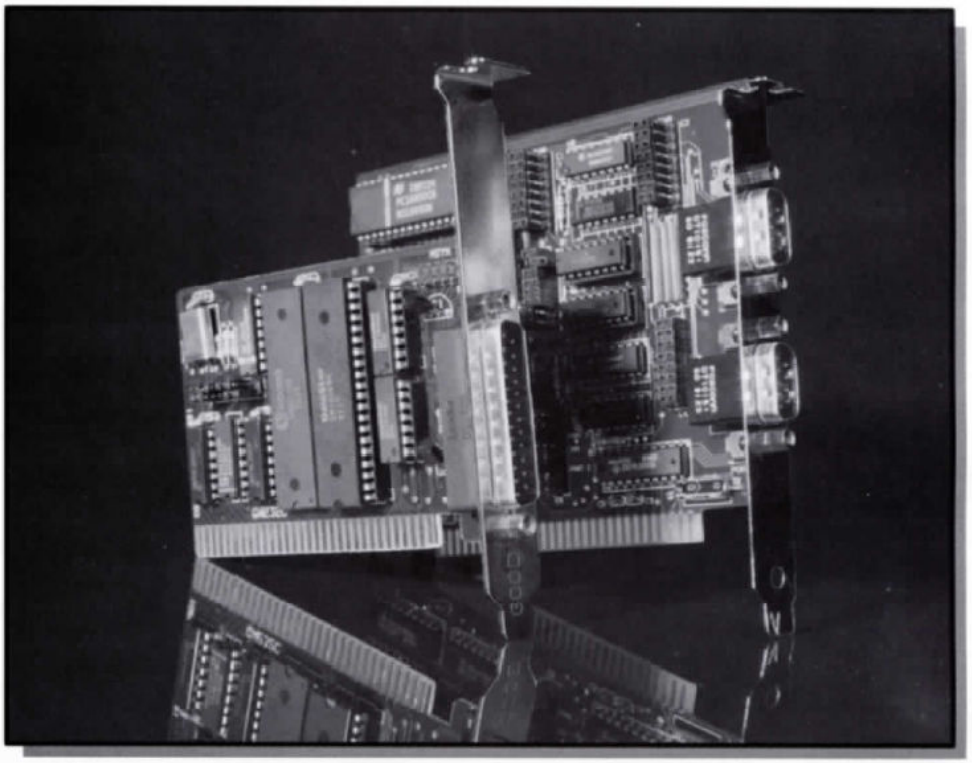
For serial communications beyond the two standard ports, additional serial communications interface adapters are available. They both provide two more serial ports which are accessed from MotionBASIC® as devices COM1 and COM2.

The GN3-232 serial communication adapter provides a primary serial port using a 25-pin, D-series connector and the RS-232 standard. An auxiliary port is interfaced through an external 25-pin connector and bracket.

The GN3-422 communications adapter provides two ports which are individually configurable for RS-232 or RS422/485. Both ports are interfaced through integral 9-pin D-Series connectors.

This optional serial adapter takes one slot in the Generation III PC/AT style expansion bus, and is a convenient method for interfacing to ORMEC's MMI-840 compact industrial terminal and ITM-270 industrial keypad.

Up to 32 keypads and displays may be attached to a single RS-422/485 serial port.



*Serial Communications Interface Adapters: simple interface to two additional RS-232 or RS-422/485 serial ports*

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