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Generation III

Model 20/40 Motion Controllers

Installation & Operation Manual
GN3-040f

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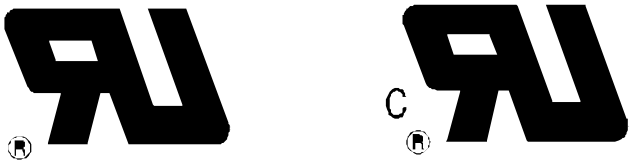


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Chapter 1
Welcome

1.0 Welcome

This manual tells you about ORMEC's Generation III Model 20 & 40 motion controllers and accessories... providing a detailed description of the Generation III hardware and information for installing, operating and "getting started" with your new Generation III motion control system.

The manual is divided into the following chapters:

Chapter 1	**Welcome** introduces you to this manual and its organization.
Chapter 2	**General Description** provides an overview of the Generation III product family. It includes descriptions of the Model 20 & 40 Motion Controllers, the DSP Axis Modules and compatible servomotors and servodrives.
Chapter 3	**Installation** provides instructions on installing your unit. It also provides a complete hardware description of the Generation III controller interfaces, including detailed information on each interface to the unit.
Chapter 4	**Operation** explains the powerup and initial configuration approach utilized by Generation III.
Chapter 5	**Getting Started** provides detailed instructions on how to run your Generation III unit for the first time.
Chapter 6	**Product History** provides a chronological revision history for the Model 20/40 Motion Controllers and DSP Axis Modules.
Chapter 7	**Specifications** provides detailed specifications for the product. These specifications include environmental, mechanical and electrical interface specifications as well as references to the interface schematics in the Appendixes.
Chapter 8	**Terms & Mnemonics** provides definitions for terms specific to motion control and/or ORMEC's motion control products.
Appendixes	**Appendixes** contain detailed drawings which document the Generation III dimensions, system interface, DSP Axis Module interface, as well as associated interface cables and accessories. See the Table of Contents for details.

NOTE: This manual concentrates on providing Generation III controller hardware and cabling documentation. Detailed information on ORMEC's MotionBASIC® programming language is found in the on-line **MotionBASIC® Hypertext Software Manual**. A diskette containing the **MotionBASIC® Hypertext Software Manual** software is included at the end of this manual. A hard copy is included in the MotionPRO™ manual.

Chapter 2
General Description

2.1 General Description

The ORMEC Generation III Model 20 & 40 Motion Controllers are industrially hardened computers designed especially for high performance control of automation using servomotors. They are fully compatible with ORMEC's lines of brushless servomotors and drives.

At the heart of both the Model 20 and 40 is a 12-Mhz Intel 80C186 main processor. It is interfaced through dual-ported "shared memory" to DSP Axis Modules which are controlled by Texas Instruments Digital Signal Processors operating at 40 Mhz. This powerful architecture provides the foundation for general purpose motion control programmed in ORMEC's industrialized superset of Microsoft BASIC called MotionBASIC®. The combination of a main processor from Intel's premier family of microprocessors and Digital Signal Processors for axis control provides speed and performance while maintaining the ease-of-use associated with interpreted BASIC.

The Model 20 provides two PC-AT style I/O slots and is designed for systems which have between $1^{1/2}$ and 4 axes of motion control. For $1^{1/2}$ to 2 axis systems, the second slot can be used for various communications options such as a video controller, a PLC network interface or additional serial interfaces. The Model 20 can provide $2^{1/2}$ to 4 axes of control for many applications. Examples of this are systems interfaced via Modbus™ or an MMI-840 Industrial Terminal, which provides an 8-line by 40-character display.

The Model 40 provides four PC-AT style I/O slots and is designed for systems which have between $2^{1/2}$ and 8 axes of motion control.

Generation III motion controllers provide electronic gearing for a virtually unlimited number of servomotors using ORMEC's proprietary MotionDATA™ communications capability. This feature can be used to either closely coordinate the motion of multiple servomotors with each other, or coordinate some number of servomotors with the motion of an external pacer encoder.

2.2 Model 20/40 Features

- 80C186, 16-bit CMOS high integration microprocessor operating at 12 Mhz
- optional 80C187 math co-processor
- powerful MotionBASIC® programming with hypertext on-line manual
- powerful and easy to use MotionPRO™ motion programming environment on an IBM-PC or compatible
- 16-bit IBM-PC/AT style backplane for DSP Servo Modules and expansion boards; Model 20 and 40 have 2 and 4 slots respectively.
- RS-232 Serial Port for program development and troubleshooting
- RS-422/485 communications port for either MotionNET™ or auxiliary serial communications
- integral Watchdog Timer and Emergency Stop circuitry
- 22 built-in diagnostic LEDs
- dual PCMCIA standard memory card slots are standard on the Model 40 and optional on the Model 20
- 16 discrete I/O points for machine control use Opto-22 style modules
- optionally add 24 TTL level I/O points which are compatible with Opto-22 style I/O racks or the Opto-22 Pamux system
- Opto-22's Pamux I/O system provides a combination of up to 512 optically isolated digital and 12-bit analog I/O points
- IBM-PC/AT compatible keyboard interface is standard on the Model 40 and optional on the Model 20
- optional EGA or monochrome video adapter for Operator Interface
- optional single or dual-channel RS-422 Serial Interfaces

2.2.1 Model 20 Model Number Description

GN3-20/1 — Generation III Model 20, 115 VAC Input

Options:

1) for 230 VAC input, change the /1 to a /2
2) to add a math co-processor, add an M
3) to add an absolute encoder backup battery, add a B
4) to add MotionCARD/Memory Disk Support, add a C
5) to add an IBM/PC-AT Keyboard Interface, add a K
6) to add an extended I/O (Pamux) Interface, add an I

GN3-20/2MBCKI — Generation III Model 20 with all options

2.2.2 Model 40 Model Number Description

GN3-40/1 — Generation III Model 40, 115 VAC Input

Options:

1) for 230 VAC input, change the /1 to a /2
2) to add a Math co-processor, add an M
3) to add an absolute encoder backup battery, add a B
4) to add an extended I/O (Pamux) Interface, add an I

GN3-40/2MBI — Generation III Model 40 with all options. Note that *MotionCARD/Memory Disk Support* and a *Keyboard Interface* are standard.

2.3 Modular Construction

- compact panel mountable steel enclosure (19.5"h x 6.0"w x 10.5"d)
- industrially hardened switching power supplies use either 115 or 230 VAC power and include a built-in switch/circuit breaker as well as a line filter for noise immunity
- isolated 24 VDC power supply for optically coupled discrete I/O is standard

2.4 DSP Axis Modules

There are two models of DSP Axis Modules including a dual axis unit, and a single axis unit with an auxiliary pacer encoder interface. They both use a 40 Mhz Texas Instruments Digital Signal Processor (DSP) to provide axis control algorithms. The DSP is interfaced to the main processor through a dual-port RAM shared memory interface for maximum speed and flexibility. DSP Axis Module features are overviewed below:

- Texas Instruments TMS-320C25 DSP operating at 40 Mhz
- direct digital loop control with up to 5 Khz servo update rates provide wide loop bandwidth for high positioning accuracy and response
- quadrature feedback 4x decoding with positioning rates to 1.2 MBit per second
- position, velocity or torque mode control
- total elimination of analog drift 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
- fully compatible with ORMEC torque mode servodrives through the individual Axis Interface Connectors
- pacer encoders for electronic gearing are interfaced through any of the DSP Axis Modules' interface connectors
- proprietary MotionDATA™ communications from DSP to DSP allows tightly coordinated multi-axis motion
- servodrive remote enable and reset functions are provided by optically coupled outputs
- open feedback wire detect 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
- shared memory data interface to main processor
- writable control store for DSP program storage is loaded from the main processor at powerup

2.4.1 DSP Axis Module Model Number Description

GN3-DSP-AQ	Single Axis DSP Module with Pacer Encoder Interface
GN3-DSP-AQ/A	Single Axis DSP Module with Pacer Encoder Interface with 4-channel 12-bit A/D converter option
GN3-DSP-A2	Dual Axis DSP Servo Control Module
GN3-DSP-A2/A	Dual Axis DSP Servo Control Module with 4-channel 12-bit A/D converter option

2.5 Servodrive Compatibility

ORMEC's SAC Series current mode servodrives provide the following features and benefits:

- operation on unisolated standard line voltages of either 115 or 230 VAC
- wide range of output power from 50 watts to 6.1 kilowatts
- high peak torque (current), typically three times rated current for a few seconds and twice rated torque for up to a minute
- wide current loop bandwidth for high positioning accuracy and response
- safety and diagnostic protection features include servo bus overvoltage, undervoltage, overload, overcurrent, open phase detection, loss of feedback detection, main circuit breaker trip, excess regeneration or drive CPU failure
- diagnostics provided by a seven segment LED Alarm Indicator with codes transmitted to the DSP Axis Module through the Axis Interface Cable
- fully compatible with our MAC Series AC Brushless Servomotors

2.6 Servomotor Compatibility

The MAC Series AC Brushless Servomotors provide exceptional performance as overviewed below:

- continuous torque from 1.6 lb-in to 560 lb-in RMS, conservatively rated
- peak torque from 4.2 lb-in to 935 lb-in
- maximum speeds from 1,500 to 4,500 RPM
- high torque inertia ratios of the motors mean more delivered power for high performance applications
- durable construction includes no brushes, high thermal efficiency frame and rugged bearings
- built in position transducer, with up to 24,000 counts per revolution
- low torque ripple, particularly compared with other brushless motors

2.6.1 MAC-A Series Motors

- Maximum Speed: 4,000 RPM
- Continuous stall torques: 10 to 110 lb-in
- Peak Torques: 26 to 257 lb-in
- Peak Acceleration: greater than 50,000 rad/sec^2 (even the largest unit)
- Rated Power: 0.43 to 4.2 HP
- Position Encoder Resolution: 6,000 cts/rev (1500 linecount)
- compatible S-Series servodrives use three phase 230 VAC incoming power
- Optional multi-revolution absolute encoders available

2.6.2 MAC-B Series Motors

- Maximum Speed: 2,500 RPM
- Continuous stall torques: 10 to 330 lb-in
- Peak Torques: 26 to 675 lb-in
- Peak Acceleration: up to 28,888 rad/sec^2 (largest unit is 5,315 rad/sec^2)
- Rated Power: 0.21 to 6.1 HP
- Position Encoder Resolution: 24,000 cts/rev (6000 linecount)
- compatible S-Series servodrives use three phase 230 VAC incoming power
- Optional multi-revolution absolute encoders available

2.6.3 MAC-C Series Motors

- Maximum Speed: 1,500 to 2,000 RPM
- Continuous stall torques: 290 to 560 lb-in
- Peak Torques: 570 to 945 lb-in
- Peak Acceleration: up to 4,488 rad/sec^2 (largest unit is 4,337 rad/sec^2)
- Rated Power: 4.1 to 8.2 HP
- Position Encoder Resolution: 24,000 cts/rev (6000 linecount)
- compatible S-Series servodrives use three phase 230 VAC incoming power
- Optional multi-revolution absolute encoders available

2.6.4 MAC-E Series Motors

- Maximum Speed: 4,000 or 4,500 RPM
- Continuous stall torques: 1.6 to 23 lb-in
- Peak Torques: 4.2 to 59 lb-in
- Peak Acceleration: up to 62,000 rad/sec^2 (largest unit is 17,900 rad/sec^2)
- Rated Power: 0.07 to 0.9 HP
- Position Encoder Resolution: 6,000 cts/rev (1500 linecount)
- Compact & inexpensive
- compatible E-Series servodrives use single phase incoming power at 115 or 230 VAC (depending on model)
- Optional multi-revolution absolute encoders available

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Chapter 3
Installation

3.1 Motion Controller Installation

3.1.1 Receiving & Inspection

ORMEC Motion Controllers and their associated accessories are put through rigorous tests at the factory before shipment. After unpacking, however, check for damage which may have been sustained in transit. The bolts and screws should all be tight, and motor output shafts should rotate freely by hand. Check the motion controller and any of the accessories for bent or broken components or any other physical damage before installing.

3.1.2 Panel Mounting & Environment

Panel mounting data is available in the Specifications Section and **Appendix A**. The motion controller's environment should be maintained as follows:

- Temperature should be between 0 and 55C.
- If the electrical panel is subjected to vibration, mount the unit on shock absorbing material.
- Avoid use in corrosive atmospheres which may cause damage over time.
- Select a location with minimum exposure to oil, water, hot air, high humidity, excessive dust or metallic particles.
- The proper mounting orientation for the motion controller is vertical on a panel using the mounting holes (4) on the base plate.

3.1.3 Input Power - TB1

Motion Controllers are available to operate on either 115 VAC or 230 VAC power (50/60 Hz). A servodrive control power output is provided at terminals **r** and **t** which is interlocked with the integral switch/circuit-breaker on the top of the unit. Use of this feature as illustrated in **Appendix B** eliminates the need for additional switches and/or circuit breakers, and assures that servodrive power will be disabled whenever power is removed from the Motion Controller. **To use this feature, the input voltage selected must match the voltage for the selected servodrive's control power.** All ORMEC servodrives are

available with 230 VAC control power; some of the lower power E-Series are also available with 115 VAC control power.

Input power connections are made on terminal block TB1, located on the top of the unit. The label near TB1 indicates the input voltage of the unit. Copper wire with an 80°C temperature rating, 10 AWG maximum, is recommended for terminal block TB1 wiring. The maximum terminal block screw torque is 5 in-lbs. Connections to TB1 are described below:

Symbol	Name	Description
L1, L2	Input Power	Single-phase 115 or 230 VAC, +10%, -15%, 50/60 Hz, with a switch and two 10 amp circuit breakers (one in each line). In most installations, these terminals would be wired with 14 gauge wire. The maximum continuous input power requirement of the Model 20/40 is 175 watts. Maximum servodrive control power for E-Series is 30 watts per axis; S-Series is 60 watts per axis. If external fusing is required in the power feed to the Model 20/40, 10 amp slow-blow fuses are recommended.
FG	Frame Ground	Connect to the enclosure chassis and earth ground, preferably with AWG 8 or larger braid.
r, t	Servodrive Control Power	Single-phase 115 or 230 VAC, +10%,-15%, 50/60 Hz. This output power is switched by the power switch and 10 amp circuit breakers in the Model 20/40. In most installations, these terminals would be wired with 14 gauge wire.

3.1.4 System Power Wiring & Interlocks - TB6

Both Motion Controllers provide integrated emergency stop and fault interlocks through terminal block TB6. Also provided on TB6 are terminals for the +24 VDC I/O power supply provided in the unit; the internal +5 VDC power supply; and also the input connections to the *I/O Power Bus*.

System wiring diagrams for standard ORMEC servodrives, which include the recommended safety and fault interlocks for a typical system, are provided in **Appendix B**. The primary features of these system wiring diagrams are:

- Servomotor power, called *Main Power*, is switched by the *Main Power Contactor*.
- For the *Main Power Contactor* to be enabled, both the *E-Stop Pushbutton* and the *No Fault Relay* must be closed.
- For the *No Fault Relay* to be closed, three conditions must be satisfied:
  1) there must be no computer diagnostic faults, including powerup diagnostics, run-time diagnostics and the watchdog timer function;
  2) there must be 24 volts applied to the *ES* input at TB6; and
  3) there must be no drive faults from any standby or active servodrives.
- Pressing the normally-open *E-Stop Reset Pushbutton* as shown provides the 24 volts to the *ES* input, and as long as the other conditions are satisfied, the Model 20/40 will close the *No Fault Relay* contact.
- Assuming the *E-Stop Pushbutton* is closed, the *Main Power Contactor* will be enabled, and its auxiliary contact, *MP-AUX*, will close maintaining the required 24 volts at the *ES* input.
- If a fault occurs in the Model 20/40, or any of the servodrives which are in Output, Torque, Velocity or Position control modes, the normally-open

No Fault Relay contact will be opened, removing *Main Power* by disabling the *Main Power Contactor*.

There are many acceptable variations of these System Wiring Diagrams, which can provide different features such as 24 VDC or 115 VAC operation of the *E-Stop Pushbutton*; 115 or 230 VAC operation of the and *Main Contactor* coil for motor power. If using a variation, it should incorporate the primary features as described above and in **Appendix B**. Contact the ORMEC Service Department with any questions you may have in this area.

Copper wire with an 80°C temperature rating, 12 AWG maximum, is recommended for terminal block TB6 wiring. The maximum terminal block screw torque is 5 in-lbs.

Before applying power, refer to Test Run Preparation in Chapter 4.

3.1.5 Emergency Stop, No-Fault Interlock & I/O Power - TB6

The Emergency Stop, No-Fault Interlock, and I/O power connections are made at a "pluggable" terminal block on the Discrete I/O board. This terminal block is located at the lower left of the front of the unit under the removable cover. See **Appendix C-5** for a description of fuses F1-F19 on the DIO Board as well as the ORMEC and Littelfuse part numbers.

Signal	Location	Function	Description
V	TB6-1	I/O Power Bus	The *I/O Power Bus* connects **all** terminals labelled **V** and **C** which are distributed on the *Integral Discrete I/O* terminal blocks **TB2-TB5**. Its purpose is to facilitate field wiring of discrete I/O without requiring additional terminal blocks. This connection is to the voltage side of the *I/O Power Bus*, and would normally be either: 1) connected to TB6-2 if the user decides to use the internal +24 VDC isolated power supply to provide power to the I/O Power Bus, or 2) connected to 115 VAC if the user decides to use 115 VAC for the *I/O Power Bus*.
24	TB6-2	+24 VDC Power	This fully isolated +24 VDC power supply rated at 2.0 A is provided for Emergency Stop and Servodrive interlocks, as well as user I/O. It would normally be used to: 1) power the Emergency Stop Reset Pushbutton; 2) power +24 VDC discrete inputs for operator inputs, limit switches, PLC interfaces, etc; and 3) power an MMI-840 Operator Interface Terminal (1/4 amp max) if one is used. It would **not** normally be used to power 24 VDC coil outputs, and if intending to use it for this purpose, the user should watch power requirements carefully and use noise prevention measures such as flyback diodes across each coil.

Signal	Location	Function	Description
ES	TB6-3	Emergency Stop Input	The E-Stop input must have +24 VDC applied to it for full operation. If removed, an emergency stop of all motors will occur. The system wiring diagrams in **Appendix B** provide an E-STOP RESET pushbutton to initially establish the voltage, allowing the No-Fault Relay to pull up. The +24 volts is then maintained by the MP-AUX auxiliary contact of the Main Power Contactor. For more detail, see the System Interlock description in the Operation Chapter.
C	TB6-4	I/O Power Bus Common	Common side of *I/O Power Bus*; see the description under TB6-1 above.
R2	TB6-5	+24 VDC Return	Return for the isolated +24 VDC power supply.
R2	TB6-6	+24 VDC Return	Return for the isolated +24 VDC power supply.
24	TB6-7	+24 VDC Power	Additional connection to the +24 VDC isolated power supply.
NF	TB6-8	No Fault Relay Contact	This fully isolated, normally-open held-closed, relay contact will be held closed as long as there is power to the unit, there is no internal fault *and* +24 VDC is applied to the Emergency Stop input. The System Wiring Diagrams in **Appendix B** show this contact being used to drive the coil of the Main Power Contactor which controls the electromotive power to the servodrive. In the case of a system with multiple motion controllers, the No Fault Relay Contacts may be wired in series.
NF	TB6-9	No Fault Relay Contact	
SH	TB6-10	Shield Point	Connection to the chassis frame for shielding cables connecting to the +5 VDC main power supply.
+5	TB6-11	+5 VDC Power	Connection to the +5 VDC main power supply. Connections to this power supply should **always** be made with a **shielded twisted pair cable** to maintain integrity of the +5 VDC internal power supply.
R5	TB6-12	+5 VDC Common	Common of the +5 VDC main power supply.

3.1.6 Integral Discrete I/O - TB2 to TB5

16 Integral Discrete I/O points are standard. These I/O points are located under the removable front cover of the unit. Connections to them are made at four pluggable terminal blocks, which are located on the left side of the unit and also provide multiple tie points to the selected *I/O Power Bus* for convenience. A cable-tray is provided down the left side of the unit with the wiring designed to exit at the lower left of the unit as it's mounted on the panel.

Mounting sites are provided for Opto-22 style I/O Modules, allowing a variety of I/O choices. The I/O circuit board features 90 mil thickness and multiple standoffs for ruggedness, as well as plug-in fuses and integral LED status indicators for each I/O point which are visible through the cover.

All of these I/O points are individually configurable from MotionBASIC® as either inputs or outputs using the IO.MODE@ variable. In addition, these I/O points can be configured to be "latched" asserted on either "high" or "low" transitions of the input voltage. They can also be used as "interrupts" using the *ON EVENT DIO@* capability provided in MotionBASIC®.

Copper wire with an 80°C temperature rating, 12 AWG maximum, is recommended for terminal block TB2-TB5 wiring. The maximum terminal block screw torque is 5 in-lbs.

See **Appendix C-5** for a description of fuses F1-F19 on the DIO Board as well as the ORMEC and Littelfuse part numbers.

Integral Discrete I/O Connections TB2-TB5

Signal	Location	Function	Description
C	TB2-1	I/O Power Common	Common side of I/O Power Bus.
1-	TB2-2	DIO@(1)-	The minus side of the I/O Module for DIO@(1)
1+	TB2-3	DIO@(1)+	The plus side of the I/O Module for DIO@(1)
V	TB2-4	I/O Power Bus	Voltage side of I/O Power Bus.
2+	TB2-5	DIO@(2)+	The plus side of the I/O Module for DIO@(2)
2-	TB2-6	DIO@(2)-	The minus side of the I/O Module for DIO@(2)
C	TB2-7	I/O Power Common	Common side of I/O Power Bus.
3-	TB2-8	DIO@(3)-	
3+	TB2-9	DIO@(3)+	
V	TB2-10	I/O Power Bus	
4+	TB2-11	DIO@(4)+	
4-	TB2-12	DIO@(4)-	
C	TB2-13	I/O Power Common	
C	TB3-1	I/O Power Common	
5-	TB3-2	DIO@(5)-	
5+	TB3-3	DIO@(5)+	
V	TB3-4	I/O Power Bus	
6+	TB3-5	DIO@(6)+	
6-	TB3-6	DIO@(6)-	
C	TB3-7	I/O Power Common	
7-	TB3-8	DIO@(7)-	
7+	TB3-9	DIO@(7)+	
V	TB3-10	I/O Power Bus	
8+	TB3-11	DIO@(8)+	
8-	TB3-12	DIO@(8)-	
C	TB3-13	I/O Power Common	
C	TB4-1	I/O Power Common	
9-	TB4-2	DIO@(9)-	
9+	TB4-3	DIO@(9)+	
V	TB4-4	I/O Power Bus	
10+	TB4-5	DIO@(10)+	
10-	TB4-6	DIO@(10)-	
C	TB4-7	I/O Power Common	
11-	TB4-8	DIO@(11)-	
11+	TB4-9	DIO@(11)+	
V	TB4-10	I/O Power Bus	
12+	TB4-11	DIO@(12)+	
12-	TB4-12	DIO@(12)-	
C	TB4-13	I/O Power Common	
C	TB5-1	I/O Power Common	
13-	TB5-2	DIO@(13)-	
13+	TB5-3	DIO@(13)+	
V	TB5-4	I/O Power Bus	
14+	TB5-5	DIO@(14)+	
14-	TB5-6	DIO@(14)-	
C	TB5-7	I/O Power Common	
15-	TB5-8	DIO@(15)-	
15+	TB5-9	DIO@(15)+	
V	TB5-10	I/O Power Bus	
16+	TB5-11	DIO@(16)+	
16-	TB5-12	DIO@(16)-	
C	TB5-13	I/O Power Common.	

I/O Interface Drawings

Appendix C-2 - I/O Panel Layout Diagram

Appendix C-5 - I/O Schematic Diagram

3.1.7 Extended I/O Connector - J3

The *Extended I/O Option* provides a 50-pin connector at the bottom-front of the unit. It provides either 24 discrete I/O points or an interface to Opto-22's Pamux I/O system. When used as discrete I/O, the I/O points (DIO@(17) to DIO@(40)) are arranged in three groups of eight as shown below. They are software selectable from MotionBASIC® as inputs or outputs using the IO.MODE@ variable. Group A I/O points are individually selectable; Group B & Group C I/O points may be selected as inputs or outputs only as a group.

The EIO Interface Option schematic is found in **Appendix C-6** and connector pin assignments are compatible with Opto-22 I/O Racks as shown below:

Groups of Extended I/O Points

Group A			Group B			Group C		
DIO(#)	Opto#	Pin#	DIO(#)	Opto#	Pin#	DIO(#)	Opto#	Pin#
17	0	47	25	8	31	33	16	15
18	1	45	26	9	29	34	17	13
19	2	43	27	10	27	35	18	11
20	3	41	28	11	25	36	19	9
21	4	39	29	12	23	37	20	7
22	5	37	30	13	21	38	21	5
23	6	35	31	14	19	39	22	3
24	7	33	32	15	17	40	23	1

All even numbered pins of connector J3 are grounded. +5 VDC is provided to Pin-49 of connector J3 through Fuse F18. See **Appendix C-5** for a description of fuses F1-F19 on the DIO Board as well as the ORMEC and Littelfuse part numbers. **Appendix F-6** and **Appendix F-7** show the compatible cables. Cable usage is as follows:

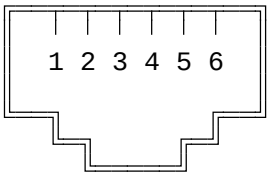
Cable #	I/O Rack #	Description
CBL-DIO/X	MIO-002-24	24-slot I/O Rack, edge-card connector
CBL-EIO/X	MIO-PB4H	4-slot I/O rack, square pin, direct I/O or Pamux
CBL-EIO/X	MIO-PB8H	8-slot I/O rack, square pin, direct I/O or Pamux
CBL-EIO/X	MIO-PB16H	16-slot I/O rack, square pin,direct I/O or Pamux
CBL-EIO/X	MIO-B5	Pamux 4/8/16 channel digital brain board
CBL-EIO/X	MIO-B6	Pamux 4/8/16 channel analog brain board

3.1.8 Pamux I/O Expansion Connector - J3

The EIO.MODE@ variable in MotionBASIC® is used to reconfigure the Optional Extended I/O Connector for Pamux. In addition to the 16 integral Discrete I/O points, this interface then provides access to an additional 512 digital and/or analog I/O points using the Opto-22 Pamux standard. These I/O points are accessed from MotionBASIC® as the DIO@(n) and AIO@(n) arrays, numbered from 17 to 528. Pamux I/O hardware is documented by Opto-22.

3.1.9 Serial Port Connector - J2

MotionBASIC® programming, system development and monitoring are done using an IBM-PC or compatible attached to the *Serial Port* connector, which is located on the right-front of the unit (See **Appendix C-2**). The *Serial Port* is an asynchronous RS-232 device. It is handled internally by half of a Z8530 dual serial communications controller, and interfaced through a 6-pin modular connector **(Appendix C-7**). Its pinout is shown below:



Pin#	Source	System Status LEDs	RS-232 Name	Pin#	Description
1	----	----	DGND	7	Signal Ground
2	Model 20/40	Sending Serial	RxD	3	Received Data
3	User-PC	Receiving Serial	TxD	2	Transmitted Data
4	Model 20/40	Ready to Receive	CTS	5	Clear to Send
5	User-PC	OK to Transmit	RTS	4	Request to Send
6	Model 20/40	----	SHIELD	1	Protective Ground

ORMEC provides coil-cord style cables for the serial port which are compatible with IBM-AT style 9 pin connectors and with IBM-PC 25 pin connectors. See **Appendixes F-1** and **F-2**.

Note that the serial port provides hardware handshaking signals *Ready to Receive* and *OK to Transmit* between the Model 20/40 and the PC used for development. These signals, as well as *Sending Serial* and *Receiving Serial* are displayed on the System Status LEDs on the front of the unit. The orange *Ready to Receive* and *OK to Transmit* bars should be lit when MotionPRO™ is running on the PC and the serial cord is in place. The red *Sending Serial* and *Receiving Serial* bars will flash whenever data is transmitted and received.

3.1.10 Keyboard Interface Connector - J8

The *Keyboard Interface*, standard on the Model 40 and optional on the Model 20, is a 5-pin DIN connector located on the bottom of the unit. It is compatible with the ORMEC *OIT-VGA* & *OIT-MONO*2 Operator Interface Terminals, as well as all IBM PC-AT compatible keyboards. A six foot cable is provided with the OIT. For distances beyond six feet a special extension cable with line drivers and receivers must be used, which allow the OIT to be located up to 150 feet from the unit. DO NOT CONNECT A KEYBOARD TO THE MOTION CONTROLLER WITH POWER ON.

3.1.11 MotionDATA™ Connectors - J4 & J5

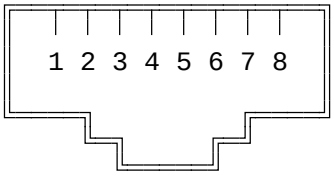
MotionDATA™ is a proprietary DSP to DSP communications network provided for electronic gearing applications, and its operation is user transparent. This communication link transfers position information with an error correcting protocol during each position loop update (typically 3000 to 4000 times per second). Use of electronic gearing by any servo axis is totally configured in MotionBASIC® software, with the actual electronic gearing configuration defined for each axis by the *MD.MODE@* variable.

Connections to the MotionDATA™ port are made at connectors J4 and J5, which are located on the bottom of the unit and labeled MotionDATA™ IN and OUT respectively (See **Appendix C-3, C-4** & **C-8**).

Differential drivers and receivers on the motherboard interface MotionDATA™ to the outside world, and internally MotionDATA™ is wired to the DSP Axis Modules in the system as described in Section 3.2 and **Appendix H-3**.

3.1.11.1 MotionDATA™ Connector Pinout

The pinout of the MotionDATA™ connectors is shown below. Note that signals are in pairs due to the balanced-pair differential configuration of MotionDATA™. **Appendix F-3** details the CBL-MOD8/NNN cable compatible with this connector. **Appendix F** also documents other CBL-MOD8 accessories.



Pin#	Signal Name	Description
1	CLOCK	Synchronous Clock (MotionDATA Active)
2	CLOCK'	
3	SYNC	MotionDATA Sync Signal
4	SYNC'	
5	DATA	MotionDATA Send/Receive Information
6	DATA'	
7	Reserved	Do not connect to this pin
8	Reserved	Do not connect to this pin

Note that the metal case, which provides a termination of the cable shield, is connected to the shield point on the motherboard for the "MotionDATA™ OUT" connector only.

3.1.12 MotionNET™ Port Connectors - J6 & J7

Connections to the MotionNET™ port are made at connectors J6 and J7, which are located on the bottom of the unit and labeled MotionNET™ IN and OUT respectively (See **Appendix C-3**, **C-4** & **C-7**).

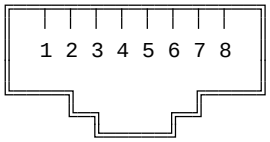
MotionBASIC® supports the MotionNET™ Port as a general purpose serial communications device. Starting with version 2.1 MotionBASIC® also provides device driver support for the:

- MMI-840 Industrial Terminal with an 8-line by 40 character display, and
- ITM-270 Industrial Numeric Keypad and Display with a single-line 16-character display.

The optional Modbus™ [1] Communications MotionCARD™ provides the ability to network one or more Generation III motion controllers with intelligent operator interface terminals and Programmable Logic Controllers using Modicon's Modbus™ factory communications network protocol.

3.1.12.1 MotionNet™ Connector Pinout

The pinout of the MotionNET™ connectors is shown below. Note that signals are in pairs due to the balanced-pair differential configuration of MotionNET™. **Appendix F-3** details the CBL-MOD8/NNN cable compatible with this connector. **Appendix F** also documents other CBL-MOD8 accessories.



Pin#	Signal Name	Description
1	TDATA	Transmitted (Send) Data
2	TDATA'	
3	RDATA	Receive Data
4	RDATA'	
5	SYNCLK	Do not connect to this pin
6	SYNCLK'	Do not connect to this pin
7	Reserved	Do not connect to this pin
8	Reserved	Do not connect to this pin

Note that the metal case, which provides a termination of the cable shield, is connected to the shield point on the motherboard for the "MotionNET™ OUT" connector only.

[1] Modbus™ is a trademark of Modicon, Inc.

3.1.12.2 RS-422/485 Serial Communications with the MotionNET™ Port

MotionBASIC® uses the "OPEN" statement to provide access to asynchronous serial communications via the RS-422/485 MotionNET™ port as device "SRL2:". This communications port is commonly used for interface to devices such as the ORMEC MMI-840 Industrial Terminal, the ITM-270 Industrial Numeric Keypad and/or the AND-200 Series Alphanumeric displays. It can also be used for programmatic serial communications with terminals, computers or programmable controllers or for background communications using *Modbus™.*

3.1.12.3 Modbus™ Communications

The Modbus™ Communications MotionCARD™ allows a Generation III Motion Controller to provide **background** Modbus™ communications as either a *Master* or a *Slave*. This factory communications link provides a convenient method for data communication between Generation III motion controllers, programmable logic controllers and other intelligent devices. A number of configurations are supported using either the MotionNET™ port or an add-in serial port.

3.2 Memory Cards

Generation III motion controllers support the use of credit card sized memory modules which conform to the international PCMCIA standard. These plug-in modules are used either as *Memory Disks* or *MotionCARD™s*.

3.2.1 Memory Disks

When a *Memory Card* is plugged into the external card slot on the front of the motion controller, it provides a removable non-volatile memory disk drive.

- Flash PROM Memory Disks provide read/write memory that is inherently non-volatile and are available in sizes from 512K to 4M bytes. They have limitations with respect to dynamic data storage.
- SRAM Memory Disks provide read/write memory with internal lithium battery backup. Read/write speeds comparable to RAM drives provide ideal dynamic data storage including random access files. They are available in sizes from 512K to 2M bytes.

Memory Disk installation, including changing the battery in an SRAM Memory Disk, is illustrated in **Appendixes H-2 & H-4**.

3.2.2 MotionCARD™s

MotionCARD™s are *Memory Cards* which plug into the internal card slot of a Generation III motion controller and are programmed at ORMEC to extend the functionality of *MotionBASIC®.* Standard *MotionCARD™s* are currently available to support Allen-Bradley and Modicon factory network communications. The location of the *MotionCARD™* slot is illustrated in **Appendix H-2**.

3.3 DSP Axis Modules

There are two models of DSP Axis Modules:
- GN3-DSP-AQ for single axis control with a pacer encoder interface, and
- GN3-DSP-A2 for dual-axis control.

The interface circuitry schematics and component layout diagram for the *DSP Axis Module* is documented in **Appendix D**.

3.3.1 Axis Addresses

Generation III Motion Controllers identify each "axis" of control in the system with an *Axis-Number* from 1 to 32. When using a "pacer encoder" for "electronic gearing" applications, it also occupies as *Axis-Number* in the system. This allows the pacer encoder to simply plug into the standard *Axis Interface Connector* of any *DSP Axis Module* and be referenced in MotionBASIC® using standard pre-defined variables. e.g. *POS.ACT@(Axis-Number)* is used to reference or preset the actual encoder position. The "Axis Control Mode" (*MODE@*) variable in MotionBASIC® allows the operation of that axis to be configured as a "Pacer Encoder", instead of a "Servo Axis".

The two *axes* controlled by a *DSP Axis Module* are referred to as *Axis-A* and *Axis-B*. For the single axis model with a pacer encoder interface, the pacer encoder is always attached to *Axis-A* and the servo is attached to *Axis-B*.

3.3.2 Setting Axis Addresses

The *Axis-Number* for each Axis-A in the system is derived by adding the *Unit-ID* (set by the rotary *Unit-ID Switch* on the front of the unit) and the *Axis-ID* of its DSP Axis Module (set by the rotary *Axis-ID Switch* in the center of the top edge of the PC board). Each Axis-B has the next consecutive *Axis-Number* after the Axis-A on the same board.

Examples:
1) If the Motion Controller's *Unit-ID* is "01" (default) and the DSP *Axis-ID* Switch is set to "0", then *Axis-A* of that module is Axis 1 and *Axis-B* is Axis 2.
2) If the Motion Controller's *Unit-ID* is "01" (default) and the DSP *Axis-ID* Switch is set to "2", then *Axis-A* of that module is Axis 3 and *Axis-B* is Axis 4.
3) If the Motion Controller's *Unit-ID* is "10" and the DSP *Axis-ID* Switch is set to "0", then *Axis-A* of that module is Axis 10 and *Axis-B* is Axis 11.

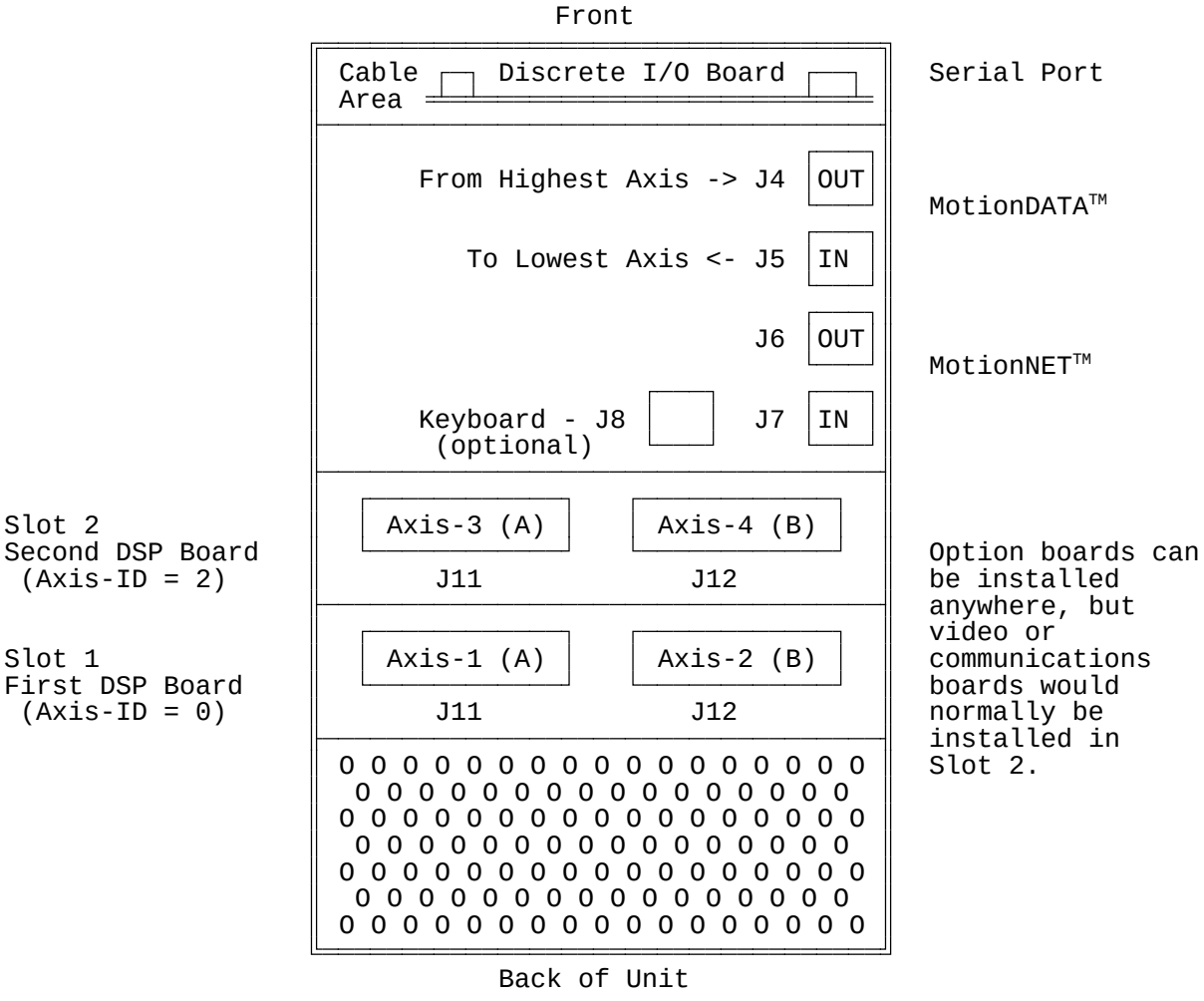
Note that when using more than two *DSP Axis Modules* in a Model 40, **an additional** *Axis-Number* must be skipped between the second and third DSP Axis Modules in the system. e.g. The standard axis assignments as shown below set *Axis-ID*'s of 0,2,5 & 7, which when combined with the standard *Unit-ID* of 1, results in axis number assignments of 1-4 and 6-9. Axis 5 is skipped.

3.3.3 Model 20 Unit-ID and Axis Installation

Shown below is a diagram of the bottom of the Model 20, indicating the *ORMEC standard installation* of DSP Axis Modules in the unit. This installation approach provides consecutive Axis-IDs starting with the Unit-ID. The Unit-ID is set to 1, the lower DSP Axis Module has address 0 selected, and the upper DSP Axis Module has address 2 selected.

If one of the DSP Axis Modules is a single axis unit with a pacer encoder interface, it will be installed in Slot 1. Systems with $2^{1/2}$ axes can utilize two $1^{1/2}$ axis modules. In the most common fully loaded configuration, the Model 20's *Unit-ID* is "1" (standard) and the DSP Axis Modules have *Axis-ID*s "0" and "2". *Axis-A* of the first module is Axis 1 in the system and *Axis-B* is Axis 2. The second module provides Axis 3 & Axis 4. MotionDATA™ is wired in a loop internally (in the order of ascending axis numbers) with the input connector going to the lowest numbered axis and the output connector attached to the highest axis. See **Appendix H** for an illustration of physical installation.

Bottom View of Model 20

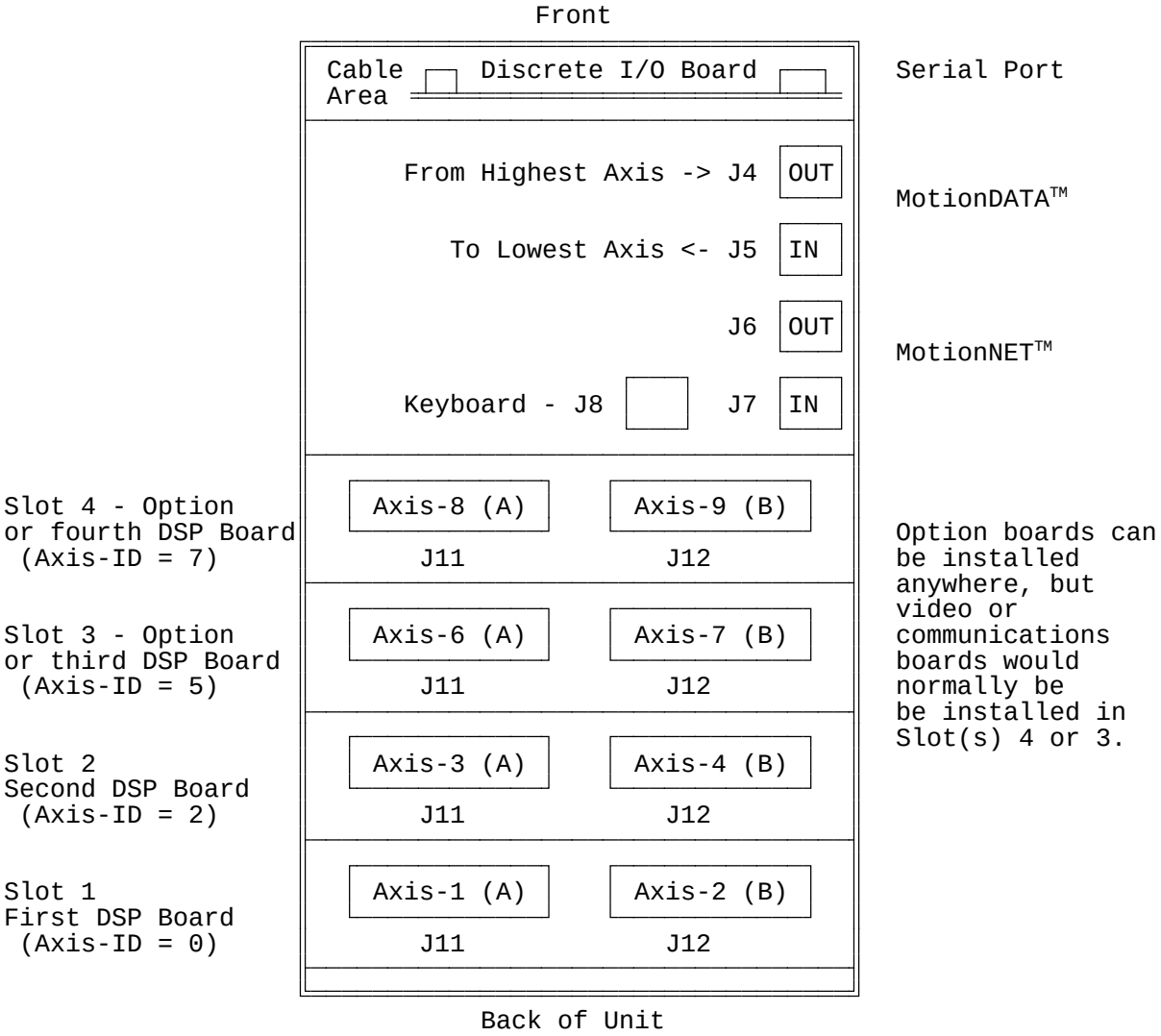


3.3.4 Model 40 Unit-ID and Axis Installation

Shown below is a diagram of the bottom of the Model 40, indicating the *ORMEC standard installation* of DSP Axis Modules in the unit. This installation approach provides consecutive Axis-IDs starting with the Unit-ID. The Unit-ID is set to 1, the lower DSP Axis Module has address 0 selected, and the upper DSP Axis Module has address 7 selected.

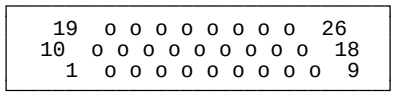
If one of the DSP Axis Modules is a single axis unit with a pacer encoder interface, it will be installed in Slot 1. Systems with $2^{1/2}$, $4^{1/2}$ or $6^{1/2}$ axes can utilize two $1^{1/2}$ axis modules (which will be in the first two slots). In the most common fully loaded configuration, the Model 40's *Unit-ID* is "1" (standard) and the DSP Axis Modules have *Axis-ID*s "0", "2", "5" and "7". MotionDATA™ is wired in a loop internally (in the order of ascending axis numbers) with the input connector going to the lowest numbered axis and the output connector attached to the highest axis. See **Appendix H** for an illustration of physical installation.

Bottom View of Model 40



3.3.5 DSP Axis Interface Connectors - J11 & J12

Axis Interface Connectors J11 and J12 are 26-pin female HDP-22 style connectors (compatible with AMP Part # 748365-1). Connections from the DSP Axis Module to servodrives or pacer encoders are normally made using pre-fabricated cables shown in **Appendix E**. The connector layout is shown **Appendixes C-3 & C-4** and interface schematics for the DSP Axis Module are found in **Appendix D**. The Axis Interface Connectors have the functionality described below:



Axis Module Interface Connector as Viewed from Bottom of unit

Cable and terminal block accessories are illustrated in **Appendix E**.

Signal	Pin #	Function	Description
ENCA ENCA'	1 2	Encoder Channel A Encoder Channel A'	Encoder Channel A and A' are differential inputs which provide one of two quadrature square wave signals used by the DSP Axis Module to determine encoder direction and travel. For axes controlling a servomotor, these signals are used for feedback. For axes used to interface to a Pacer encoder, these signals are used to determine the direction and travel of the external encoder only. Forward travel (reversible in software from MotionBASIC®) is defined as the direction for which ENCA leads ENCB by 90 degrees.
Open Wire Detection			Both quadrature feedback channels are monitored by open wire detection circuitry, and if any open wire is detected, servo operation is interrupted, the *No Fault Relay* is disabled, and the T-ENABLE' output below is turned OFF.
DRV-CMD	3	Output Command	This ±10 VDC 12-bit analog output is used to command ± full-scale servomotor output torque (current) or velocity.
AGND	4	Analog Signal Ground	This pin is a ground reference point for DRV-CMD.
V-	5,7,8	Servodrive Interlock Voltage Common	The negative terminal of a 5 to 24 VDC power supply which is used to drive the *servodrive interlock opto-isolators*. Connection to this power supply is also provided at the *DSP I/O Header (J10)*.
ALM-RESET'	6	Servodrive Alarm Reset	This open collector optically isolated output is turned ON (asserted) to reset servodrive alarms. It is rated for 24 volt operation and can sink 25 mA to the *V- Servodrive Interlock Voltage Common*.
T-ENABLE'	9	Torque Enable	This optically isolated output is turned on to enable servodrive output torque. It is rated for 24 volt operation and can conduct 25 mA. With default jumper strapping, this output sinks current to the *V- Servodrive Interlock Voltage Common*. Alternatively, the emitter of this optically isolated transistor (T-ENABLE2' at pin 15 below) can be isolated from *V-* to allow "active high" operation of this function.
SHIELD	10	Cable Shield	This pin is internally connected to frame ground and provided for termination of a shield for the Axis Interface Cable.

ENCB ENCB'	11 12	Encoder Channel B Encoder Channel B'	Encoder Channel B and B' are differential inputs which provide one of two quadrature square wave signals used by the DSP axis module to determine encoder direction and travel.
+5V	13	+5 VDC	This pin is internally connected to the main +5 VDC power supply of the DSP Board and provided for external use (500 mA maximum).
AIN2	14	Axis Analog Input 2	This is one of two optional 12-bit analog inputs.
T-ENABLE2'	15	Active High Torque Enable	This output is the emitter of an optically isolated transistor which is turned on to enable servodrive output torque. See T-ENABLE' above. By default it is strapped to V- (pins 5,7 & 8) by removable jumpers between pins 5 & 6 of header J18 (J19 for Axis-B), but for servodrives which require an "active high" *Torque Enable* input, the jumper(s) may be removed, D.C. power attached to T-ENABLE', and this output attached to the servodrive.
BAT-	16	Battery Common	The negative terminal of an optional 3 VDC lithium battery is provided for battery backup of absolute encoder circuitry associated with special drives which support multi-revolution absolute encoders.
ABS	17	Absolute Encoder Read Command	This TTL-level signal is raised by the motion controller when the MotionBASIC® statement *POS.ACT@ = POS.ABS@* is executed to cause absolute encoder position information to be sent; and normal operation initiated for special multi-revolution absolute encoders only. Call ORMEC for details.
BAT+ NO-ALARM	18 Pin 18	Battery Voltage or Servodrive Alarm	The positive terminal of an optional 3 VDC lithium battery is provided for battery backup of absolute encoder circuitry associated with special drives which support multi-revolution absolute encoders. For servodrives which provide an "active high" *No-Alarm* interlock, this terminal may be jumper strapped to the NO-ALARM opto-isolator input. See **Section 3.3.12** and **Appendix D**.
ENCZ ENCZ'	19 20	Encoder Channel Z Encoder Channel Z'	Encoder Channel Z and Z' are differential inputs which produce a reference pulse for use by the DSP Axis Module. This reference pulse is normally asserted by the feedback or pacer encoder once per revolution of that device. In some cases, however, these signals can come from another device such as a registration sensor or an external home sensor. *DSP I/O Header J10* is provided for convenient field wiring of these signals when they are not obtained from the standard position encoder.
DGND	21	Digital Signal Ground	This pin is a ground reference point for the +5 VDC output.
V+	22	Servodrive Interlock Voltage	The positive terminal of a 5 to 24 VDC power supply which is used to drive the *servodrive interlock opto-isolators*. Connection to this power supply is also provided at the *DSP I/O Header (J10)*.
NO-ALARM'	23	Servodrive Alarm	This input from the servodrive must be between 4 and 25 volts lower than the DC *Servodrive Interlock Voltage* provided on Pin 22 to be asserted, indicating that the servodrive has no alarm condition. If this input is not asserted, then the Model 20/40 will detect a servodrive alarm fault, drop out the *No Fault Relay* and report the fault through MotionBASIC®. The servodrive output circuitry must be able to sink 0.7 to 7 mA of current from this input to operate, depending on the value of the DC Servodrive Interface Voltage.
AL03' AL02' AL01'	24 25 26	Alarm Code 3 Alarm Code 2 Alarm Code 1	These three inputs provide a "servodrive alarm code" which is used by MotionBASIC® to provide user servodrive diagnostic information. Depending on the value of the DC *Servodrive Interlock Voltage*, the servodrive output circuitry driving these inputs must be capable of sinking 0.7 to 7 mA of current.

3.3.6 SAC-E Series Axis Interface

The connections to SAC-E series servodrives are documented in **Appendix E-1**. This interface description assumes that the default jumpers are in place on the DSP Axis Module, and the interface features **described at the pins of the DSP Axis Module**, include:

Signal(s)	Pin#(s)	Description
DRV-CMD	3	This ±10 VDC analog output from the D/A converter is provided to command torque (current) in the E-Series torque mode servodrive.
AGND	4	Analog signal ground is a ground reference point for the DRV-CMD signal.
DGND	21	Digital signal ground is a ground reference point for the +5 VDC output.
ENCA & ENCA'	1,2	These differential signals are one of the quadrature feedback signals for the servo.
ENCB & ENCB'	11,12	These differential signals are one of the quadrature feedback signals for the servo.
ENCZ & ENCZ'	19,20	These differential signals are the "once-per-revolution" marker signal for the feedback encoder.
T-ENABLE'	9	This optically coupled output must be ON, providing a low resistance path to the *V-* terminal to enable torque in the servodrive.
F-ENABLE' (V-)	8	This *V-* terminal point enables forward torque in the servodrive.
R-ENABLE' (V-)	7	This *V-* terminal point enables reverse torque in the servodrive.
ALM-RESET'	6	This optically coupled output must be ON, providing a low resistance path to the *V-* terminal to clear alarm conditions in the E-Series servodrive. It is asserted by the motion controller when the AFAULT@ variable is cleared.
AL01'-AL03'	26,25,24	For the E-Series servodrives these three signals form a coded alarm with values 0-7. This code makes up the second digit of the ALARM@ variable whenever there is an alarm condition.
NO-ALARM'	23	This optically coupled input must be ON, sinking current from the *V+* terminal for the servo axis to operate in standby, output, velocity or position mode. If it is not sinking current, the ALARM@ variable will have a value of 10 or more, with the second digit dependent on the state of AL01'-AL03'.
V+ V-	22 5	Supply point and common for the *Servodrive Interlock Voltage* **provided by the servodrive** to operate the DSP Axis Module's NO-ALARM' and AL01'-AL03' opto-isolated interlock inputs. These electrical nodes are also connected to the *DSP I/O Header* (connector J10).
SHIELD	10	This Axis Interface Cable shield termination point is internally connected to frame ground.

3.3.7 SAC-S Series Axis Interface

The connections to SAC-S series servodrives are documented in **Appendix E-2**. This interface description assumes that the default jumpers are in place on the DSP Axis Module, and the interface features **described at the pins of the DSP Axis Module**, include:

Signal(s)	Pin#(s)	Description
DRV-CMD	3	This ±10 VDC analog output from the D/A converter is provided to command torque (current) in the S-Series torque mode servodrive.
AGND	4	Analog signal ground is a ground reference point for the DRV-CMD signal.
DGND	21	Digital signal ground is a ground reference point for the +5 VDC output.
ENCA & ENCA'	1,2	These differential signals are one of the quadrature feedback signals for the servo.
ENCB & ENCB'	11,12	These differential signals are one of the quadrature feedback signals for the servo.
ENCZ & ENCZ'	19,20	These differential signals are the "once-per-revolution" marker signal for the feedback encoder.
T-ENABLE'	9	This optically coupled output must be ON, providing a low resistance path to the *V-* terminal to enable torque in the servodrive.
F-ENABLE' (V-)	8	This *V-* terminal point enables forward torque in the servodrive.
R-ENABLE' (V-)	7	This *V-* terminal point enables reverse torque in the servodrive.
ALM-RESET'	6	S-Series servodrives do not provide an external alarm reset input, and must be reset by pressing the blue reset button next to the drive Alarm Status Indicator.
MOT-DET (AL03')	24	This signal is asserted when the servo motor is moving at a speed greater than approximately 1% of maximum speed. Use the ALARM@ MotionBASIC® variable to determine its state.
MCCB (AL02')	25	This signal is asserted when the main circuit breaker has tripped. Use the ALARM@ MotionBASIC® variable to determine its state.
CUR-LMT (AL01')	26	This signal is asserted when the S-Series servodrives is in a current limit condition and is provided for information only. Use the ALARM@ MotionBASIC® variable to determine its state.
NO-ALARM'	23	This optically coupled input must be ON, sinking current from the *V+* terminal for the servo axis to operate in standby, output, velocity or position mode. If it is not sinking current, the ALARM@ variable will have a value of 10 or more, with the second digit dependent on the state of AL01'-AL03'.
V+ V-	22 5	Supply point and common for the *Servodrive Interlock Voltage* **provided by the servodrive** to operate the DSP Axis Module's NO-ALARM' and AL01'-AL03' opto-isolated interlock inputs. These electrical nodes are also connected to the *DSP I/O Header* (connector J10).
SHIELD	10	This Axis Interface Cable shield termination point is internally connected to the frame.

3.3.8 Pacer Encoder Axis Interface

The connections to an EDR-25 series pacer encoder are documented in **Appendix E-8**. This interface description assumes that the default jumpers are in place on the DSP Axis Module, and the interface features **described at the pins of the DSP Axis Module**, include:

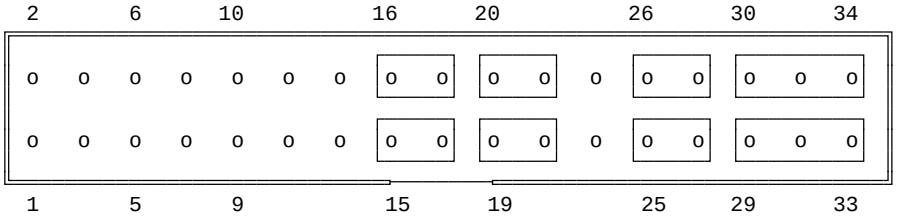
Signal(s)	Pin#(s)	Description
ENCA & ENCA'	1,2	These differential signals drive one of the quadrature inputs from the pacer encoder.
ENCB & ENCB'	11,12	These differential signals drive one of the quadrature inputs from the pacer encoder.
ENCZ & ENCZ'	19,20	These differential signals drive the "once-per-revolution" marker signal for the pacer encoder.
+5V & DGND	13,21	The DSP Axis Module provides +5 VDC to power the pacer encoder.
SHIELD	10	The cable to the pacer encoder should always be shielded to protect the pacer encoder signals as well as the +5 VDC power.

3.3.9 DSP I/O Header Connector - J10

A 34-pin header connector (J10) is provided on the DSP Axis Module for convenient field interface to:

- two high speed sensor inputs with 1 micro-second response,
- three programmable electronic limit switches per axis,
- one 12-bit analog input per axis (extra cost DSP Axis Module option), and
- two hardware overtravel limit switches per axis.

It also allows the user to conveniently obtain the ENCZ (and ENCZ') input(s) for either or both axes of the DSP Axis Module from external devices instead of the Axis Interface Cable. Interface schematics for the DSP I/O Header are found in **Appendix D**, and it has the functionality documented below.



Jumper straps are installed as shown when the unit is shipped from the factory, shunting pins 15-17, 16-18, 19-21, 20-22, 25-27, 26-28, 29-31-33 & 30-32-34.

A terminal block and cable assembly (CBL-DSP-IO/X) to connect to header J10 is detailed in **Appendix E-9**. The cable assembly (CBL-DSP-IO/X) exits the Model 20/40 through the space provided between the door and the chassis, as detailed in **Appendixes C-3** and **C-4**. To install it the jumper straps on the header must be removed. The ENCZ & ENCZ' inputs for Axis-A and Axis-B can be strapped through from the servodrives by placing jumpers between pins 15-17, 16-18, 19-21 & 20-22 respectively as on the header. Alternately, one or both can be received from a separate sensor at terminals 17 & 21 and/or pins 18 & 22.

If hardware overtravel limits are not used, then the jumpers shown above on pins 25-34 must also be replaced at the terminal block.

DSP I/O Header Connector

Signal	Pin #	Function	Description
V+SEN V-SEN	1 2	Sensor Power Supply Sensor Power Common	Connections for a D.C. power supply (often the +24 VDC supply in the Model 20 or 40) used to operate high speed sensors attached to ASEN and/or BSEN. This power supply can also be used to pull up the Electronic Limit Switch Outputs (ELS1, ELS2 and ELS3) documented below.
ASEN BSEN	3 4	High Speed Axis Sensor-A High Speed Axis Sensor-B	These single-ended, high-speed digital sensor inputs to the DSP Axis Module can be used to capture axis position in one microsecond; or synchronize a motion change within one position loop update time (usually 250 to 333 microseconds). The operation of these inputs is configurable in MotionBASIC® and they can also be internally gated by the electronic limit switches as indicated in **Appendix D**.
ELS1'(A,B) ELS2'(A,B) ELS3'(A,B)	5,6 7,8 9,10	Electronic Limit Switch 1 Electronic Limit Switch 2 Electronic Limit Switch 3	Each axis has three programmable electronic limit switches which are automatically controlled by the DSP based on position limits set in MotionBASIC® and updated at each loop update (normally 3000 to 4000 times per second). With the default jumper configuration, these "active low" outputs are pulled up to +5VDC, but by moving the jumper the outputs can be pulled up to the *Sensor Power Supply* (V+SEN) or be operated "open collector".
AIN1(A,B)	11,12	Analog Input 1	An optional 12-bit, ±10 VDC, analog input can be provided for each axis. It is read by MotionBASIC® as the AIN1@(n) variable, which is indexed on Axis-ID. A second analog input, AIN2@(n) is available at the Axis Interface Connector.
DGND	13,14	Digital Ground	Common for the +5 VDC power supply.
ENCZX(A,B)	15,16	Encoder Channel Z(J11,J12)	This connection is to Encoder Channel Z at the Axis Interface Connectors (J11,J12).
ENCZ(A,B)	17,18	Encoder Channel Z(A,B)	Encoder Channel Z input to the DSP Axis Module.
ENCZX'(A,B)	19,20	EncoderChannel Z'(J11,J12)	This connection is to Encoder Channel Z' at the Axis Interface Connectors (J11,J12).
ENCZ'(A,B)	21,22	Encoder Channel Z'(A,B)	Encoder Channel Z' input to the DSP Axis Module.
SHIELD	23	Cable Shield	Connection for Axis Interface Cable shield.
+5 VDC	24	+5 VDC Power Supply	+5 VDC power is provided for use by *Pacer Encoders*.
V+(A,B) V-(A,B)	25,26 33,34	Servodrive Interlock Power Supply & Common	Connections to a 5 to 24 VDC power supply which is required to drive each servodrive's *interlock opto-isolators*. Connection to these electrical nodes is also provided at the *Axis Interface Connectors* (J11, J12). **Since most servodrives provide power for their interlocks through those connectors, USE CAUTION** before attaching power to these terminals. See Sections 3.3.6 & 3.3.7 for descriptions of the interface to ORMEC *SAC-E Series* and *SAC-S Series* servodrives.
V+HTL(A,B)	27,28	Hardware Overtravel Limit Power Supply	The positive terminal of a 5 to 24 VDC power supply which is required for the hardware overtravel limit opto-isolators.
HTL-REV(A,B)	29,30	Reverse Hardware Overtravel Limit (A,B)	The hardware overtravel limit input(s) must be sinking current in opto-isolator(s) UA37 (and UA38) or else a reverse overtravel limit condition will exist, disabling the servo axis.
HTL-FWD(A,B)	31,32	Forward Hardware Overtravel Limit (A,B)	The hardware overtravel limit input(s) must be sinking current in opto-isolator(s) UA37 (and UA38) or else a forward overtravel limit condition will exist, disabling the servo axis.

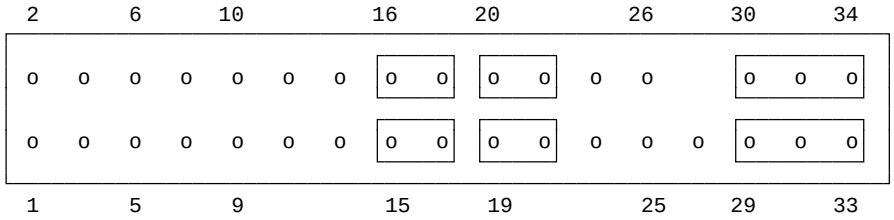
3.3.10 DSP I/O Header Connector - J10 (Old Version DSP)

This section is ONLY for GN3-DSP-AX DSP Axis Interface Modules prior to hardware revision level 3.0a and after revision 1.1b.

A 34-pin header connector (J10) is provided on the DSP Axis Module for convenient field interface to:

- two high speed sensor inputs with 1 micro-second response,
- three programmable electronic limit switches per axis,
- one 12-bit analog input per axis (extra cost DSP Axis Module option), and
- two hardware overtravel limit switches per axis.

It also allows the user to conveniently obtain the ENCZ (and ENCZ') input(s) for either or both axes of the DSP Axis Module from external devices instead of the Axis Interface Cable. Interface schematics for the DSP I/O Header are found in **Appendix D**, and it has the functionality documented below.



Jumper straps are installed as shown when the unit is shipped from the factory. i.e. Shunting pins 15-17, 16-18, 19-21, 20-22, 29-31-33 & 30-32-34.

A terminal block and cable assembly (CBL-DSP-IO/X) to connect to header J10 is detailed in **Appendix E-9**. To install it the jumper straps on the header must be removed. The ENCZ & ENCZ' inputs for Axis-A and Axis-B can be strapped through from the servodrives by placing jumpers between pins 15-17, 16-18, 19-21 & 20-22 respectively as on the header. Alternately, one or both can be received from a separate sensor at terminals 17 & 21 and/or pins 18 & 22.

DSP I/O Header Connector

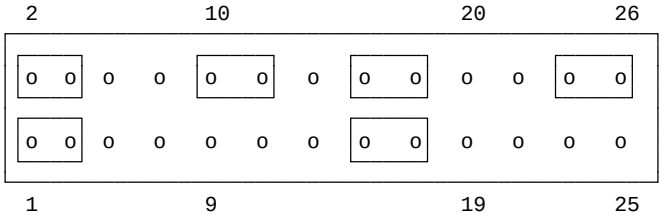
Signal	Pin #	Function	Description
ASEN' ASEN	1 3	High Speed Axis Sensor-A' High Speed Axis Sensor-A	ASEN and ASEN' are differential inputs which produce a high speed digital sensor input on the DSP Axis Module. These inputs are used by MotionBASIC® for one microsecond position capture or fast synchronization of a motion.
BSEN' BSEN	2 4	High Speed Axis Sensor-B' High Speed Axis Sensor-B	BSEN and BSEN' are differential inputs which produce a second high speed digital sensor input on the DSP Axis Module. These inputs are used by MotionBASIC® for one microsecond position capture or fast motion synchronization.
ELS1(A,B) ELS2(A,B) ELS3(A,B)	5,6 7,8 9,10	Electronic Limit Switch 1 Electronic Limit Switch 2 Electronic Limit Switch 3	Each axis has three programmable electronic limit switches which are automatically controlled by the DSP based on position limits set in MotionBASIC® and updated at each loop update (normally 3000 to 4000 times per second).
AIN1(A,B)	11,12	Analog Input 1	An optional 12-bit, ±10 VDC, analog input can be provided for each axis. It is read by MotionBASIC® as the AIN1@(n) variable, which is indexed on Axis-ID. A second analog input, AIN2@(n) is available at the Axis Interface Connector.
DGND	13,14	Digital Ground	Common for the +5 VDC power supply.
ENCZX(A,B)	15,16	Encoder Channel Z(J11,J12)	This connection is to Encoder Channel Z at the Axis Interface Connectors (J11,J12).
ENCZ(A,B)	17,18	Encoder Channel Z(A,B)	Encoder Channel Z input to the DSP Axis Module.
ENCZX'(A,B)	19,20	EncoderChannel Z'(J11,J12)	This connection is to Encoder Channel Z' at the Axis Interface Connectors (J11,J12).
ENCZ'(A,B)	21,22	Encoder Channel Z'(A,B)	Encoder Channel Z' input to the DSP Axis Module.
SHIELD	23	Cable Shield	Connection for Axis Interface Cable shield.
+5 VDC	24	+5 VDC Power Supply	+5 VDC power is provided for use by *Pacer Encoders*.
V+(A,B)	25,26	Servodrive Interlock Voltage	The positive terminal of a 5 to 24 VDC power supply which is required for operation of the servodrive interlock opto-isolators.
NC	27	No Connection	Do not connect anything to this pin.
KEY	28	No Connection & No Pin	This pin is removed to allow mating connectors to be keyed.
HTL-REV(A,B)	29,30	Reverse Hardware Overtravel Limit (A,B)	The hardware overtravel limit input(s) must be sinking current in opto-isolator(s) UA37 (and 38) or else a reverse overtravel limit condition will exist, disabling the servo axis.
HTL-FWD(A,B)	31,32	Forward Hardware Overtravel Limit (A,B)	The hardware overtravel limit input(s) must be sinking current in opto-isolator(s) UA37 (and 38) or else a forward overtravel limit condition will exist, disabling the servo axis.
V-	33,34	Servodrive Interlock Voltage Common	The negative terminal of a 5 to 25 VDC power supply which is required for operation of the servodrive interlock opto-isolators.

3.3.11 DSP Sensor Header Connector - J10 (for earlier model DSP Axis Modules)

This section is ONLY for GN3-DSP-AX DSP Axis Interface Modules prior to hardware revision level 1.1b.

These DSP Boards are only compatible with MotionBASIC® Versions up through Version 1.2.

A 26-pin header connector (J10) was provided on the DSP Axis Module for convenient field interface to two high speed sensor inputs. It also allows the user to conveniently obtain the ENCZ and AIN inputs for either or both axes of the DSP Axis Module from either the Axis Interface Cable or external devices.



Jumper straps are installed as shown above when the unit is shipped from the factory. i.e. Jumper straps shunt pins 1-3, 2-4, 10-12, 15-17, 16-18 and 24-26.

A terminal block and cable assembly to connect to header J10 is detailed in **Appendix E-10**. To install this cable the jumper straps on the header must be removed. Four differentially received high speed inputs to the DSP Axis Module are then available at the terminal block:

- ENCZ-A & ENCZ-A' Axis-A Encoder Channel Z
- ASEN & ASEN' High Speed Sensor-A
- ENCZ-B & ENCZ-B' Axis-B Encoder Channel Z
- BSEN & BSEN' High Speed Sensor-B

The two ENCZ inputs for Axis-A and Axis-B can be strapped through from the servodrives by placing jumpers between pins 1-3 & 2-4 and pins 15-17 & 16-18 respectively. Alternately, one or both of them can be received from a separate sensor input by at pins 3 & 4 and/or pins 17 & 18.
Similarly, the two analog inputs, AIN-A (pin 12) and AIN-B (pin 26) can be strapped to the servodrives at pins 10 and 24 respectively, or may be wired directly to an external analog signal via the terminal block.

Signal	Pin #	Function	Description
ENCZ-J11	1	J-11 Encoder Channel Z	This connection allows Encoder Channel Z to be received from the Axis Interface Connector (J11).
ENCZ-J11'	2	J-11 Encoder Channel Z'	This connection allows Encoder Channel Z' to be received from the Axis Interface Connector (J11).
ENCZ-A	3	Axis-A Encoder Channel Z	Encoder Channel Z Input to DSP Axis Module for Axis-A.
ENCZ-A'	4	Axis-A Encoder Channel Z'	Encoder Channel Z' Input to DSP Axis Module for Axis-A.
ASEN	6	High Speed Axis Sensor-A	ASEN and ASEN' are differential inputs which produce one of two high speed digital sensor inputs on each DSP Axis Module. These inputs are used by MotionBASIC® for applications such as printing registration systems or causing a motion to occur based on a very fast (less than 20 microsecond) signal.
ASEN'	8	High Speed Axis Sensor-A'	
ELS1-A	5	Axis-A Electronic Limit Switch 1	Each axis has three programmable electronic limit switches which are automatically controlled by the DSP based on position limits set in MotionBASIC®.
ELS2-A	7	Axis-A Electronic Limit Switch 2	
ELS3-A	9	Axis-A Electronic Limit Switch 3	
AIN-J11	10	J11 Analog Input	This connection allows the AIN Analog Input to be received from the Axis Interface Connector (J11).
DGND	11	Digital Ground	Common for the +5 VDC power supply.
AIN-A	12	Axis-A Analog Input	This $\pm$10 VDC, 8-bit analog input is accessed by the MotionBASIC® AIN@ variable, which is indexed on Axis-ID.
SHIELD	13	Cable Shield	Connection for Axis Interface Cable shield.
+5 VDC	14	+5 VDC Power Supply	This connection allows the DSP Axis Module to provide +5 VDC power.
ENCZ-J12	15	J-12 Encoder Channel Z	This connection allows Encoder Channel Z to be received from the Axis Interface Connector (J12).
ENCZ-J12'	16	J-12 Encoder Channel Z'	This connection allows Encoder Channel Z' to be received from the Axis Interface Connector (J12).
ENCZ-B	17	Axis-B Encoder Channel Z	Encoder Channel Z Input to DSP Axis Module for Axis-B.
ENCZ-B'	18	Axis-B Encoder Channel Z'	Encoder Channel Z' Input to DSP Axis Module for Axis-B.
BSEN	20	High Speed Axis Sensor-B	BSEN and BSEN' are differential inputs which produce one of two high speed digital sensor inputs on each DSP Axis Module. These inputs are used by MotionBASIC® for applications such as printing registration systems or causing a motion to occur based on a very fast (less than 20 microsecond) signal.
BSEN'	22	High Speed Axis Sensor-B'	
ELS1-B	19	Axis-B Electronic Limit Switch 1	Each axis has three programmable electronic limit switches which are automatically controlled by the DSP based on position limits set in MotionBASIC®.
ELS2-B	21	Axis-B Electronic Limit Switch 2	
ELS3-B	23	Axis-B Electronic Limit Switch 3	
AIN-J12	24	J12 Analog Input	This connection allows the AIN Analog Input to be received from the Axis Interface Connector (J12).
DGND	25	Digital Ground	Common for the +5 VDC power supply.
AIN-B	26	Axis-B Analog Input	This $\pm$10 VDC, 8-bit analog input is accessed by the MotionBASIC® AIN@ variable, which is indexed on Axis-ID.

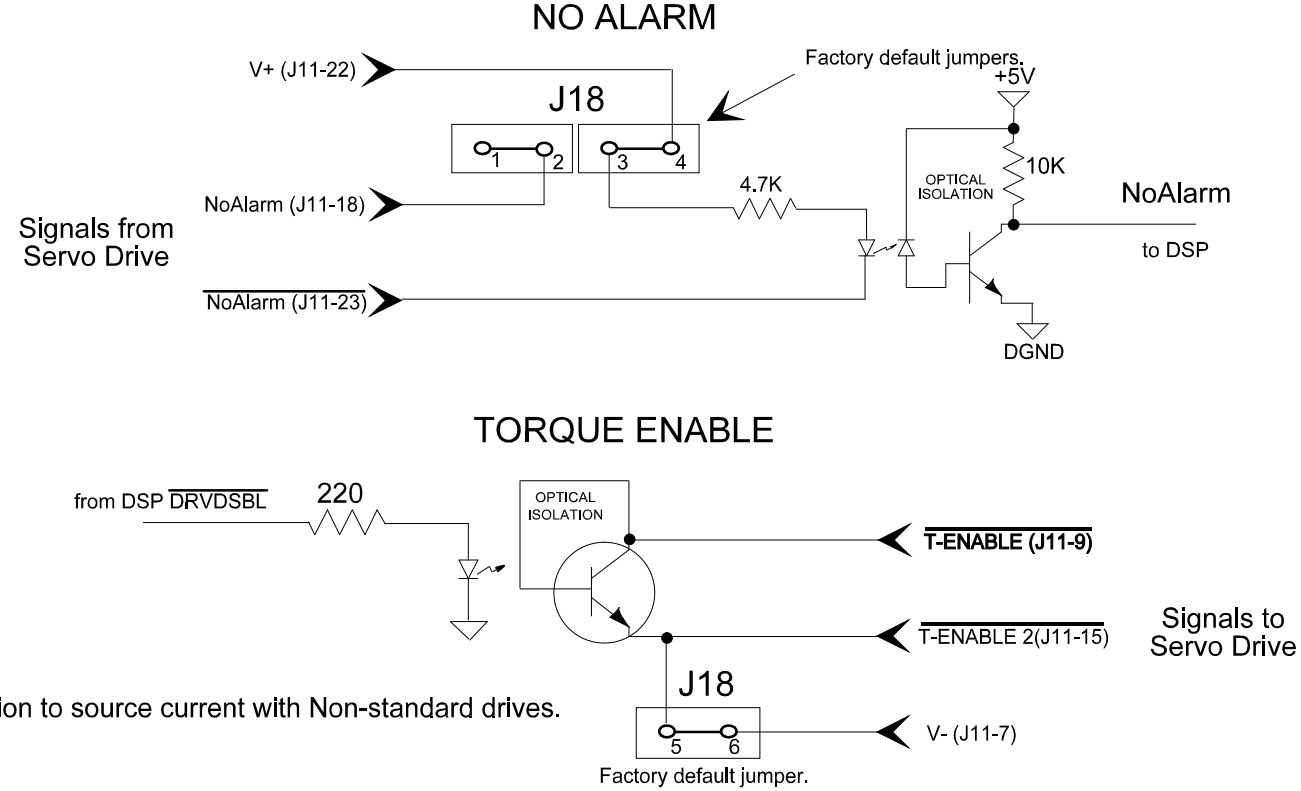
3.3.12 DSP Axis Module Configuration Jumpers

Removable jumpers are provided on the DSP Axis Module for the following changes in configuration:

• **Servodrive Interface:** For greater flexibility in interfacing various servodrives, the No-Alarm input from the servodrive and the Torque-Enable output to the servodrive can both be configured for “active high” rather than the standard “active low” operation.

- To allow “active high” operation of the No-Alarm input, remove the two jumpers on header J18 for Axis-A (and J19 for Axis-B) from pins 1-2 and 3-4, and place one of them between pins 2-3 of the same header. Refer to the figure below.
- To provide an “active high” Torque Enable output, remove the jumper between pins 5-6 of header J18 for Axis-A and J19 for Axis-B. See the description of the T-ENABLE’ and T-ENABLE2’ outputs in **Section 3.3.5**. Refer to the figure below, and to Appendices D-1 and D-3 for further information.

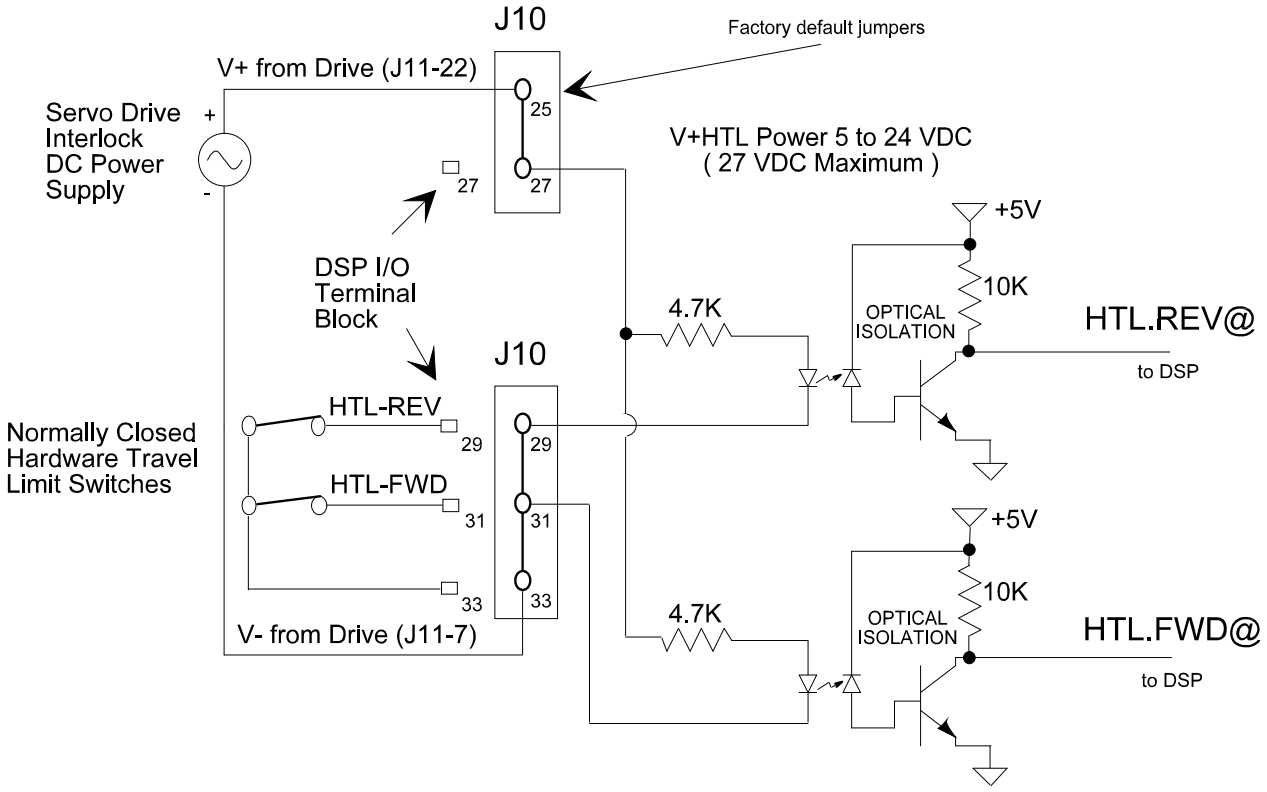
Axis A
DSP Servodrive Interface



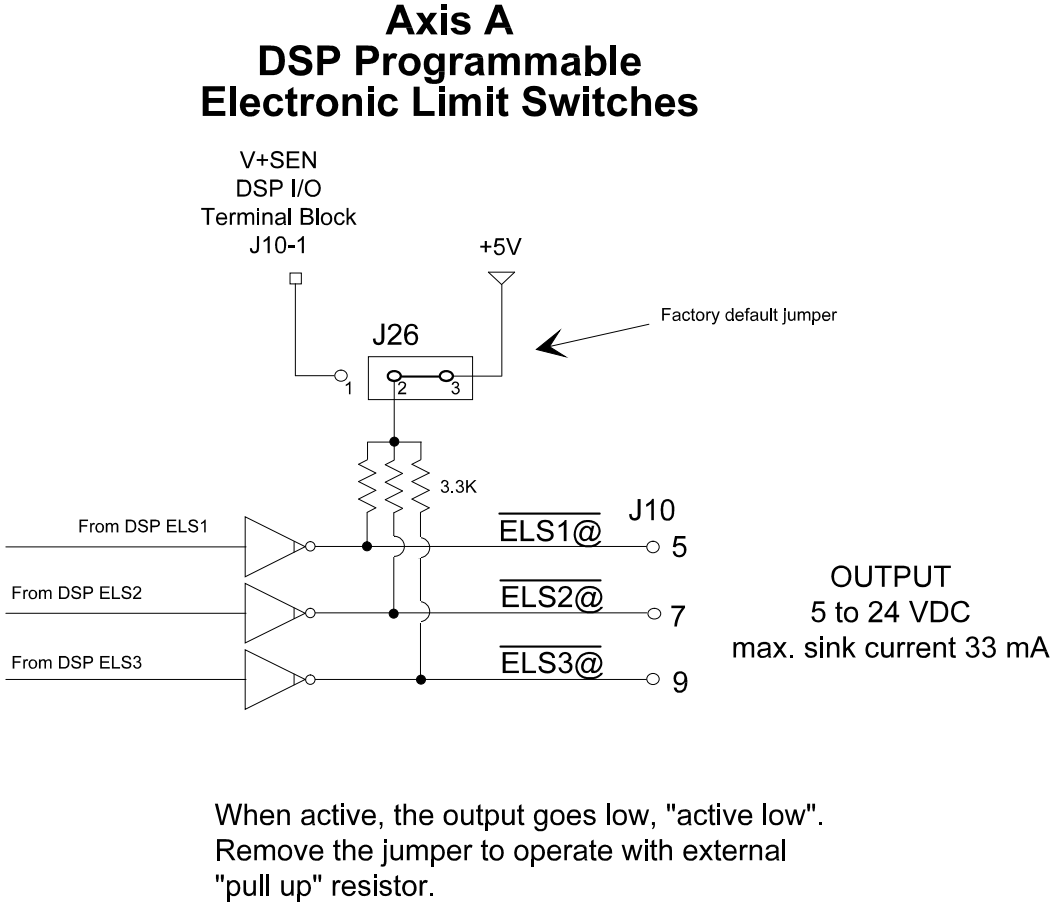
Option to source current with Non-standard drives.

- **Hardware Overtravel Limits:** By removing a jumper between pins 25-27 of the DSP I/O header (or more probably the DSP terminal block), Axis-A's overtravel limit switch inputs can be isolated from the servodrive interface voltages (V+ and V-), which are +12 VDC for our standard servodrives. Most typically this would be done to instead use the Model 20 or 40's integral 24 VDC power supply. The corresponding jumper for Axis-B is between pins 26-28. Refer to the figure below, and to Appendices D-1 and D-3 for further information.

Axis A
DSP Hardware Overtravel Limits



- **Electronic Limit Switch Output Voltage:** Move the jumper from pins 2-3 of header J26 to pins 1-2 to attach the pullup resistors for the Electronic Limit Switch outputs to V+SEN (provided at the DSP I/O Header) instead of +5 VDC. In most cases the integral +24 VDC power supply would be used. If an external power supply is used, a common ground connection must be provided between the external supply and the Model 20/40 power supply. Refer to the figure below, and to Appendices D-2 and D-4 for further information.

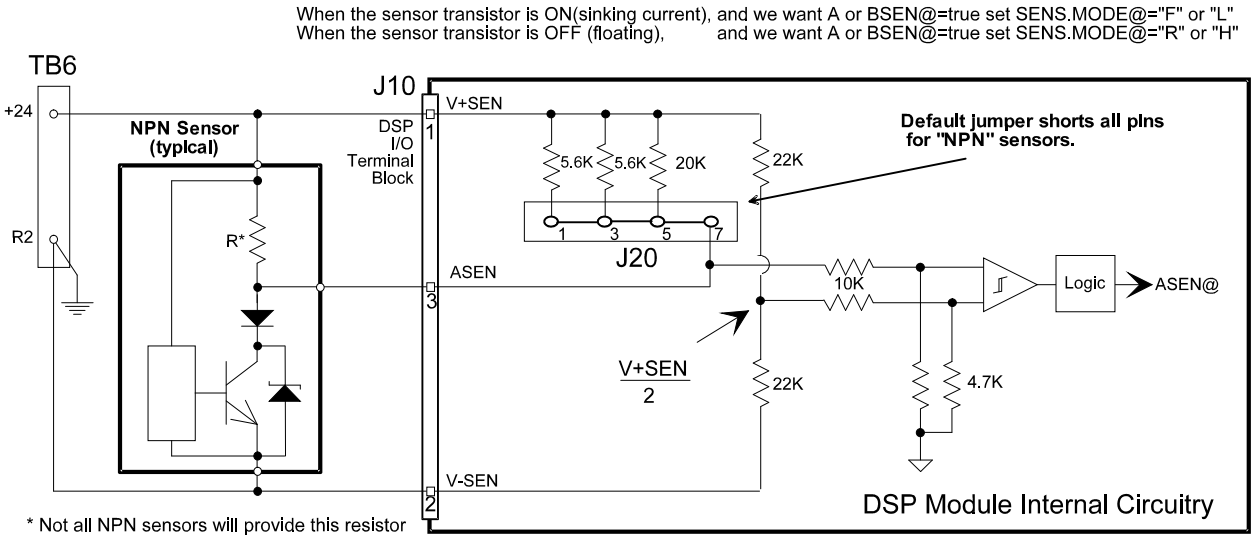


- **High Speed Sensor Input Configuration:** The High Speed Sensor Inputs (ASEN & BSEN) are default configured for operation with sensors which have NPN-type output transistors. The default positions of the shorting bars on Header J20 are to short pins 1,3,5,7 for Axis-A and pins 2,4,6,8 for Axis-B. This provides an input pull-up resistance of 2.5K ohms to the Sensor Power Supply (V+SEN). For use with sensors which have less current drive capability, the shorting bar can be moved “to the right” one or two positions as shown in the following table:

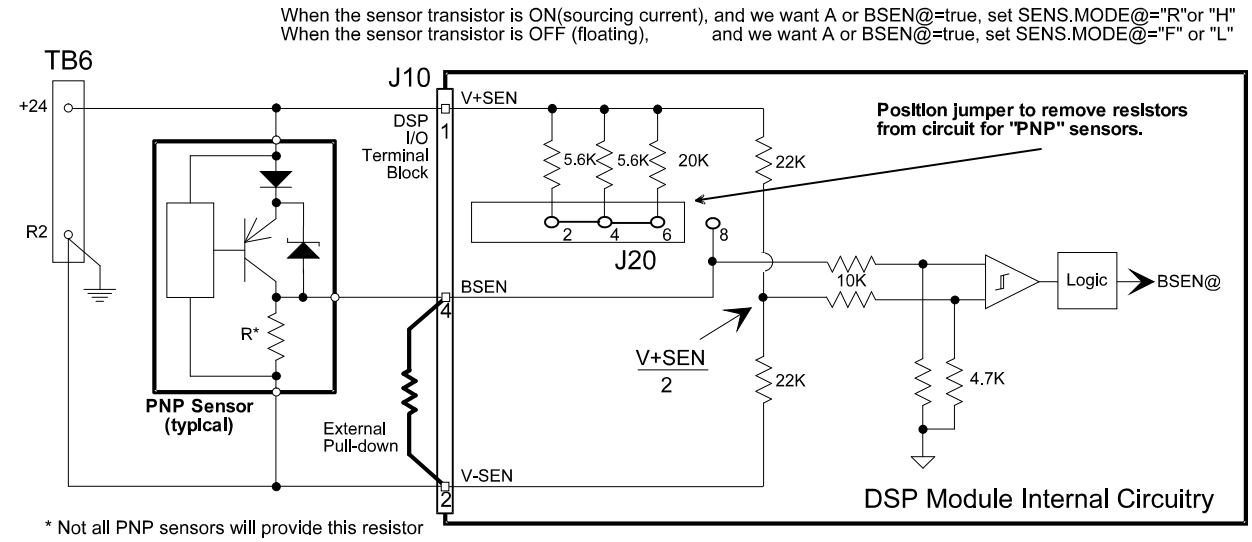
Axis	Shorting Bar Position / Pull-up Resistance				
A	1,3,5,7	3,5,7	5,7	1,3,5	
B	2,4,6,8	4,6,8	6,8	2,4,6	
Pull-up Resistance	2.5K	4.4K	20K	none	ohms
Current @24V	9.1	5.2	1.1	1.6	mA

Moving the shorting bar one position “to the left”, across the pins indicated in the right column above, eliminates the pull-up resistance for compatibility with sensors which have PNP-type output transistors. The input impedance in this mode is approximately 15K ohms. Refer to the figure below, and to Appendices D-11 and D-3 for further information.

ASEN configured for a NPN type sensor.



BSEN configured for a PNP type sensor.



3.4 Video Display Adapter

The video display adapters, GN3-VDA2 and GN3-VDA2/M, each features IBM-PC monochrome (MDA), and color (EGA and VGA) compatibility. The GN3-VDA2/M version of the video adapter is required when using an additional interface card which is 8 bit addressable and accesses segment D000 (ie. when using a Data Highway interface card). Both analog and digital monitors are supported, providing a MotionBASIC® video interface to Industrial Operator Terminals which follow these IBM-PC standards.

These interfaces are compatible with ORMEC Operator Interface Terminals (OIT-VGA, OIT-EGA, OIT-MONO, & OIT-MONO2). A six foot cable is provided with the OIT. For distances beyond six feet a special extension cable with line drivers and receivers must be used.

NOTE: MotionBASIC® version 2.1i or later is required for use with the GN3-VDA2 and GN3-VDA2/M.

3.4.1 Analog Monitor Connector - CN1

This 15-pin female D-Series connector follows the industry standard pin out, for analog monitors only, as described below:

Pin #	Function
1	Red (0 - 0.7v)
2	Green (0 - 0.7v)
3	Blue (0 - 0.7v)
4	Mon ID (2)
5	Ground
6	Red Return
7	Green Return
8	Blue Return
9	(no pin)
10	Sync Return
11	Mon ID (0)
12	Mon ID (1)
13	Horizontal Sync
14	Vertical Sync
15	(reserved)

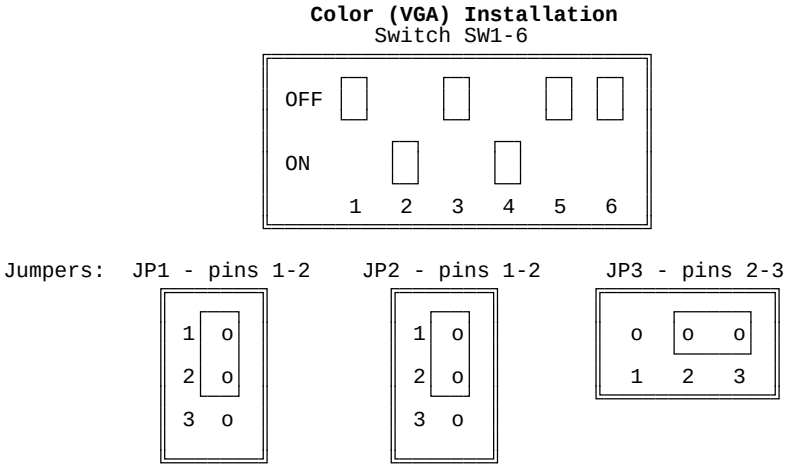
3.4.2 Digital Monitor Connector - CN2

This 9-pin female D-Series connector follows the industry standard pin out, for digital monitors only, as described below:

Pin #	Mono Function	Color Function
1	Ground	Ground
2	Ground	Secondary Red
3	N/A	Primary Red
4	N/A	Primary Green
5	N/A	Primary Blue
6	Intensity	Secondary Green
7	Video	Secondary Blue
8	Horizontal Sync (+)	Horizontal Sync (+)
9	Vertical Sync	Vertical Sync (-)

3.4.3 Video Adapter VGA Installation

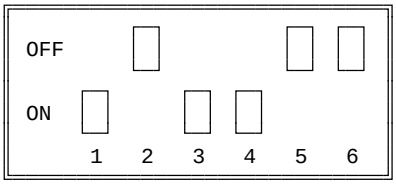
To install the video adapter for color VGA operation , you must set switches SW1-6 and the Jumpers on headers JP1, JP2, and JP3 as shown below. The video adapter is shipped configured for VGA operation as the factory default.



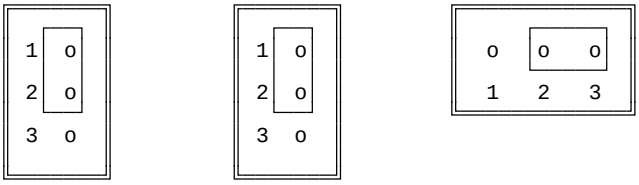
3.4.4 Video Adapter Monochrome Installation

To install the video adapter for monochrome (MDA) operation , you must set switches SW1-6 and the Jumpers on headers JP1, JP2, and JP3 as shown below.

Monochrome (MDA) Installation
Switch SW1-6



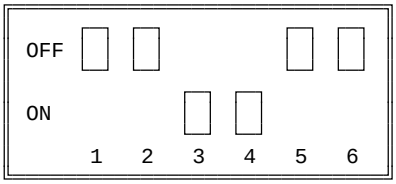
Jumpers: JP1 - pins 1-2 JP2 - pins 1-2 JP3 - pins 2-3



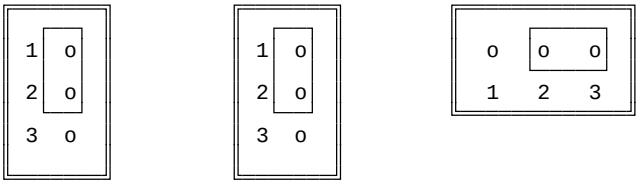
3.4.5 Video Adapter EGA Installation

To install the video adapter for color EGA operation , you must set switches SW1-6 and the Jumpers on headers JP1, JP2, and JP3 as shown below.

Color (EGA) Installation
Switch SW1-6



Jumpers: JP1 - pins 1-2 JP2 - pins 1-2 JP3 - pins 2-3



3.5 Video Display Adapter (Old Version)

This section is ONLY for GN3-VDA Video Display Adapter.

The video display adapter features include IBM-PC monochrome and color compatibility at Connector J1, providing a MotionBASIC® video interface to both monochrome (MDA) and color (EGA) Industrial Operator Terminals which follow the IBM-PC standards.

This interface is compatible with ORMEC Operator Interface Terminals (OIT-EGA & OIT-MONO). A six foot cable is provided with the OIT. For distances beyond six feet a special extension cable with line drivers and receivers must be used. This extension cable (CBL-EGAX/NNN) is available for lengths (NNN) up to 150 feet and works with either MDA or EGA terminals.

3.5.1 MDA/EGA Connector - J1

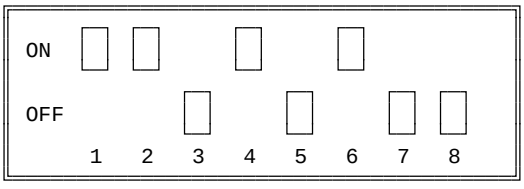
This 9-pin female D-Series connector follows the industry standard pinout, for digital monitors only, as described below:

Signal	Pin #	Function
GND	1	Ground
SEC-RED	2	Secondary Red
PRI-RED	3	Primary Red
PRI-GRN	4	Primary Green
PRI-BLU	5	Primary Blue
SEC-GRN/I	6	Secondary Green/Intensity
SEC-BLU/M	7	Secondary Blue/Mono Video
H-SYNC	8	Horizontal Sync
V-SYNC	9	Vertical Sync.

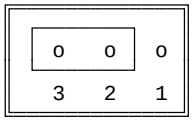
3.5.2 Video Adapter Installation

To install the video adapter, you must set switches SW1-8 and the Jumper on header JP1 depending on whether the installation is for color or monochrome operation. The diagrams below assume that you are looking at the video board with the PC-AT connector at the bottom and the 9-pin digital video connector at the upper right.

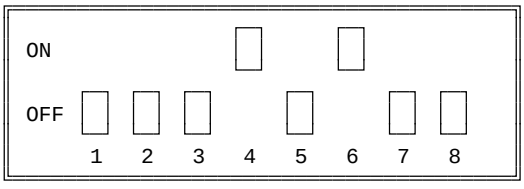
Color (EGA) Installation
Switch SW1-8



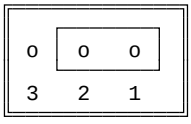
Jumpers: JP1 - pins 2-3



Monochrome (MDA) Installation
Switch SW1-8



JP1 - pins 1-2



3.6 GN3-422 Serial Communications Adapter

The serial communications adapter is a half length card which has two serial ports that can be configured as RS-232 or RS422/485. There is a DB-9 serial connector for each port. The Model 20/40 supports only one dual-port Serial Communication Interface at a time.

Factory default settings are presented and then all the settings are presented to allow for changes.

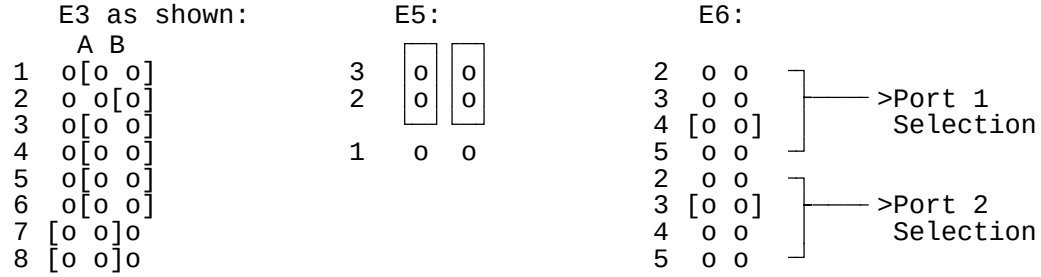
3.6.1 Device Configuration - Factory Default Settings Summary

The factory defaults set the Serial Communications Adaptor in the following mode:

Port 1: configured for standard RS-232
COM1, Port Enabled, RS-232, IRQ4, Flow control used.
Port 2: configured for use with ITM-270
COM2, Port Enabled, RS-422/485, Driver ON, Flow control not used.

Item	Switch Settings							
	1	2	3	4	5	6	7	8
Port 1:	Off	Off	Off	Off	Off	Off	Off	On
Port 2:	Off	On	Off	Off	Off	Off	Off	On

E1 all in position "A"
E2 all in position "A"
E4 all in position "B"



3.6.2 Device Configuration - Port 1 & Port 2

This table shows the settings for Port 1 & Ports 2 which determine the I/O address of each serial port. The Port 1 switches determine the address of the Port 1 connector and the Port 2 switches determine the address of the Port 2 connector.

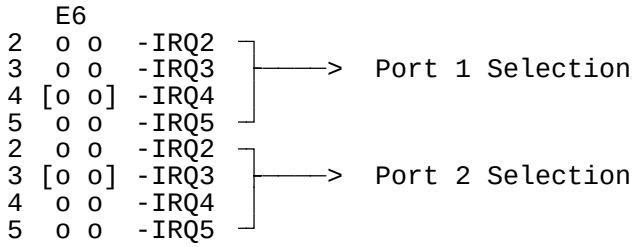
Device	Switch Settings							
	1	2	3	4	5	6	7	Address
COM1:	Off	Off	Off	Off	Off	Off	Off	3F8-3FF
COM2:	Off	On	Off	Off	Off	Off	Off	2F8-2FF
COM3:	Off	Off	Off	Off	Off	On	Off	3E8-3EF
COM4:	Off	On	Off	Off	Off	On	Off	2E8-2EF

3.6.3 Port Enable/Disable - Switches Port 1 & Port 2 position 8

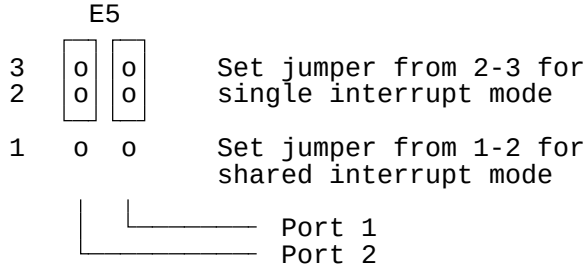
Port 1 can be disabled by turning position 8 of Port 1 Off. Port 2 can be disabled by turning position 8 of Port 2 Off. When a port is disabled, it's IRQ jumper should also be removed (see the next section). The factory default is On.

3.6.4 Interrupt Request

The interrupt request (IRQ) is configured at jumper block E6. The upper half selects the IRQ for Port 1 and the lower half selects the IRQ for Port 2. The number to the left of the block (2 or 3 or 4 or 5) indicates the IRQ level selected.



Jumper E5 selects the (normal) single interrupt per port mode or the multi interrupt mode, which allows you to share the interrupt on the ports. The multi interrupt mode also allows you to share the IRQ signals.



3.6.5 Driver Enable

When using an RS-422/485 port as "master only", as with ITM-270 Industrial Numeric Keyboards and/of AND Alphanumeric Displays, the RS-485 driver should always be enabled. This is the default with jumper blocks E1 and E3 position 7 set to "A". (For detail see previous section.)

If a port is to be used for rotating master RS-485 communications, the driver disable signal can be connected to the RTS signal from the appropriate port by moving the jumper to position "B".

3.6.6 RS-232 and RS-422/485 Configuration

Each port can be independently configured for RS-232 or RS-422/485. This configuration is done using jumper blocks E1, E2, E3 and E4. The table below shows the two settings for each port.

Port	Interface	Jumper Position
Port 1	RS-232	E2 "A" E1 "A"
	RS422/485	E2 "B" E1 "B"
Port 2	RS-232	E4 "A" E3 "A"
	RS422/485	E4 "B" E3 "B"

Note that on jumper blocks E2 and E4 you must move all eight push-on jumpers. This is required to fully isolate the RS-232 and RS-422/485 signals. However, on jumper blocks E1 and E3 there are some options as described below.

If the serial port is configured for RS-232 mode:

You are given the option of using the modem control signals or forcing them to their RS-232 TRUE levels.

E1 or E3	A B	
1	[o o]o - RD	"A" selects RS-232 Receive Data.
2	[o o]o - CTS	"A" uses CTS. Remove to set TRUE (low).
3	[o o]o - DSR	"A" uses DSR. "B" sets if TRUE (low)
4	[o o]o - DCD	"A" uses DCD. "B" sets if TRUE (low)
5	[o o]o - RI	"A" uses RI. "B" sets if TRUE (high)
6	[o o]o - CTS	"A" uses CTS. "B" sets if TRUE (low)
7	[o o]o	"A" for RS-232. "B" for RS-422/485
8	[o o]o	"A" for RS-232. "B" for RS-422/485

If the serial port is configured for RS-422/485 mode:

You are given the option of using the modem control signals or forcing them to their RS-232 TRUE levels.

E1 or E3	A B	
1	o[o o] - RD	"B" selects RS-422/485 Receive Data.
2	o o[o]- CTS	"B" uses CTS. Remove to set TRUE (low).
3	o[o o] - DSR	"B" for 422/485. Not used-is set TRUE (low).
4	o[o o] - DCD	"B" for 422/485. Not used-is set TRUE (low).
5	o[o o] - RI	"B" for 422/485. Not used-is set TRUE (low).
6	o[o o] - CTS	"A" uses CTS. "B" sets if TRUE (low).
7	[o o]o	"A" enables driver always. "B" RTS enables driver.
8	[o o]o	"A" direct ground. "B" selects 100 ohm ground.

NOTE: If CTS signal is required, install jumper 2 in the "B" position and 6 in the "A" position. If CTS is to be ignored, remove jumper 2 and install jumper 6 in the "B" position.

3.6.7 DB-9 Pin Description

RS-232 Signal	Pin	RS-422/485 Signal	Pin
RxD	2	RxD+	1
TxD	3	RxD-	2
GND	5	TxD-	3
RTS	7	TxD+	4
CTS	8	GND	5
DCD	1	RTS+	6
DSR	6	RTS-	7
DTR	4	CTS-	8
RI	9	CTS+	9

3.6.8 Use with the ITM-270s and/or AND-Series Alphanumeric Displays

ITM-270 Industrial Numeric Keypad and Displays receive their power through a 2-pin power connector. They can be powered by the +5 VDC power supply available at TB-6. The power cable is documented in **Appendix F-5**.

The serial adapter must be configured for RS-422/485, and can be cabled to the ITM-270 or AND-Series Display using one of the following options:

- a modular cable and adapters - **Appendixes F-3**, **F-4** & **F-9**,
- a dedicated non-modular cable - **Appendix F-8**
- cables (and/or terminal blocks) allowing terminal block bussing of multi-dropped devices - **Appendixes F-10**, **F-11**, **F-12**, & **F-13**.

3.7 GN3-422 Serial Communications Adapter (Old Version)

This section is ONLY for GN3-422 Serial Communications Adapter version A.

The GN3-422 serial communications adapter is a half length card which has two serial ports that can be configured as RS-232 or RS422/485. There is a DB-9 serial connector for each port. Model 20/40 motion controllers support only one dual-port Serial Communications Interface at a time.

3.7.1 Device Configuration - Switches S1 & S2

Each port can be configured as COM1 or COM2. Switch S1 is used to configure port 1 and switch S2 is used to configure port 2. The following table shows the switch settings for each device:

Device	Switch Settings							Address
	1	2	3	4	5	6	7	
COM1:	Off	Off	Off	Off	Off	Off	Off	3F8-3FF
COM2:	Off	On	Off	Off	Off	Off	Off	2F8-2FF

3.7.2 Port Enable/Disable - Switches S1 & S2, Pin 8

Port 1 can be disabled by turning position 8 of S1 Off. Port 2 can be disabled by turning position 8 of S2 Off. When a port is disabled, it's IRQ jumper should also be removed (see the next section).

3.7.3 Interrupt Request

The interrupt request (IRQ) is configured at jumper block E1 for port 1 and E2 for port 2. The following table shows the jumper setting for **each** IRQ:

IRQ	Jumpers	Location	Comments
IRQ4	5 to 6	4	COM1: (Default for Port 1)
IRQ3	3 to 4	3	COM2: (Default for Port 2)

3.7.4 Driver Enable

When using an RS-422/485 port as "master only", as with ITM-270 Industrial Numeric Keyboards and/or AND Alphanumeric Displays, the RS-485 driver should always be enabled. This is the default with NO jumper on E3 for port 1 or E4 for port 2.

If a port is to be used for rotating master RS-485 communications, the driver disable signal can be connected to the RTS signal from the appropriate communications port by installing the respective jumper.

3.7.5 RS-232 and RS-422/485 Configuration

Each port can be independently configured for RS-232 or RS422/485. This configuration requires the installation and removal of driver chips and/or the floating of pins on these chips.

Port 1 = RS-232 : Port 2 = RS-232
If both ports are to be configured as RS-232, install the 1488 driver chip in the socket at U13 and remove the 75174 driver chip from the socket at U5.

Port 1 = RS-422/485 : Port 2 = RS-422/485
If both ports are to be configured as RS-422/485, install the 75174 driver chip in the socket at U5 and remove the 1488 driver chip from the socket at U13.

Port 1 = RS-232 : Port 2 = RS-422/485 (DEFAULT)
If port 1 is to be configured as RS-232 and port 2 as RS-422/485, both chips must be installed, but with certain pins floating. The 1488 driver chip should be installed in the socket at U13 with pins 3 and 6 floating. The 75174 driver chip should be installed in the socket at U5 with pins 2,3,5 and 6 floating.

Port 1 = RS-422/485 : Port 2 = RS-232

If port 1 is to be configured as RS-422/485 and port 2 as RS-232, both chips must be installed, but with certain pins floating. The 1488 driver chip should be installed in the socket at U13 with pins 8 and 11 floating. The 75174 driver chip should be installed in the socket at U5 with pins 10,11,13 and 14 floating.

3.7.6 DB-9 Pin Description

RS-232	
Signal	Pin
RxD	2
TxD	3
GND	5
RTS	7
CTS	8

RS-422/485	
Signal	Pin
RxD+	1
RxD-	2
TxD-	3
TxD+	4
GND	5
RTS+	6
RTS-	7
CTS-	8
CTS+	9

3.7.7 Use with the ITM-270s and/or AND-Series Alphanumeric Displays

ITM-270 Industrial Numeric Keypad and Displays receive their power through a 2-pin power connector. They can be powered by the +5 VDC power supply available at TB-6. The power cable is documented in **Appendix F-5**.

The serial adapter must be configured for RS-422/485, and can be cabled to the ITM-270 or AND-Series Display using one of the following options:

- a modular cable and adapters - **Appendixes F-3**, **F-4** & **F-9**,
- a dedicated non-modular cable - **Appendix F-8**
- cables (and/or terminal blocks) allowing terminal block bussing of multi-dropped devices - **Appendixes F-10**, **F-11**, **F-12**, & **F-13**.

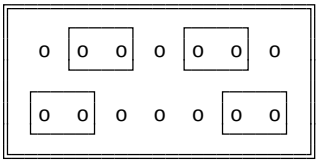
3.8 GN3-232 Serial Communications Adapter

The GN3-232 serial communications adapter is a half length card which has one integral and one auxiliary RS-232 serial port. An integral DB-25 serial connector is provided for the main (*COM1:*) port. The auxiliary (*COM2:*) port is interfaced through a ribbon cable to a remote DB-25 connector. The mounting bracket provided requires a spare slot in the Model 20/40 motion controller. Model 20/40 motion controllers support only one dual-port Serial Communications Interface at a time.

3.8.1 Device Configuration - Header JP1

This communications card is configured using header JP1 as follows:

COM1: address $3F8_H$ with IRQ4 (Integral connector)
COM2: address $2F8_H$ with IRQ3 (Remote connector cabled to *ASYN2*)



3.8.2 Connector Pin Assignments

Both connectors have the same pin assignments which are shown below.

Pin #	Description
2	Transmit Data
3	Receive Data
4	Request to Send
5	Clear to Send
6	Data Set Ready
7	Ground
8	Carrier Detect
20	Data Terminal Ready
22	Ring Indicator

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Chapter 4
Operation

4.1 Powerup

Generation III motion controllers are user-programmable devices and operation is dependent on the MotionBASIC® program loaded in battery-backed program memory.

Whenever AC power is applied to the unit, or the *Red RESET Pushbutton* on the front of the unit is depressed the motion controller goes through the following powerup sequence.

1) **If the *Black PB1 Pushbutton* on the front of the unit is held in:**
   a) The controller checks for the presence of a *Memory Disk*, and for a file in its root directory named *PB1LOAD.BAS*. If found, this file will be loaded into the battery-backed program memory. The *Green User 1 Status LED* on the front of the unit will flash while the program is loading.
   b) All MotionBASIC® program execution will be inhibited[2] (even if there is a statement at line 0 of the MotionBASIC® program in memory).
2) **If the *Black PB1 Pushbutton* on the front of the unit is not held in:**
   a) The controller checks for the presence of a *Memory Disk*, and for a file in its root directory named *AUTOLOAD.BAS*. If found, this file will be loaded into the battery-backed program memory.
   b) The MotionBASIC® program in memory is then checked for the presence of a statement at *line 0*.
      - If a statement is found, MotionBASIC® program execution will be automatically initiated at line 0.
      - If not, MotionBASIC® operation is inhibited.

---

[2] **Load and start up a new program from Memory Disk as follows:**
1) Power down the unit and insert a Memory Disk that has a *PB1LOAD.BAS* program in the root directory.
2) Turn on power while holding *the Black PB1 Pushbutton* depressed. Wait until the *Green User 1 Status LED* stops flashing, indicating that the program is fully loaded.
3) Turn off the power and remove the Memory Disk.

When power is restored (without *PB1* depressed) the new MotionBASIC® program will start up and run (as long as it has a statement in line 0.) If power is restored with *PB1* depressed, but with no Memory Disk installed, program operation will **always** be inhibited.

It is important to note that:

- MotionBASIC® maintains all current values for program variables, with the exception of string variables, through powerdown and powerup cycles. This allows user programs to easily preserve operator and machine adjustments. However, when a new program is loaded from disk, all variables will have initial values of zero until initialized by the program itself.
- Therefore, programs which "auto-start" because of the presence of a statement at line 0 will always start up with all the variable values the same as they were when it powered down.
- When the program is automatically loaded from the *Memory Disk* at each powerup using the *AUTOLOAD.BAS* capability, initialization of values for MotionBASIC® variables is the responsibility of the programmer.

Program development is done with ORMEC's MotionPRO™ *Motion Program Development Software* which operates on an IBM-PC or compatible.

4.2 System Status LEDs

Twenty system status LEDs (2 - 10 segment LEDs) are provided on the front of the Model 20/40 to aid in system debug and status monitoring. Refer to the table which follows for a list of the LEDs and what they indicate. For further information regarding the System Status LEDs refer to the **MotionBASIC® Hypertext Software Manual**.

Name	Color	Description
Memory Fault	Flashing Red	Indicates a **Battery Failure** when the Power Fault LED is lit. - or - Indicates a **RAM Checksum Error** or **String Space Corrupted** when the Power Fault LED is not lit.
Program Error	Red	Indicates that MotionBASIC® has issued a program error code which was not trapped by an error handler in the user program. Program operation has been aborted and the unit is operating in direct mode.
Power Fault	Orange	Indicates a **Battery Failure** when the System Watchdog OK LEDs is flashing. - or - Indicates a **Temporary Power Loss** when the Memory Fault and System Watchdog OK LEDs are not flashing.
Servo Fault	Orange	Indicates either an **Axis Module Failure** or **Axis Fault** as indicated by the MotionBASIC® FAULT@ variable.
User 1 User 2	Green Green	Provided for user program status indication. These LEDs are controlled by the value of the MotionBASIC® USER1.LED@ and USER2.LED@ variables. The User 1 LED also flashes during a powerup program download from a Memory Disk.

OK to Transmit	Orange	Indicates that the serial programming port "handshake" signal is properly configured to allow the Model 20/40 to transmit data to the IBM-PC or compatible running MotionPRO. **This LED will not be lit if the serial cable is disconnected.**
Ready to Receive	Orange	Indicates that the serial programming port "handshake" signal is properly configured to allow the IBM-PC or compatible running MotionPRO to transmit data to the Model 20/40.
Sending Serial	Red	Indicates that the Model 20/40 is transmitting data through the serial programming port to the IBM-PC or compatible running MotionPRO.
Receiving Serial	Red	Indicates that the Model 20/40 is receiving data through the serial programming port from the IBM-PC or compatible running MotionPRO.
MotionNET Alarm In	Red	Unused by Model 20/40 controllers using MotionBASIC®
MotionNET Alarm Out	Red	version 2.1a and later. Previous versions of MotionBASIC® used these LEDs to indicate that the MotionNET serial port (SRL2) was enabled when both LEDs were lit.
Sending MotionDATA	Orange	Indicates that the Model 20/40 is transmitting MotionDATA.
Receiving MotionDATA	Orange	Indicates that the Model 20/40 is receiving MotionDATA.
MotionDATA Active	Green	Indicates that the Model 20/40 MotionDATA port is enabled and the controller is receiving data on it's MotionDATA clock line input.
System Watchdog OK	Green	During normal operation this LED will flash approximately once per second. If this LED is not flashing it indicates that a **Watchdog Timeout** or **Temporary Power Loss** has occurred, the No Fault Relay and all local DIO outputs will be disabled.
Loss of Feedback	Orange	Indicates that an "open wire" condition exists in one of the encoder quadrature channels, or one of the feedback signals is out of specification.
MotionNET Talker	Orange	Unused
Sending MotionNET	Red	Indicates that the Model 20/40 is transmitting serial data through the MotionNET port (SRL2).
Receiving MotionNET	Red	Indicates that the Model 20/40 is receiving serial data through the MotionNET port (SRL2).

4.3 Initial Configuration

All Generation III motion control systems are configured, tested and receive a final system level burn-in at ORMEC as a complete system. As part of that procedure, a MotionBASIC® program named SETUP.BAS is installed in the non-volatile MotionBASIC® program memory.

In addition, if a "lot system test" has been provided, the technical parameters for the motors purchased with the system are selected using MotionPRO™ and the selection is loaded into the MP.CONFIG routine of the unit. This program, along with the associated documentation about the system configuration which we send to you, is designed to facilitate setting up your motion control system and checking it out for the first time.

Chapter 5
Getting Started

5.1 Test Run Preparation

For the test run, you need to configure your system according to the Installation Chapter and with appropriate System Wiring Diagram in **Appendix B**.

DO NOT connect the motor shafts to the driven machine until after the test run is complete! Before the test run, do the following checks of the servomotor and motion controller and their installation. Correct any problems before proceeding.

5.1.1 Motion Controller Checks

1) Power fused properly and system power wiring and grounding correct. *See Section 3.1.4 and **Appendix B** of this manual, as well as the Servodrive Manual.*
2) Axis Interface Cables **must be** installed the same as they were at the factory. Servodrives and motors must be connected in the same order because the servo loop configuration parameters are stored in the MP.CONFIG routine of the unit by *Axis-Number*. *See **Appendix B**, **Section 3.3**, and **Section 4.2**.*
3) Encoder Cables installed. *See **Appendix B**.*
4) Motor wiring and grounding correct. *See **Appendix B** and the Servodrive Manual.*
5) Check for compatible voltage ratings on all servodrives deriving control power from terminals **r** & **t**.
6) All wiring leads firmly connected to terminals.
7) IBM-PC or compatible with MotionPRO™ attached to the *Serial Port*.
8) Incoming voltage: **CHECK THE LABEL ON THE TOP OF THE UNIT!**
   a) *For 230 VAC motion controllers, the power supplied to it should have its voltage between 208 and 230 VAC nominal, **with a minimum of 190 VAC and an absolute maximum of 253 VAC.***
   b) *For 115 VAC models, the power supplied to it should have its voltage between 110 and 120 VAC nominal, **with a minimum of 95 VAC and an absolute maximum of 127 VAC.***

CHECK POWER BEFORE APPLYING IT TO THE MOTION CONTROLLER!

5.1.2 Servomotor Checks

1) Motor mounting proper **and shaft not connected to load**.
2) Mounting bolts and nuts tight.
3) Motor rotates freely by hand.
4) For motors with oil seals, (standard on the C-Series) the seals should be in good condition and properly lubricated.
5) Keyway removed, or taped down, for the test.
6) Motor and Encoder Cables properly attached.

5.1.3 Apply Control Power

1) After checking items above, apply control power (L1 and L2 and the switch on the top of the unit).
2) The green watchdog timer light should flash at a rate of approximately once per second. The system is now up and operating.

5.2 MotionPRO™ Servo Development Software

Once you have applied power to your system, you should run MotionPRO™ to communicate with it. Consult the MotionPRO™ manual for installation, startup and communications details.

5.3 Test Running Your System

Once communications is established between the IBM-PC and the unit, type RUN and press the Enter key to run the SETUP program installed in the unit at the factory.

The SETUP program is menu-driven and will allow you to:
1) Home, Index and Run all the motors;
2) Configure, observe and manipulate the Integral and Extended I/O; and
3) Interactively adjust servo loop configuration after the motors are connected to their respective loads if required.

After setting up your system, you may save the system's loop and I/O configuration, using the *Gen-III Configuration* Menu in MotionPRO™.

When the system is configured for your application, you should proceed to develop your application software. MotionPRO™ includes a number of application software development tools called MotionBASIC® Tools. These programs and documentation are designed to make applications program development much easier by providing working program modules for accomplishing functions to most motion control applications, such as an Error Handler and an I/O Menu. The Generation III training class provides instruction in the use of these tools.

Chapter 6
Product History

6.1 Model 20/40 (GN3-20 & GN3-40) History

A. ***Version 1.0*** - May, 1990 (Generation III introduction)

B. ***Version 1.1*** - November, 1990
   1. Added 14.31818 Mhz oscillator on the expansion bus for Data Highway compatibility.
   2. Improved CPU noise immunity.
   3. ***Compatibility:***
      a. MotionBASIC 1.1 required; it supported noise immunity enhancements.
      b. MotionBASIC 1.0 would not operate with Version 1.0 units.

C. ***Version 1.2*** - March, 1992
   1. Changed termination method on the EIO connector to be a pullup only.
   2. ***Compatibility***:
      a. MotionBASIC 1.1 or later required.
      b. MotionBASIC 1.1e is the last version which supports this CPU board . (The GN3-40 CPU board changes to version 2.0.)

D. ***Version 2.0*** - March, 1992
   1. Introduced the GN3-20.
   2. Added support for two industry standard PCMCIA memory cards.
   3. Added battery for absolute encoder support.
   4. Made it easier to reconfigure the unit for different line voltages.
   5. Improved the style of battery used for battery backup of the SRAM. (A replacement for this style is P/N GN3-BAT.)
   6. ***Compatibility***:
      a. MotionBASIC 2.0 or later required; it provided access to the PCMCIA interface and supported other board changes.
      b. MotionBASIC 1.2e provided for software compatibility with Version 2.0 hardware, without the ability to use the latest enhancements.

E. ***Version 2.1*** - March, 1993
   1. Shortened the length of the locking latches on the EIO connector to be compatible with Opto-22 PAMUX boards.

2. Added AC input transient protection to better protect the Motion Controller.
3. ***Compatibility***:
   a. No MotionBASIC changes required.
   b. When used with older versions of the CBL-EIO and CBL-DIO it is necessary to remove the strain relief on the cable.
   c. This will affect Hi-Pot testing. Contact ORMEC for additional information.

F. ***Version 2.2*** - March, 1994
1. Changes made to subassemblies for U.L. Recognized Components Program compliance.
2. Compatibility:
   a. No MotionBASIC changes required.

6.2 DSP Axis Module (GN3-AQ & GN3-A2) History

A. ***Version 1.0*** - May, 1990 (Generation III Introduction)

B. ***Version 1.1*** - January, 1991
1. Added optional 12-bit analog inputs.
2. Added hardware overtravel limits.
3. Changed DSP-IO header from 26 to 34 pins.
4. ***Compatibility***:
   a. MotionBASIC 1.1 required; it provided access to the optional analog inputs.
   b. MotionBASIC 1.1 maintained compatibility with Version 1.0 DSP Axis Modules.

C. ***Version 2.0*** - March, 1992
1. Increased program memory from 16K to 64K bytes.
2. Polarized the DSP I/O Header connector by elimination of unused pin 28.
3. ***Compatibility***:
   a. MotionBASIC 2.1a required upgrade of old DSPs to the level because of it's reliance on the additional program memory for new features.
   b. Version 2.0 DSP Axis Module hardware is fully compatible with MotionBASIC 1.1a and later.

D. ***Version 2.1*** - July, 1992
1. Added hardware sensor gating capability based on electronic limit switches.
   a. A-Sensor can be gated with ELS1@ of the axis using it.
   b. B-Sensor can be gated with ELS2@ of the opposite axis.
2. ***Compatibility***:
   a. MotionBASIC 2.1d or later is required only for access to the hardware gating capability using the enhanced, but backwardly compatible, SENS.MODE@ variable.
   b. Version 2.1 DSP Axis Module hardware is fully compatible with MotionBASIC 1.1a and later.

E. ***Version 3.0*** - October, 1992
   1. High Speed Sensor Interface: The sensor input circuitry has been improved to more easily accommodate standard single-ended sensors and provide higher noise immunity:
      a. Sensor operating voltages up to +24 VDC nominal (+27 VDC max).
      b. The nominal switching threshold is set at 50% of the operating voltage (V+SEN).
      c. Jumper configuration provides three levels of pullup current with NPN-type sensors or allows use of PNP-type sensors by moving a jumper to one of four locations.
         1) NPN-type sensors with 2.5K, 4.4K or 20K ohms pullup resistance. At 24 VDC this corresponds to approximately 9.1, 5.2 and 1.1 mA of input current.
         2) PNP-type sensors with 15K input impedance and no pullup.
   2. Hardware Travel Limits: By removing a jumper, any axis's overtravel limit inputs can be isolated from the servodrive interface voltages (V+ and V-) which are +12 VDC for our standard servodrives. (Most typically allowing +24 VDC operation.)
      a. Input voltage & current ratings: 5-24 VDC at 7 mA max
      b. Minimum operating voltage & current: 4.5 VDC & 0.7 mA
   3. Electronic Limit Switches: By moving a jumper, these outputs can be configured for up to +24 VDC operation (instead of the standard +5 VDC).
   4. DSP I/O Header: Changed to 4-wall polarized header and now uses pin 28.
   5. Servodrive Interface: Added the following flexibility to allow more convenient interfacing for certain non-standard servodrives.
      a. T-ENABLE' is now jumper configurable to source instead of sink current.
      b. NO ALARM' is now jumper configurable as an active high input (instead of our standard active low) while maintaining our failsafe input current requirement.
      c. Reduced interlock current requirements by changing from 1.8K to 4.7K ohms.
   6. ***Compatibility***:
      a. When not using the DSP I/O Header, Version 3.0 hardware (with the default jumpers) is fully compatible with old DSP Axis Modules from version 1.1 to 2.1.
      b. When using the DSP I/O Header, rewire the A & B sensors as appropriate and add two jumpers (25-27, 26-28) for the default Hardware Overtravel Limit power.
      c. Version 3.0 DSP hardware is fully compatible with MotionBASIC 1.1a and later.

Chapter 7
Specifications

7.1 General Specifications

CPU Type 80C186 Speed 12 MHZ

MotionBASIC® Program Memory
- 60300 bytes battery backed RAM for program and variable storage[3]
- up to 20k bytes battery backed RAM for additional comment storage[4]
- 10 yr typical battery life at 25C. Higher temperatures reduce battery life.

Memory Disks

SRAM	512K to 2M bytes
Flash PROM	512K to 4M bytes

7.2 Power Specifications

7.2.1 Power Requirements

Motion Controller (L1 to L2)	95 to 127 VAC or 190 to 253 VAC, depending on model selected 175 watts maximum
E-Series Drives Control Power	95 to 127 VAC or 190 to 253 VAC, depending on model selected, 30 watts maximum Note that feedback encoders derive power from servodrives which require no DC power from the motion controller.

[3] The 60300 bytes is used to store programs and to meet the dynamic memory needs of MotionBASIC® for variables and control memory.

[4] Up to 20k bytes of comment memory is used to store program comments transparent to the user. Once filled, additional comments are stored within the 60300 byte program storage memory. The amount of comment memory may be reduced by the use of a MotionCARD™.

S-Series Drives Control Power	190 to 253 VAC, 60 watts maximum *Note that feedback encoders derive power from servodrives which require no DC power from the motion controller.*
DSP Axis Module	
	5 VDC @ 1A, +12 VDC @ 75 mA, -12 VDC @ 75 mA, 6.8 W Total
Lineshaft Pacer Encoders	
EDR-25S/Annnn	5 VDC @ 245 mA maximum, 1.23 W Total
EDR-25S/Bnnnn	5 VDC @ 450 mA maximum, 2.25 W Total
EDR-25S/Dnnnn	5 VDC @ 450 mA maximum, 2.25 W Total
EDR-25S/Ennnn	5 VDC @ 450 mA maximum, 2.25 W Total
Numeric Keypad	
ITM-270	5 VDC @ 350 mA maximum, 1.75 W Total
Alphanumeric Displays	
AND-202/5	5 VDC @ 375 mA maximum, 1.88 W Total
AND-204/5	5 VDC @ 560 mA maximum, 2.80 W Total
AND-206/5	5 VDC @ 1.1 A maximum, 5.5 W Total
Video Display Adapter	
GN3-VDA	5 VDC @ 1 A, 5 W Total
DC Input Module	
IDC-5	24 VDC @ 20 mA maximum, 0.48 W Total

7.2.2 Outgoing Power

AC Power	
TB1, r & t	VAC out matches VAC in at L1 & L2 3 A RMS maximum[5]
DC Power	
+24 VDC to (return)	24 VDC ± 9%, fully isolated
TB6-2,7 to (TB6-5,6)	2 A maximum
+5 VDC	5 VDC ± 5%
TB6-11	1.1 A maximum
DSP Axis Module, J10-24	500 mA maximum
DSP Axis Module, J11-13	500 mA maximum
DSP Axis Module, J12-13	500 mA maximum
backplane slot	1.5 A maximum each slot
± 12 VDC	± 12 VDC ± 7%
DIO	500 mA maximum, each voltage
backplane slot	200 mA maximum each slot each voltage

[5] Model 20/40 motion controllers are designed to handle the in-rush currents associated with up to eight SAC-S or SAC-E series drives.

Note: The above specifications show the per pin maximums. The additional aggregate limits below must also be met at a maximum of 50C. Derate all values linearly to 87.5% for operation between 50C and 55C.

Total +24 VDC	2.0 A maximum
Total + 5 VDC	6.0 A maximum
Total +12 VDC	1.0 A maximum
Total -12 VDC	1.0 A maximum
Total DC power	65 W maximum

The above values are the total current and power available for DSPs, backplane cards and external needs.

Example:
A system with 2 DSPs, one EDR-25S/A pacer encoder, and eight IDC-5 DC Input Modules using 24 VDC provided at TB6. To analyze power requirements, first ascertain that each voltage/current requirement is within specifications. Then ascertain that the total wattage requirements are within specification.

Calculate +5 VDC usage:

Two DSP Axis Modules	2 * 1 A	= 2 A
One EDR-25S/A	0.245 A	= 0.245 A
	Total	= 2.245 A

This is less than the available 6.0 A of +5 VDC and so is acceptable. It is also less than 87.5% of 6.0 A (5.25 A), allowing system operation at 55C.

Calculate +24 VDC usage:

Eight IDC-5 Input Modules	8 * 20 mA	= 0.16 A

This is less than the available 2.0 A of +24 VDC and so is acceptable. It is also less than 87.5% of 2.0 A (1.75 A), allowing system operation at 55C.

Calculate the total power usage:

Two DSP Axis Modules	2 * 6.8 W	= 14 W
EDR-25S/A	1.23 W	= 1.23 W
Eight IDC-5 Input Modules	8 * 0.48 W	= 3.84 W
	Total	= 18.07 W

This is less than the available 65 W and so is acceptable. It is also less than 87.5% of 65 W (56.9W), allowing system operation at 55C.

7.2 Battery Specifications

The specifications below apply to the Lithium battery used to back up MotionBASIC® program memory and the optional absolute encoders.

Shelf Life:	10	years
Capacity:	1.2	amp hours
Output voltage:	3.0 to 3.1	vdc when new
	2.75	vdc with 10% life left
	2.5	vdc with 1% life left

7.3 Interface Specifications

7.3.1 Serial Port - J2

Appendix C-7

Connector	RJ11 Modular Jack		
Standards	EIA RS-232C	data bits	8
		stop bits	1
		parity	none
Baud Rates	38400, 19200, 9600, 4800, 2400 Unit will autobaud to one of the above baud rates upon receipt of two "carriage return" characters after "powerup" or "reset". See the MotionBASIC® manual for details.		

7.3.2 MotionDATA™ Interface J4 & J5

Appendix C-8

Connector	RJ45 Modular Jack
Standards	EIA RS-422/485

7.3.3 MotionNET™ Interface J6 & J7

Appendix C-7

Connector	RJ45		
Standards	EIA RS-422/485		
	When used as SRL2:	data bits	8
		stop bits	1
		parity	none
Baud Rate	9600		

7.3.4 DSP I/O Header - J10

Appendix D

Connector 34 pin header

- **V+SEN, V-SEN** (pins 1, 2) — Sensor Power & Return — Appendix D-1, D-3

  Externally supplied voltage for driving Sensor or ELS interface.

  max voltage from pin 1 to 2 ± 27 VDC maximum

- **ASEN, BSEN** (pins 3, 4) — Digital Inputs — Appendix D-1, D-3

  max voltage any input V+SEN
  minimum acceptance time 1 micro-second

  turn-on voltage

ASEN or BSEN	Receiver Output
V_{IN} > 0.47*(V+SEN) + 0.75 v	H
V_{IN} < 0.47*(V+SEN) - 0.75 v	L

- **ELS1', ELS2', ELS3'** (pins 5,6,7,8,9,10) — Digital Outputs — Appendix D-2, D-4

max sink current	33 mA
low level voltage	0.7 V maximum (I_c = 33 mA)
high level voltage	4.5 V typical with default jumper (V+SEN) - 0.5 volts typical when using V+SEN
absolute maximum	30 VDC

- **AIN1** (Optional) (pins 11, 12) — Analog Input — Appendix D-1, D-3

Input range	± 10 VDC
Max input	± 15 VDC maximum
passive filter	1 kHz cutoff typical

• **ENCZ, ENCZ'** Digital Inputs
(pins 17,18,21,22) Appendix D-1, D-3

common mode input voltage	-12 V to 12 V maximum
absolute max input voltage	± 25 V
minimum acceptance time	1 micro-second

Differential turn on voltage

Differential inputs

ENCZ-ENCZ'	Receiver Output
V_{ID} > 0.2 v	H
-0.2 < V_{ID} < 0.2 v	?
V_{ID} < -0.2v	L

• **V+, V-** Servodrive Interlock Power Supply
(pins 25,26,33,34) Appendix D-1 through D-4

Externally supplied voltage for driving opto-coupled servodrive interface.

voltage from V+ to V-	27 VDC maximum 4.5 VDC min for operation 0 VDC minimum

• **V+HTL** Hardware Travel Limit Power Supply
(pins 27,28) Appendix D-1, D-3

Externally supplied voltage for driving opto-coupled hardware overtravel limit interface.

voltage from V+HTL to HTL-FWD & HTL-REV	27 VDC maximum 4.5 VDC min for operation 0 VDC minimum

• **HTL-REV, HTL-FWD** Optically Coupled Digital Inputs
(pins 29,30,31,32) Appendix D-1, D-3

Must sink current from V+HTL to change opto-coupler output state.

Current to turn on	0.7 mA minimum 7.0 mA maximum
Voltage max.	5V + (V+HTL) maximum[6]

[6] The reverse breakdown voltage of the input diode is 5V. Therefore the input must not exceed the V+HTL input by more than 5 volts.

7.3.5 DSP Axis Interface Connector - J11 &J12

Appendix D

Connector 26 pin high density D-sub

- **ENCA, ENCA', ENCB, ENCB'** Differential Digital Inputs
  (pins 1,2,11,12) Appendix D-1, D-3

common mode input voltage	-15 V to 15 V maximum
absolute max input voltage	± 25 V
maximum frequency	275 kHz (before 4x quadrature decode)

Differential turn on voltage

Differential inputs

ENCA-ENCA' / ENCB-ENCB'	Receiver Output
V_{ID} > 0.7 v	H
-0.7 < V_{ID} < 0.7 v	?
V_{ID} < -0.7v	L

line termination	100 Ohm minimum, 180 typical, 300 maximum

- **DRV-CMD** Analog Output
  (pin 3) Appendix D-2, D-4

Voltage output range	± 10 VDC
Current output	5 mA maximum
Load Resistance	2K ohms minimum

- **V+, V-** Servodrive Interlock Power Supply
  (pins 5,22) Appendix D-1 through D-4

Externally supplied voltage for driving opto-coupled servodrive interface.

voltage from V+ to V-	30 VDC maximum 4.5 VDC minimum

- **ALM-RESET', T-ENABLE', T-ENABLE2'** Optically Coupled Digital Output
  (pins 6, 9, 15) Appendix D-2, D-4

Opto-couplers which sink current to V- when on.
T-ENABLE2' can be optionally jumpered to source current at pin 15.

max current	35 mA maximum
max voltage	35 v maximum
voltage when on (V_{sat})	.4 v maximum (I_c=2.5mA)
power dissipation	100 mW absolute maximum

• **AIN2** Analog Input
(pin 14) Appendix D-1, D-3

Input range	± 10 VDC
Max input	± 15 VDC maximum
passive filter	1 kHz cutoff typical

• **ENCZ, ENCZ'** Differential Digital Inputs
(pins 19,20) Appendix D-1, D-3

common mode input voltage	-12 V to 12 V
absolute max input voltage	± 25 V

Differential turn on voltage

Differential inputs

ENCZ-ENCZ'	Receiver Output
V_{ID} > 0.2 v	H
-0.2 < V_{ID} < 0.2 v	?
V_{ID} < -0.2v	L

• **NO ALARM', ALO3', ALO2', ALO1'** Optically Coupled Digital Inputs
(pins 23,24,25,26) Appendix D-2, D-4

Must sink current from V+ to change opto-coupler output state. Active-high failsafe NO-ALARM interlocks can be accommodated with an optional jumper which connects NOALM to pin 18.

Current to turn on	0.7 mA minimum 7.0 mA maximum
Input Voltage	5V + V+ maximum[7]

7.4 Mechanical and Environmental Specifications

Dimensions	20.5" H x 6.0"W x 10.5" D maximum
Weight	Motion Controller: 16.4 pounds, without I/O modules DSP Axis module: 12 ounces
Temperature ranges	
Operating	0C to 55C (32°F to 131°F)
Storage	-25C to 85C
Relative Humidity	0 to 90% non-condensing
Mounting & Air Flow	Mounting must be vertical; airflow must be unrestricted but no fans or special cooling are required.

[7] The reverse breakdown voltage of the input diode is 5V. Therefore the input must not exceed the V+ input by more than 5 volts.

Chapter 8
Terms & Mnemonics

There are a number of terms or "buzzwords" which are often used in the Motion Control Industry, some of which have very specific meanings in ORMEC's products and systems. This section attempts to define many of these terms used in this document which may be unfamiliar.

Axis - This term normally refers to one of the servomotors in the system, either by name or axis number from 1 to 32. It may also be used to refer to a *Pacer Encoder* in the system. Many ORMEC pre-defined variables in MotionBASIC® are defined for each axis in the system and are therefore indexed by axis number.

DSP - Digital Signal Processors are special purpose micro-controllers used in ORMEC Generation III motion controls to perform servomotor loop control. They are also used to interface *pacer encoders* to the motion control system.

DSP Axis Module - An IBM-PC/AT style printed circuit board which contains a DSP, shared dual-port memory, and two axis interface connectors. It is used to perform the digital control algorithms and interface servo axes in the system, or interface to a pacer encoder.

Electronic Gearing - A means of precisely coordinating the motion of a number of *servo axes* with a *pacer encoder* or a *pacer* servo axes.

Electronic Limit Switch (or ELS) - An output that can be programmed to turn ON and OFF automatically when the axis reaches preset positions. Each *axis* in a Generation III provides three of them.

Encoder - A digital position transducer used to determine the position of a motor, a rotating shaft on a machine, or a linear position associated with a machine. It has two *quadrature* channels (A & B) which determine incremental movements and a single *encoder reference* channel (Z) which defines a unique position within its travel. Most, but not all, position encoders internally utilize optical gratings and sensors.

Encoder Reference - A signal generated by the position *encoder* once per revolution which may be used to determine the encoder's overall angular or linear orientation. Also sometimes called an *encoder marker pulse*.

Follower - A servo axis which is controlling its motion as a function of MotionDATA™ generated by a *pacer* axis. Follower motions are generated with the GEAR statement in MotionBASIC®.

Home Position - A reference position for either a servo or an encoder *axis*.

Hardware Overtravel Limits - Optically isolated inputs to a *DSP Axis Module* which must be driven for a servo axis to operate.

Loop Update - *Servo Loops* in Generation III motion control systems are updated by the *DSP Axis Module* at rates of between 1,000 and 5,000 times per second. At each *Loop Update*, the DSP performs housekeeping operations such as updating the axis position and the electronic limit switches in addition to performing the real-time control algorithm for that servomotor.

Machine Sensor - Any of a number of types of ON-OFF sensors such as various proximity switches or mechanical switches mounted to a machine.

Memory Cards - Credit card sized memory modules which conform to the international PCMCIA standard and plug into Generation III motion controllers. They are used either as a *Memory Disks* or *MotionCARD™s*.

Memory Disk - When a *Memory Card* is plugged into the external card slot on the front of the motion controller, it provides a removable non-volatile memory disk drive.

- Flash PROM Memory Disks provide read/write memory that is inherently non-volatile and are available in sizes from 512K to 4M bytes. They have limitations with respect to dynamic data storage.
- SRAM Memory Disks provide read/write memory with internal lithium battery backup. Read/write speeds comparable to RAM drives provide ideal dynamic data storage including random access files. They are available in sizes from 512K to 2M bytes.

MMI-840 - The MMI-840 is a compact industrial terminal featuring an 8-line by 40-character backlit display and a 30-key keypad. The front panel is designed to NEMA-4 (washdown) specifications, and the large rubberized keys feature tactile feel. Three color-coded groups of keys are fully supported by MotionBASIC® to provide menu selection and editing as well as alphanumeric data entry. It operates on 24 VDC (provided by the motion controller) and is interfaced via RS-422 to either the MotionNET Port or a Serial Interface Adapter.

MotionBASIC® - The Generation III motion programming language which enhances industry standard BASIC with additional built-in statements and pre-defined variables specifically for motion control applications.

MotionCARD™ - *Memory Cards* which plug into the internal card slot of a Generation III motion controller and are programmed at ORMEC to extend the functionality of *MotionBASIC®*. Standard *MotionCARD™s* are currently

available to support Allen-Bradley and Modicon factory network communications.

MotionDATA™ - Generation III high speed motion information used to coordinate motion among multiple *axes* controlled by DSPs.

MotionPRO™ - Generation III development software with on-line help manual.

Pacer - A *servo* or *encoder axis* which transmits either its actual or commanded motion to other servo axes through the MotionDATA™ communication channel to another servo axis.

Pacer Encoder - Any optical incremental encoder or other device which generates *quadrature* signals which are to be used by other servo axes when they operate as *followers*.

Quadrature - Quadrature or "phase quadrature" signals are the most commonly used method of electronically determining or transmitting bidirectional position information. The two quadrature signals are digital square waves which have their cycles displaced 90 degrees (of the 360 electrical degrees in the repeated waveform). All four edges of the two digital signals are normally used for the maximum possible position resolution ("4x").

Registration Control - The act of maintaining a fixed position relationship between machine tooling and a product in the machine. Registration is normally measured by capturing the tooling position with respect to the product using a registration sensor of some type. It is controlled by phasing the tooling ahead or behind based on the difference between the actual and desired positional orientation.

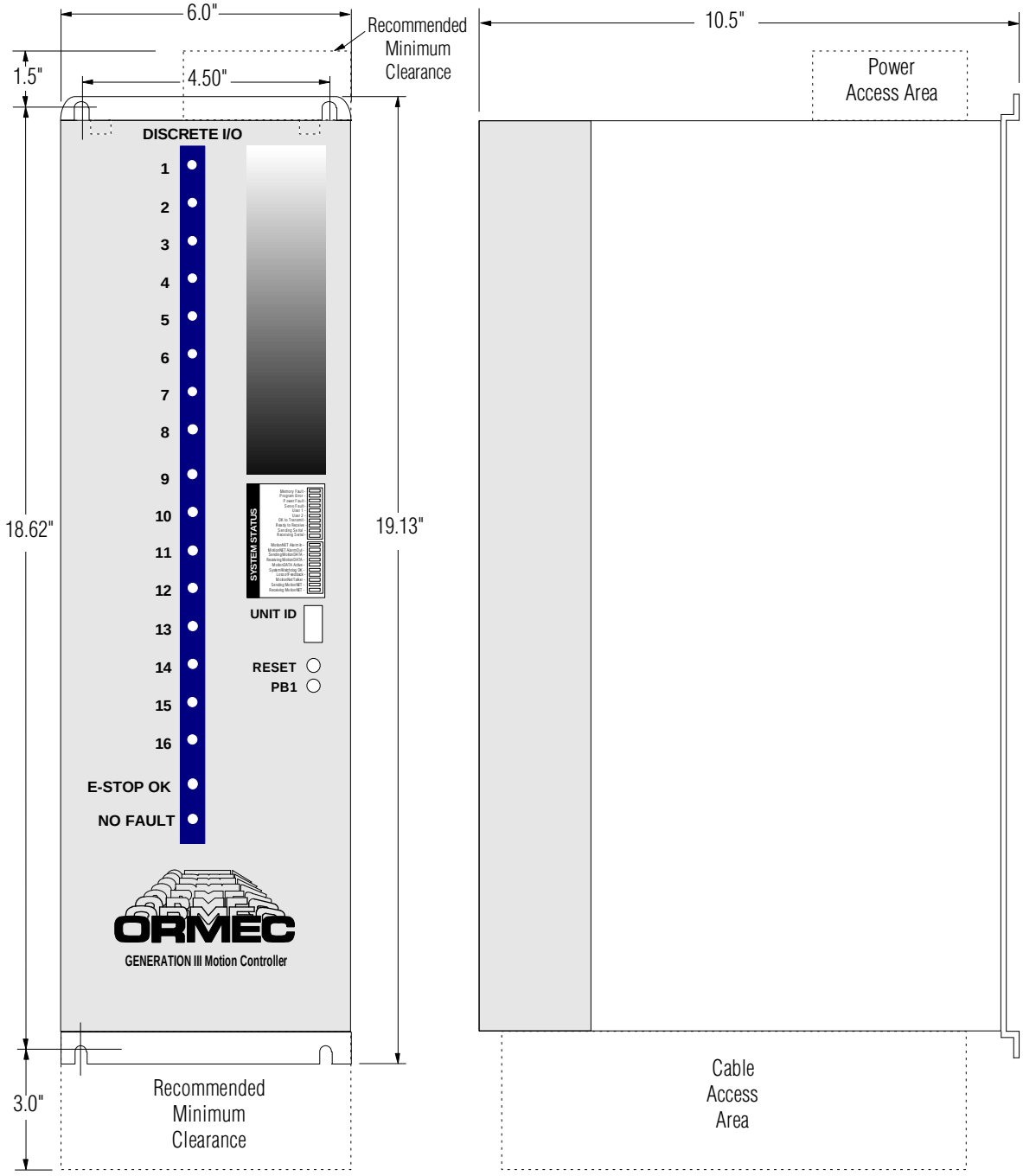
Resolver - A position transducer used to determine the position of a motor. Resolvers are rotary transformer devices with analog interfaces. However, in ORMEC motion control systems which use resolvers, the servodrive decodes the resolver position digitally and provides two *quadrature* channels (A & B) which determine incremental movement and a single *encoder reference* channel (Z) which defines a unique position within a motor revolution.

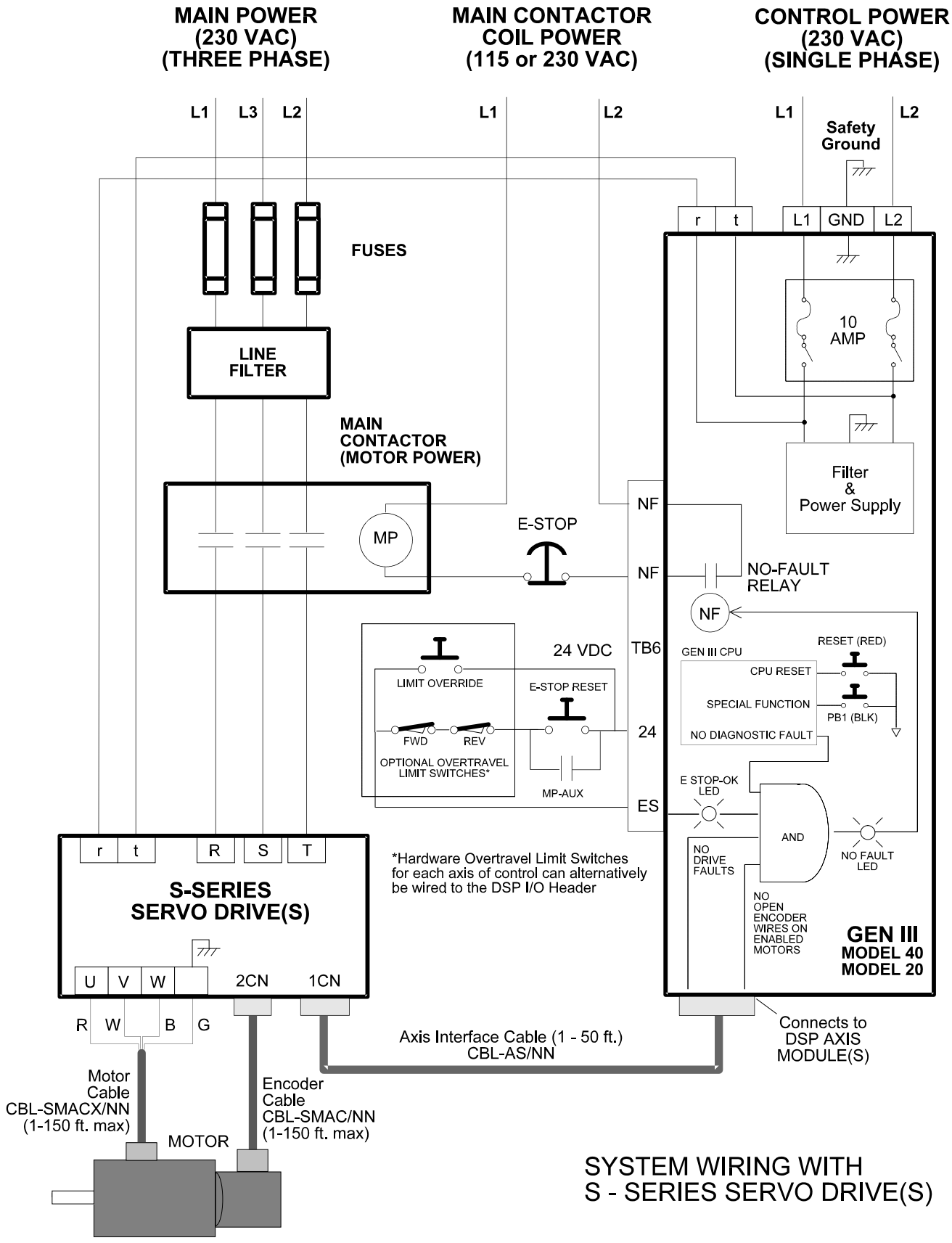
Servo (or Servomotor) - A special motor which is controlled positionally by comparing its measured position with its desired position. ORMEC's MAC Series servomotors are considered AC Brushless Servomotors (also sometimes called DC Brushless Servomotors) because of the permanent magnet rotors and the wound stators.

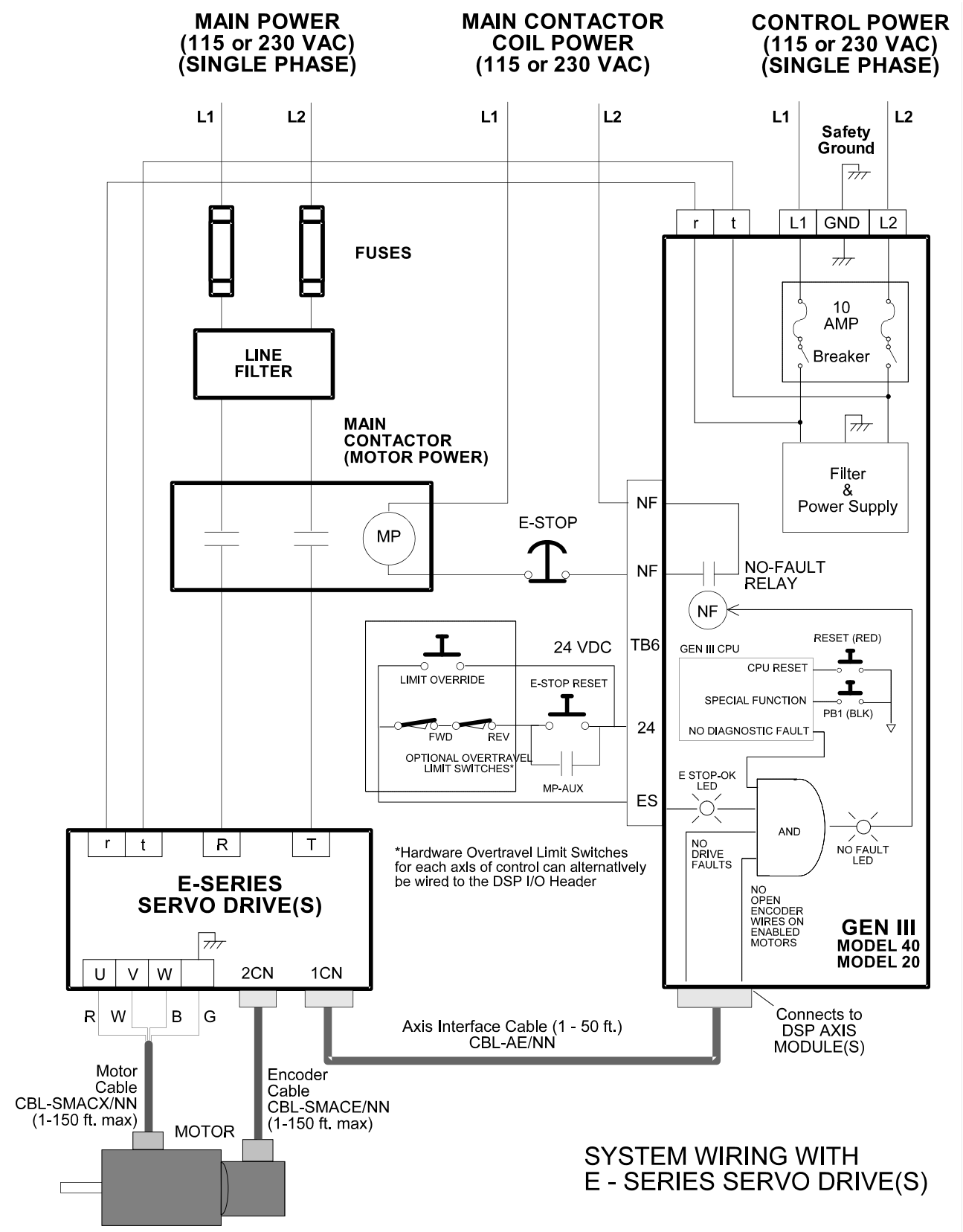
Servodrive - A power unit for amplifying a small-signal ($\pm$10 VDC) drive command to the power necessary to control a servomotor. ORMEC's SAC Series servodrives are matched with the MAC Series servomotors to provide fully integrated control as well as extensive fault diagnostic capabilities.

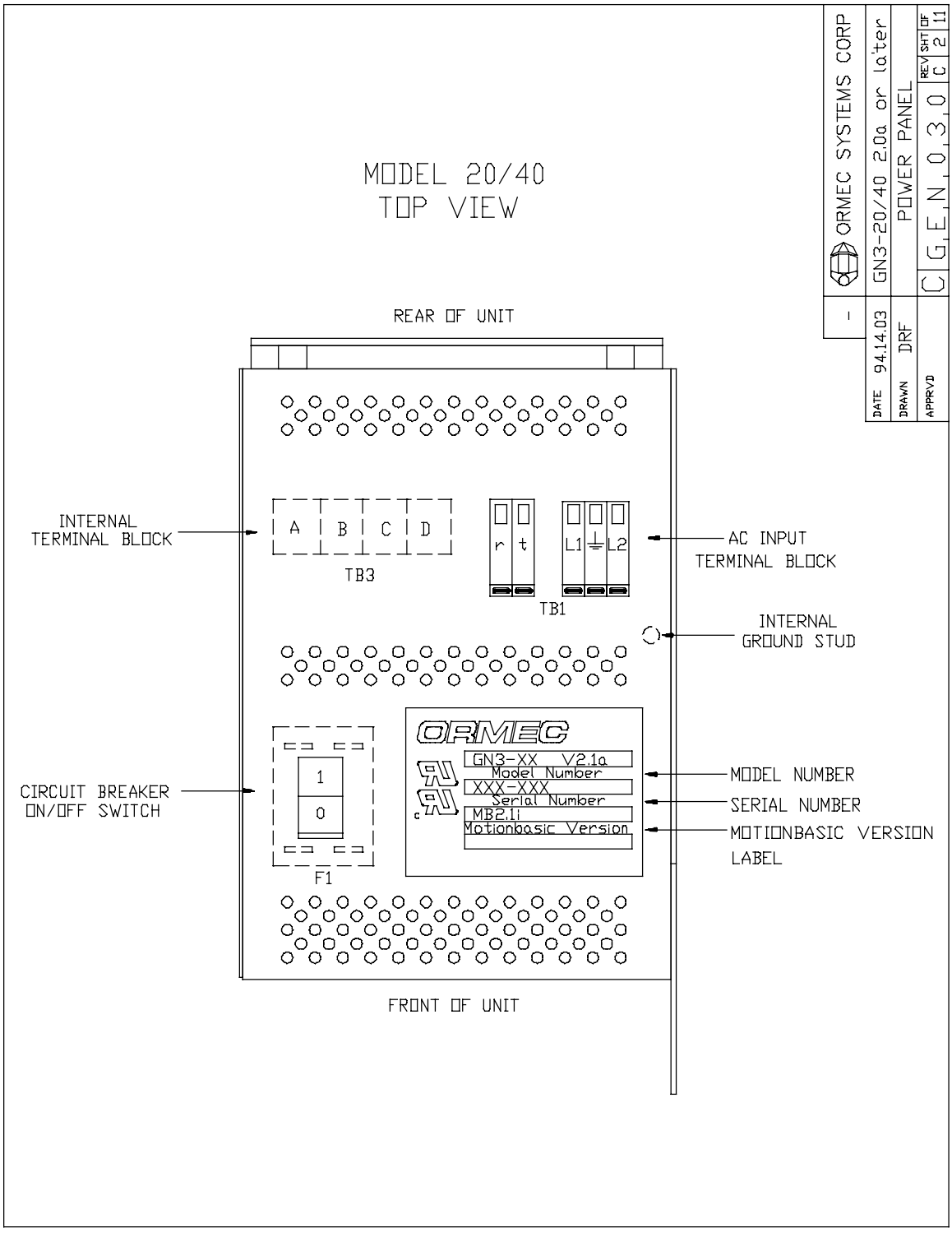
Servo Loop - The act of controlling a servo by repeatedly observing its speed and position and adjusting its torque creates a "servo loop". With Generation III motion controllers, these digital loops are "closed" by the *DSP Axis Modules* at *loop update* rates of 1,000 to 5,000 times per second.

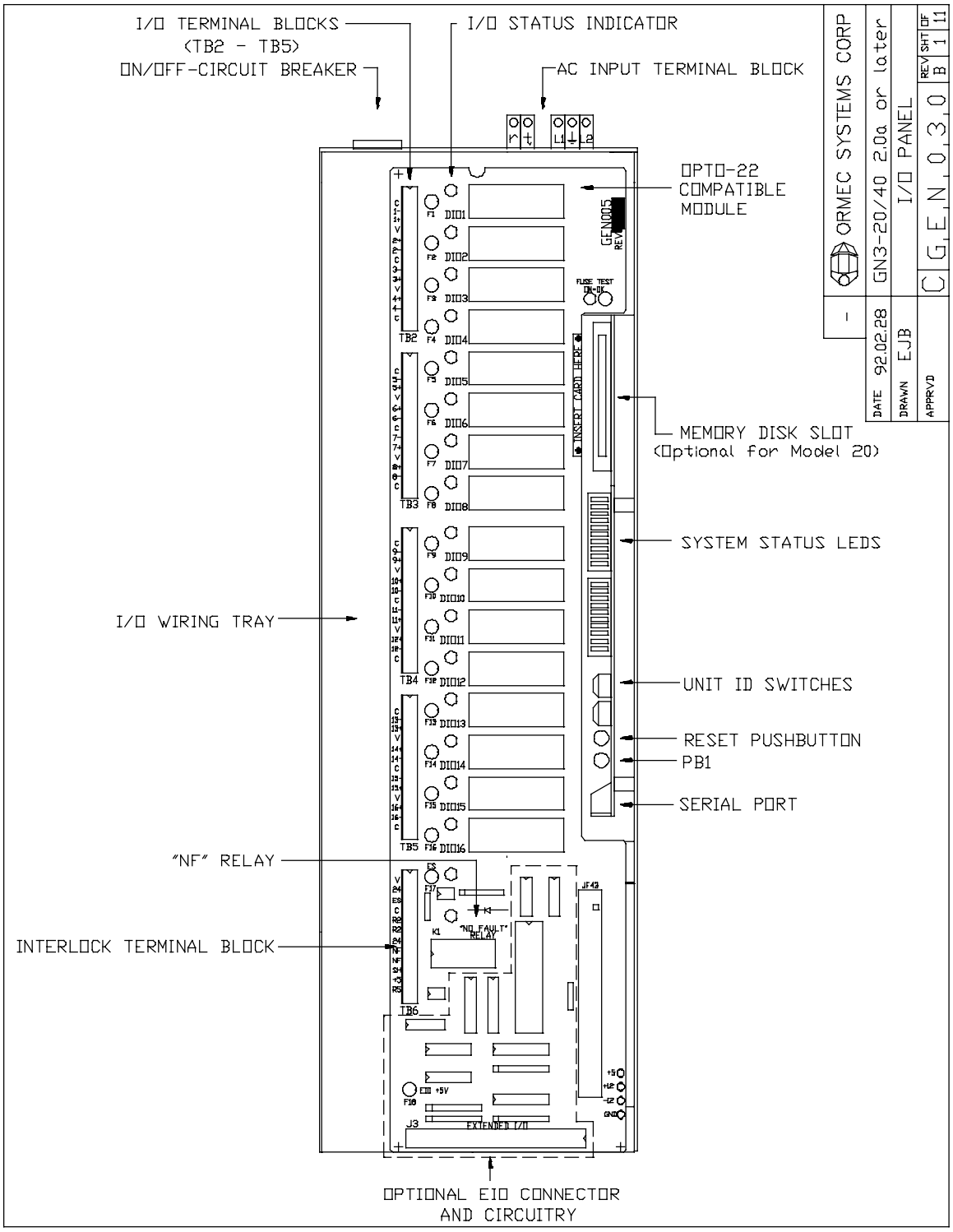
Model 20/40 Installation Diagram

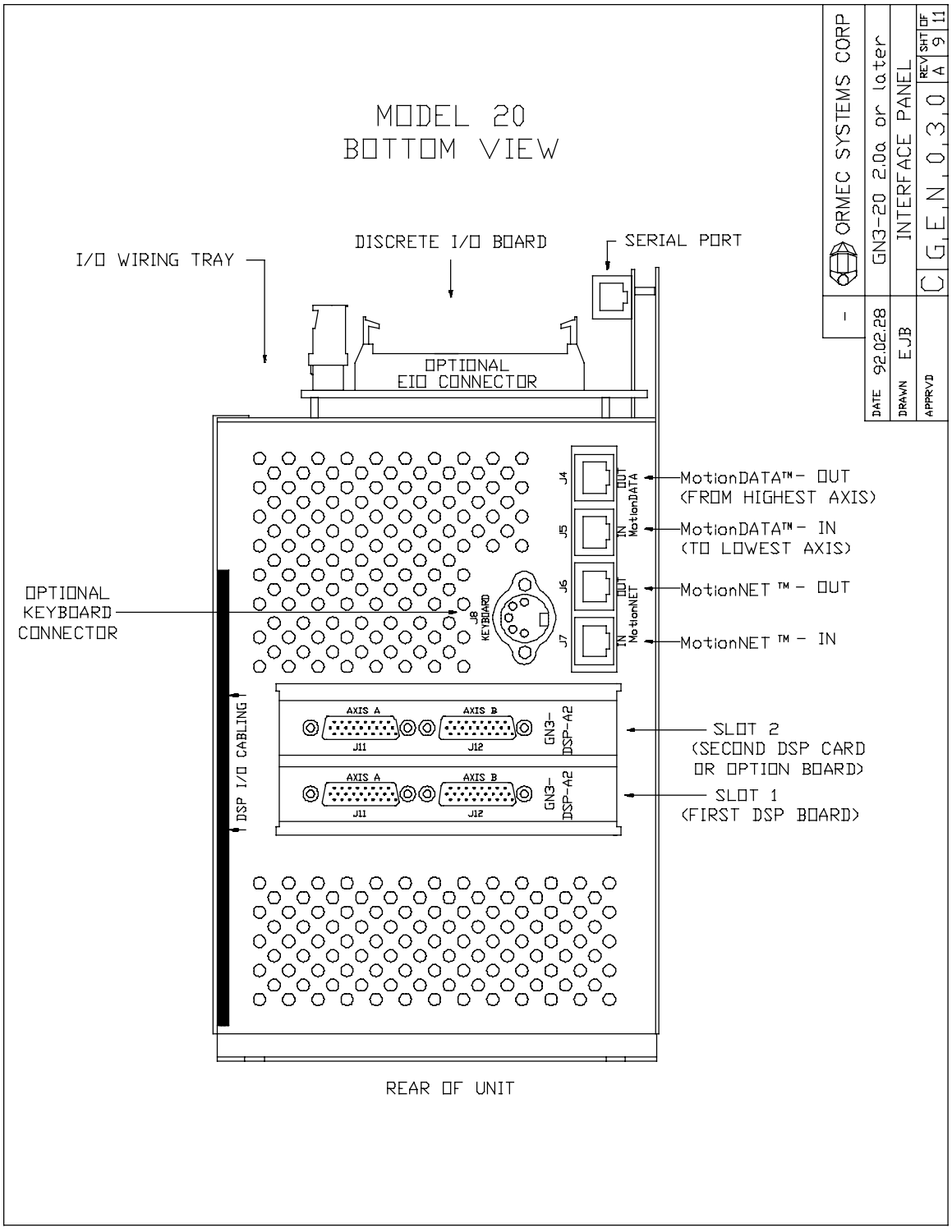


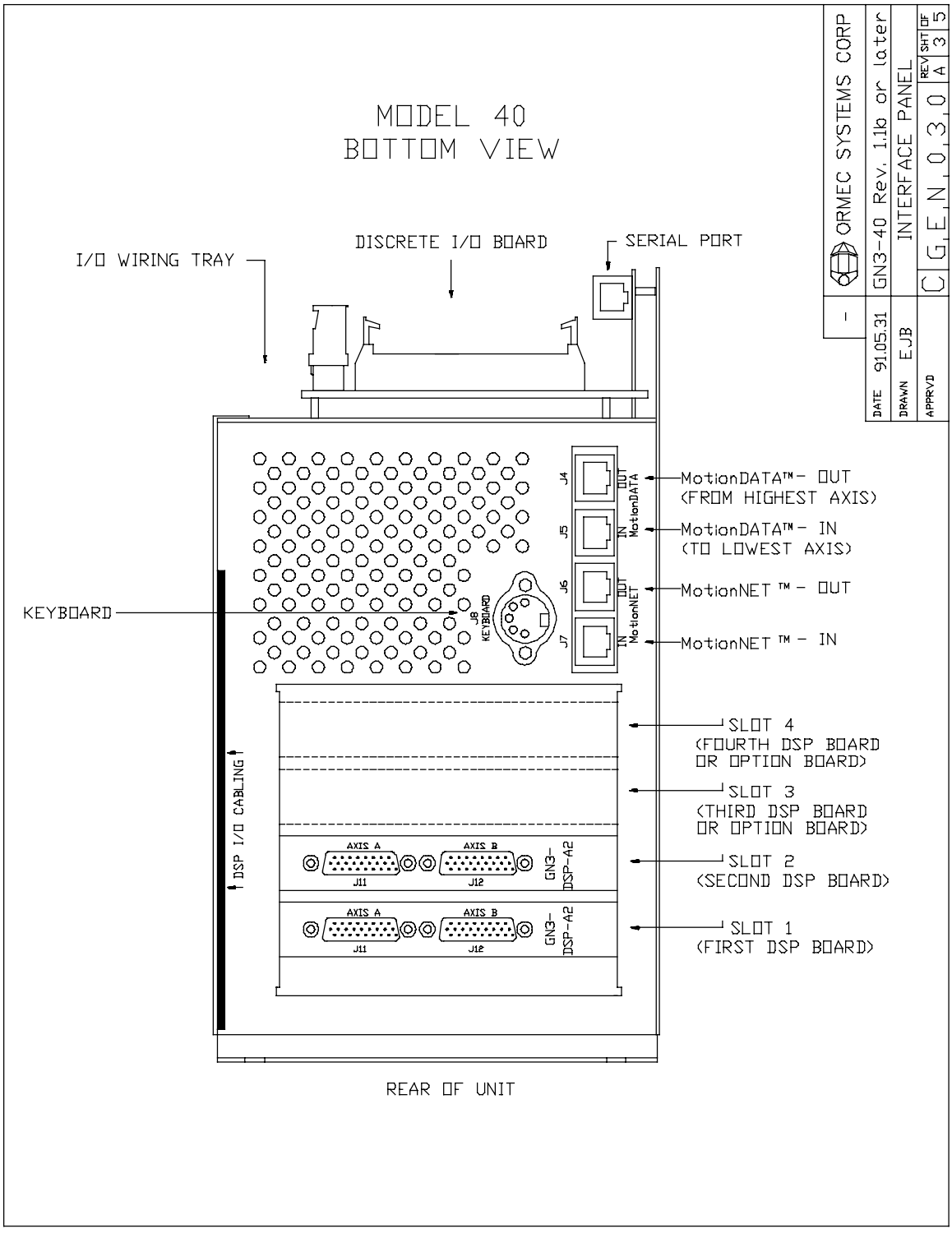

MAIN POWER
(230 VAC)
(THREE PHASE)
MAIN CONTACTOR
COIL POWER
(115 or 230 VAC)
CONTROL POWER
(230 VAC)
(SINGLE PHASE)
L1
L3
L2
L1
L2
L1
Safety
Ground
L2
r
t
L1
GND
L2
FUSES
LINE
FILTER
10
AMP
MAIN
CONTACTOR
(MOTOR POWER)
Filter
&
Power Supply
MP
E-STOP
NF
NF
NO-FAULT
RELAY
NF
TB6
24 VDC
GEN III CPU
RESET (RED)
CPU RESET
SPECIAL FUNCTION
PB1 (BLK)
NO DIAGNOSTIC FAULT
LIMIT OVERRIDE
E-STOP RESET
FWD
REV
OPTIONAL OVERTRAVEL
LIMIT SWITCHES*
24
MP-AUX
ES
E STOP-OK
LED
AND
NO
DRIVE
FAULTS
NO FAULT
LED
NO
OPEN
ENCODER
WIRES ON
ENABLED
MOTORS
GEN III
MODEL 40
MODEL 20
r
t
R
S
T
S-SERIES
SERVO DRIVE(S)
U
V
W
2CN
1CN
*Hardware Overtravel Limit Switches
for each axis of control can alternatively
be wired to the DSP I/O Header
R
W
B
G
Axis Interface Cable (1 - 50 ft.)
CBL-AS/NN
Connects to
DSP AXIS
MODULE(S)
Motor
Cable
CBL-SMACX/NN
(1-150 ft. max)
Encoder
Cable
CBL-SMAC/NN
(1-150 ft. max)
MOTOR
SYSTEM WIRING WITH
S - SERIES SERVO DRIVE(S)

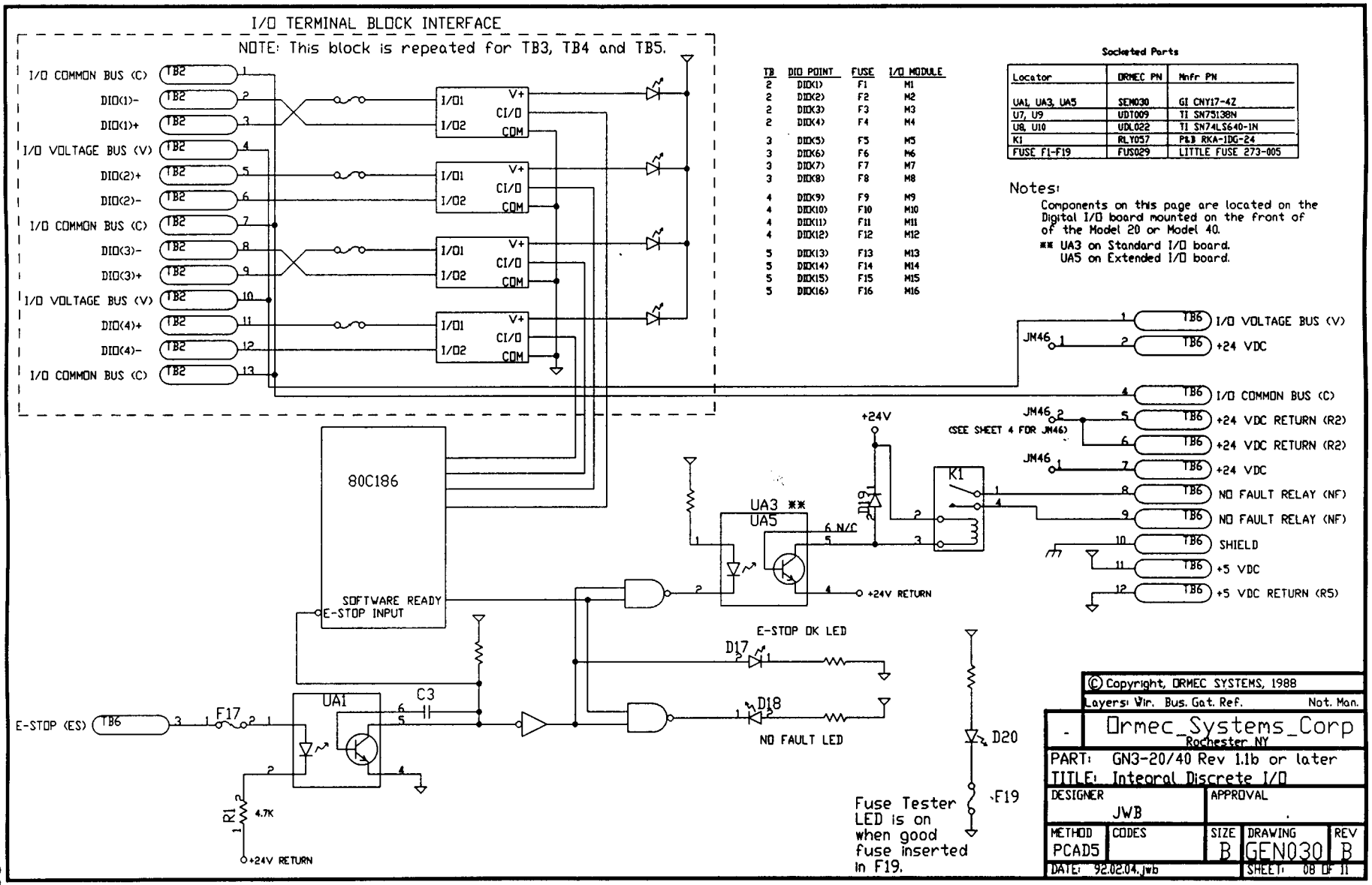

MAIN POWER
(115 or 230 VAC)
(SINGLE PHASE)
MAIN CONTACTOR
COIL POWER
(115 or 230 VAC)
CONTROL POWER
(115 or 230 VAC)
(SINGLE PHASE)
L1
L2
Safety
Ground
r
t
GND
FUSES
LINE
FILTER
10
AMP
Breaker
MAIN
CONTACTOR
(MOTOR POWER)
MP
E-STOP
NF
NO-FAULT
RELAY
Filter
&
Power Supply
24 VDC
TB6
GEN III CPU
RESET (RED)
CPU RESET
SPECIAL FUNCTION
PB1 (BLK)
NO DIAGNOSTIC FAULT
LIMIT OVERRIDE
E-STOP RESET
FWD
REV
24
OPTIONAL OVERTRAVEL
LIMIT SWITCHES*
MP-AUX
E STOP-OK
LED
ES
AND
NO FAULT
LED
NO
DRIVE
FAULTS
NO
OPEN
ENCODER
WIRES ON
ENABLED
MOTORS
GEN III
MODEL 40
MODEL 20
R
T
E-SERIES
SERVO DRIVE(S)
*Hardware Overtravel Limit Switches
for each axis of control can alternatively
be wired to the DSP I/O Header
U
V
W
2CN
1CN
R
W
B
G
Axis Interface Cable (1 - 50 ft.)
CBL-AE/NN
Connects to
DSP AXIS
MODULE(S)
Motor
Cable
CBL-SMACX/NN
(1-150 ft. max)
Encoder
Cable
CBL-SMACE/NN
(1-150 ft. max)
MOTOR
SYSTEM WIRING WITH
E - SERIES SERVO DRIVE(S)

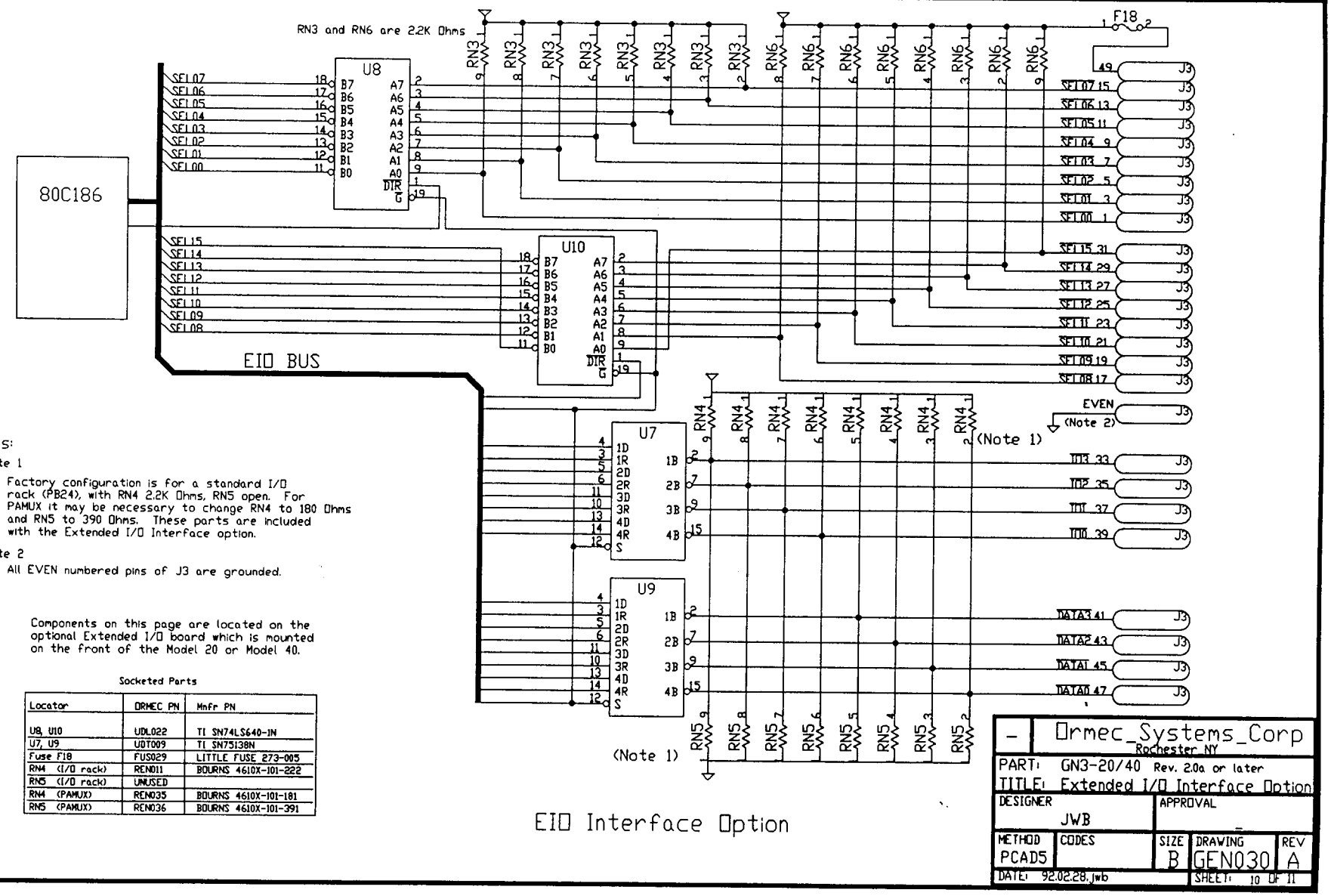

ORMEC SYSTEMS CORP
GN3-20/40 2.0a or later
POWER PANEL
C G,E,N,0,3,0
REV C
SHT 2 OF 11
DATE 94.14.03
DRAWN DRF
APPRVD
MODEL 20/40
TOP VIEW
REAR OF UNIT
INTERNAL TERMINAL BLOCK
A B C D
TB3
r t
L1 L2
TB1
AC INPUT TERMINAL BLOCK
INTERNAL GROUND STUD
CIRCUIT BREAKER ON/OFF SWITCH
1
0
F1
ORMEC
GN3-XX V2.1a
Model Number
XXX-XXX
Serial Number
MB2.1i
Motionbasic Version
MODEL NUMBER
SERIAL NUMBER
MOTIONBASIC VERSION LABEL
FRONT OF UNIT


I/O TERMINAL BLOCKS
(TB2 - TB5)
ON/OFF-CIRCUIT BREAKER
I/O STATUS INDICATOR
AC INPUT TERMINAL BLOCK
OPTO-22
COMPATIBLE
MODULE
MEMORY DISK SLOT
(Optional for Model 20)
SYSTEM STATUS LEDS
I/O WIRING TRAY
UNIT ID SWITCHES
RESET PUSHBUTTON
PB1
SERIAL PORT
"NF" RELAY
INTERLOCK TERMINAL BLOCK
OPTIONAL EIO CONNECTOR
AND CIRCUITRY
ORMEC SYSTEMS CORP
GN3-20/40 2.0a or later
I/O PANEL
C,G,E,N,0,3,0
REV B
SHT 1 OF 11
DATE 92.02.28
DRAWN EJB
APPRVD


MODEL 20
BOTTOM VIEW
ORMEC SYSTEMS CORP
GN3-20 2.0a or later
INTERFACE PANEL
C G,E,N,0,3,0
REV A
SHT 9
OF 11
DATE 92.02.28
DRAWN EJB
APPRVD
I/O WIRING TRAY
DISCRETE I/O BOARD
SERIAL PORT
OPTIONAL
EIO CONNECTOR
J4 OUT MotionDATA
J5 IN MotionDATA
J6 OUT MotionNET
J7 IN MotionNET
J8 KEYBOARD
MotionDATA™- OUT
(FROM HIGHEST AXIS)
MotionDATA™- IN
(TO LOWEST AXIS)
MotionNET ™- OUT
MotionNET ™- IN
OPTIONAL
KEYBOARD
CONNECTOR
DSP I/O CABLING
AXIS A
AXIS B
J11
J12
GN3-DSP-A2
SLOT 2
(SECOND DSP CARD
OR OPTION BOARD)
SLOT 1
(FIRST DSP BOARD)
REAR OF UNIT


MODEL 40
BOTTOM VIEW
ORMEC SYSTEMS CORP
GN3-40 Rev. 1.1b or later
INTERFACE PANEL
C G,E,N,0,3,0
REV A
SHT 3 OF 5
DATE 91.05.31
DRAWN EJB
APPRVD
I/O WIRING TRAY
DISCRETE I/O BOARD
SERIAL PORT
MotionDATA™- OUT (FROM HIGHEST AXIS)
MotionDATA™- IN (TO LOWEST AXIS)
MotionNET ™- OUT
MotionNET ™- IN
KEYBOARD
J4 OUT MotionDATA
J5 IN MotionDATA
J6 OUT MotionNET
J7 IN MotionNET
J8 KEYBOARD
SLOT 4 (FOURTH DSP BOARD OR OPTION BOARD)
SLOT 3 (THIRD DSP BOARD OR OPTION BOARD)
SLOT 2 (SECOND DSP BOARD)
SLOT 1 (FIRST DSP BOARD)
DSP I/O CABLING
AXIS A
AXIS B
J11
J12
GN3-DSP-A2
REAR OF UNIT


I/O TERMINAL BLOCK INTERFACE
NOTE: This block is repeated for TB3, TB4 and TB5.
I/O COMMON BUS (C)
DIO(1)-
DIO(1)+
I/O VOLTAGE BUS (V)
DIO(2)+
DIO(2)-
I/O COMMON BUS (C)
DIO(3)-
DIO(3)+
I/O VOLTAGE BUS (V)
DIO(4)+
DIO(4)-
I/O COMMON BUS (C)
TB2
I/O1
I/O2
V+
CI/O
COM
TB DIO POINT FUSE I/O MODULE
2 DIO(1) F1 M1
2 DIO(2) F2 M2
2 DIO(3) F3 M3
2 DIO(4) F4 M4
3 DIO(5) F5 M5
3 DIO(6) F6 M6
3 DIO(7) F7 M7
3 DIO(8) F8 M8
4 DIO(9) F9 M9
4 DIO(10) F10 M10
4 DIO(11) F11 M11
4 DIO(12) F12 M12
5 DIO(13) F13 M13
5 DIO(14) F14 M14
5 DIO(15) F15 M15
5 DIO(16) F16 M16
Socketed Parts
Locator | ORMEC PN | Mnfr PN
UA1, UA3, UA5 | SEM030 | GI CNY17-4Z
U7, U9 | UDT009 | TI SN75138N
U8, U10 | UDL022 | TI SN74LS640-1N
K1 | RLY057 | P&B RKA-1DG-24
FUSE F1-F19 | FUS029 | LITTLE FUSE 273-005
Notes:
Components on this page are located on the Digital I/O board mounted on the front of of the Model 20 or Model 40.
** UA3 on Standard I/O board. UA5 on Extended I/O board.
80C186
SOFTWARE READY
E-STOP INPUT
UA3 **
UA5
6 N/C
+24V RETURN
+24V
K1
D19
JM46
(SEE SHEET 4 FOR JM46)
TB6
I/O VOLTAGE BUS (V)
+24 VDC
I/O COMMON BUS (C)
+24 VDC RETURN (R2)
+24 VDC RETURN (R2)
+24 VDC
NO FAULT RELAY (NF)
NO FAULT RELAY (NF)
SHIELD
+5 VDC
+5 VDC RETURN (R5)
E-STOP DK LED
D17
D18
NO FAULT LED
D20
F19
Fuse Tester LED is on when good fuse inserted in F19.
E-STOP (ES)
F17
UA1
C3
R1
4.7K
+24V RETURN
© Copyright, ORMEC SYSTEMS, 1988
Layers: Wir. Bus. Gat. Ref. Not. Man.
Ormec_Systems_Corp
Rochester NY
PART: GN3-20/40 Rev 1.1b or later
TITLE: Integral Discrete I/O
DESIGNER JWB
APPROVAL
METHOD PCAD5
CODES
SIZE B
DRAWING GEN030
REV B
DATE: 92.02.04.jwb
SHEET: 08 OF 11



Notes:

Note 1

Factory configuration is for a standard I/O rack (PB24), with RN4 2.2K Ohms, RN5 open. For PAMUX it may be necessary to change RN4 to 180 Ohms and RN5 to 390 Ohms. These parts are included with the Extended I/O Interface option.

Note 2

All EVEN numbered pins of J3 are grounded.

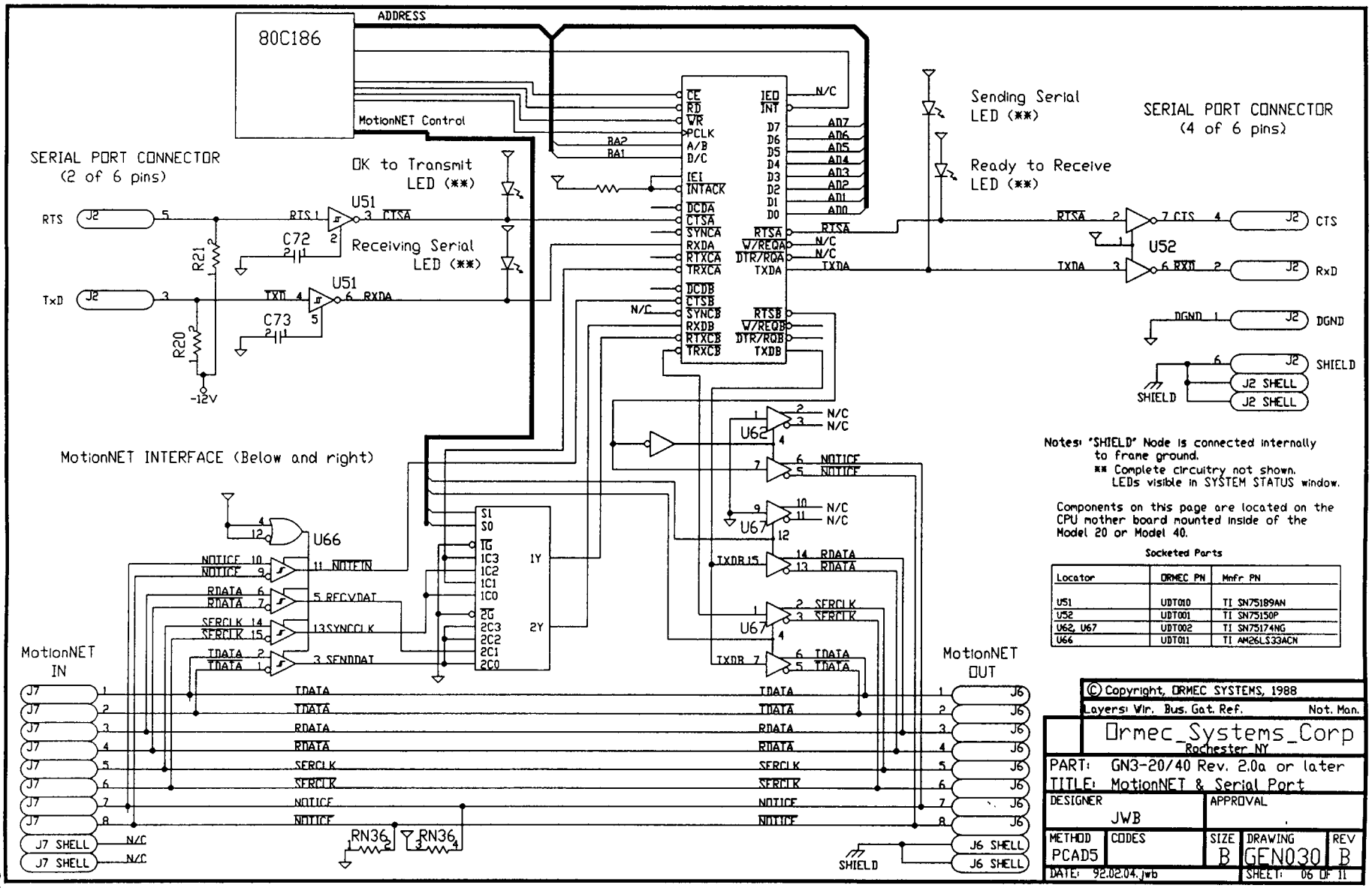
Components on this page are located on the optional Extended I/O board which is mounted on the front of the Model 20 or Model 40.

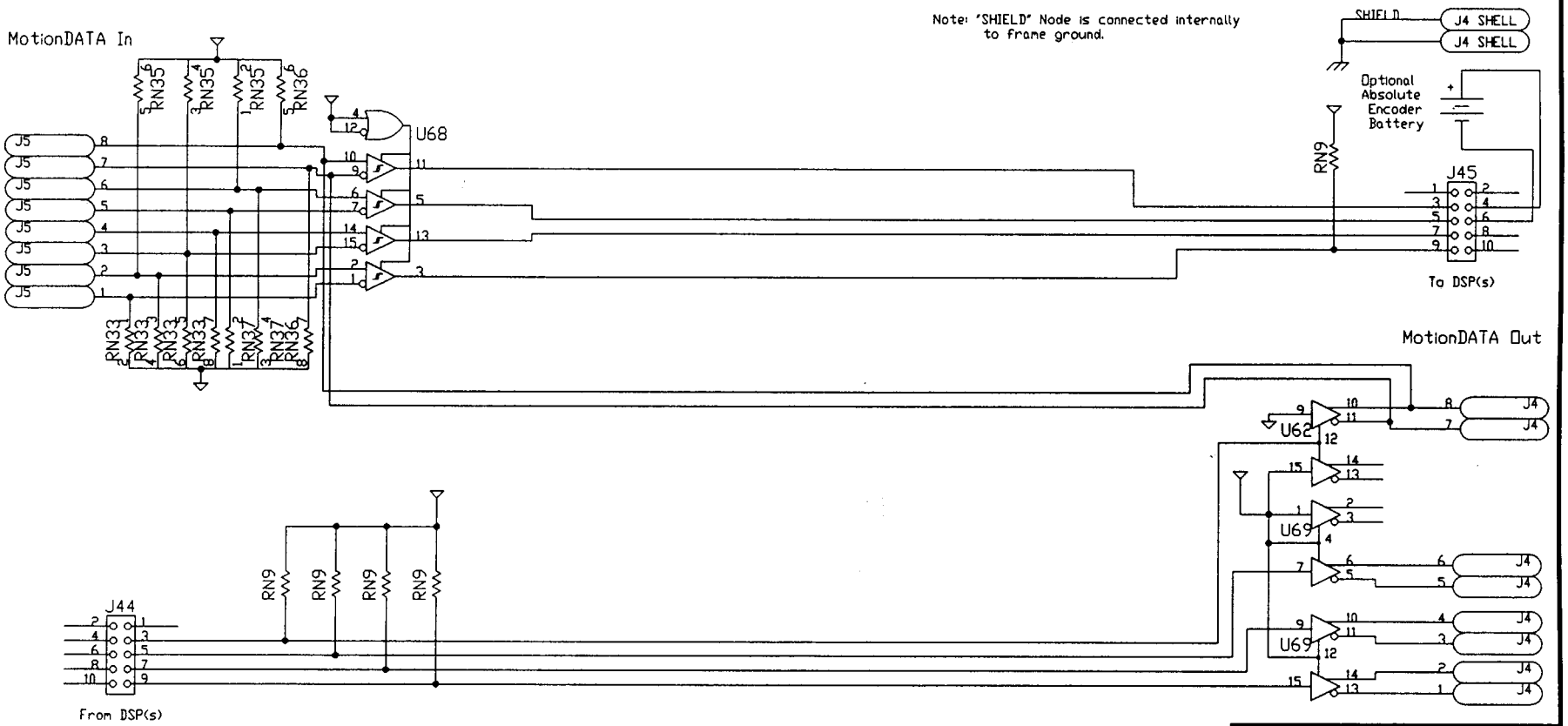
Socketed Parts

Locator	ORMEC PN	Mnfr PN
U8, U10	UDL022	TI SN74LS640-1N
U7, U9	UDT009	TI SN75138N
Fuse F18	FUS029	LITTLE FUSE 273-005
RN4 (I/O rack)	REN011	BOURNS 4610X-101-222
RN5 (I/O rack)	UNUSED	
RN4 (PAMUX)	REN035	BOURNS 4610X-101-181
RN5 (PAMUX)	REN036	BOURNS 4610X-101-391

EIO Interface Option

-	Ormec_Systems_Corp Rochester NY
PART:	GN3-20/40 Rev. 2.0a or later
TITLE:	Extended I/O Interface Option
DESIGNER: JWB	APPROVAL:
METHOD: PCAD5	CODES:
SIZE: B	DRAWING: GEN030
REV: A	
DATE: 92.02.28.jwb	SHEET: 10 OF 11


80C186
ADDRESS
MotionNET Control
SERIAL PORT CONNECTOR
(2 of 6 pins)
OK to Transmit
LED (**)
Receiving Serial
LED (**)
Sending Serial
LED (**)
Ready to Receive
LED (**)
SERIAL PORT CONNECTOR
(4 of 6 pins)
RTS
TxD
-12V
U51
U52
C72
C73
R21
R20
MotionNET INTERFACE (Below and right)
U62
U67
U66
MotionNET
IN
MotionNET
OUT
RN36
RN36
SHIELD
J7 SHELL
J6 SHELL
J2 SHELL
CTS
RxD
DGND
SHIELD
Notes: 'SHIELD' Node is connected internally
to frame ground.
** Complete circuitry not shown.
LEDs visible in SYSTEM STATUS window.
Components on this page are located on the
CPU mother board mounted inside of the
Model 20 or Model 40.
Socketed Parts
Locator | ORMEC PN | Mnfr PN
U51 | UDT010 | TI SN75189AN
U52 | UDT001 | TI SN75150P
U62, U67 | UDT002 | TI SN75174NG
U66 | UDT011 | TI AM26LS33ACN
© Copyright, ORMEC SYSTEMS, 1988
Layers: Wir. Bus. Gat. Ref. Not. Man.
Ormec_Systems_Corp
Rochester NY
PART: GN3-20/40 Rev. 2.0a or later
TITLE: MotionNET & Serial Port
DESIGNER JWB
APPROVAL
METHOD PCAD5
CODES
SIZE B
DRAWING GEN030
REV B
DATE: 92.02.04.jwb
SHEET: 06 OF 11



Components on this page are located on the CPU mother board mounted inside of the Model 20 or Model 40.

Socketed Parts

Locator	ORMEC PN	Mnfr PN
U62, U69	UDT002	TI SN75174NG
U68	UDT011	TI AM26LS33ACN

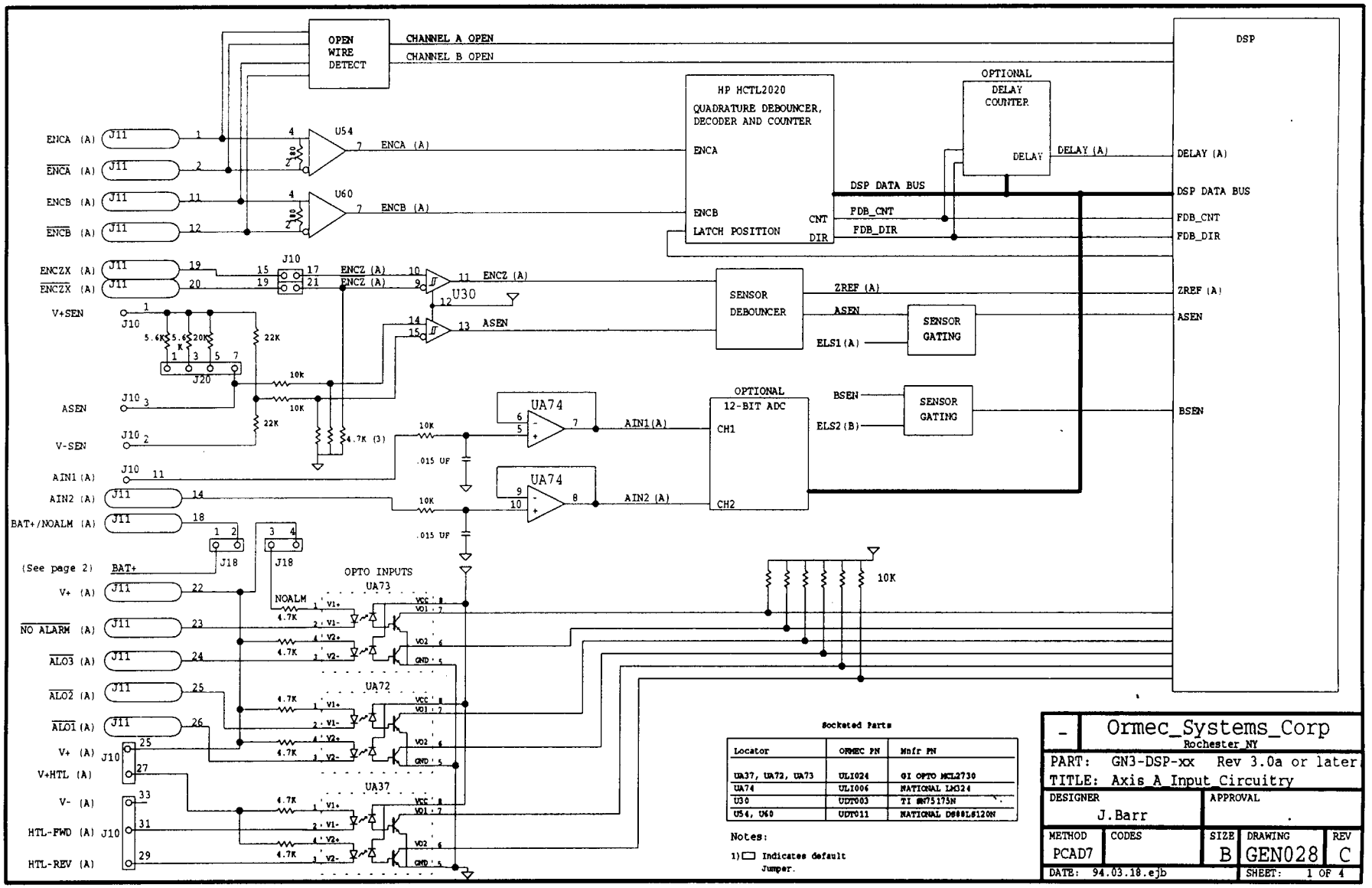
© Copyright, ORMEC SYSTEMS, 1988

Layers: Wir. Bus. Gat. Ref. Not. Man.

Ormec_Systems_Corp
Rochester NY

PART: GN3-20/40 Rev 2.0a or later
TITLE: MotionDATA Interface

DESIGNER	APPROVAL			
JWB				
METHOD	CODES	SIZE	DRAWING	REV
PCAD5		B	GEN030	B
DATE: 92.02.28.jwb		SHEET: 07 OF 11		



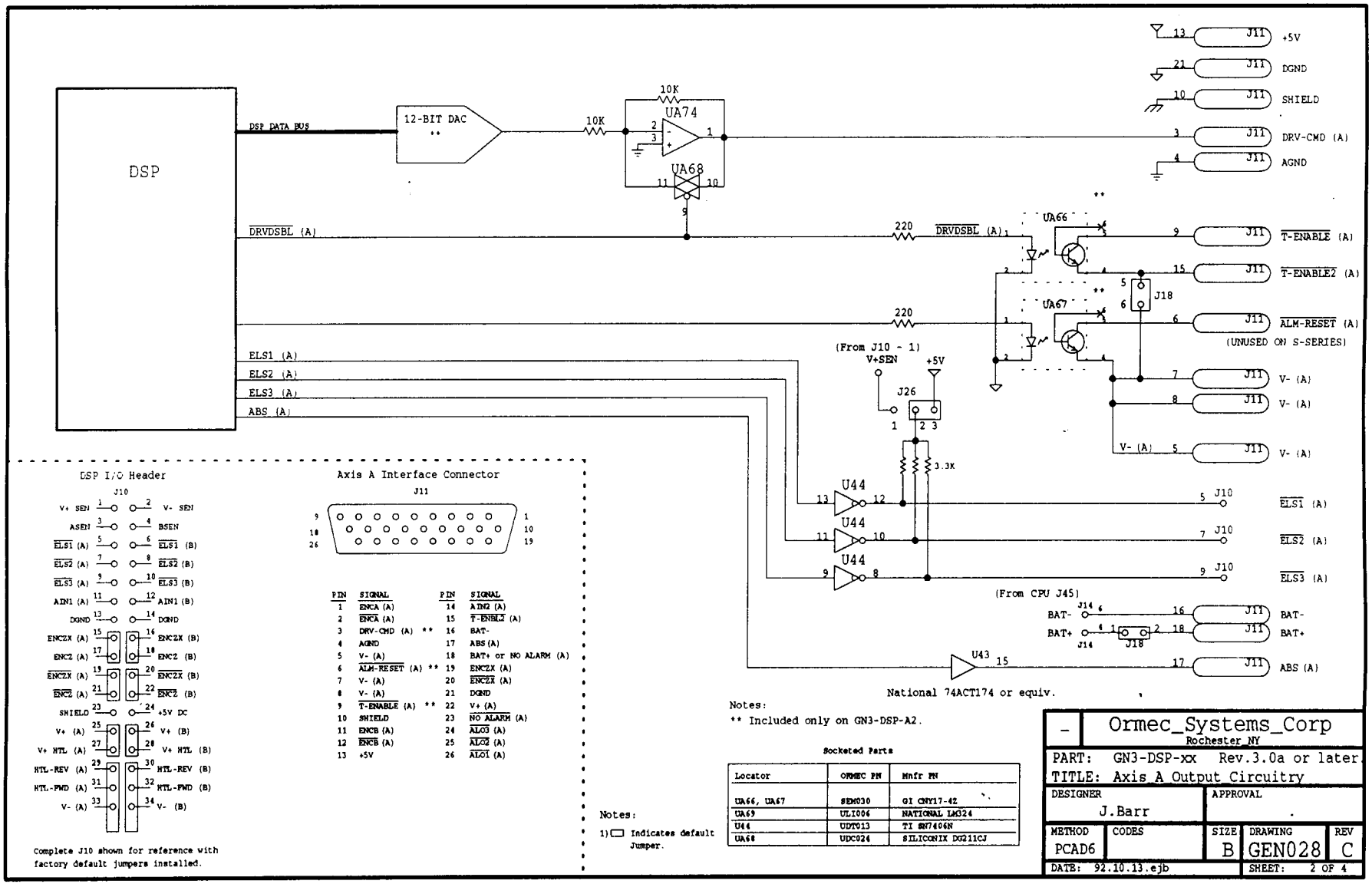
Socketed Parts

Locator	ORMEC PN	Mnfr PN
UA37, UA72, UA73	ULI024	GI OPTO MCL2730
UA74	ULI006	NATIONAL LM324
U30	UDT003	TI SN75175N
U54, U60	UDT011	NATIONAL DS88LS120N

Notes:

1) ☐ Indicates default Jumper.

-	Ormec_Systems_Corp Rochester_NY			
PART: GN3-DSP-xx Rev 3.0a or later				
TITLE: Axis_A_Input_Circuitry				
DESIGNER J.Barr	APPROVAL .			
METHOD PCAD7	CODES	SIZE B	DRAWING GEN028	REV C
DATE: 94.03.18.ejb			SHEET: 1 OF 4	



DSP I/O Header

J10

V+ SEN	1	2	V- SEN
ASEN	3	4	BSEN
ELS1 (A)	5	6	ELS1 (B)
ELS2 (A)	7	8	ELS2 (B)
ELS3 (A)	9	10	ELS3 (B)
AIN1 (A)	11	12	AIN1 (B)
DGND	13	14	DGND
ENC2X (A)	15	16	ENC2X (B)
ENC2 (A)	17	18	ENC2 (B)
ENC2X (A)	19	20	ENC2X (B)
ENC2 (A)	21	22	ENC2 (B)
SHIELD	23	24	+5V DC
V+ (A)	25	26	V+ (B)
V+ HTL (A)	27	28	V+ HTL (B)
HTL-REV (A)	29	30	HTL-REV (B)
HTL-FWD (A)	31	32	HTL-FWD (B)
V- (A)	33	34	V- (B)

Complete J10 shown for reference with factory default jumpers installed.

Axis A Interface Connector

J11

PIN	SIGNAL	PIN	SIGNAL
1	ENCA (A)	14	AIN2 (A)
2	ENCA (A)	15	T-ENBL2 (A)
3	DRV-CMD (A) **	16	BAT-
4	AGND	17	ABS (A)
5	V- (A)	18	BAT+ or NO ALARM (A)
6	ALM-RESET (A) **	19	ENC2X (A)
7	V- (A)	20	ENC2X (A)
8	V- (A)	21	DGND
9	T-ENABLE (A) **	22	V+ (A)
10	SHIELD	23	NO ALARM (A)
11	ENCB (A)	24	ALO3 (A)
12	ENCB (A)	25	ALO2 (A)
13	+5V	26	ALO1 (A)

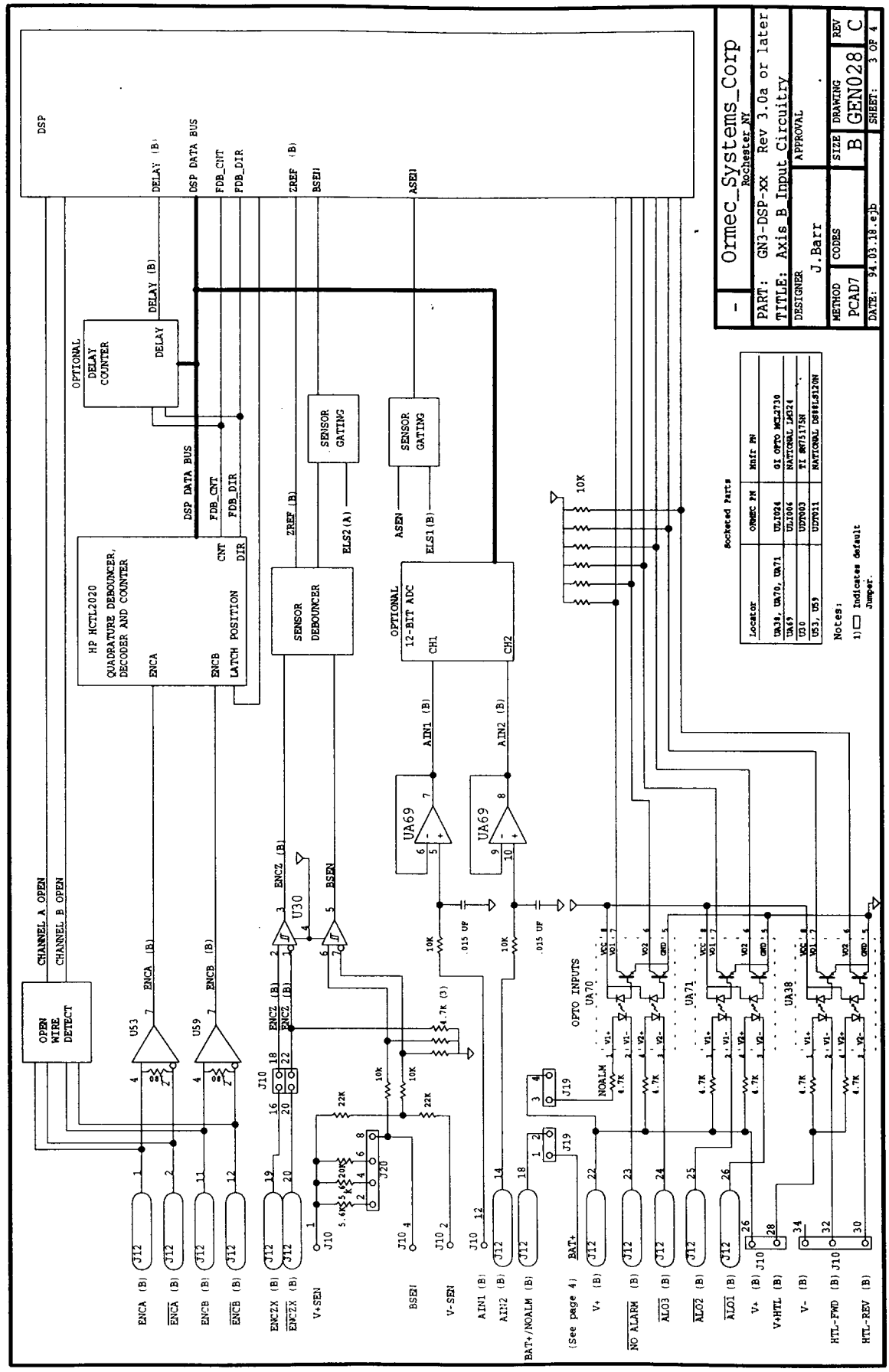
Notes:
** Included only on GN3-DSP-A2.

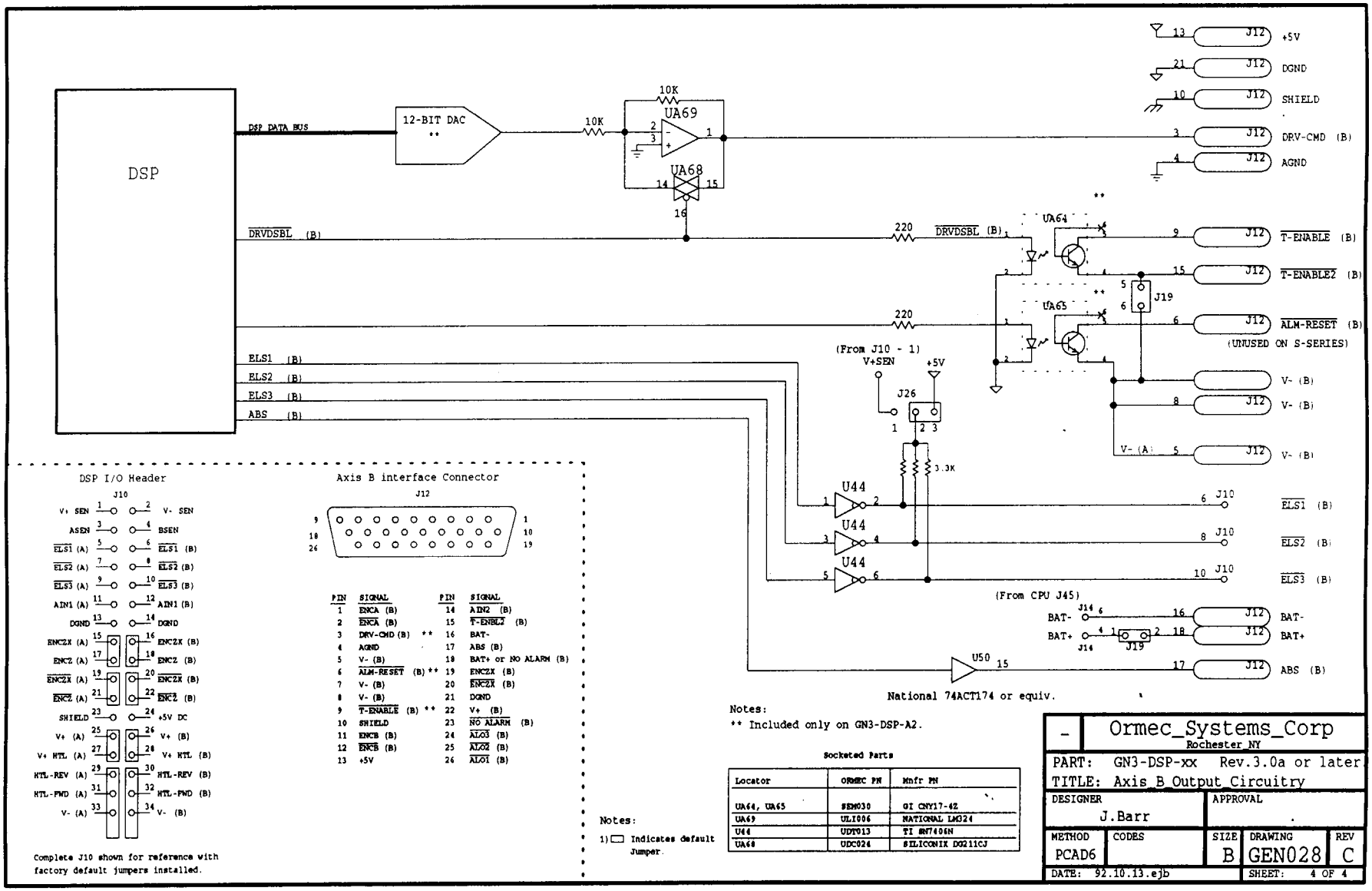
Notes:
1) ☐ Indicates default Jumper.

Socketed Parts

Locator	ORMEC PN	Mnfr PN
UA66, UA67	SEM030	GI CNY17-4Z
UA69	ULI006	NATIONAL LM324
U44	UDT013	TI SN7406N
UA68	UDC024	SILICONIX DG211CJ

–	Ormec_Systems_Corp Rochester_NY			
PART: GN3-DSP-xx Rev.3.0a or later				
TITLE: Axis_A Output Circuitry				
DESIGNER J.Barr		APPROVAL .		
METHOD PCAD6	CODES	SIZE B	DRAWING GEN028	REV C
DATE: 92.10.13.ejb			SHEET: 2 OF 4	


Ormec_Systems_Corp
Rochester,NY
PART: GN3-DSP-xx Rev 3.0a or later
TITLE: Axis B Input Circuitry
DESIGNER J.Barr
APPROVAL
METHOD PCAD7
CODES
SIZE B
DRAWING GEN028
REV C
DATE: 94.03.18.ejb
SHEET: 3 OF 4
DSP
DSP DATA BUS
FDB_CNT
FDB_DIR
DELAY (B)
ZREF (B)
BSEN
ASEN
OPTIONAL DELAY COUNTER
HP HCTL2020 QUADRATURE DEBOUNCER, DECODER AND COUNTER
ENCA
ENCB
LATCH POSITION
CNT
DIR
SENSOR GATING
SENSOR DEBOUNCER
OPTIONAL 12-BIT ADC
CH1
CH2
AIN1 (B)
AIN2 (B)
ELS2 (A)
ELS1 (B)
CHANNEL A OPEN
CHANNEL B OPEN
OPEN WIRE DETECT
U53
U59
U30
UA69
UA70
UA71
UA38
10K
.015 UF
22K
4.7K
OPTO INPUTS
NOALM
Socketed Parts
Locator
ORMEC PN
Mnfr PN
UA38, UA70, UA71
UA69
U30
U53, U59
UD1024
UD1006
UD7003
UD7011
GI OPTO MCL2730
NATIONAL LM324
TI AM7517SN
NATIONAL DS8913BN
Notes:
1) Indicates default Jumper.
ENCA (B)
ENCB (B)
V+SEN
V-SEN
BAT+/NOALM (B)
NO ALARM (B)
V+ (B)
V- (B)
V+HTL (B)
HTL-FWD (B)
HTL-REV (B)



DSP I/O Header

J10

V+ SEN	1	2	V- SEN
ASEN	3	4	BSEN
$\overline{ELS1}$ (A)	5	6	$\overline{ELS1}$ (B)
$\overline{ELS2}$ (A)	7	8	$\overline{ELS2}$ (B)
$\overline{ELS3}$ (A)	9	10	$\overline{ELS3}$ (B)
AIN1 (A)	11	12	AIN1 (B)
DGND	13	14	DGND
ENCZX (A)	15	16	ENCZX (B)
ENCZ (A)	17	18	ENCZ (B)
$\overline{ENCZX}$ (A)	19	20	$\overline{ENCZX}$ (B)
$\overline{ENCZ}$ (A)	21	22	$\overline{ENCZ}$ (B)
SHIELD	23	24	+5V DC
V+ (A)	25	26	V+ (B)
V+ HTL (A)	27	28	V+ HTL (B)
HTL-REV (A)	29	30	HTL-REV (B)
HTL-FWD (A)	31	32	HTL-FWD (B)
V- (A)	33	34	V- (B)

Complete J10 shown for reference with factory default jumpers installed.

Axis B interface Connector

J12

PIN	SIGNAL	PIN	SIGNAL
1	ENCA (B)	14	AIN2 (B)
2	$\overline{ENCA}$ (B)	15	$\overline{T\text{-}ENBL2}$ (B)
3	DRV-CMD (B) **	16	BAT-
4	AGND	17	ABS (B)
5	V- (B)	18	BAT+ or NO ALARM (B)
6	$\overline{ALM\text{-}RESET}$ (B) **	19	ENCZX (B)
7	V- (B)	20	$\overline{ENCZX}$ (B)
8	V- (B)	21	DGND
9	$\overline{T\text{-}ENABLE}$ (B) **	22	V+ (B)
10	SHIELD	23	$\overline{NO\ ALARM}$ (B)
11	ENCB (B)	24	$\overline{ALO3}$ (B)
12	$\overline{ENCB}$ (B)	25	$\overline{ALO2}$ (B)
13	+5V	26	$\overline{ALO1}$ (B)

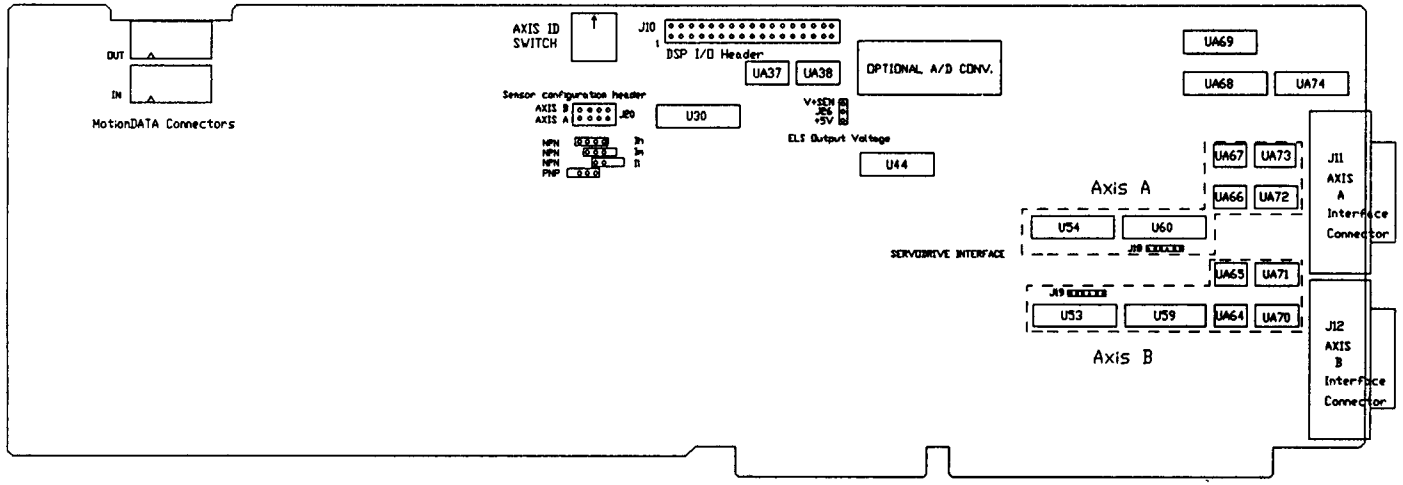
Notes:
1) ▭ Indicates default Jumper.

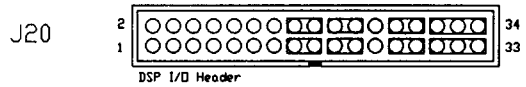
Notes:
** Included only on GN3-DSP-A2.

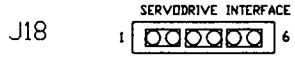
Socketed Parts

Locator	ORMEC PN	Mnfr PN
UA64, UA65	SEM030	GI CNY17-4Z
UA69	ULI006	NATIONAL LM324
U44	UDT013	TI SN7406N
UA68	UDC024	SILICONIX DG211CJ

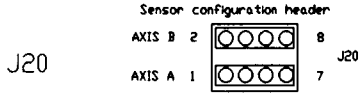
-	Ormec_Systems_Corp Rochester_NY			
PART: GN3-DSP-xx Rev.3.0a or later				
TITLE: Axis_B_Output_Circuitry				
DESIGNER J.Barr		APPROVAL		
METHOD PCAD6	CODES	SIZE B	DRAWING GEN028	REV C
DATE: 92.10.13.ejb			SHEET: 4 OF 4	

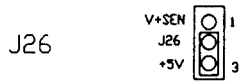






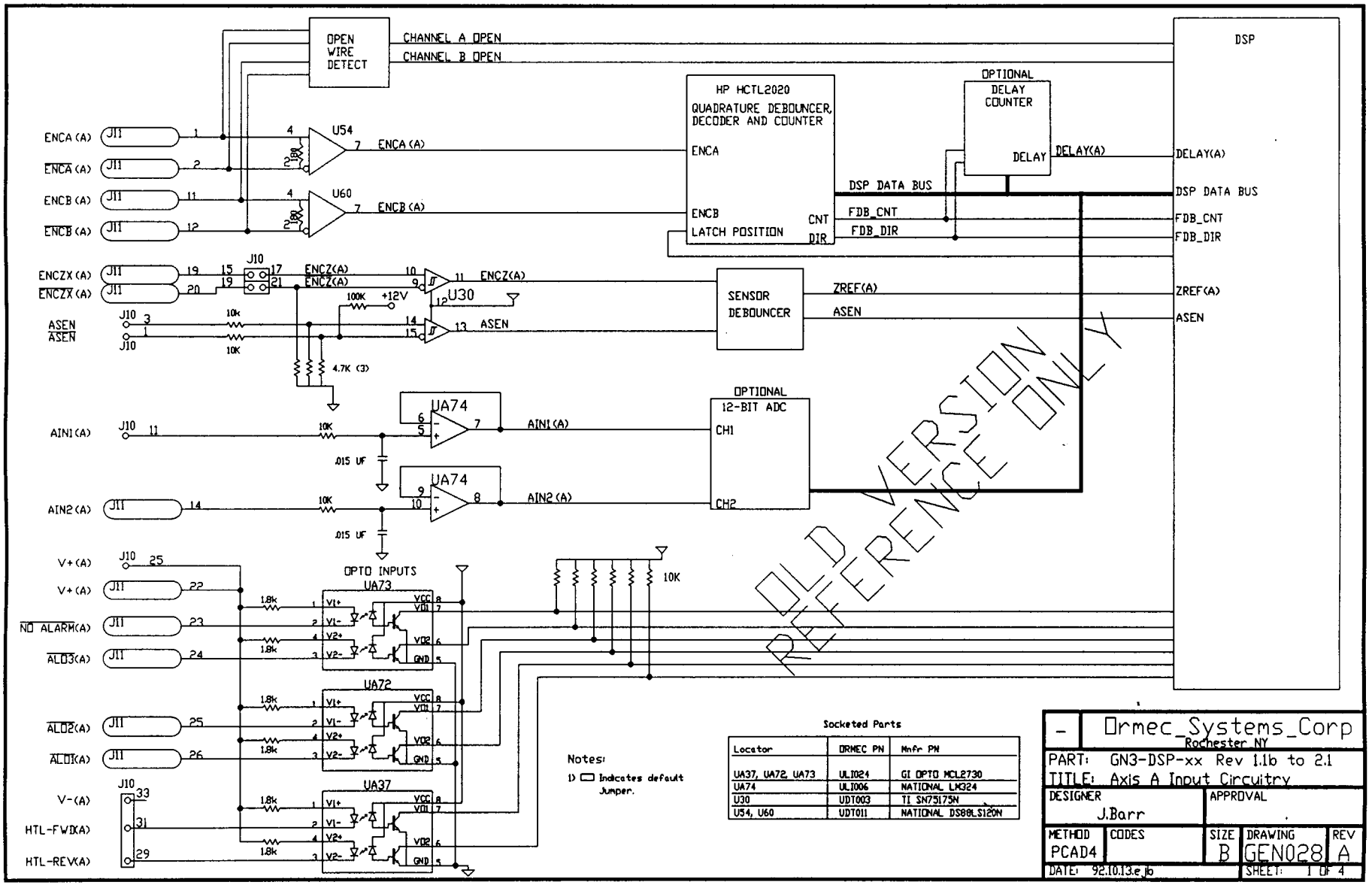






DEFAULT HEADER CONFIGURATIONS

ORMEC SYSTEMS CORP Rochester NY	
PART: GN3-DSP-XX Rev 3.0a or later	
TITLE: DSP COMPONENT LOCATIONS	
	DRAWING GEN028 / REV B
DATE: 94.03.21 DRF	SHEET: 5 of 5



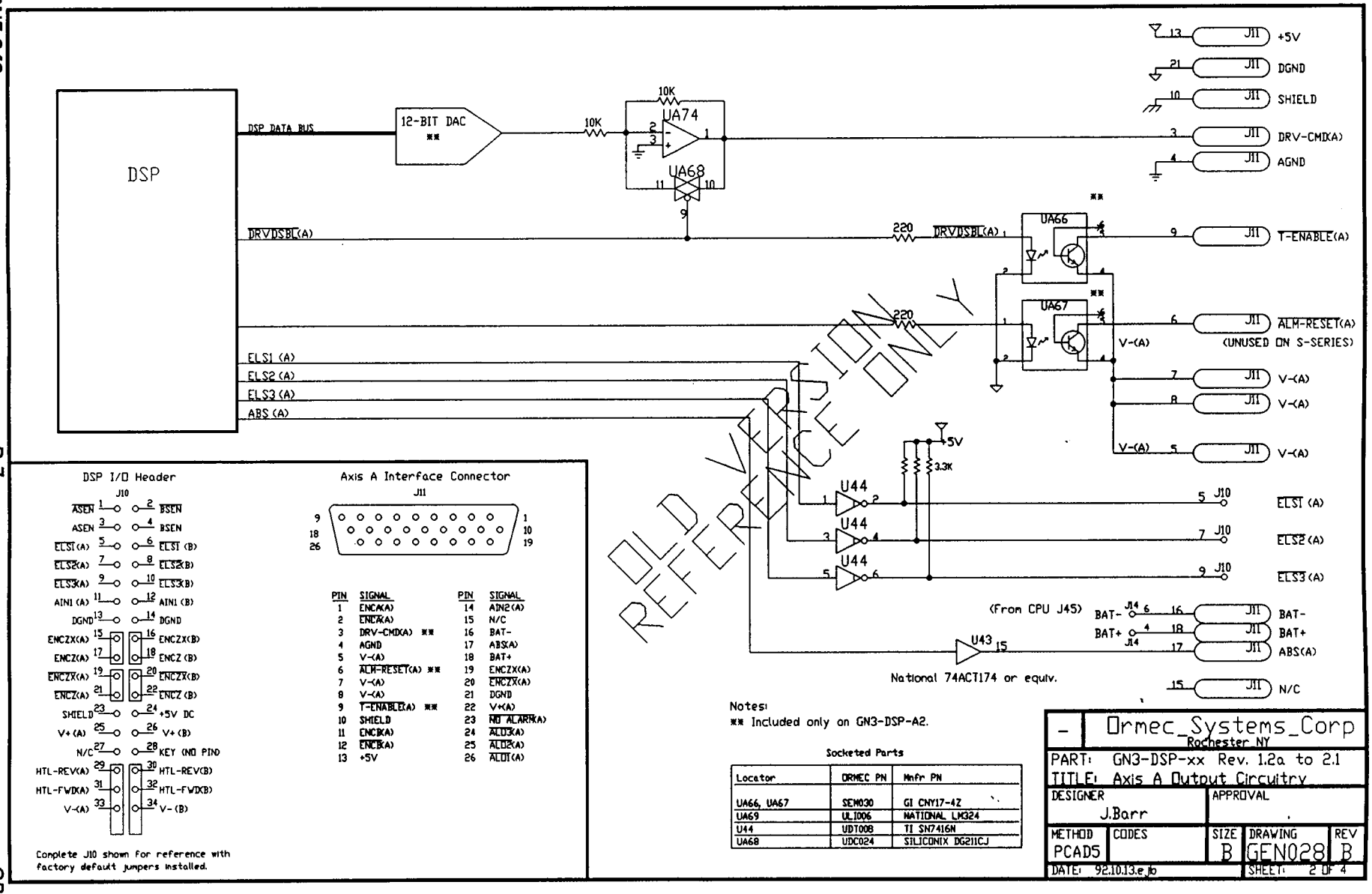
Notes:

1) ☐ Indicates default Jumper.

Socketed Parts

Locator	ORMEC PN	Mnfr PN
UA37, UA72, UA73	UL1024	GI OPTO MCL2730
UA74	UL1006	NATIONAL LM324
U30	UDT003	TI SN75175N
U54, U60	UDT011	NATIONAL DS88LS120N

-	Ormec_Systems_Corp Rochester NY			
PART: GN3-DSP-xx Rev 1.1b to 2.1				
TITLE: Axis A Input Circuitry				
DESIGNER J.Barr	APPROVAL			
METHOD PCAD4	CODES	SIZE B	DRAWING GEN028	REV A
DATE: 92.10.13.e.jb			SHEET: 1 OF 4	



DSP I/O Header

J10

ASEN	1	2	BSEN
ASEN	3	4	BSEN
ELS1(A)	5	6	ELS1 (B)
ELS2(A)	7	8	ELS2(B)
ELS3(A)	9	10	ELS3(B)
AIN1 (A)	11	12	AIN1 (B)
DGND	13	14	DGND
ENCZX(A)	15	16	ENCZX(B)
ENCZ(A)	17	18	ENCZ (B)
ENCZX(A)	19	20	ENCZX(B)
ENCZ(A)	21	22	ENCZ (B)
SHIELD	23	24	+5V DC
V+(A)	25	26	V+(B)
N/C	27	28	KEY (NO PIN)
HTL-REV(A)	29	30	HTL-REV(B)
HTL-FWD(A)	31	32	HTL-FWD(B)
V-(A)	33	34	V-(B)

Complete J10 shown for reference with factory default jumpers installed.

Axis A Interface Connector

J11

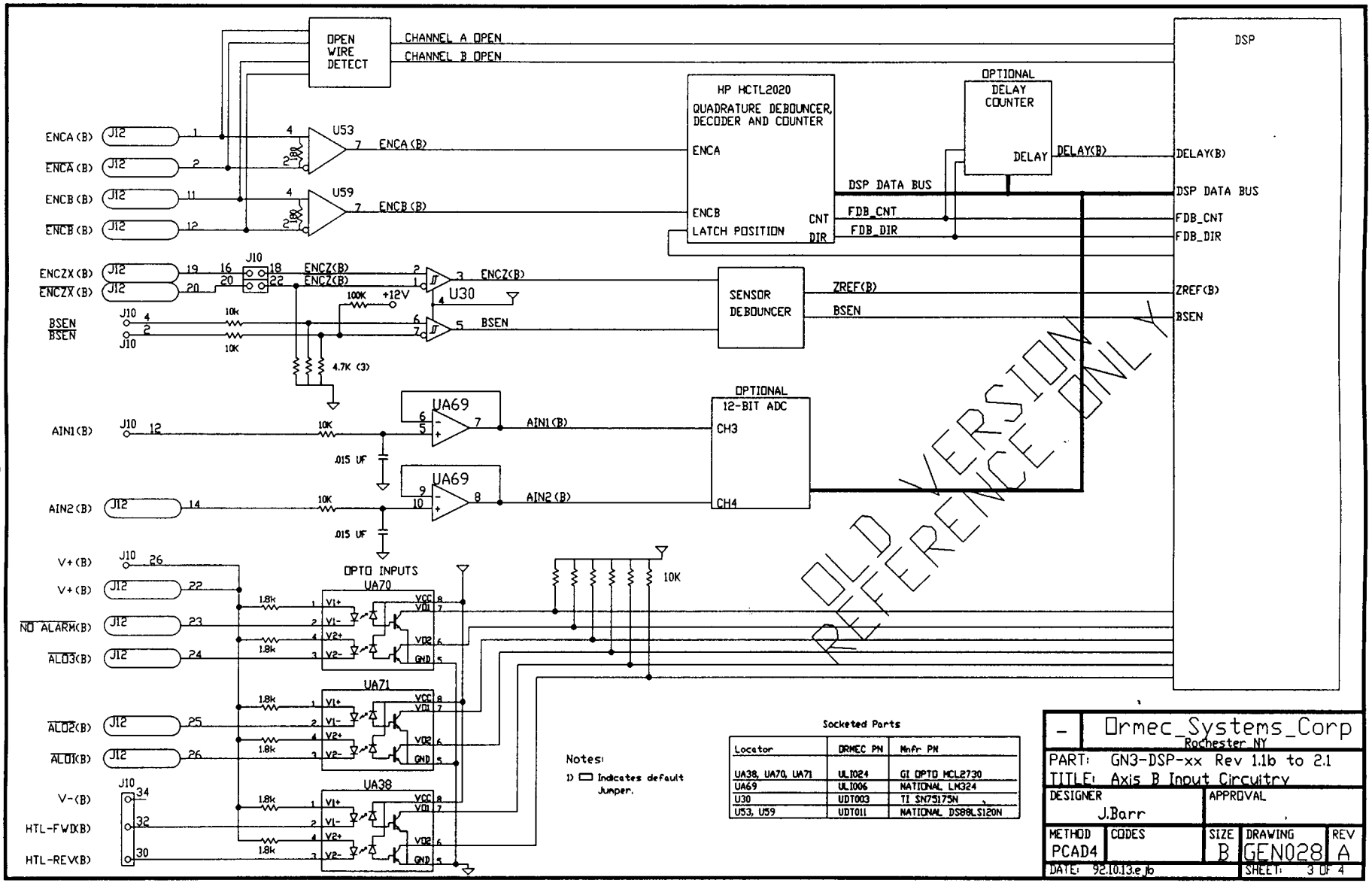
PIN	SIGNAL	PIN	SIGNAL
1	ENC(A)	14	AIN2(A)
2	ENC(A)	15	N/C
3	DRV-CMD(A) **	16	BAT-
4	AGND	17	ABS(A)
5	V-(A)	18	BAT+
6	ALM-RESET(A) **	19	ENCZX(A)
7	V-(A)	20	ENCZX(A)
8	V-(A)	21	DGND
9	T-ENABLE(A) **	22	V+(A)
10	SHIELD	23	NO ALARM(A)
11	ENC(A)	24	ALD3(A)
12	ENC(A)	25	ALD2(A)
13	+5V	26	ALD1(A)

Notes:
** Included only on GN3-DSP-A2.

Socketed Parts

Locator	ORMEC PN	Mnfr PN
UA66, UA67	SEM030	GI CNY17-4Z
UA69	ULI006	NATIONAL LM324
U44	UDT008	TI SN7416N
UA68	UDC024	SILICONIX DG211CJ

-	Ormec_Systems_Corp Rochester NY		
PART: GN3-DSP-xx Rev. 1.2a to 2.1			
TITLE: Axis A Output Circuitry			
DESIGNER J.Barr	APPROVAL		
METHOD PCAD5	CODES	SIZE B	DRAWING GEN028 REV B
DATE: 92.10.13.e.jb		SHEET: 2 OF 4	

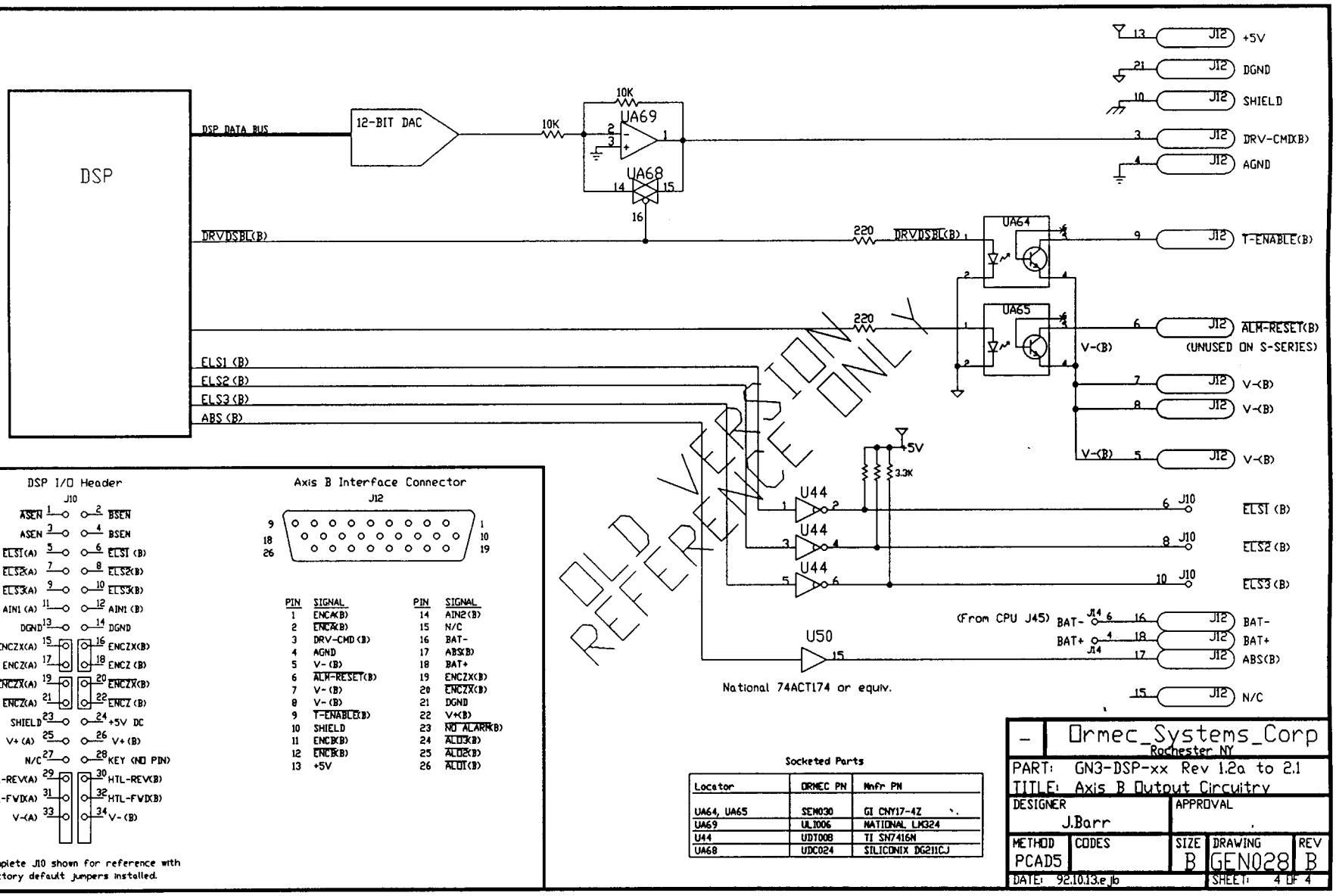


Notes:
1) ☐ Indicates default Jumper.

Socketed Parts

Locator	ORMEC PN	Mnfr PN
UA38, UA70, UA71	UL1024	GI OPTO MCL2730
UA69	UL1006	NATIONAL LM324
U30	UDT003	TI SN75175N
U53, U59	UDT011	NATIONAL DS88LS120N

–	Ormec_Systems_Corp Rochester NY			
PART: GN3-DSP-xx Rev 1.1b to 2.1				
TITLE: Axis B Input Circuitry				
DESIGNER J.Barr	APPROVAL			
METHOD PCAD4	CODES	SIZE B	DRAWING GEN028	REV A
DATE: 92.10.13.e.jb			SHEET: 3 OF 4	



DSP I/O Header

J10

ASEN	1	2	BSEN
ASEN	3	4	BSEN
ELS1(A)	5	6	ELS1 (B)
ELS2(A)	7	8	ELS2(B)
ELS3(A)	9	10	ELS3(B)
AIN1 (A)	11	12	AIN1 (B)
DGND	13	14	DGND
ENCZX(A)	15	16	ENCZX(B)
ENCZ(A)	17	18	ENCZ (B)
ENCZX(A)	19	20	ENCZX(B)
ENCZ(A)	21	22	ENCZ (B)
SHIELD	23	24	+5V DC
V+ (A)	25	26	V+ (B)
N/C	27	28	KEY (NO PIN)
HTL-REV(A)	29	30	HTL-REV(B)
HTL-FWD(A)	31	32	HTL-FWD(B)
V-(A)	33	34	V- (B)

Complete J10 shown for reference with factory default jumpers installed.

Axis B Interface Connector

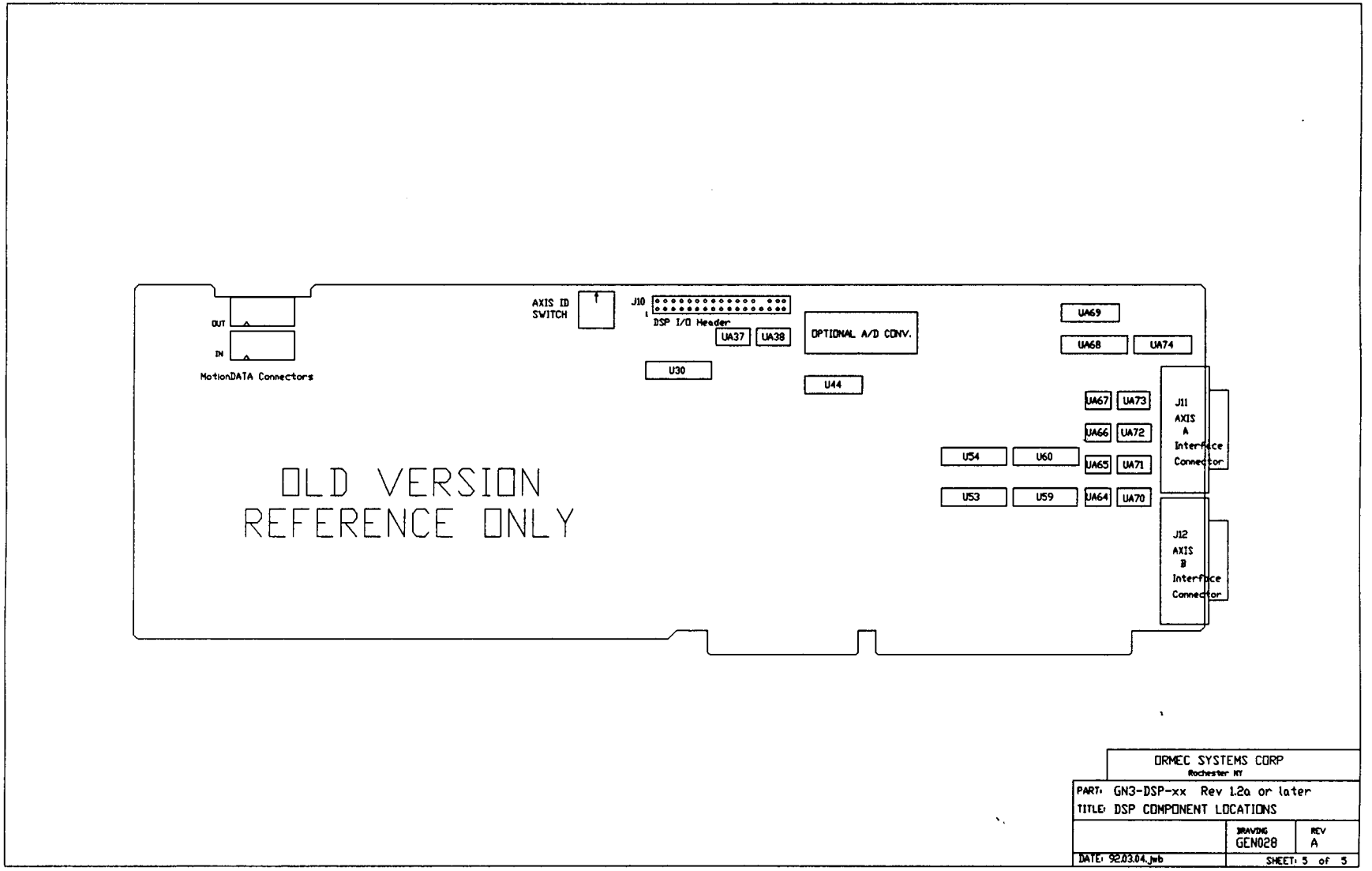
J12

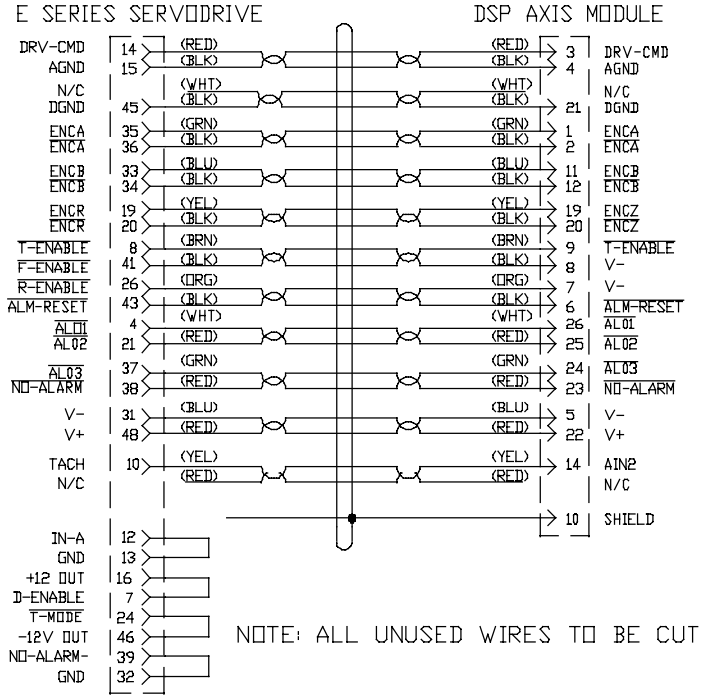
PIN	SIGNAL	PIN	SIGNAL
1	ENCA(B)	14	AIN2(B)
2	ENCA(B)	15	N/C
3	DRV-CMD (B)	16	BAT-
4	AGND	17	ABS(B)
5	V- (B)	18	BAT+
6	ALM-RESET(B)	19	ENCZX(B)
7	V- (B)	20	ENCZX(B)
8	V- (B)	21	DGND
9	T-ENABLE(B)	22	V+(B)
10	SHIELD	23	NO ALARM(B)
11	ENCB(B)	24	ALOI(B)
12	ENCB(B)	25	ALOI(B)
13	+5V	26	ALOI(B)

Socketed Parts

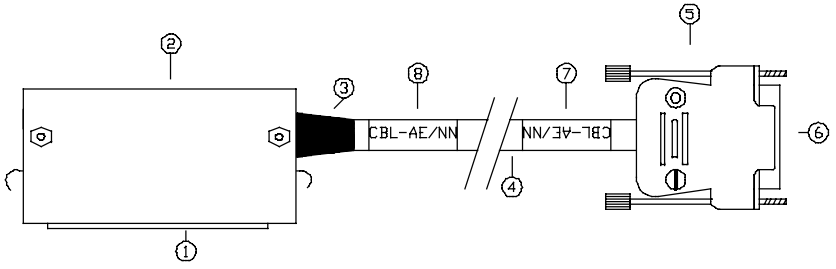
Locator	ORMEC PN	Mnfr PN
UA64, UA65	SEM030	GI CNY17-4Z
UA69	ULI006	NATIONAL LM324
U44	UDT008	TI SN7416N
UA68	UDC024	SILICONIX DG211CJ

–	Ormec_Systems_Corp Rochester NY			
PART: GN3-DSP-xx Rev 1.2a to 2.1				
TITLE: Axis B Output Circuitry				
DESIGNER J.Barr	APPROVAL			
METHOD PCAD5	CODES	SIZE B	DRAWING GEN028	REV B
DATE: 92.10.13.e jb			SHEET: 4 OF 4	

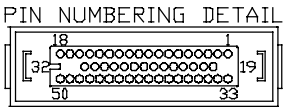

OUT
IN
MotionDATA Connectors
AXIS ID SWITCH
J10
DSP I/O Header
UA37
UA38
U30
OPTIONAL A/D CONV.
U44
UA69
UA68
UA74
UA67
UA73
UA66
UA72
U54
U60
UA65
UA71
U53
U59
UA64
UA70
J11 AXIS A Interface Connector
J12 AXIS B Interface Connector
OLD VERSION
REFERENCE ONLY
ORMEC SYSTEMS CORP
Rochester NY
PART: GN3-DSP-xx Rev 1.2a or later
TITLE: DSP COMPONENT LOCATIONS
DRAWING GEN028
REV A
DATE: 92.03.04.jwb
SHEET: 5 of 5



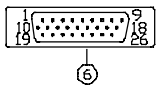
NOTE: ALL UNUSED WIRES TO BE CUT OFF AND DISCARDED



PIN NUMBERING DETAIL



PIN NUMBERING DETAIL



1. FEMALE 50 PIN CONNECTOR
2. CONNECTOR SHELL, w/ LATCHING CLIPS AND CAPTIVE SCREWS
3. RUBBER BOOTS
4. 15 PAIR, SHIELDED, .42"O.D.
5. CONNECTOR SHELL w/ CAPTIVE SCREWS
6. MALE, 26 PIN HI DENSITY CONNECTOR
7. MODEL# LABEL, LOCATE APPROX 1/2 INCH AWAY FROM RUBBER BOOTS OR SHRINK TUBING CLEAR HEATSHRINK SHOULD COVER CABLE LABEL

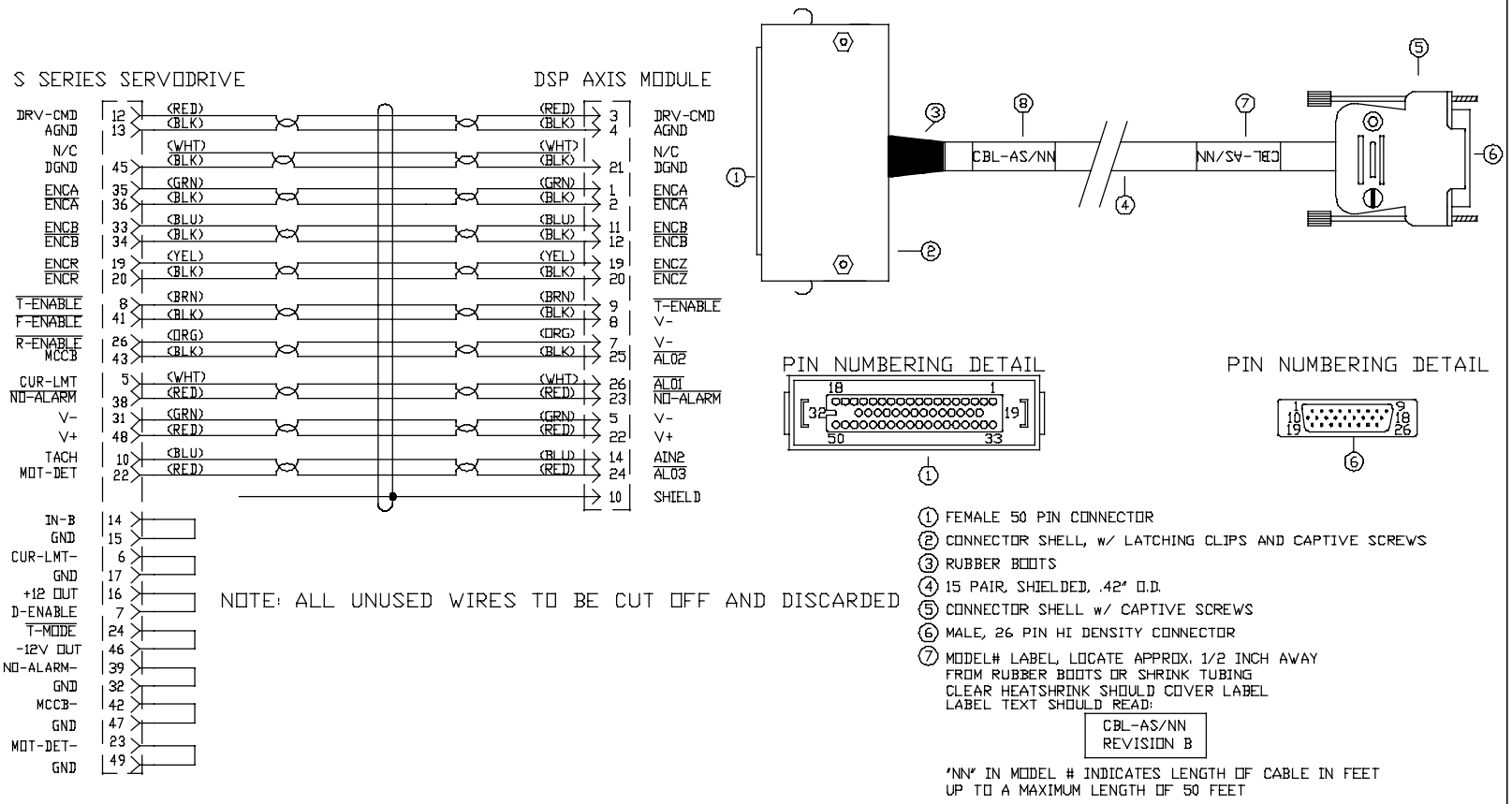
LABEL TEXT SHOULD READ:

CBL-AE/NN
REVISION B

'NN' IN MODEL # INDICATES THE LENGHT OF CABLE IN FEET UP TO A MAXIMUM OF 50 FEET

E-SERIES AXIS INTERFACE CABLE

E H D L	–	ORMEC SYSTEMS CORP
DATE 11.10.92		PART NO: CBL-AE/NN
DESIGNER EJB		TITLE: DSP TO E SERIES CABLE
DRAWN BY EJB		ASSEMBLY DRAWING
APPROVAL	METHOD ACAD	B CBA157-1 OF 1 REV C



NOTE: ALL UNUSED WIRES TO BE CUT OFF AND DISCARDED

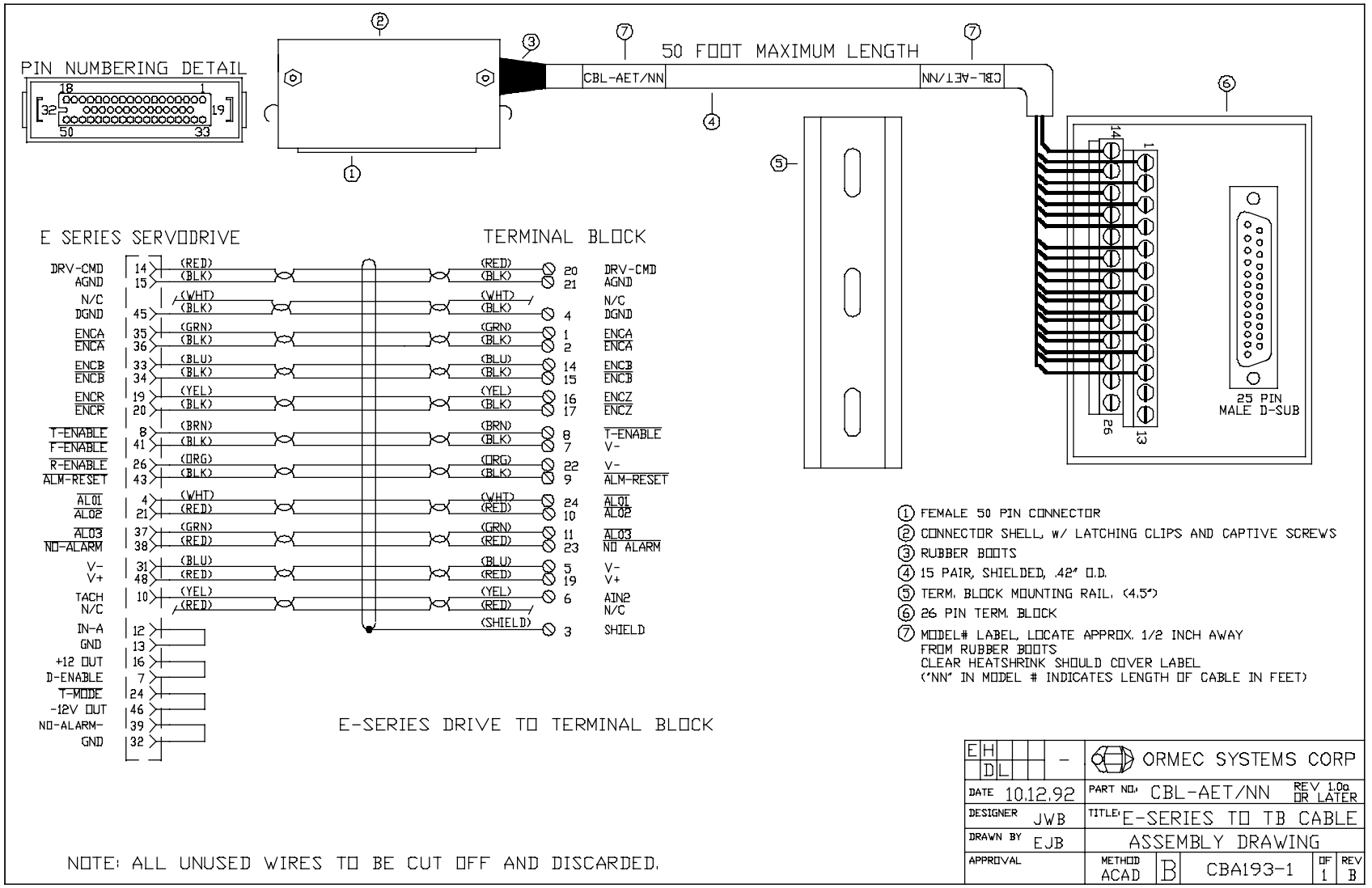
1. FEMALE 50 PIN CONNECTOR
2. CONNECTOR SHELL, w/ LATCHING CLIPS AND CAPTIVE SCREWS
3. RUBBER BOOTS
4. 15 PAIR, SHIELDED, .42" O.D.
5. CONNECTOR SHELL w/ CAPTIVE SCREWS
6. MALE, 26 PIN HI DENSITY CONNECTOR
7. MODEL# LABEL, LOCATE APPROX. 1/2 INCH AWAY FROM RUBBER BOOTS OR SHRINK TUBING
   CLEAR HEATSHRINK SHOULD COVER LABEL
   LABEL TEXT SHOULD READ:

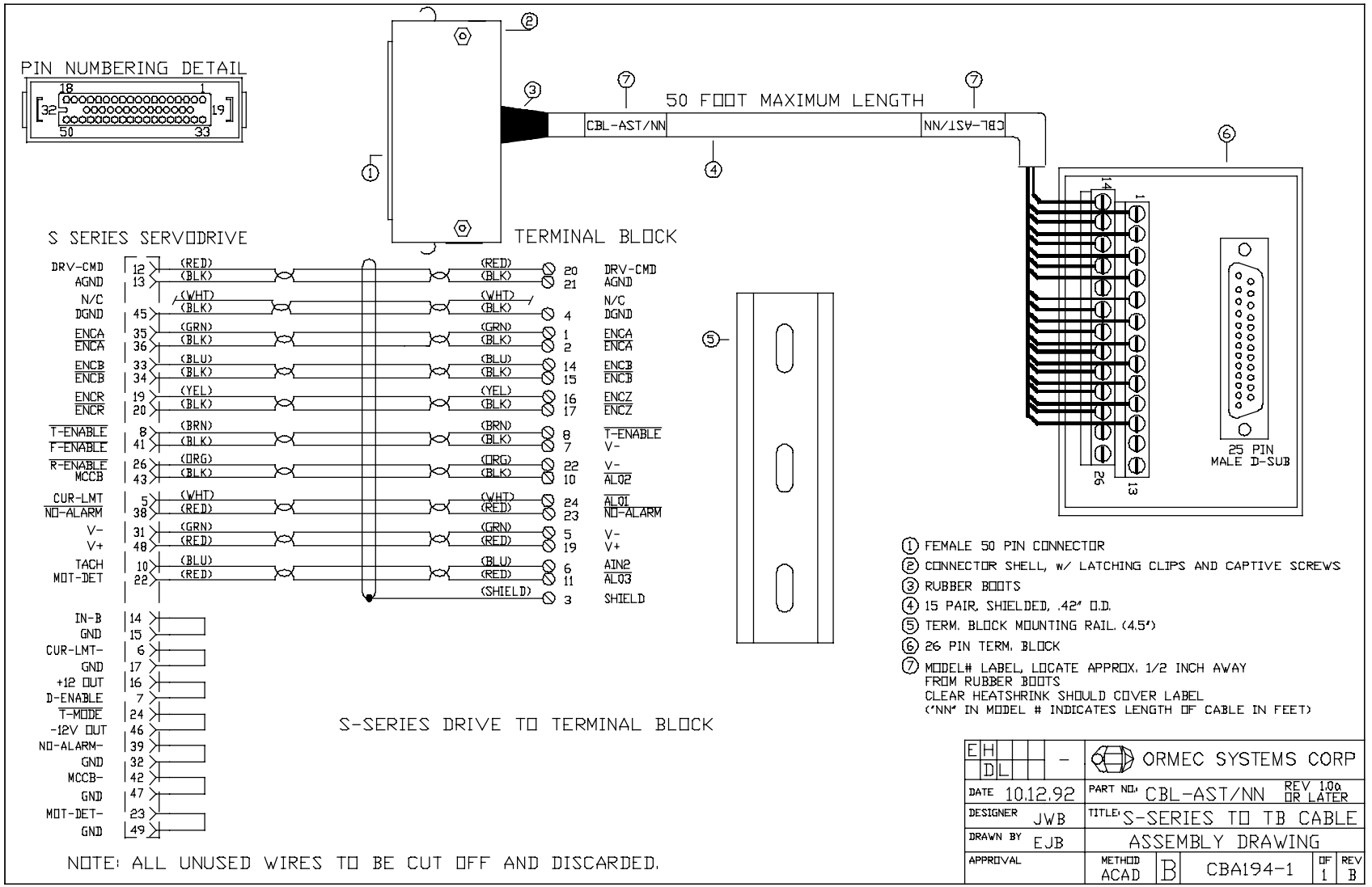
   CBL-AS/NN
   REVISION B

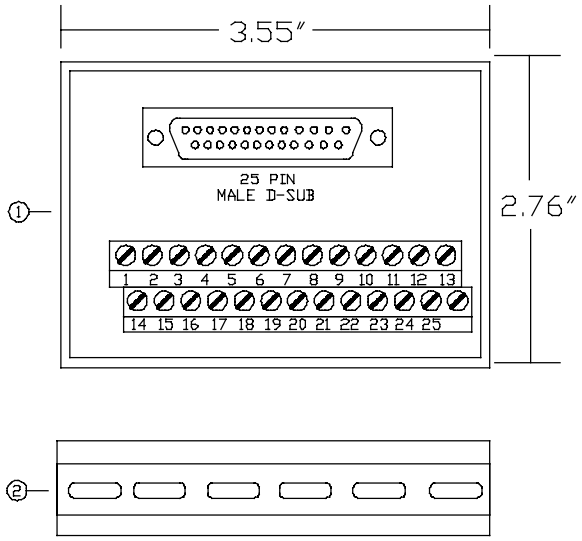
"NN" IN MODEL # INDICATES LENGTH OF CABLE IN FEET
UP TO A MAXIMUM LENGTH OF 50 FEET

S-SERIES AXIS INTERFACE CABLE

E H / D L	-	ORMEC SYSTEMS CORP
DATE 11.10.92		PART NO. CBL-AS/NN
DESIGNER EJB		TITLE DSP TO S SERIES CABLE
DRAWN BY EJB		ASSEMBLY DRAWING
APPROVAL	METHOD ACAD	B CBA156-1 OF 1 REV C

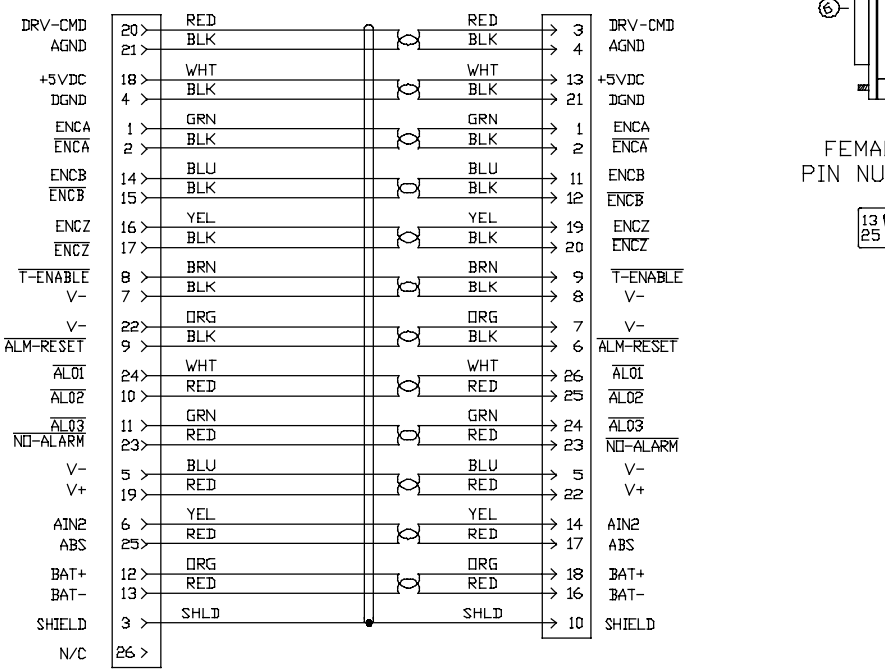

PIN NUMBERING DETAIL
50 FOOT MAXIMUM LENGTH
CBL-AET/NN
25 PIN MALE D-SUB
E SERIES SERVODRIVE
TERMINAL BLOCK
DRV-CMD
AGND
N/C
DGND
ENCA
ENCA
ENCB
ENCB
ENCR
ENCR
T-ENABLE
F-ENABLE
R-ENABLE
ALM-RESET
AL01
AL02
AL03
NO-ALARM
V-
V+
TACH
N/C
IN-A
GND
+12 OUT
D-ENABLE
T-MODE
-12V OUT
NO-ALARM-
GND
(RED)
(BLK)
(WHT)
(GRN)
(BLU)
(YEL)
(BRN)
(ORG)
(SHIELD)
AIN2
SHIELD
E-SERIES DRIVE TO TERMINAL BLOCK
1 FEMALE 50 PIN CONNECTOR
2 CONNECTOR SHELL, W/ LATCHING CLIPS AND CAPTIVE SCREWS
3 RUBBER BOOTS
4 15 PAIR, SHIELDED, .42" O.D.
5 TERM. BLOCK MOUNTING RAIL. (4.5")
6 26 PIN TERM. BLOCK
7 MODEL# LABEL, LOCATE APPROX. 1/2 INCH AWAY FROM RUBBER BOOTS
CLEAR HEATSHRINK SHOULD COVER LABEL
("NN" IN MODEL # INDICATES LENGTH OF CABLE IN FEET)
NOTE: ALL UNUSED WIRES TO BE CUT OFF AND DISCARDED.
ORMEC SYSTEMS CORP
DATE 10.12.92
PART NO: CBL-AET/NN
REV 1.0a OR LATER
DESIGNER JWB
TITLE: E-SERIES TO TB CABLE
DRAWN BY EJB
ASSEMBLY DRAWING
APPROVAL
METHOD ACAD
B
CBA193-1
OF 1
REV B


PIN NUMBERING DETAIL
50 FOOT MAXIMUM LENGTH
CBL-AST/NN
S SERIES SERVODRIVE
TERMINAL BLOCK
25 PIN MALE D-SUB
DRV-CMD 12 (RED) (RED) 20 DRV-CMD
AGND 13 (BLK) (BLK) 21 AGND
N/C (WHT) (WHT) N/C
DGND 45 (BLK) (BLK) 4 DGND
ENCA 35 (GRN) (GRN) 1 ENCA
ENCA 36 (BLK) (BLK) 2 ENCA
ENCB 33 (BLU) (BLU) 14 ENCB
ENCB 34 (BLK) (BLK) 15 ENCB
ENCR 19 (YEL) (YEL) 16 ENCZ
ENCR 20 (BLK) (BLK) 17 ENCZ
T-ENABLE 8 (BRN) (BRN) 8 T-ENABLE
T-ENABLE 41 (BLK) (BLK) 7 V-
R-ENABLE 26 (ORG) (ORG) 22 V-
MCCB 43 (BLK) (BLK) 10 AL02
CUR-LMT 5 (WHT) (WHT) 24 AL01
NO-ALARM 38 (RED) (RED) 23 NO-ALARM
V- 31 (GRN) (GRN) 5 V-
V+ 48 (RED) (RED) 19 V+
TACH 10 (BLU) (BLU) 6 AIN2
MOT-DET 22 (RED) (RED) 11 AL03
(SHIELD) 3 SHIELD
IN-B 14
GND 15
CUR-LMT- 6
GND 17
+12 OUT 16
D-ENABLE 7
T-MODE 24
-12V OUT 46
NO-ALARM- 39
GND 32
MCCB- 42
GND 47
MOT-DET- 23
GND 49
S-SERIES DRIVE TO TERMINAL BLOCK
NOTE: ALL UNUSED WIRES TO BE CUT OFF AND DISCARDED.
1 FEMALE 50 PIN CONNECTOR
2 CONNECTOR SHELL, w/ LATCHING CLIPS AND CAPTIVE SCREWS
3 RUBBER BOOTS
4 15 PAIR, SHIELDED, .42" O.D.
5 TERM. BLOCK MOUNTING RAIL. (4.5")
6 26 PIN TERM. BLOCK
7 MODEL# LABEL, LOCATE APPROX. 1/2 INCH AWAY FROM RUBBER BOOTS
CLEAR HEATSHRINK SHOULD COVER LABEL
('NN' IN MODEL # INDICATES LENGTH OF CABLE IN FEET)
ORMEC SYSTEMS CORP
DATE 10.12.92
PART NO. CBL-AST/NN
REV 1.0a OR LATER
DESIGNER JWB
TITLE: S-SERIES TO TB CABLE
DRAWN BY EJB
ASSEMBLY DRAWING
APPROVAL
METHOD ACAD
B
CBA194-1
OF 1
REV B



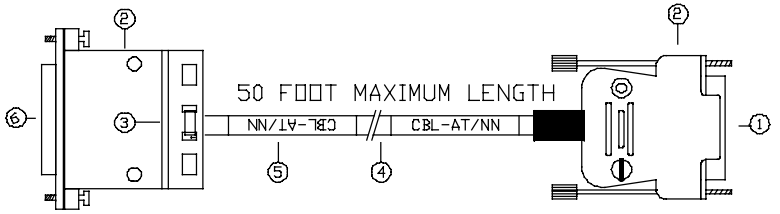
① SNAP-TRACK TERMINAL BLOCK
② 4.5″ OF TERMINAL BLOCK MOUNTING RAIL

EH DL –	ORMEC SYSTEMS CORP	
DATE 020792	PART NO. TBC-D25	
DESIGNER DVH	TITLE: TERMINAL BLOCK, 25 POSITION	
DRAWN BY EJB	ASSEMBLY DRAWING	
APPROVAL	METHOD ACAD | B | CBA998-1	OF 1 | REV A

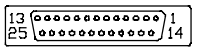


NOTE: ALL UNUSED WIRES TO BE CUT OFF AND DISCARDED

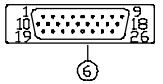
DSP AXIS INTERFACE TO D-SUB CABLE



FEMALE CONNECTOR
PIN NUMBERING DETAIL

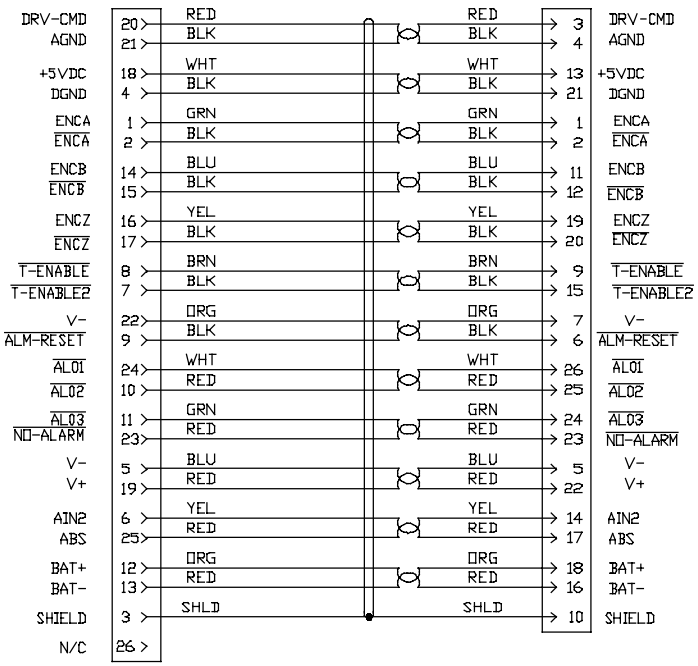


PIN NUMBERING DETAIL



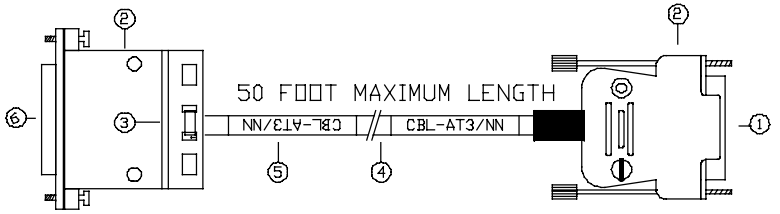
1. MALE, 26 PIN HI DENSITY CONNECTOR
2. CONNECTOR SHELL W/ THUMB SCREWS
3. TIE WRAP
4. 15 TWISTED PAIR, SHIELDED, .42 O.D.
5. CABLE LABEL LOCATED AT EACH END
   CLEAR HEATSHRINK SHOULD COVER CABLE LABEL
6. 25 PIN FEMALE INSULATION DISPLACEMENT CONNECTOR

E H / D L	–	ORMEC SYSTEMS CORP
DATE 10.12.92		PART NO.: CBL-AT/NN
DESIGNER RJM		TITLE: DSP TO TERMINAL BLOCK
DRAWN BY EJB		ASSEMBLY DRAWING
APPROVAL		METHOD ACAD 10 | B | CBA192-1 | OF 1 | REV B

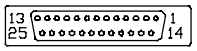


NOTE: ALL UNUSED WIRES TO BE CUT OFF AND DISCARDED

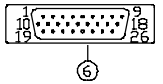
DSP AXIS INTERFACE TO D-SUB CABLE



FEMALE CONNECTOR
PIN NUMBERING DETAIL

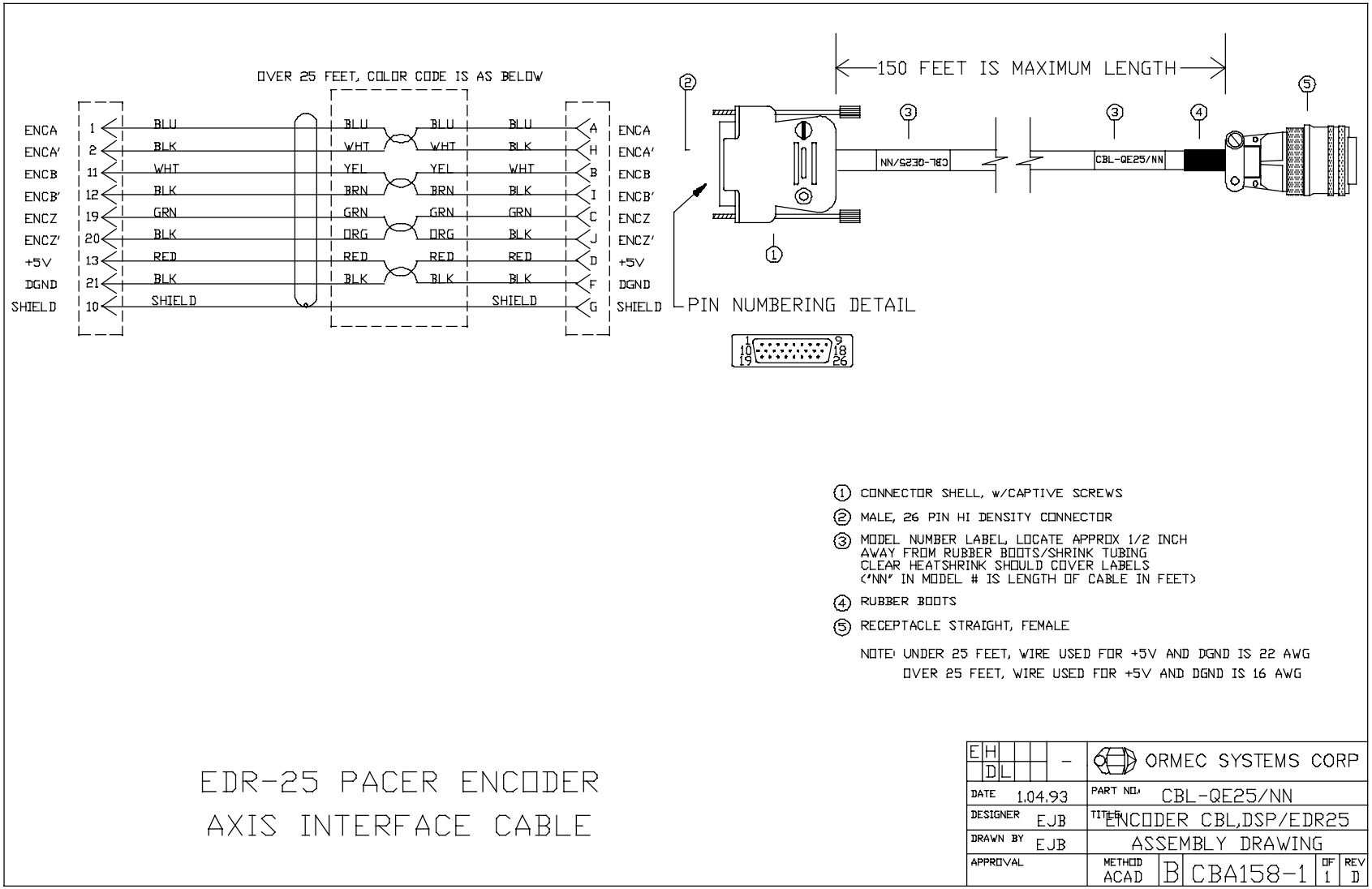


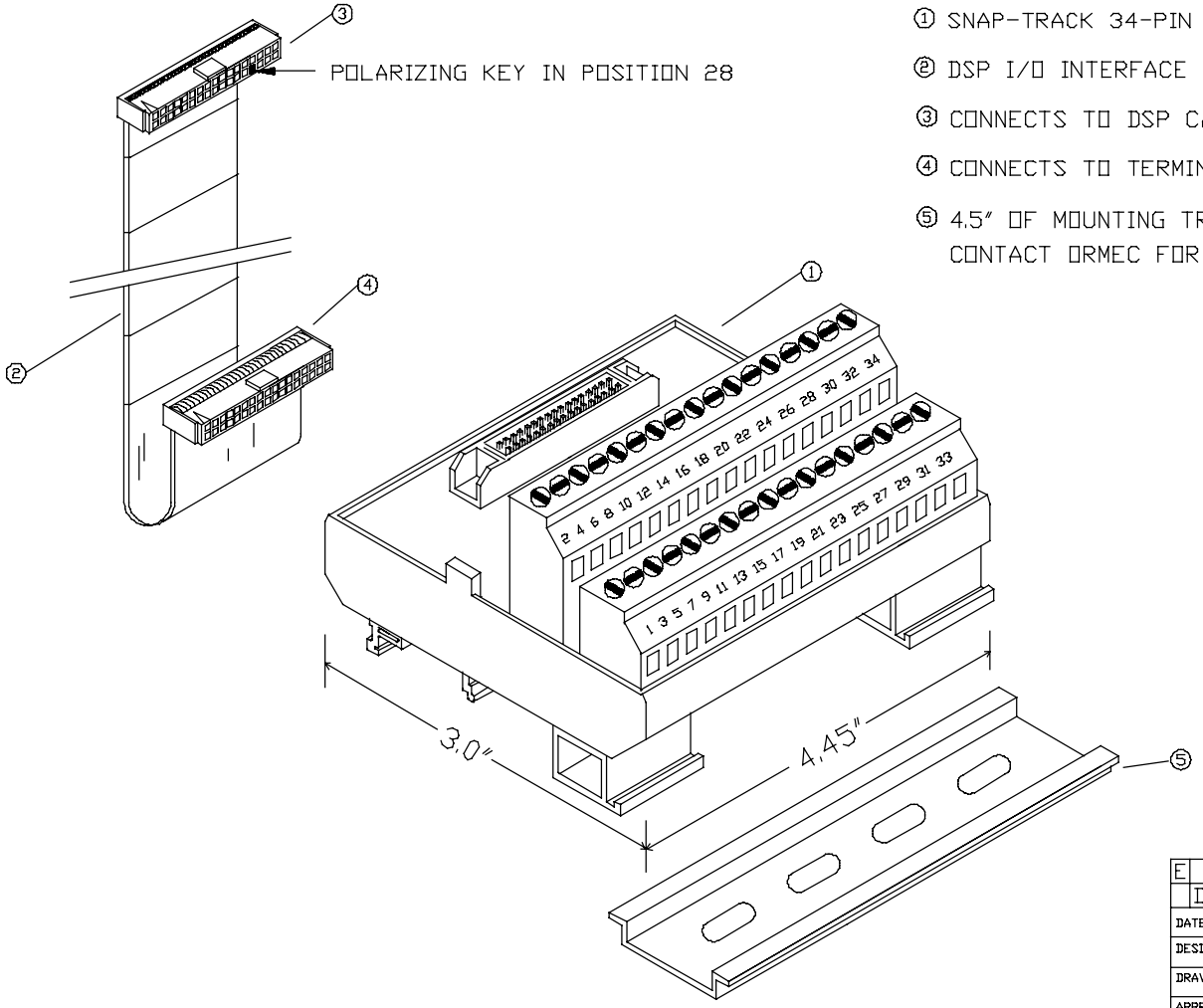
PIN NUMBERING DETAIL



1. MALE, 26 PIN HI DENSITY CONNECTOR
2. CONNECTOR SHELL W/ THUMB SCREWS
3. TIE WRAP
4. 15 TWISTED PAIR, SHIELDED, .42 O.D.
5. CABLE LABEL LOCATED AT EACH END
   CLEAR HEATSHRINK SHOULD COVER CABLE LABEL
6. 25 PIN FEMALE INSULATION DISPLACEMENT CONNECTOR

E H / D L	–	ORMEC SYSTEMS CORP
DATE 12.11.92		PART NO. CBL-AT3/NN
DESIGNER RJM		TITLE DSP TO TERMINAL BLOCK
DRAWN BY EJB		ASSEMBLY DRAWING
APPROVAL		METHOD ACAD 10 | B | CBA198-1 | OF 1 | REV A


OVER 25 FEET, COLOR CODE IS AS BELOW
ENCA 1 BLU BLU BLU BLU A ENCA
ENCA' 2 BLK WHT WHT BLK H ENCA'
ENCB 11 WHT YEL YEL WHT B ENCB
ENCB' 12 BLK BRN BRN BLK I ENCB'
ENCZ 19 GRN GRN GRN GRN C ENCZ
ENCZ' 20 BLK ORG ORG BLK J ENCZ'
+5V 13 RED RED RED RED D +5V
DGND 21 BLK BLK BLK BLK F DGND
SHIELD 10 SHIELD SHIELD G SHIELD
150 FEET IS MAXIMUM LENGTH
CBL-QE25/NN
CBL-QE25/NN
PIN NUMBERING DETAIL
1 CONNECTOR SHELL, w/CAPTIVE SCREWS
2 MALE, 26 PIN HI DENSITY CONNECTOR
3 MODEL NUMBER LABEL, LOCATE APPROX 1/2 INCH AWAY FROM RUBBER BOOTS/SHRINK TUBING CLEAR HEATSHRINK SHOULD COVER LABELS ('NN' IN MODEL # IS LENGTH OF CABLE IN FEET)
4 RUBBER BOOTS
5 RECEPTACLE STRAIGHT, FEMALE
NOTE: UNDER 25 FEET, WIRE USED FOR +5V AND DGND IS 22 AWG
OVER 25 FEET, WIRE USED FOR +5V AND DGND IS 16 AWG
EDR-25 PACER ENCODER
AXIS INTERFACE CABLE
ORMEC SYSTEMS CORP
DATE 1.04.93
PART NO. CBL-QE25/NN
DESIGNER EJB
TITLE ENCODER CBL,DSP/EDR25
DRAWN BY EJB
ASSEMBLY DRAWING
APPROVAL
METHOD ACAD
B CBA158-1
OF 1
REV D



① SNAP-TRACK 34-PIN TERMINAL BLOCK FOR RIBBON CABLE

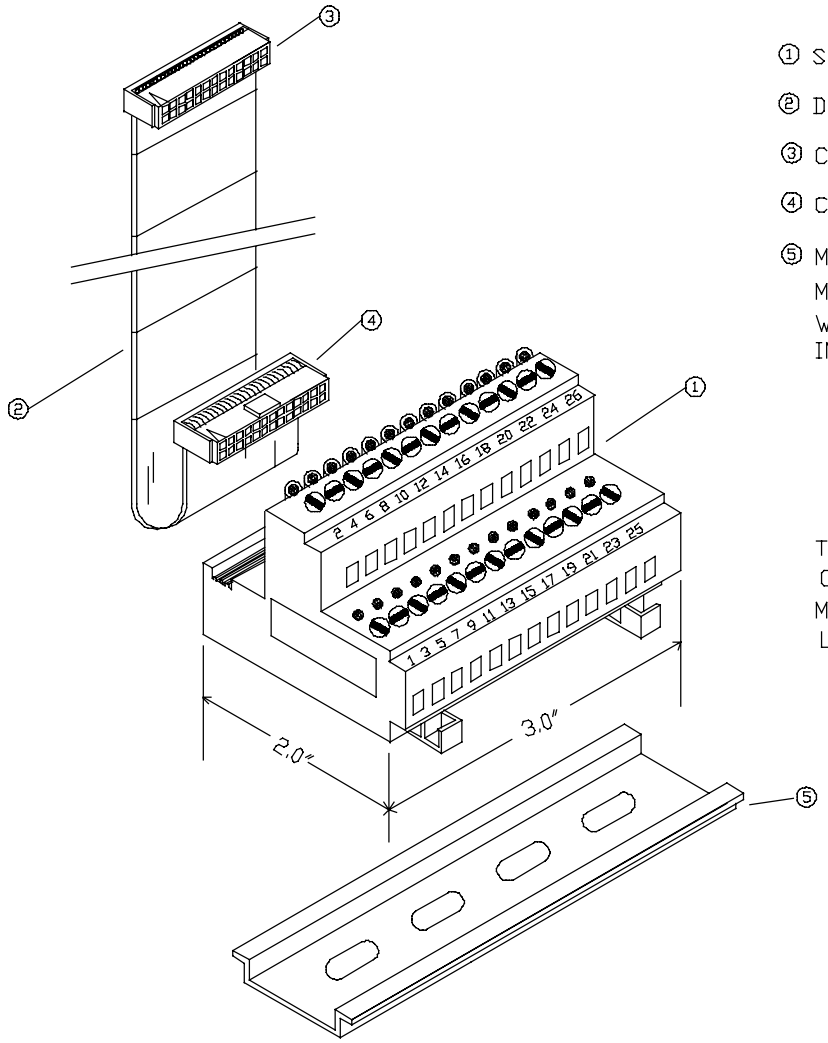
② DSP I/O INTERFACE CABLE

③ CONNECTS TO DSP CARD

④ CONNECTS TO TERMINAL BLOCK

⑤ 4.5″ OF MOUNTING TRACK INCLUDED.
CONTACT ORMEC FOR DIFFERENT OR ADDITIONAL LENGTHS

E / DL	–	ORMEC SYSTEMS CORP
DATE 92.01.31		PART NO. CBL-DSP-IO/X
DESIGNER krf		TITLE: DSP I/O TERMINAL BLOCK
DRAWN BY ejb		ASSEMBLY DRAWING
APPROVAL		METHOD ACAD | B | CBA189-2 | OF 2 | REV B



① SNAP-TRACK 26-PIN TERMINAL BLOCK FOR RIBBON CABLE

② DSP SENSOR CABLE

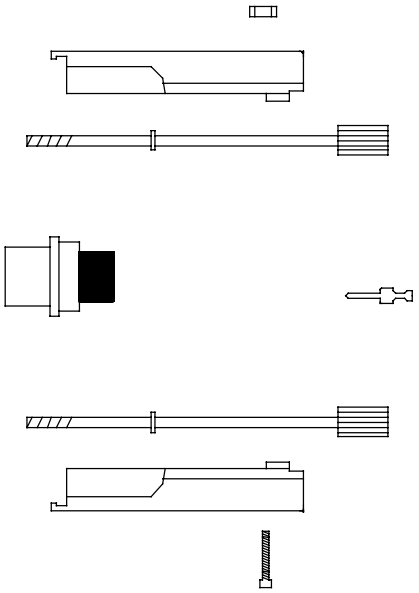
③ CONNECTS TO DSP CARD

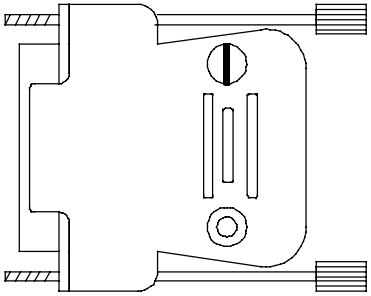
④ CONNECTS TO TERMINAL BLOCK

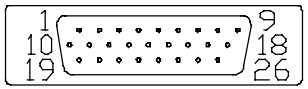
⑤ MOUNTING RACK ACC-MTR/NN
MUST BE PURCHASED SEPARATELY
WHERE "NN" SPECIFIES TOTAL LENGTH,
IN INCHES, FROM 1 TO 78

THIS UNIT IS ONLY FOR
GN3-DSP-AX DSP AXIS
MODULES PRIOR TO REVISION
LEVEL 1.1B

E / DL –	ORMEC SYSTEMS CORP
DATE 92.02.28	PART NO: CBL-DSP-TB/NN
DESIGNER krf	TITLE: DSP SENSOR TERMINAL BLK
DRAWN BY ejb	ASSEMBLY DRAWING
APPROVAL	METHOD ACAD | B | CBA183-2 | DF 2 | REV A



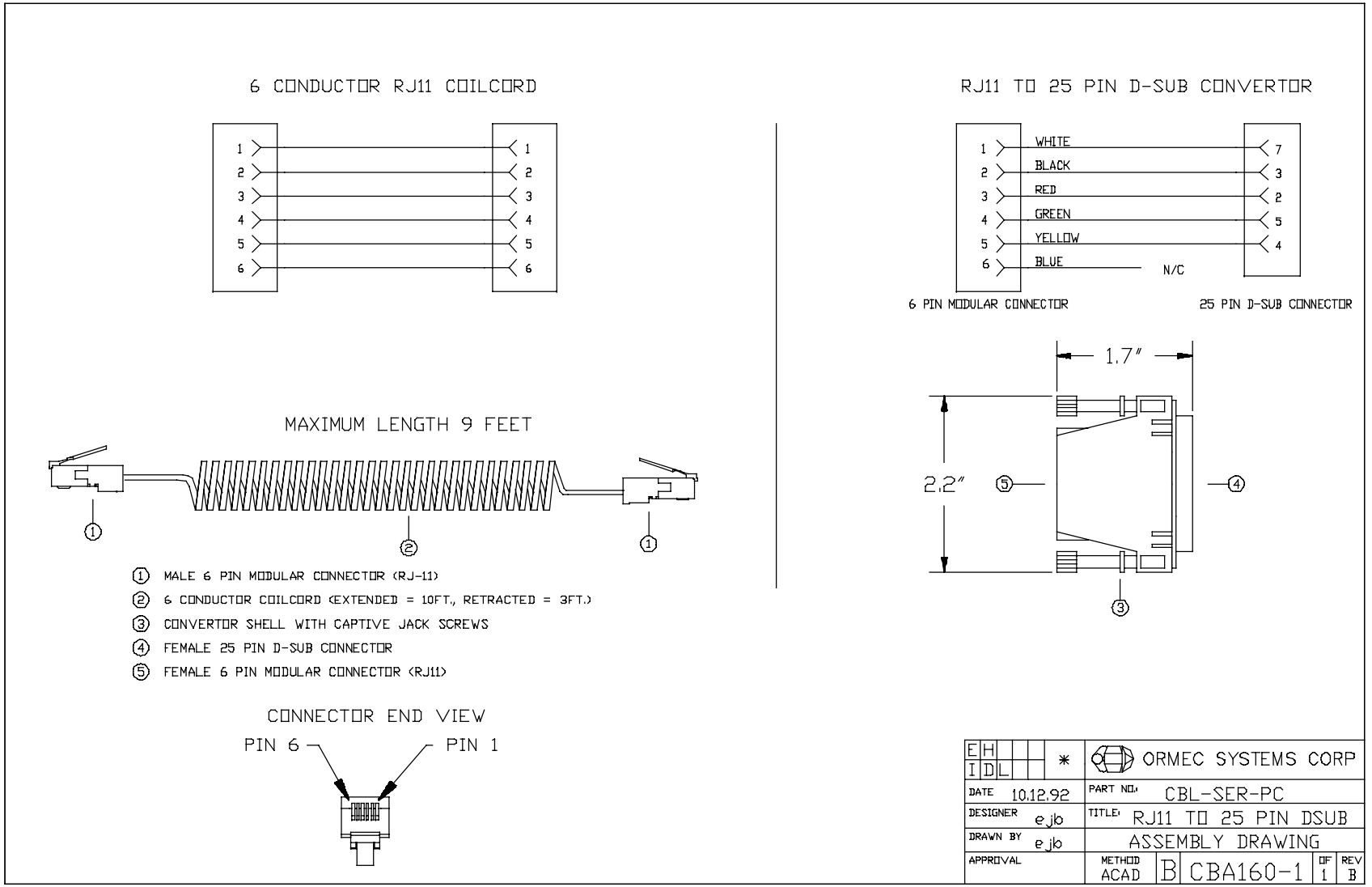




Connector: 1 ea. AMP P/N 748365-1. HDP-22 Style Plug.
Pins: 30 ea. AMP P/N 748333-4. Wire 22-28 AWG, .040" max insulation dia.
Shell: 1 ea. AMP P/N 745122-2. Max. cable dia. 0.400"

Note: For a reliable connection ORMEC and AMP recommend the use of AMP P/N 90430-1 to crimp the pins.

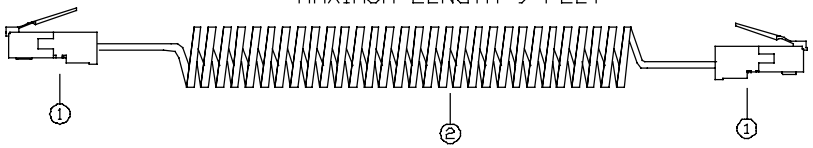
E H / D L		ORMEC SYSTEMS CORP
DATE 91.05.01	PART NO.	CON-2Q
DESIGNER EJB	TITLE:	DSP I/F CONNECTOR
DRAWN BY EJB		ASSEMBLY DRAWING
APPROVAL	METHOD ACAD	B CBA999-1 | DF 1 | REV A


6 CONDUCTOR RJ11 COILCORD
1
2
3
4
5
6
MAXIMUM LENGTH 9 FEET
1 MALE 6 PIN MODULAR CONNECTOR (RJ-11)
2 6 CONDUCTOR COILCORD (EXTENDED = 10FT., RETRACTED = 3FT.)
3 CONVERTOR SHELL WITH CAPTIVE JACK SCREWS
4 FEMALE 25 PIN D-SUB CONNECTOR
5 FEMALE 6 PIN MODULAR CONNECTOR (RJ11)
CONNECTOR END VIEW
PIN 6
PIN 1
RJ11 TO 25 PIN D-SUB CONVERTOR
WHITE
BLACK
RED
GREEN
YELLOW
BLUE
N/C
7
3
2
5
4
6 PIN MODULAR CONNECTOR
25 PIN D-SUB CONNECTOR
1.7"
2.2"
ORMEC SYSTEMS CORP
PART NO. CBL-SER-PC
DATE 10.12.92
DESIGNER e.jb
TITLE RJ11 TO 25 PIN DSUB
DRAWN BY e.jb
ASSEMBLY DRAWING
APPROVAL
METHOD ACAD
B CBA160-1
DF 1
REV B

6 CONDUCTOR RJ11 COILCORD

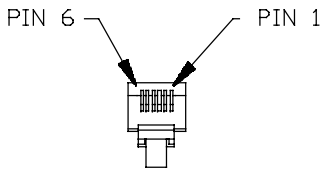


MAXIMUM LENGTH 9 FEET

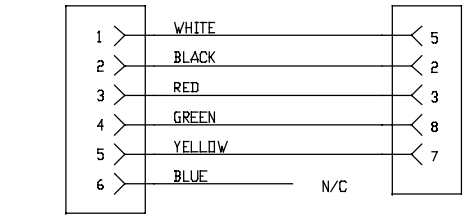


1. MALE 6 PIN MODULAR CONNECTOR (RJ-11)
2. 6 CONDUCTOR COILCORD (EXTENDED = 10FT., RETRACTED = 3FT.)
3. CONVERTOR SHELL WITH CAPTIVE JACK SCREWS
4. FEMALE 9 PIN D-SUB CONNECTOR
5. FEMALE 6 PIN MODULAR CONNECTOR (RJ11)

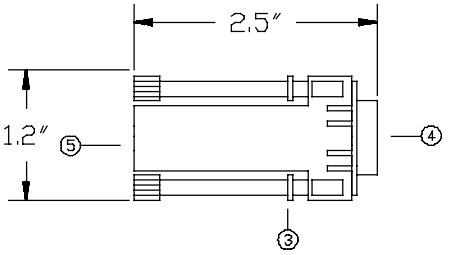
CONNECTOR END VIEW



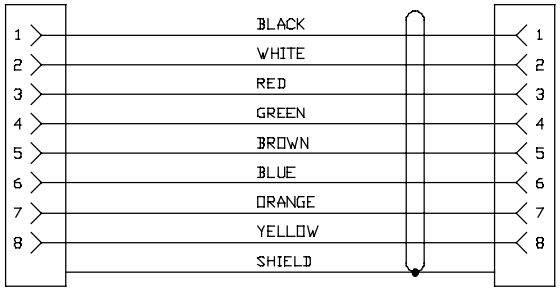
RJ11 TO 9 PIN D-SUB CONVERTOR

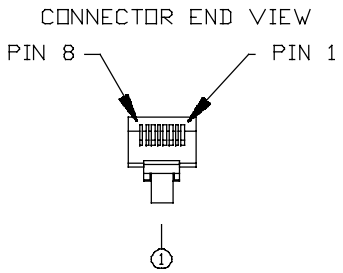


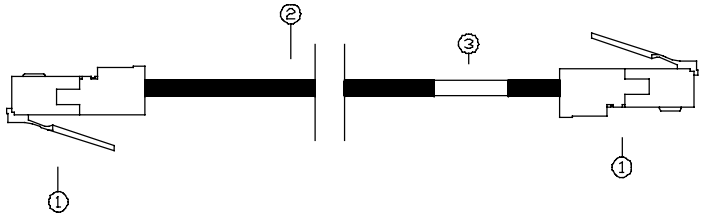
6 PIN MODULAR CONNECTOR — 9 PIN D-SUB CONNECTOR



E H I D L *	ORMEC SYSTEMS CORP	
DATE 10.12.92	PART NO. CBL-SER-AT	
DESIGNER krf	TITLE: RJ11 TO 9 PIN DSUB	
DRAWN BY ejb	ASSEMBLY DRAWING	
APPROVAL	METHOD ACAD	B CBA159-1 DF 1 REV B





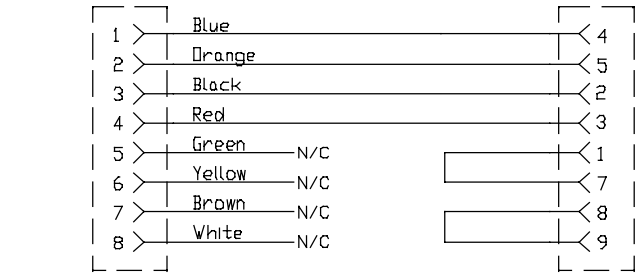


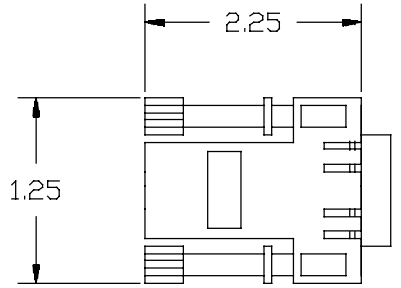
1. 8 PIN, MALE, SHIELDED, MODULAR CONNECTOR : AMP PART # 5-555178-4
   TERMINATING TOOL FOR ABOVE: AMP PART # 231652-1
   SEE AMP APPLICATION SPECIFICATION # 114-06016 FOR INSTRUCTIONS
2. 8 CONDUCTOR, SHIELDED, FLAT OVAL CABLE
3. LABEL, THE LAST TWO DIGITS OF THE PART NUMBER
   SPECIFY THE LENGTH OF THE CABLE IN FEET

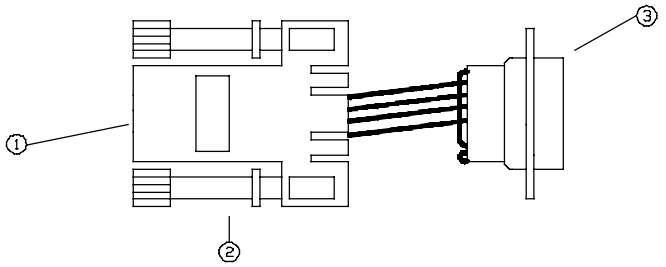
PRINT CABLE LABEL AS SHOWN
WHERE NNN = CABLE LENGTH (MAXIMUM CABLE LENGTH IS 500 Ft.)



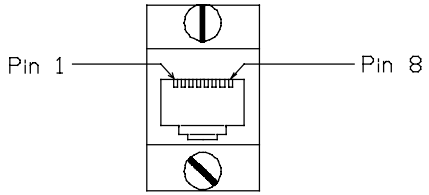
E H D L –	ORMEC SYSTEMS CORP
DATE 10.12.92	PART NO: CBL-MOD8/NNN
DESIGNER KRF	TITLE MotionDATA CBL,CPU/CPU
DRAWN BY EJB	ASSEMBLY DRAWING
APPROVAL	METHOD ACAD | B | CBA162-1 | OF 1 | REV B



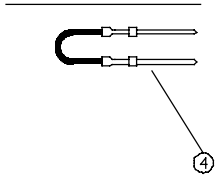




Modular connector pin numbering detail

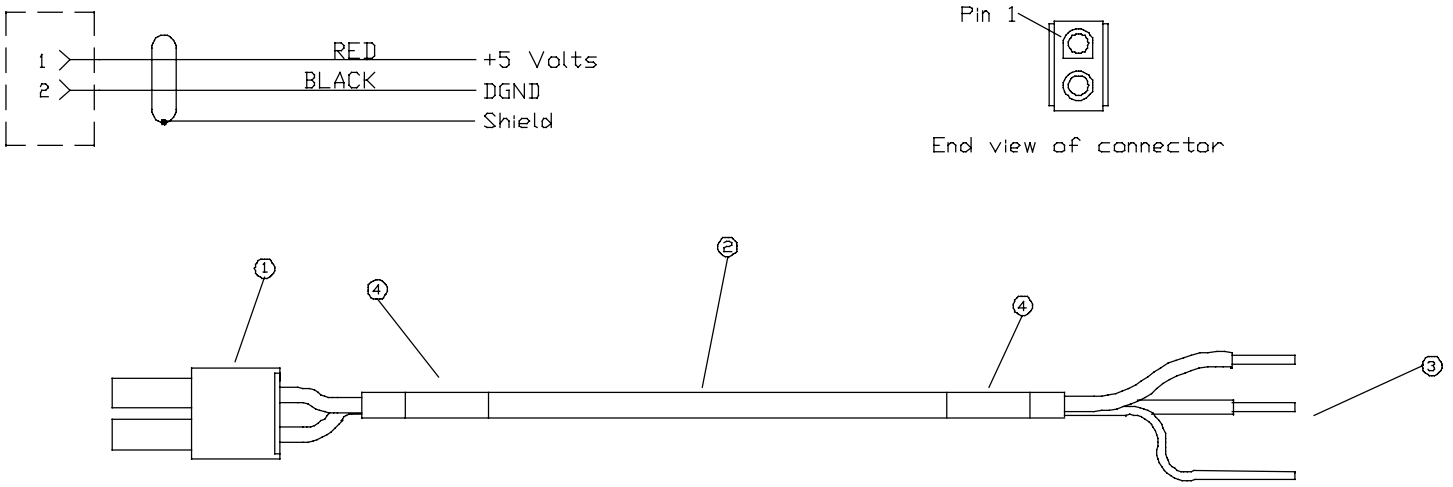


Jumper detail



① Female 8-pin modular (RJ-45) connector.
② Converter shell with captive jack screws.
③ 9-Pin Male D-Sub Connector
④ D-Sub Connector jumpers. (2 per Converter)

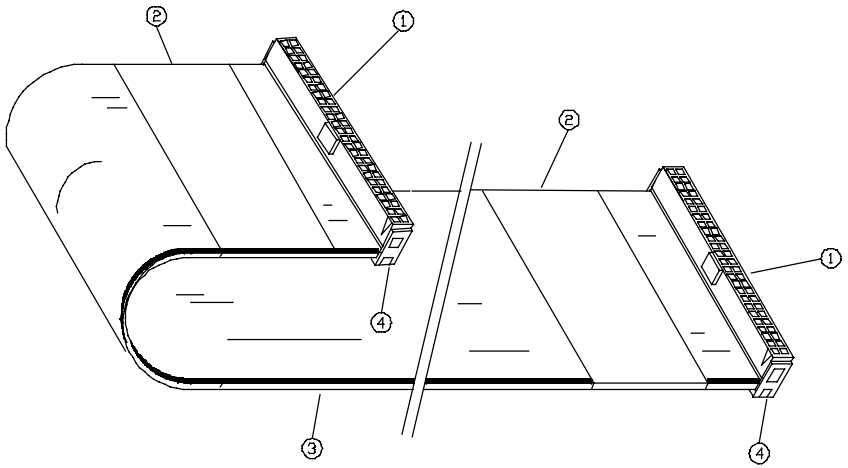
E H / D L	–	ORMEC SYSTEMS CORP
DATE 90.05.14		PART NO. CON-MOD8-ITM
DESIGNER krf		TITLE: ITM-270 to RJ-45 Conv.
DRAWN BY krf		ASSEMBLY DRAWING
APPROVAL		METHOD ACAD | B | CBA174-1 | OF 1 | REV A



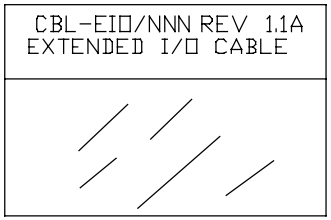
① 2-PIN POWER CONNECTOR
② CABLE, 2 CONDUCTOR, 16 AWG, W/SHIELD
③ STRIPPED AND TINNED LEADS
④ CLEAR HEATSHRINK COVERING CABLE LABEL
PRINT CABLE LABEL AS SHOWN,
WHERE NNN=LENGTH (MAXIMUM IS 150 Ft.)

CBL-ITMPWR/NN ITM-270 Power Cable

E H / D L	–	ORMEC SYSTEMS CORP
DATE 90.05.14		PART NO. CBL-ITMPWR/NNN
DESIGNER krf		TITLE: ITM-270 Power Cable
DRAWN BY EJB		ASSEMBLY DRAWING
APPROVAL		METHOD ACAD | B | CBA175-1 | DF 1 | REV B



A. PRINT CABLE LABEL AS SHOWN:
WHERE NNN = CABLE LENGTH
(MAXIMUM LENGTH IS 500 Ft.)



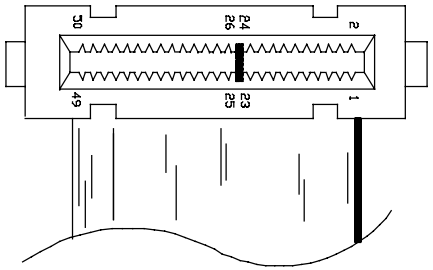
B. ARROW ON CONNECTORS DENOTES PIN 1 LOCATION.

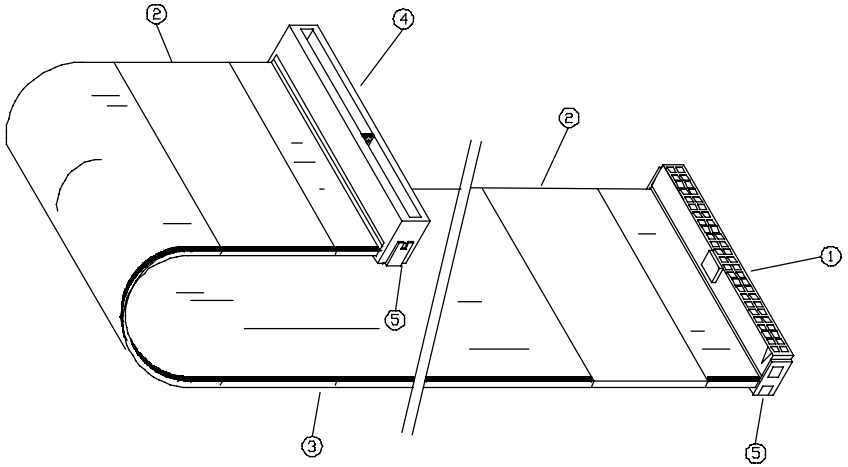
C. CONTINUITY BETWEEN CONNECTORS IS 1:1.
(e.g. PIN 1 TO PIN 1, PIN 2 TO PIN 2,...)

① 50-PIN IDC CONNECTOR
② CABLE LABEL
③ 50 CONDUCTOR, 28 AWG, FLAT CABLE
④ DO NOT USE STRAIN RELIEF

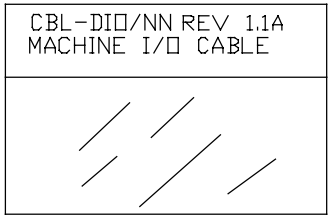
E H / D L	–	ORMEC SYSTEMS CORP
DATE 12.08.92		PART NO. CBL-EIO/NNN REV 1.1A
DESIGNER JWB		TITLE: EXTENDED I/O CABLE
DRAWN BY MTC		ASSEMBLY DRAWING
APPROVAL		METHOD ACAD | B | CBA176-1 | DF 1 | REV B

POLARIZATION KEY DETAIL





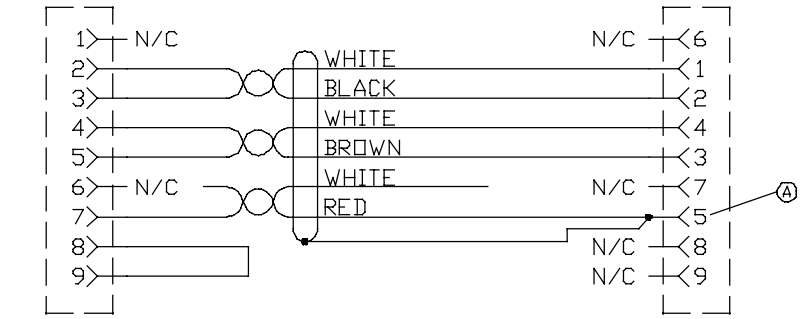
A. PRINT CABLE LABEL AS SHOWN:
WHERE NN = LENGTH (MAXIMUM LENGTH IS 9 Ft.)

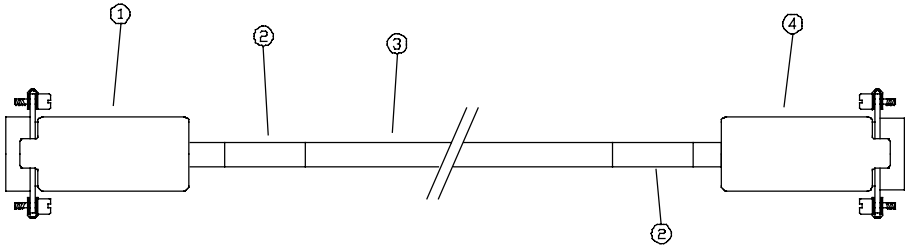


B. ARROW ON IDC CONNECTOR DENOTES PIN 1 LOCATION
C. CONTINUITY BETWEEN CONNECTORS IS 1:1.
(e.g. PIN 1 TO PIN 1, PIN 2 TO PIN 2,...)

① 50-PIN IDC CONNECTOR
② CABLE LABEL(S)
③ 50 CONDUCTOR, 28 AWG, FLAT CABLE
④ 50-PIN IDC TYPE CARDEDGE CONNECTOR
⑤ NO STRAIN RELIEF

E H / D L	–	ORMEC SYSTEMS CORP
DATE 12.08.92		PART NO. CBL-DIO/NN REV 1.1A
DESIGNER krf		TITLE: MACHINE I/O CABLE
DRAWN BY MTC		ASSEMBLY DRAWING
APPROVAL		METHOD ACAD | B | CBA102-1 | OF 1 | REV B





① 9-PIN, MALE, D-SUB IDC TYPE CONNECTOR
② CABLE LABEL COVERED BY CLEAR HEATSHRINK
PRINT CABLE LABEL AS SHOWN,
WHERE NNN = CABLE LENGTH
(MAXIMUM CABLE LENGTH IS 500 Ft.)

CBL-422-ITM/NNN 422-ITM-SIGNAL CABLE

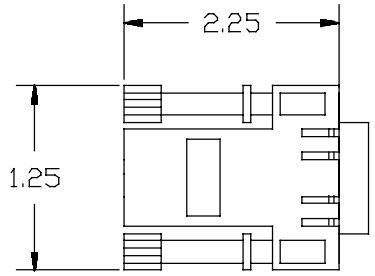
③ 6 CONDUCTOR (3 TWISTED PAIR) 22 AWG, W/SHIELD
④ 9-PIN, FEMALE, D-SUB IDC TYPE CONNECTOR

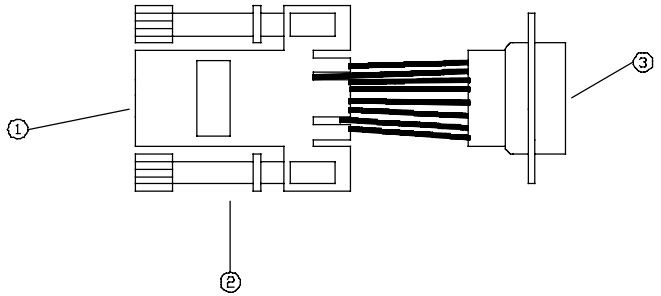
NOTES:

Ⓐ WHEN ATTACHING TWO WIRES TO A SINGLE PIN, USE THE CRIMP PIN LISTED ON THE PARTS LIST. AFTER CRIMPING WIRES INTO THE PIN, REPLACE THE PRE-INSTALLED PIN IN THE CONNECTOR WITH CRIMPED PIN.

E H / D L –	ORMEC SYSTEMS CORP	
DATE 90.06.22	PART NO: CBL-422-ITM/NNN	
DESIGNER krf	TITLE: GN3-422 TO ITM-270 CABLE	
DRAWN BY krf	ASSEMBLY DRAWING	
APPROVAL	METHOD ACAD	B CBA179-1 DF 1 REV A

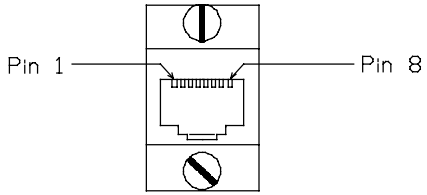




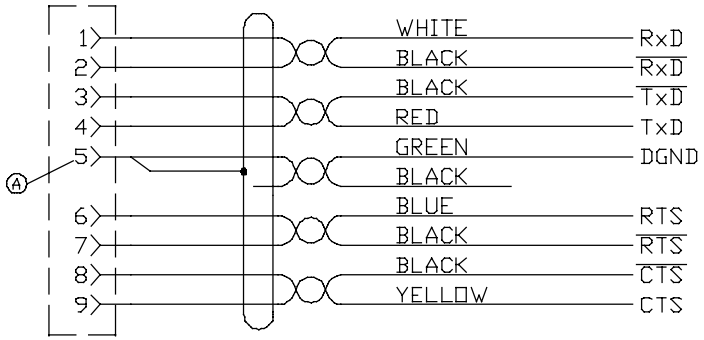


① FEMALE 8-PIN MODULAR (RJ-45) CONNECTOR
② CONVERTER SHELL WITH CAPTIVE JACK SCREWS
③ 9-PIN FEMALE CONNECTOR

Modular connector pin numbering detail



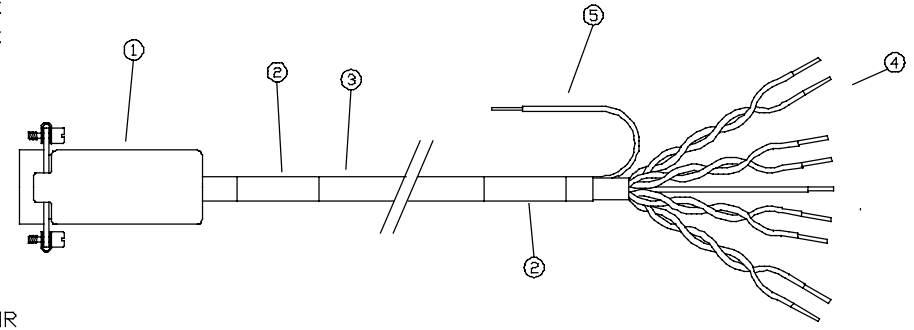
E H D L –		ORMEC SYSTEMS CORP
DATE 90.05.16	PART NO.	CON-422-MOD8
DESIGNER krf	TITLE:	GN3-422 TO RJ-45 CONV.
DRAWN BY krf		ASSEMBLY DRAWING
APPROVAL	METHOD ACAD	B CBA182-1 DF 1 REV A



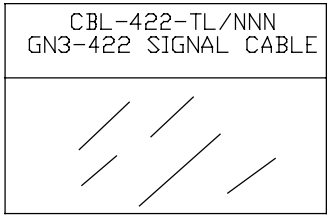
9-PIN FEMALE D-SUB CONN.

NOTES:

Ⓐ WHEN ATTACHING TWO WIRES TO A SINGLE PIN, USE THE CRIMP PIN LISTED ON THE PARTS LIST. AFTER CRIMPING WIRES INTO THE PIN, REPLACE THE PRE-INSTALLED PIN IN THE CONNECTOR WITH CRIMPED PIN.

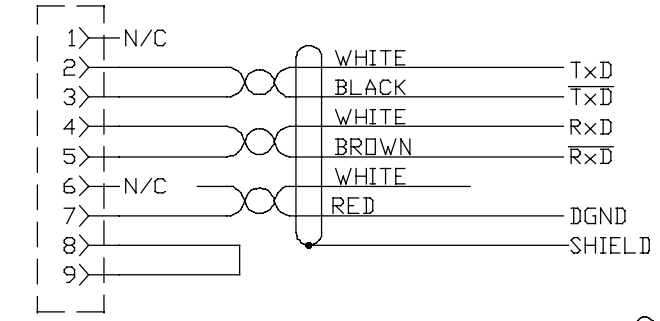


① 9-PIN, FEMALE, D-SUB IDC TYPE CONNECTOR
② CABLE LABEL COVERED BY CLEAR HEATSHRINK
PRINT CABLE LABEL AS SHOWN:
WHERE NNN = CABLE LENGTH (MAXIMUM LENGTH IS 500 Ft.)

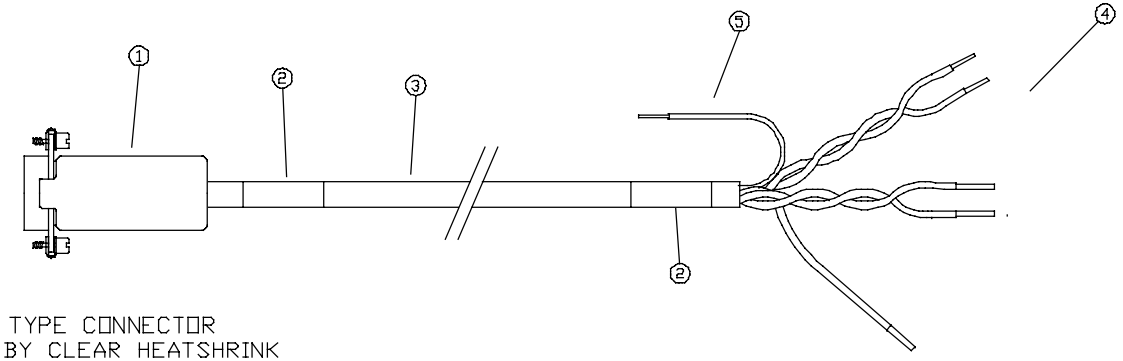


③ 6 CONDUCTOR (3 TWISTED PAIR) 22 AWG, W/SHIELD
④ STRIPPED AND TINNED LEADS
⑤ SHIELD LEAD COVERED WITH 3/32" CLEAR HEATSHRINK & TINNED

E H D L –	ORMEC SYSTEMS CORP	
DATE 90.05.17	PART NO: CBL-422-TL/NNN	
DESIGNER krf	TITLE: GN3-422 TO TINNED LEADS	
DRAWN BY krf	ASSEMBLY DRAWING	
APPROVAL	METHOD ACAD | B | CBA180-1	DF 1 | REV A



9-PIN MALE D-SUB CONNECTOR



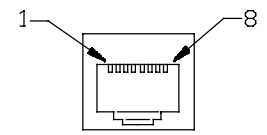
① 9-PIN, MALE D-SUB IDC TYPE CONNECTOR
② CABLE LABEL COVERED BY CLEAR HEATSHRINK
PRINT CABLE LABEL AS SHOWN:
WHERE NNN=CABLE LENGTH (MAXIMUM LENGTH IS 500 Ft.)

CBL-ITM-TL/NNN ITM-270 SIGNAL CABLE

③ 6 CONDUCTOR (3 TWISTED PAIR) 22 AWG, W/SHIELD
④ STRIPPED AND TINNED LEADS
⑤ SHIELD LEAD COVERED WITH 3/32" CLEAR HEATSHRINK & TINNED

EH DL –	ORMEC SYSTEMS CORP	
DATE 90.06.22	PART NO: CBL-ITM-TL/NNN	
DESIGNER krf	TITLE: ITM-270 TO TINNED LEADS	
DRAWN BY krf	ASSEMBLY DRAWING	
APPROVAL	METHOD ACAD | B | CBA181-1	DF 1 | REV A

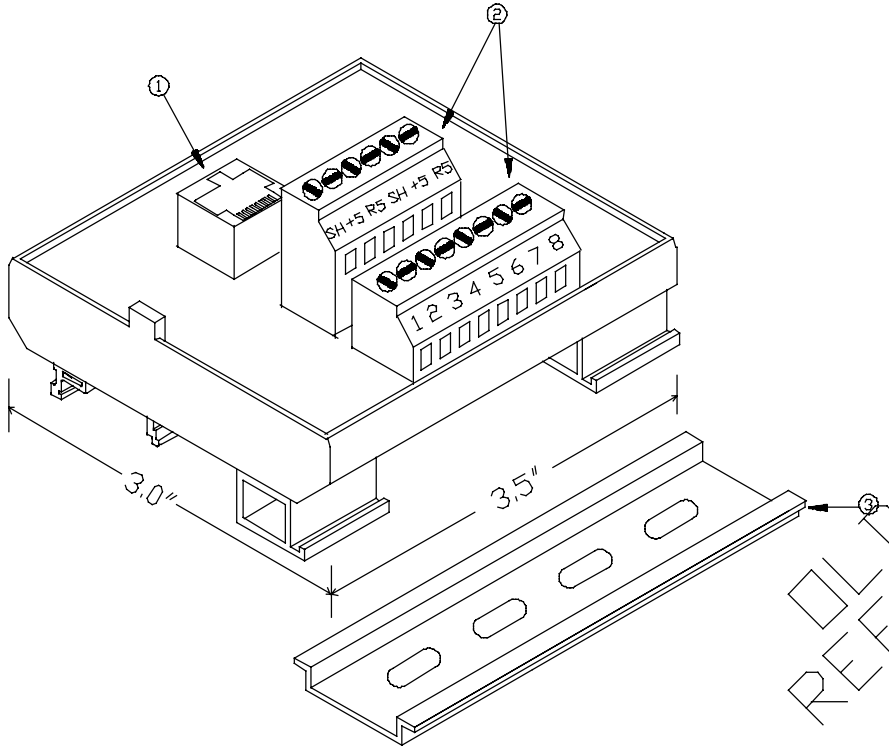
DETAIL OF J1 PINOUT

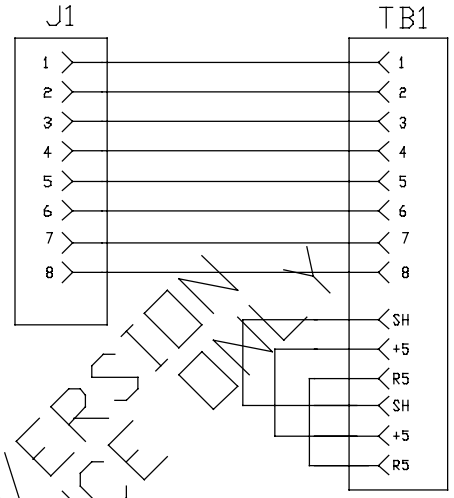


① J1 - 8 PIN MODULAR FEMALE CONNECTOR

② TB1 - DISCRETE WIRE TERMINAL BLOCK

③ 4.5 INCHES OF MOUNTING TRACK INCLUDED

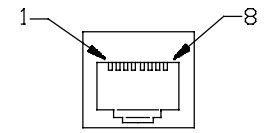




OLD VERSION
REFERENCE ONLY

E / DL	-	ORMEC SYSTEMS CORP
DATE 91.06.05		PART NO. CON-MOD8-TB
DESIGNER krf		TITLE CON FROM MOD8 TO TERM BLOCK
DRAWN BY ejb		ASSEMBLY DRAWING
APPROVAL		METHOD ACAD | B | CON344-1 | OF 1 | REV A

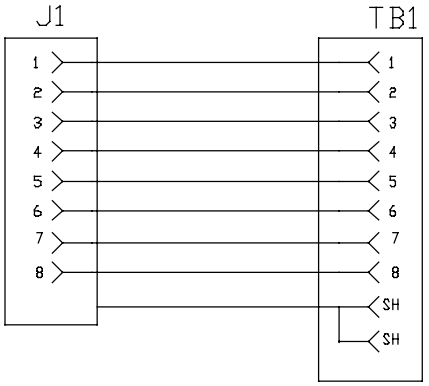
DETAIL OF J1 PINOUT

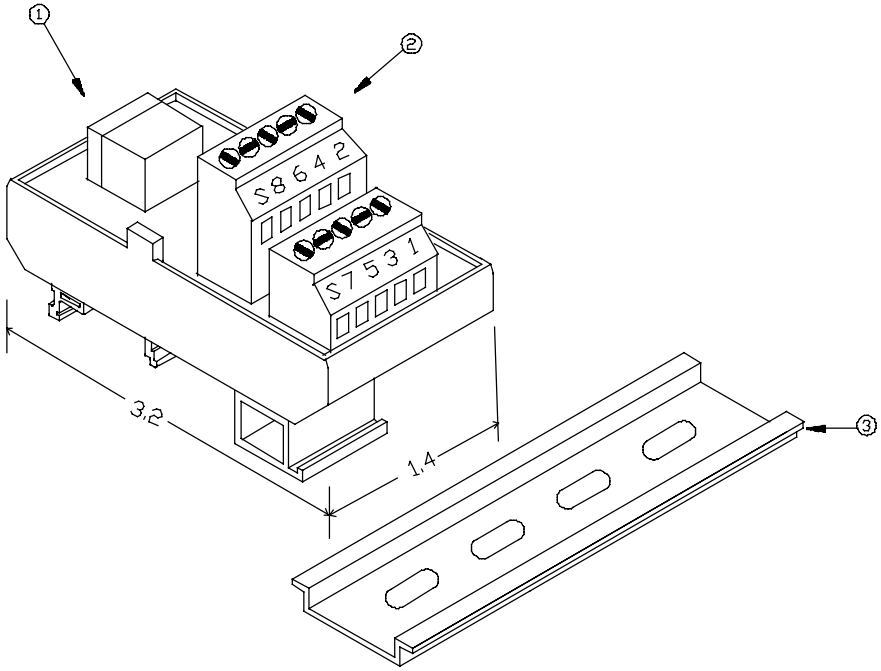


① J1 - 8 PIN SHIELDED MODULAR FEMALE CONNECTOR

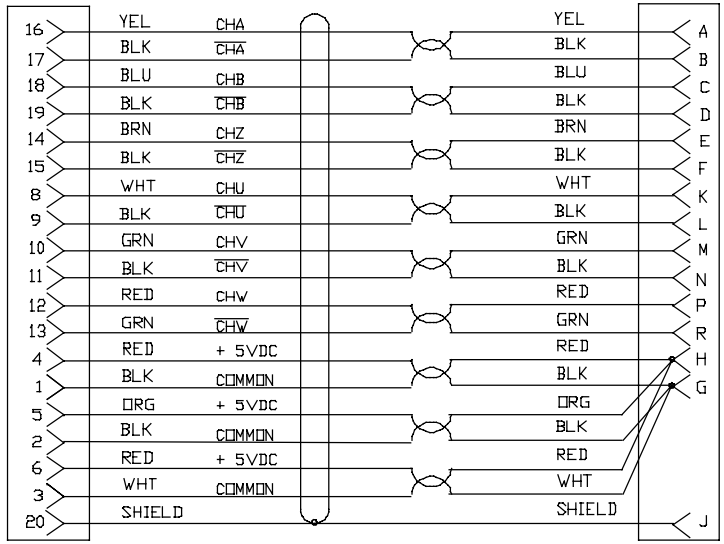
② TB1 - DISCRETE WIRE TERMINAL BLOCK

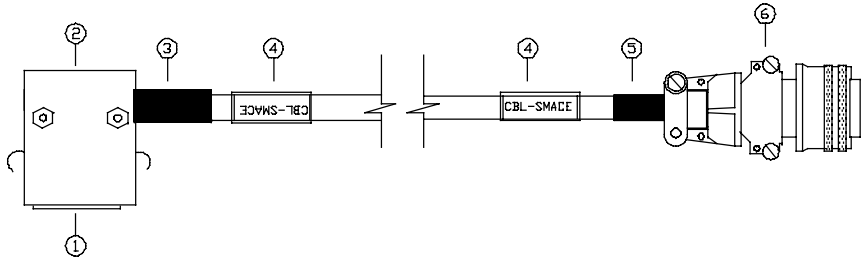
③ 3.0 INCHES OF MOUNTING TRACK INCLUDED





E / DL –	ORMEC SYSTEMS CORP
DATE 93.10.06	PART NO. CON-MOD8-TB2
DESIGNER e.jb	TITLE CON FROM MOD8 TO TERM BLOCK
DRAWN BY e.jb	ASSEMBLY DRAWING
APPROVAL	METHOD ACAD | B | CON456-1 | OF 1 | REV A



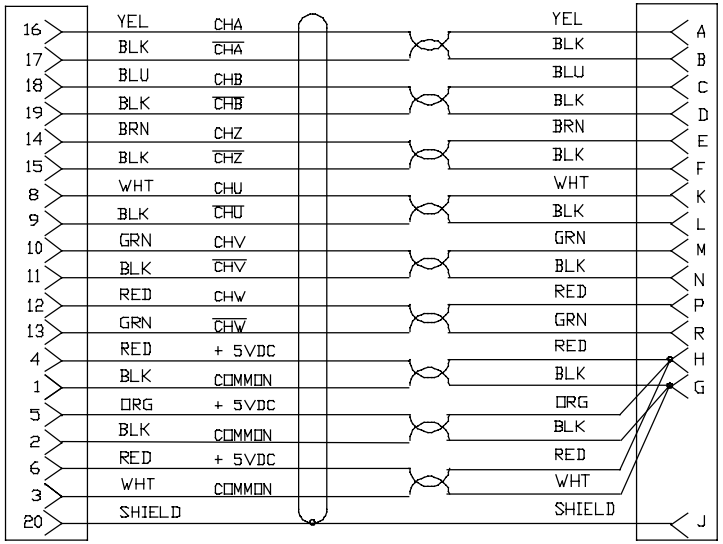


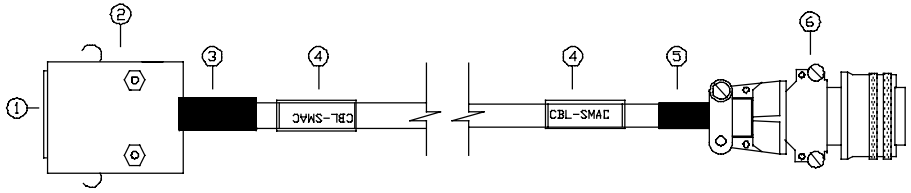
1. FEMALE 20 PIN CONNECTOR
2. CONNECTOR SHELL, W/LATCHING CLIPS AND CAPTIVE SCREWS
3. HEAT SHRINK TUBING 1.5"
4. MODEL NUMBER LABEL / COVERED WITH CLEAR HEATSHRINK
5. RUBBER BOOTS
6. HEAT SHRINK TUBING 1.5" (UNDER BOOTS)

NOTE:

1) WIRE SIZE 22AWG
2) MIN. CABLE LENGTH: 3 FEET
3) MAX. CABLE LENGTH: 150 FEET
4) THE LAST TWO DIGITS OF THE PART NO. SPECIFY THE LENGTH OF THE CABLE IN FEET. (NN) = 3 TO 150 FEET

E H / I D L +	ORMEC SYSTEMS CORP		
DATE 050690	PART NO: CBL-SMACE/NN		
DESIGNER EJB	TITLE: ENCODER CABLE		
DRAWN BY EJB	ASSEMBLY DRAWING		
APPROVAL	METHOD ACAD	B CBA169-1	OF 1 / REV A



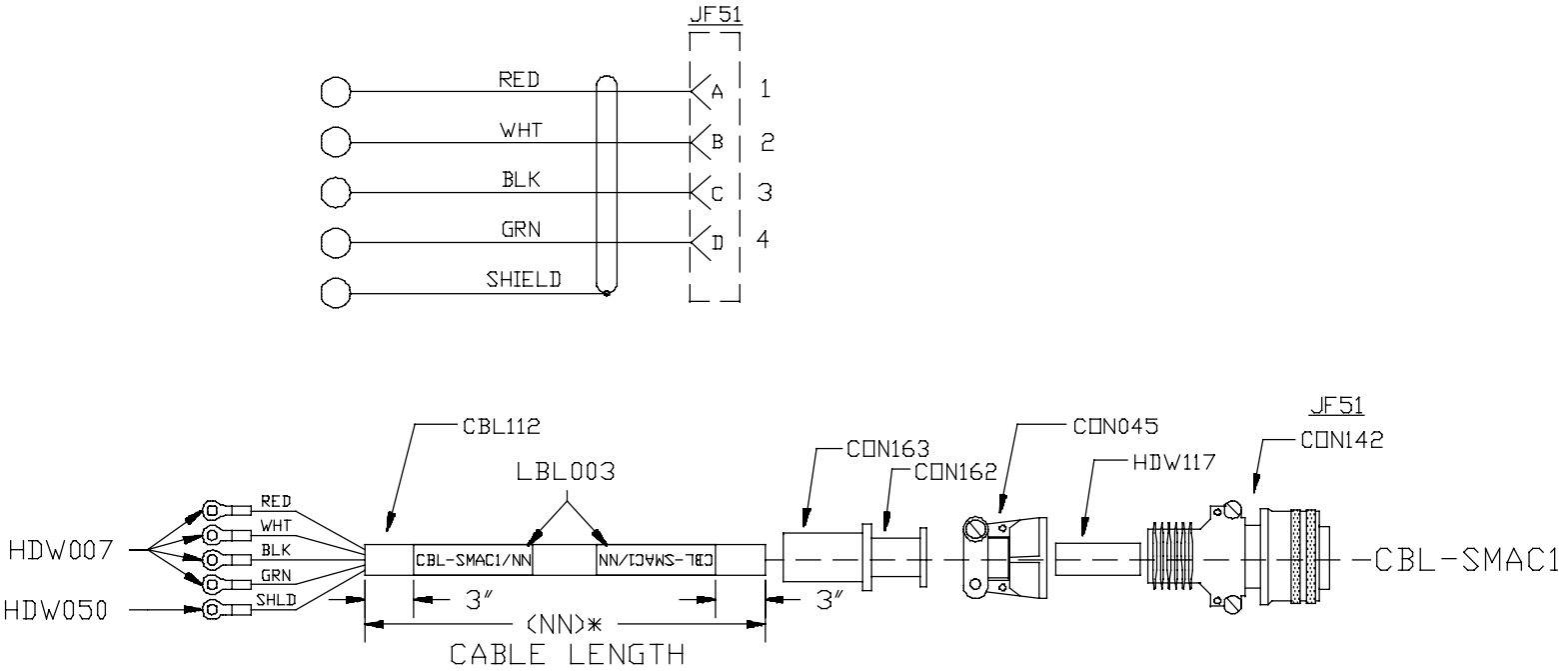


1. FEMALE 20 PIN CONNECTOR
2. CONNECTOR SHELL, W/LATCHING CLIPS AND CAPTIVE SCREWS
3. HEAT SHRINK TUBING 1.5"
4. MODEL NUMBER LABEL / COVERED WITH CLEAR HEATSHRINK
5. RUBBER BOOTS
6. HEAT SHRINK TUBING 1.5" (UNDER BOOTS)

NOTE:

1) WIRE SIZE 22AWG
2) MIN. CABLE LENGTH: 3 FEET
3) MAX. CABLE LENGTH: 150 FEET
4) THE LAST TWO DIGITS OF THE PART NO. SPECIFY THE LENGTH OF THE CABLE IN FEET. (NN) = 3 TO 150 FEET

E H / I D L +	ORMEC SYSTEMS CORP
DATE 062090	PART NO: CBL-SMAC/NN
DESIGNER EJB	TITLE: ENCODER CABLE
DRAWN BY EJB	ASSEMBLY DRAWING
APPROVAL	METHOD ACAD | B | CBA188-1 | OF 1 | REV A



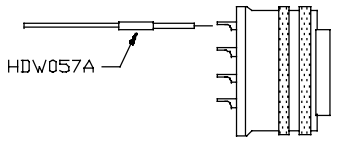
*NOTE:

1) HEATSHRINK IS TO BE USED INSIDE THE CONNECTOR COVERING BOTH THE WIRE AND THE SOLDER CUP.

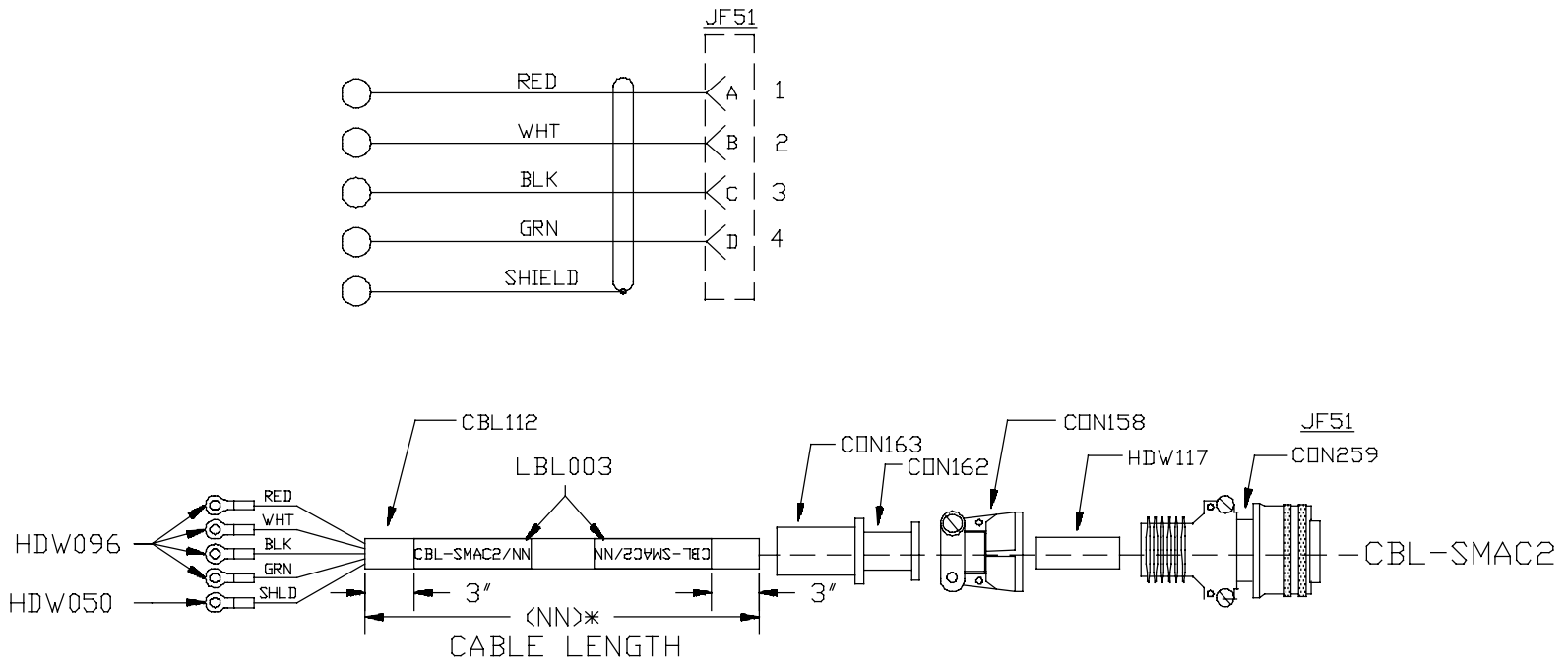
2) MAX. CABLE LENGTH 150 FEET.

3) THE LAST TWO DIGITS OF THE PART NO. SPECIFY THE LENGTH OF THE CABLE IN FEET. (NN) = 25 TO 150 FEET.

SOLDERING DETAIL



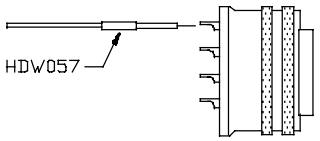
E H / I D L	*	ORMEC SYSTEMS CORP
DATE 050490		PART NO: CBL-SMAC1/NN
DESIGNER DTC		TITLE: S-SERIES MOTOR CABLE
DRAWN BY EJB		ASSEMBLY DRAWING
APPROVAL		METHOD ACAD | B | CBA171-1 | OF 1 | REV A



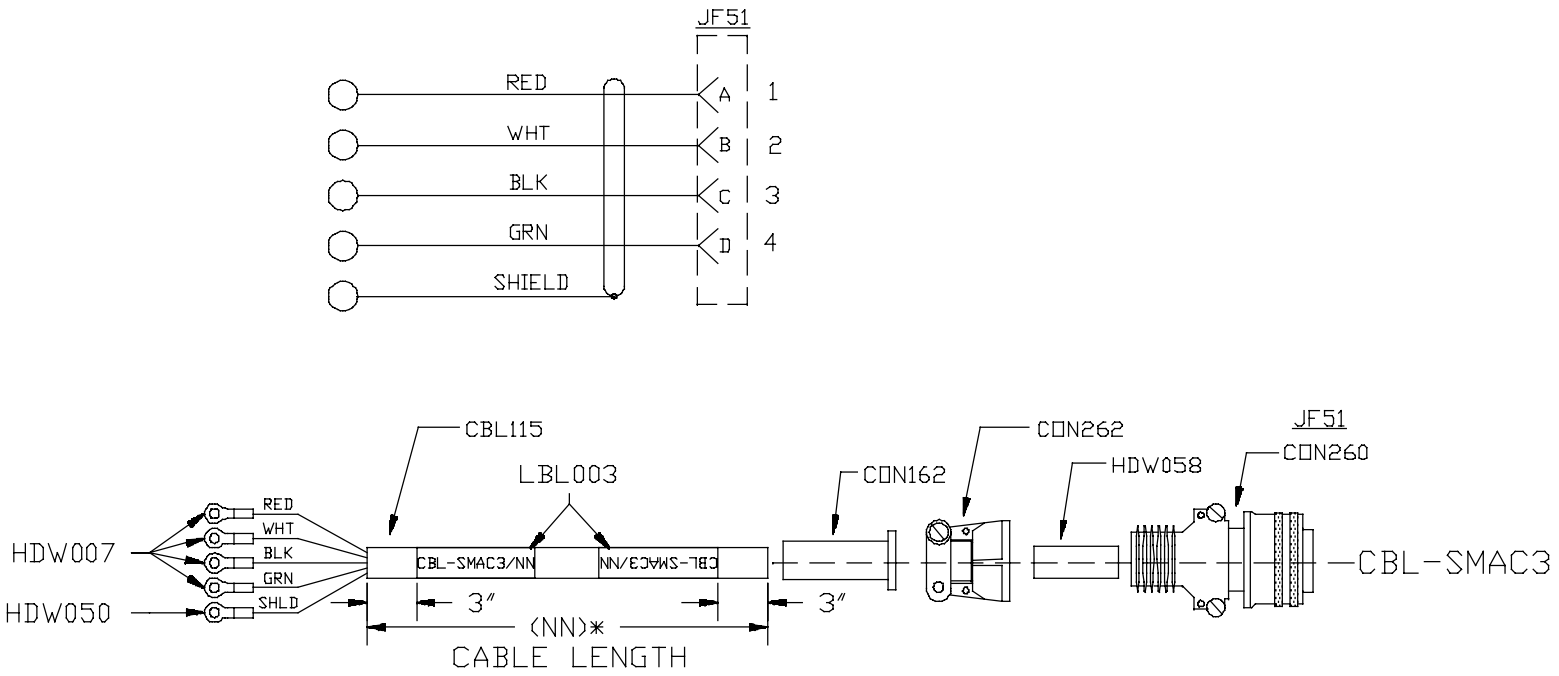
*NOTE:

1) HEATSHRINK IS TO BE USED INSIDE THE CONNECTOR COVERING BOTH THE WIRE AND THE SOLDER CUP.
2) MAX. CABLE LENGTH 150 FEET.
3) THE LAST TWO DIGITS OF THE PART NO. SPECIFY THE LENGTH OF THE CABLE IN FEET. (NN) = 25 TO 150 FEET.

SOLDERING DETAIL



E H / I D L	*	ORMEC SYSTEMS CORP
DATE 050490		PART NO: CBL-SMAC2/NN
DESIGNER DTC		TITLE: S-SERIES MOTOR CABLE
DRAWN BY RJM		ASSEMBLY DRAWINGS
APPROVAL	METHOD ACAD	B CBA172-1 DF 1 REV A



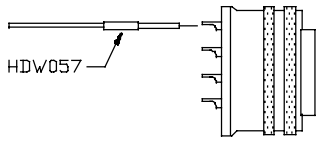
*NOTE:

1) HEATSHRINK IS TO BE USED INSIDE THE CONNECTOR COVERING BOTH THE WIRE AND THE SOLDER CUP.

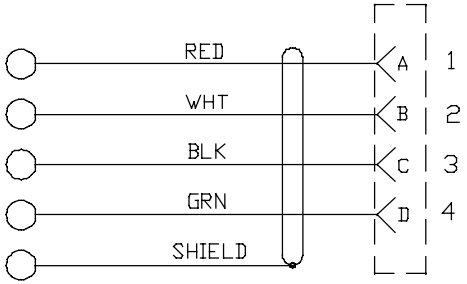
2) MAX. CABLE LENGTH 150 FEET.

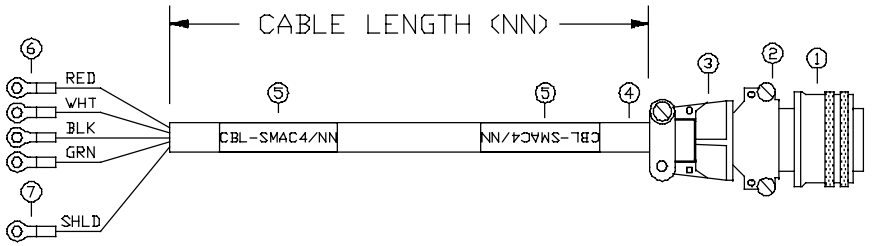
3) THE LAST TWO DIGITS OF THE PART NO. SPECIFY THE LENGTH OF THE CABLE IN FEET. (NN) = 25 TO 150 FEET.

SOLDERING DETAIL



E H / I D L	*	ORMEC SYSTEMS CORP
DATE 050490		PART NO: CBL-SMAC3/NN
DESIGNER DTC		TITLE: S-SERIES MOTOR CABLE
DRAWN BY EJB		ASSEMBLY DRAWINGS
APPROVAL		METHOD ACAD | B | CBA170 | OF 1 | REV A





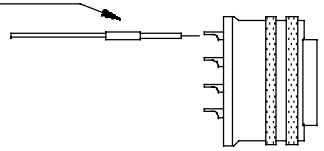
1. PLUG, STRAIGHT
2. RUBBER BOOTS/HEAT SHRINK TUBING UNDER CONNECTOR/CLAMP
3. CABLE CLAMP
4. CABLE, 4 COND, 12 AWG, SHLD, 600V, O.D.=.46
5. MODEL# LABEL, LOCATE APPROX. 1/2 INCH AWAY FROM ENDS OF CABLE ('NN' IN MODEL# INDICATES LENGTH OF CABLE IN FEET)
6. LUG, RING STYLE, #10, 14-18 AWG
7. LUG, RING STYLE, #8, 14-18 AWG

NOTE:

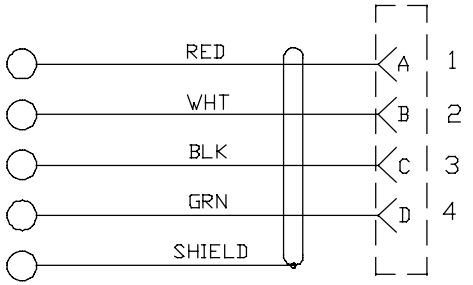
1) HEATSHRINK IS TO BE USED INSIDE THE CONNECTOR COVERING BOTH THE WIRE AND THE SOLDER CUP.

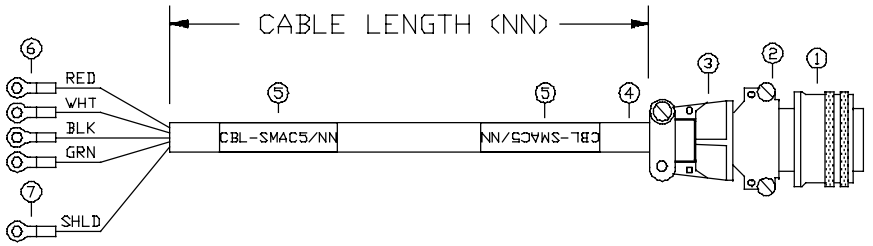
2) MAX. CABLE LENGTH 150 FEET.

SOLDERING DETAIL:



E H I D L *	ORMEC SYSTEMS CORP	
DATE 061690	PART NO: CBL-SMAC4/NN	
DESIGNER DTC	TITLE: S-SERIES MOTOR CABLE	
DRAWN BY EJB	ASSEMBLY DRAWINGS	
APPROVAL	METHOD ACAD	B CBA184-1 DF 1 REV A





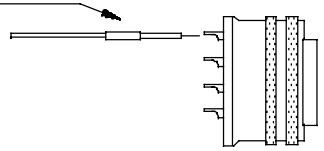
1. PLUG, STRAIGHT
2. RUBBER BOOTS/HEAT SHRINK TUBING UNDER CONNECTOR/CLAMP
3. CABLE CLAMP
4. CABLE, 4 COND, 12 AWG, SHLD, 600V, O.D.=.46
5. MODEL# LABEL, LOCATE APPROX. 1/2 INCH AWAY FROM ENDS OF CABLE ("NN" IN MODEL# INDICATES LENGTH OF CABLE IN FEET)
6. LUG, RING STYLE, #8, 12 AWG
7. LUG, RING STYLE, #8, 14-18 AWG

NOTE:

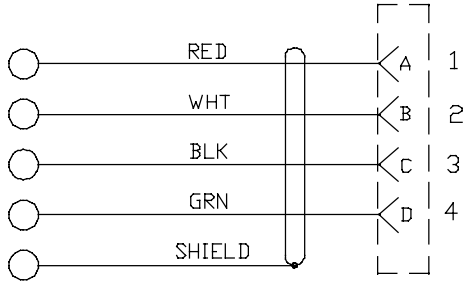
1) HEATSHRINK IS TO BE USED INSIDE THE CONNECTOR COVERING BOTH THE WIRE AND THE SOLDER CUP.

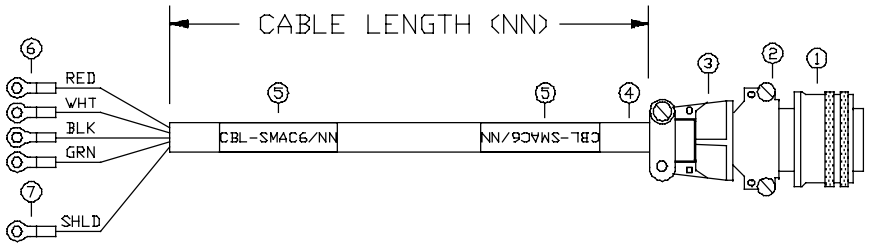
2) MAX. CABLE LENGTH 150 FEET.

SOLDERING DETAIL



E H / I D L	*	ORMEC SYSTEMS CORP
DATE 061690		PART NO. CBL-SMAC5/NN
DESIGNER DTC		TITLE: S-SERIES MOTOR CABLE
DRAWN BY EJB		ASSEMBLY DRAWINGS
APPROVAL	METHOD ACAD	B CBA185-1 DF 1 REV A

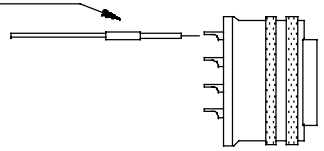




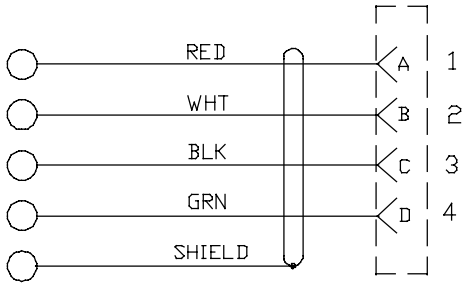
① PLUG, STRAIGHT
② RUBBER BOOTS/HEAT SHRINK TUBING UNDER CONNECTOR/CLAMP
③ CABLE CLAMP
④ CABLE, 4 COND, 8 AWG, SHLD, 600V, O.D.=.72
⑤ MODEL# LABEL, LOCATE APPROX. 1/2 INCH AWAY FROM ENDS OF CABLE ('NN' IN MODEL# INDICATES LENGTH OF CABLE IN FEET)
⑥ LUG, RING STYLE, #10, 8 AWG
⑦ LUG, RING STYLE, #8, 12 AWG

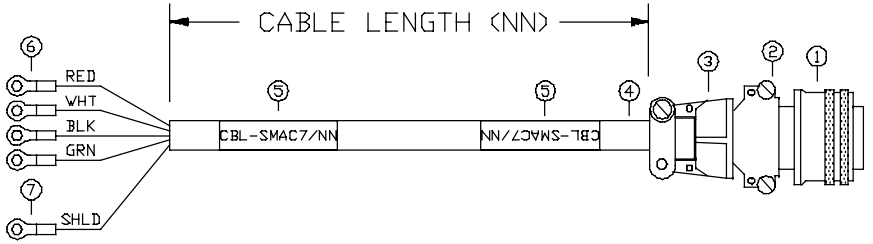
NOTE:
1) HEATSHRINK IS TO BE USED INSIDE THE CONNECTOR COVERING BOTH THE WIRE AND THE SOLDER CUP.
2) MAX. CABLE LENGTH 150 FEET.

SOLDERING DETAIL



E H / I D L	*	ORMEC SYSTEMS CORP
DATE 061690		PART NO. CBL-SMAC6/NN
DESIGNER DTC		TITLE: S-SERIES MOTOR CABLE
DRAWN BY EJB		ASSEMBLY DRAWINGS
APPROVAL	METHOD ACAD	B CBA186-1 DF 1 REV A





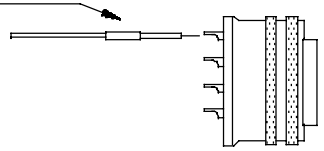
1. PLUG, STRAIGHT
2. RUBBER BOOTS/HEAT SHRINK TUBING UNDER CONNECTOR/CLAMP
3. CABLE CLAMP
4. CABLE, 4 COND, 6 AWG, SHLD, 600V, O.D.=.92
5. MODEL# LABEL, LOCATE APPROX. 1/2 INCH AWAY FROM ENDS OF CABLE ("NN" IN MODEL# INDICATES LENGTH OF CABLE IN FEET)
6. LUG, RING STYLE, #10, 6 AWG
7. LUG, RING STYLE, #8, 10 AWG

NOTE:

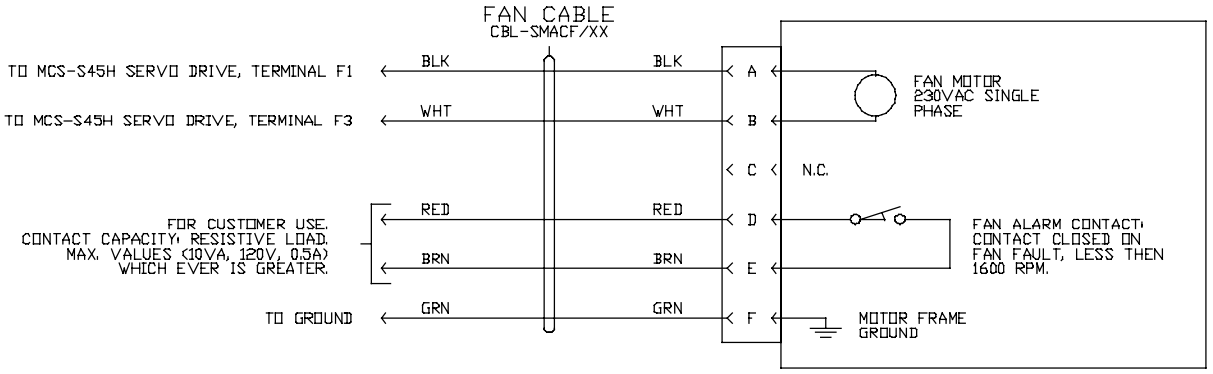
1) HEATSHRINK IS TO BE USED INSIDE THE CONNECTOR COVERING BOTH THE WIRE AND THE SOLDER CUP.

2) MAX. CABLE LENGTH 150 FEET.

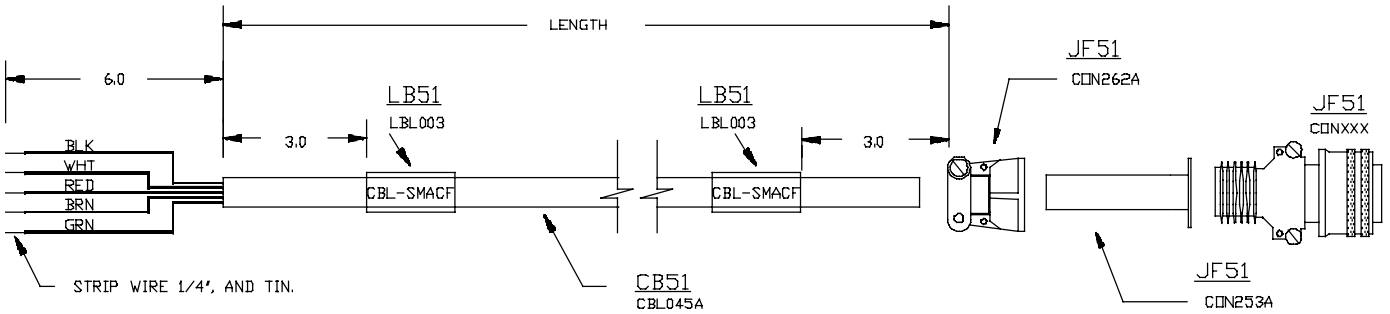
SOLDERING DETAIL:



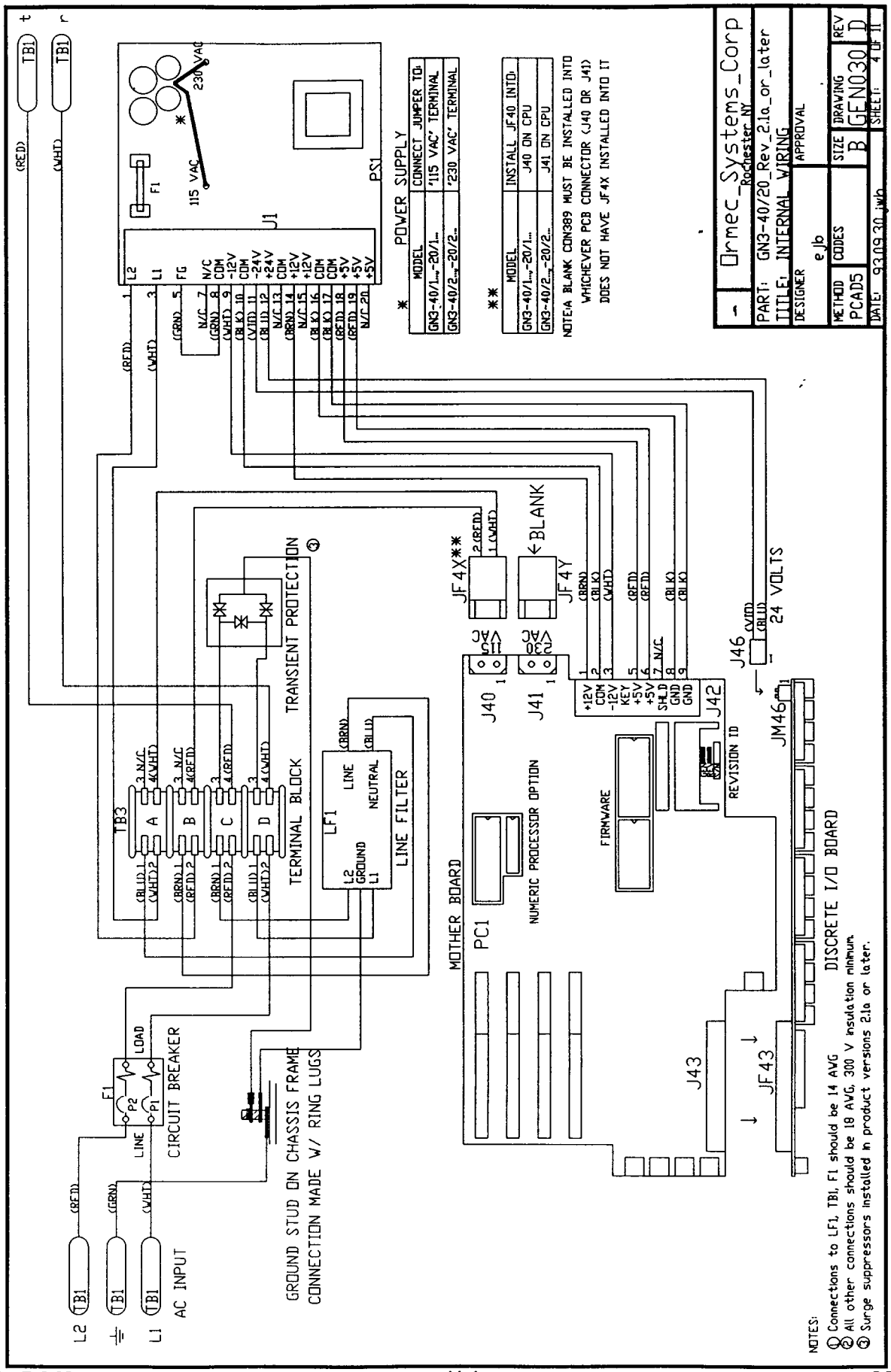
E H / I D L *	ORMEC SYSTEMS CORP	
DATE 061690	PART NO: CBL-SMAC7/NN	
DESIGNER DTC	TITLE: S-SERIES MOTOR CABLE	
DRAWN BY EJB	ASSEMBLY DRAWINGS	
APPROVAL	METHOD ACAD	B CBA187-1 DF 1 REV A

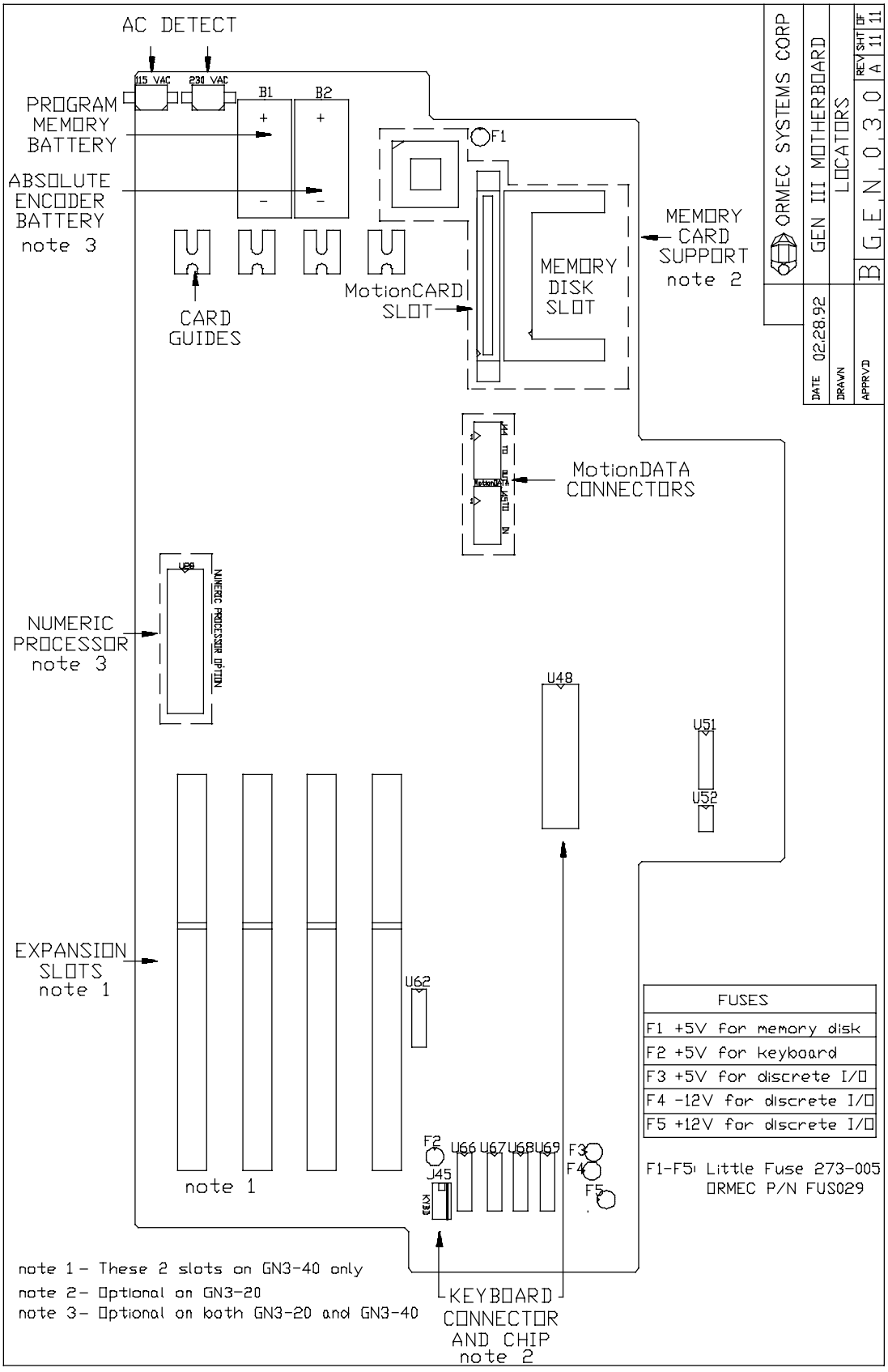


MOTOR FAN FOR
MAC-C560H/K1A
SERVO MOTORS

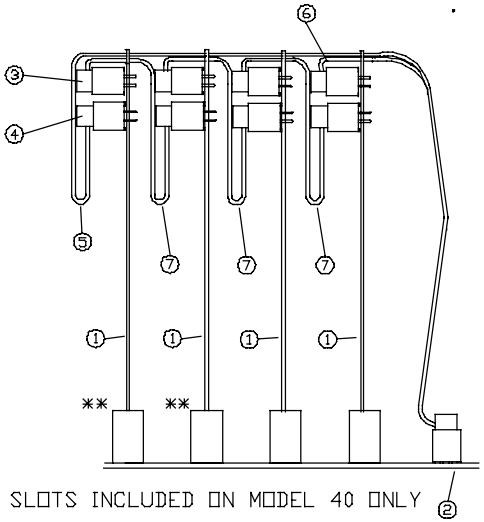


E H / I D L +		ORMEC SYSTEMS CORP
DATE 032994		CBL-SMACF/NN
DESIGNER GMW		FAN CABLE
DRAWN BY DRF		ASSEMBLY DRAWING
APPROVR	METHOD ACAD	B CBA199-1 DF 1 REV A


Ormec_Systems_Corp
Rochester NY
PART: GN3-40/20_Rev_2.1a_or_later
TITLE: INTERNAL WIRING
DESIGNER ejb
APPROVAL
METHOD PCAD5
CODES
SIZE B
DRAWING GEN030
REV D
DATE: 93.09.30.jwb
SHEET: 4 OF 11
POWER SUPPLY
MODEL | CONNECT JUMPER TO
GN3-40/1...-20/1... | '115 VAC' TERMINAL
GN3-40/2...-20/2... | '230 VAC' TERMINAL
MODEL | INSTALL JF40 INTO
GN3-40/1...-20/1... | J40 ON CPU
GN3-40/2...-20/2... | J41 ON CPU
NOTE: A BLANK CON389 MUST BE INSTALLED INTO WHICHEVER PCB CONNECTOR (J40 OR J41) DOES NOT HAVE JF4X INSTALLED INTO IT
AC INPUT
L2
L1
CIRCUIT BREAKER
LINE
LOAD
GROUND STUD ON CHASSIS FRAME
CONNECTION MADE W/ RING LUGS
TERMINAL BLOCK
TRANSIENT PROTECTION
LINE FILTER
LF1
LINE
NEUTRAL
GROUND
MOTHER BOARD
PC1
NUMERIC PROCESSOR OPTION
FIRMWARE
REVISION ID
DISCRETE I/O BOARD
JF43
J43
J40
J41
J42
JM46
JF4X
JF4Y
BLANK
24 VOLTS
J46
PS1
J1
F1
115 VAC
230 VAC
NOTES:
1. Connections to LF1, TB1, F1 should be 14 AWG
2. All other connections should be 18 AWG, 300 V insulation minimum.
3. Surge suppressors installed in product versions 2.1a or later.

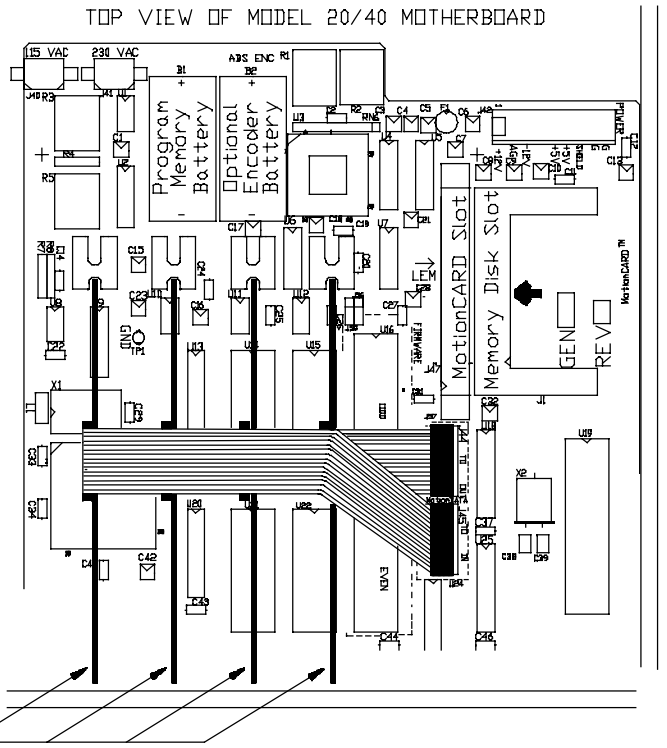

AC DETECT
115 VAC
230 VAC
PROGRAM MEMORY BATTERY
ABSOLUTE ENCODER BATTERY
note 3
B1
B2
F1
CARD GUIDES
MotionCARD SLOT
MEMORY DISK SLOT
MEMORY CARD SUPPORT
note 2
ORMEC SYSTEMS CORP
GEN III MOTHERBOARD
LOCATORS
B.G.E.N.0.3.0
REV SHT DF
A 11 11
DATE 02.28.92
DRAWN
APPRVD
MotionDATA CONNECTORS
NUMERIC PROCESSOR
NUMERIC PROCESSOR OPTION
NUMERIC PROCESSOR note 3
U48
U51
U52
U62
EXPANSION SLOTS note 1
note 1
F2
U66 U67 U68 U69
F3
F4
F5
J45
K33
FUSES
F1 +5V for memory disk
F2 +5V for keyboard
F3 +5V for discrete I/O
F4 -12V for discrete I/O
F5 +12V for discrete I/O
F1-F5: Little Fuse 273-005
ORMEC P/N FUS029
note 1 - These 2 slots on GN3-40 only
note 2- Optional on GN3-20
note 3- Optional on both GN3-20 and GN3-40
KEYBOARD CONNECTOR AND CHIP
note 2

① DSP CARDS (See Note 1)
② GEN-III CPU BOARD
③ DSP's MotionDATA OUTPUT CONNECTOR (See Note 1)
④ DSP's MotionDATA INPUT CONNECTOR (See Note 1)
⑤ CABLE CBA167 - INCLUDED WITH MODEL20/40, GOES TO DSP INPUT
⑥ CABLE CBA167 - INCLUDED WITH MODEL 20/40, GOES TO DSP OUTPUT
⑦ CABLE CBA167 - INCLUDED WITH DSP CARD
GOES FROM BOARD TO BOARD, FROM OUTPUT TO INPUT



** SLOTS INCLUDED ON MODEL 40 ONLY

TOP VIEW OF MODEL 20/40 MOTHERBOARD



DSP AXIS INTERFACE MODULE

MODEL 20/40 INTERNAL MotionDATA CONNECTIONS

-	ORMEC SYSTEMS CORP
DATE 94.03.17	GN3-20/40 2.0a or later
DRAWN EJB	MOTIONDATA CABLING
APPRVD	C GEN030 REV C SHT 5 OF 11

NOTE 1: ON REVISION "A" DSP's THE INPUT AND OUTPUT CONNECTORS ARE REVERSED. PLEASE PAY ATTENTION TO THE SILKSCREEN.

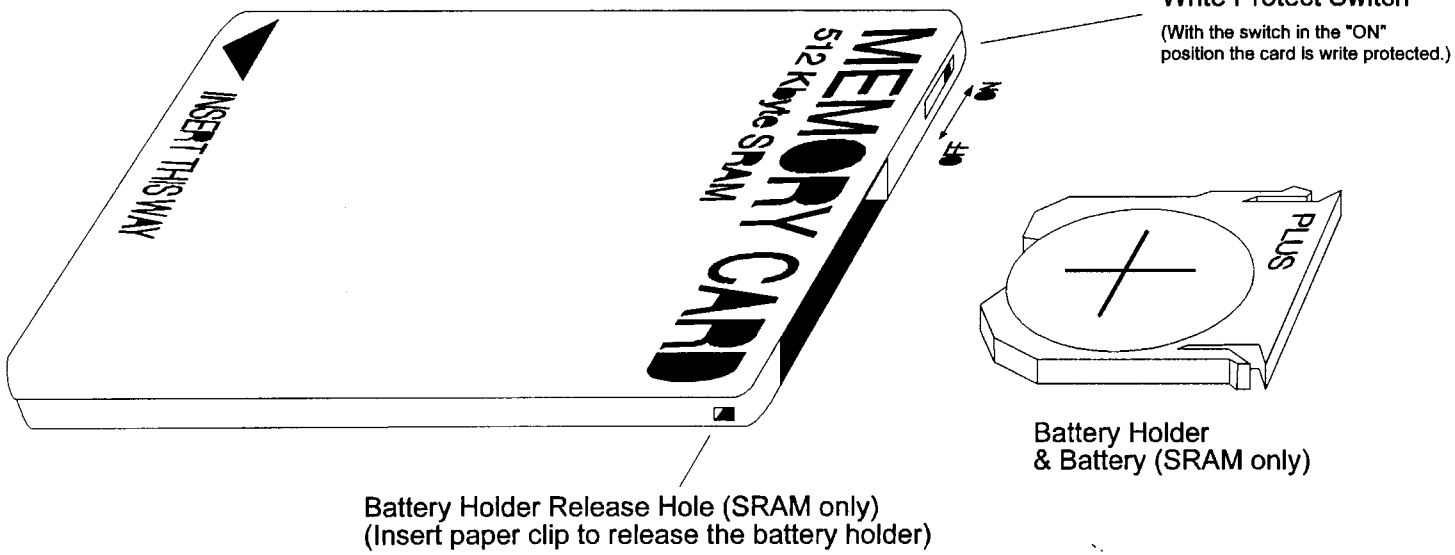
INSTALLATION NOTES:

Memory Disk Installation and Removal

1) Turn Incoming AC power OFF when installing and removing Memory Disks to insure against data loss.
2) New Memory Disks must be formatted with the MotionBASIC **FORMAT** command.

Battery Installation / Replacement (SRAM Memory Disks Only)

1) Insert the end of a paper clip, or similar slender object, into the Battery Release Hole to depress the battery holder latch.
2) While holding the latch depressed, pull the battery holder straight out as shown.
3) Handle the new battery only by the edges; DO NOT leave any fingerprints on its top or bottom surface.
4) Install the new battery in the holder with the PLUS (+) side up, as shown.
5) Reinsert the battery holder into the memory card, insuring that it is properly latched in place.
6) A battery MUST be replaced within 30 minutes to avoid data loss.
7) Use BR2325 or equivalent 3 volt dc Lithium battery.



Memory Disk Installation

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