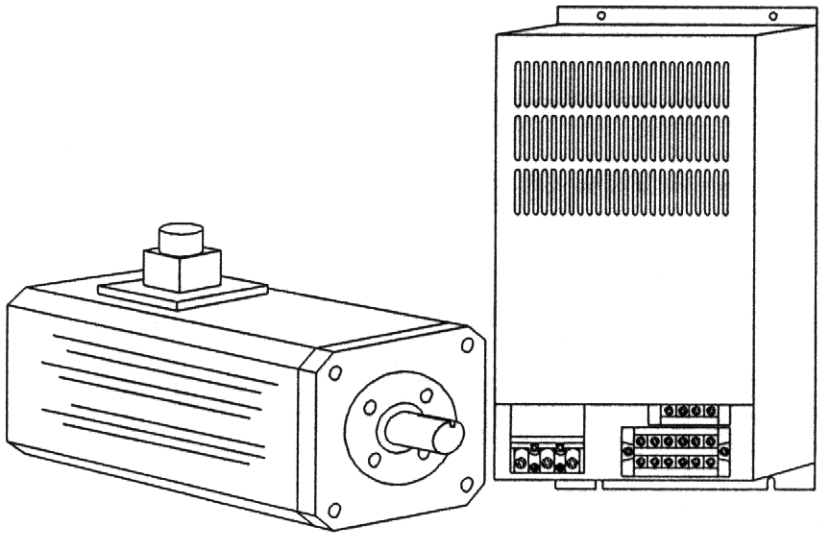
SERIES 5 MOTION DEVICES



USER'S GUIDE

INDUSTRIAL INDEXING SYSTEMS, Inc.

Revision - A

ER-6005

ERRATA SHEET, IB-14B005 JANUARY 1996

Date	Rev.	ECN No.	DR	CHK	CHK
11/12/92	M	ECN 92-303 (See Note 1)	MFE		
02/16/93	N	ECN 93-058 (See Note 2)	MFE		
06/15/93	P	ECN 93-140 (See Note 3)	EB		
05/13/94	R	ECN 94-118 (See Note 4)	KY	ELS	
06/02/94	T	ECN 94-119 (See Note 5)	DAD	EB	
12/13/94	U	ECN 94-304 (See Note 6)	EB		
01/24/96	V	ECN-95-292 (See Note 7)	CWB	EB	

Notes:

1) Section 2, page 2-3, dated NOVEMBER 1992, supersedes MAY 1992. Page 2-11 is added to Section 2. Added drawing C-220YYY to Appendix G.

2) Appendix D, page 1, dated FEBRUARY 1993, supersedes Appendix D, page 1, dated MAY 1992. Drawing number SU-043011 added to Appendix D.

3) Section 2, page 2-8, dated JUNE 1993, supersedes MAY 1993.

4) Section 4, page 4-1, dated MAY 1994, supersedes May 1992.

5) Appendix D, Drive set-up SU-043002 Rev C supersedes SU-043002 Rev B.

6) Appendix D, page 1, dated DECEMBER 1994, supersedes Appendix D, page 1, dated FEBRUARY 1993. Drawing number SU-043013 added to Appendix D.

7) Appendix D, dated JANUARY 1996, supersedes Appendix D, dated DECEMBER 1994.

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INTRODUCTION

The Industrial Indexing Systems Series 5 Motion Devices are a group of brushless motor assemblies, drive packages, and transformers especially suited for indexing and positioning applications in which high torque-to-inertias, high peak horsepower, and rapid acceleration/deceleration rates are required.

This manual describes proper installation, operation, and troubleshooting procedures for the Series 5 Motion Devices. These devices include the motors and drives which make up the Motor/Drive Packages and the transformers which make up the Power Supply Packages.

The manual assumes no prior knowledge of Industrial Indexing System equipment. It does assume knowledge of proper mechanical, electrical, and electronic maintenance and safety procedures. Information in this manual is subject to change without prior notification.

The manual uses a variety of highlighted blocks to emphasize important information. Always pay careful attention to this information. The types of highlighted blocks used are:

WARNING

USED TO ALERT THE READER TO ACTIONS OR CONDITIONS WHICH MIGHT PRESENT HAZARDS OR CAUSE INJURY TO PERSONNEL.

CAUTION

USED TO ALERT THE READER TO ACTIONS WHICH MIGHT CAUSE LOSS OF MATERIALS OR DAMAGE TO EQUIPMENT.

NOTE

Used to identify unusual or unexpected conditions or to point out the need for alternate procedures. It is also used for emphasis when a CAUTION or WARNING is not required.

Industrial Indexing Systems fully supports all equipment it manufactures and supplies. If there are any problems with this equipment or if assistance is required for installation or operation, contact our Integrated Technical Services Department.

Assistance and training is available in our factory, for a fee. In addition, Industrial Indexing Systems can custom configure Series 5 Motion Devices for O.E.M. applications.

SECTION 1 – DESCRIPTION

The Industrial Indexing Systems Series 5 Motion Devices are a group of brushless motor/drive packages and power supply packages especially suited for indexing and positioning applications in which high torque-to-inertia ratios, high peak horsepower, and rapid acceleration/deceleration rates are required. The drives are matched to the specific motors for optimum working performance. The motors and drives are used in conjunction with a closed-loop controller to accurately fix the position of the motor shaft.

1.1 INDEXING DRIVE SYSTEM OVERVIEW

An indexing drive system (or indexing system) may be used in a variety of applications where accurate movement or positioning is required. A basic system consists of the main components illustrated in **Figure 1.1**.

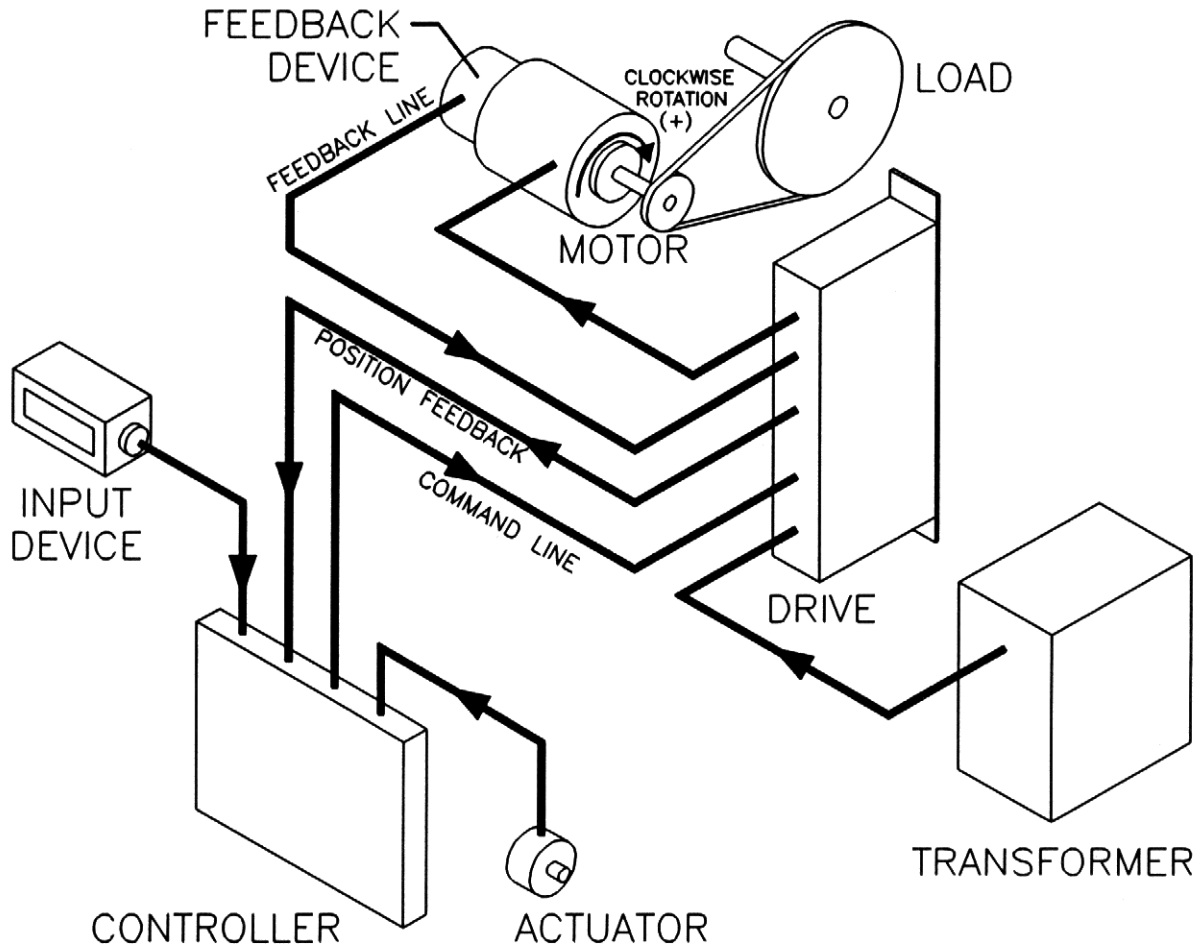


Figure 1.1 - Basic Indexing System

1. Input Device: The input device provides data to the controller. It is the interface between the operator (or system computer or programmable logic controller) and the indexing system. In a given system, there may be several input devices.

2. Controller: The controller receives data from the input device and issues commands to the drive. It also accepts information from the feedback device. The programming and settings of the controller determine what types of commands are issued to the drive in response to the data inputs and feedback.

3. Actuator: The actuator supplies the signal which causes the controller to initiate the specified sequences.

4. Power Supply: The power supply conditions the secondary power so it can be used by the drive.

5. Drive: The drive (also called a servo-amplifier) converts AC input power from the transformer into DC power and amplifies a low voltage velocity command signal from the controller into the necessary voltage and current to cause the motor shaft to rotate. The amount of power and polarity (positive or negative) of the voltage supplied to the motor is determined by the command signals from the controller.

6. Transformer: The transformer converts prime supply voltage into the required input voltage for the drive and isolates the drive from the prime supply ground.

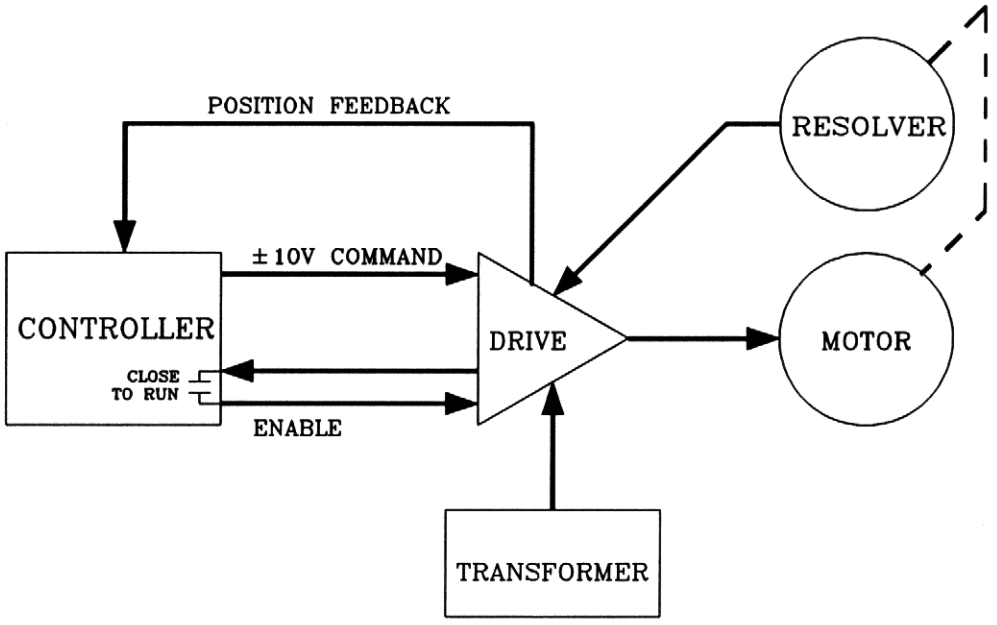


Figure 1.2 - Position Loop

7. Motor: The motor is the device being controlled by the indexing system. The system controls the position and speed of motor shaft rotation.

8. Load: The load is the object of the motion. It absorbs the work energy of the motor.

9. Feedback Device: The feedback device (usually a resolver) monitors the position of the motor shaft and sends this information to the controller.

The components of the basic indexing drive system form two information loops. The position loop is a closed-loop which consists of the controller, drive, motor, and feedback device. (The Series 5 motion devices use a resolver as the feedback device.) The controller, after receiving data from the input device, sends a command to the drive, which causes the motor shaft to move, which is monitored by the feedback device, which sends data to the controller, which sends a command to the drive, etc.

The velocity loop is also a closed-loop system. An input voltage to this loop changes the voltage applied to the motor (the drive output), which changes the speed of the motor-shaft rotation, which changes the signal to the drive, which influences the drive output, etc.

The position loop and velocity loop are independent loops, but the controller uses the velocity loop to achieve movement to the desired position. When data is received by the controller specifying a movement, the controller calculates the time required to accelerate

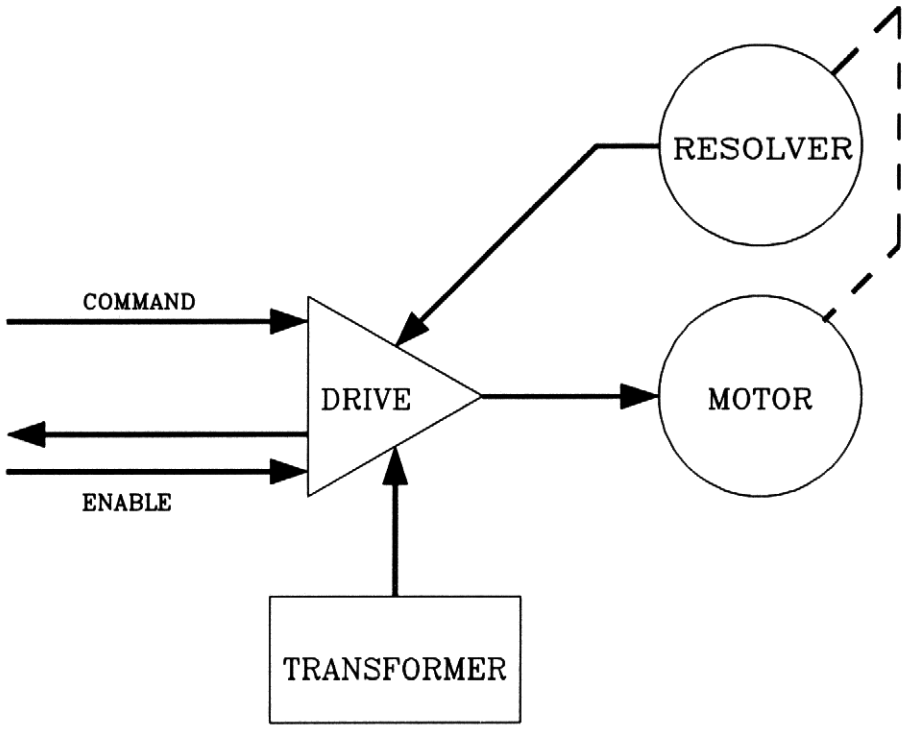


Figure 1.3 - Velocity Loop

to maximum speed and to decelerate from maximum speed. It then calculates the time at maximum speed necessary to complete the movement. This information is then transmitted to the drive by the controller.

1.2 MOTION DEVICES

The motion device components of the indexing drive system discussed in this manual include the drives and motors (Motor/Drive Packages), and transformers (Power Supply Packages).

1.2.1 PRE-ENGINEERED SYSTEMS

The combination of a specific drive and motor assembly (motor plus feedback device) is designated as a Motor/Drive Package (MDPAK™). The specific transformer used to provide power to a specific MDPAK or group of MDPAKs is designated as a Power Supply Package (PWRPAK™). (This designation as a PWRPAK for the single transformer component is used to maintain continuity with the other MDPAKs and PWRPAKs supplied by Industrial Indexing Systems.) Each of these packages has been pre-engineered and pre-tested to offer system-level performances. The components of each package are selected to work properly with each other at the rated performance levels and the Motor/Drive Packages and Power Supply Packages of a specific series are selected to work properly with each other.

NOTE

Each motor/drive package in this manual belongs to the MDPAK5 series. Each power supply package belongs to the PWRPAK5 series.

Selection of a PWRPAK or MDPAK depends on the system requirements of speed, torque, peak torque, horsepower, and physical size. The specifications for all Series 5 motion devices are contained in the appendices to this manual. Refer to **Paragraph 1.2.2** and **Section 1.4** for details on reading these specifications.

1.2.2 ORDER/SHIPPING CORRELATION

When an order is placed with Industrial Indexing Systems, Inc., the motion devices are specified as a MDPAK and a PWRPAK, with the appropriate numerical designations. However, when the units are shipped, the individual components are specified — rather than the package designations — to make sure that all items are supplied properly. If several MDPAKs and PWRPAKs are ordered, there will be similar components in the shipment with no cross reference as to which Motor/Drive Package or Power Supply Package they belong to. To avoid confusion and potential error when the units are assembled by the customer, **Appendix B** and **Appendix E** of this manual include Bills of Materials and specifications for all Series 5 Motor/Drive Packages and Power Supply Packages currently supplied by Industrial Indexing Systems, Inc. Similarly, the appendices for each of the other motion devices series manuals contain complete Bills of Materials and specifications for those series.

The Bills of Materials for a Series 5 MDPAK™ includes the motor part number, the drive part number, and the manual part number for that MDPAK. It also shows the part number (drawing number) for the setup specifications. The setup specifications are used to configure the drive compensation package to match the appropriate motor assembly and are unique for a given MDPAK. The specifications for a Series 5 PWRPAK™ shows the part numbers for the transformer which makes up that PWRPAK and the manual part number.

CAUTION

THE INDIVIDUAL DRIVES WILL BE SUPPLIED WITH DIFFERENT INPUT OR INTERFACE CIRCUIT BOARDS DEPENDING ON THE CONTROLLER (ACE-850 OR MM-10-T) TO BE USED WITH THE SYSTEM. REFER TO "SECTION 2 - INSTALLATION" FOR ADDITIONAL INFORMATION ON THESE CONNECTION DIFFERENCES.

NOTE

When a shipment is received, the components should be identified according to the appropriate MDPAK or PWRPAK before they are installed.

1.3 COMPONENTS

The Series 5 Motor/Drive Packages and Power Supply Packages are based on the use of brushless motors with resolvers as feedback devices. Each drive is matched to the motor for the specific MDPAK™ application. Each drive is used with only one motor assembly. Each PWRPAK™ (transformer) can be used with one or more drives, depending on the wattage requirements of the drives.

The Motor/Drive Package consists of the motor and drive. Dimensions and specifications for each of the Series 5 motors and drives are contained in **Appendix C**. The resolvers — used as feedback devices — are an integral part of the motor assembly.

1.3.1 MOTOR ASSEMBLIES

There are several different motor assemblies used in the Series 5 MDPAKs. **Appendix C** contains the drawings, with dimensions and wiring connections, for each of the motor assemblies used in the Series 5 Motor/Drive Packages. **Figure 1.4** shows a representative motor assembly illustration including the typical location of the components which will need to be accessed during installation or operation of the motor assembly.

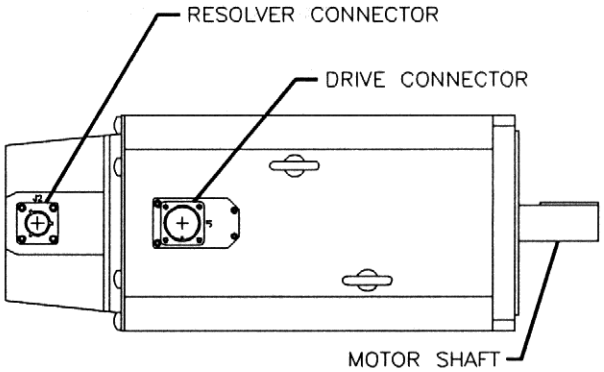


Figure 1.4
Motor Assembly

Drive Connector: The drive connector is used for the power supply cable from the drive to the motor.

Resolver Connector: This connector is used for the resolver cable from the drive. In Series 5 Motor/Drive packages, the resolver sends all signals to the drive. The drive produces an output signal that simulates an encoder output signal which is sent to the controller.

1.3.2 DRIVES

The drive converts the signals from the controller and the power from the transformer into useable energy to rotate the motor shaft. The drive has its power supply, control section, driver section and output stage integrated into one chassis (refer to **Figure 1.5**). Access to any setup, fault indication, or reset components requires removal of the cover. **Appendix C** contains the installation drawings for each of the drives used with Series 5 Motor/Drive Packages.

WARNING

HIGH VOLTAGES MAY BE PRESENT IN THE DRIVE EVEN WITH THE POWER DISCONNECTED. USE EXTREME CAUTION WHEN ACCESSING THE INTERIOR OF THE DRIVE.

1. RESET BUTTON: After a fault has been corrected, the RESET button must be pressed to reset any fault indications by the FAULT LEDs. (Refer to **"Section 3 - Controls and Operation"** for additional information on the RESET button.)

2. TEST POINTS: Various voltage test points are provided on the circuit board for troubleshooting assistance. (Refer to **"Section 4 - Maintenance"** for specific test applications.)

3. SWITCH SW1: This 6-position DIP (Dual In-line Package) switch is used to match the drive to the speed requirements of the motor assembly.

4. JUMPERS: A variety of jumpers are provided on the drive circuit board to allow configuring the drive to the motor assembly. (Refer to **"Section 2 - Installation"** and **"Appendix D - Drive Setups"** for additional information on the jumpers.)

5. SETUP POTENTIOMETERS: These potentiometers are used along with the jumpers to configure the drive to a specific motor assembly. (Refer to

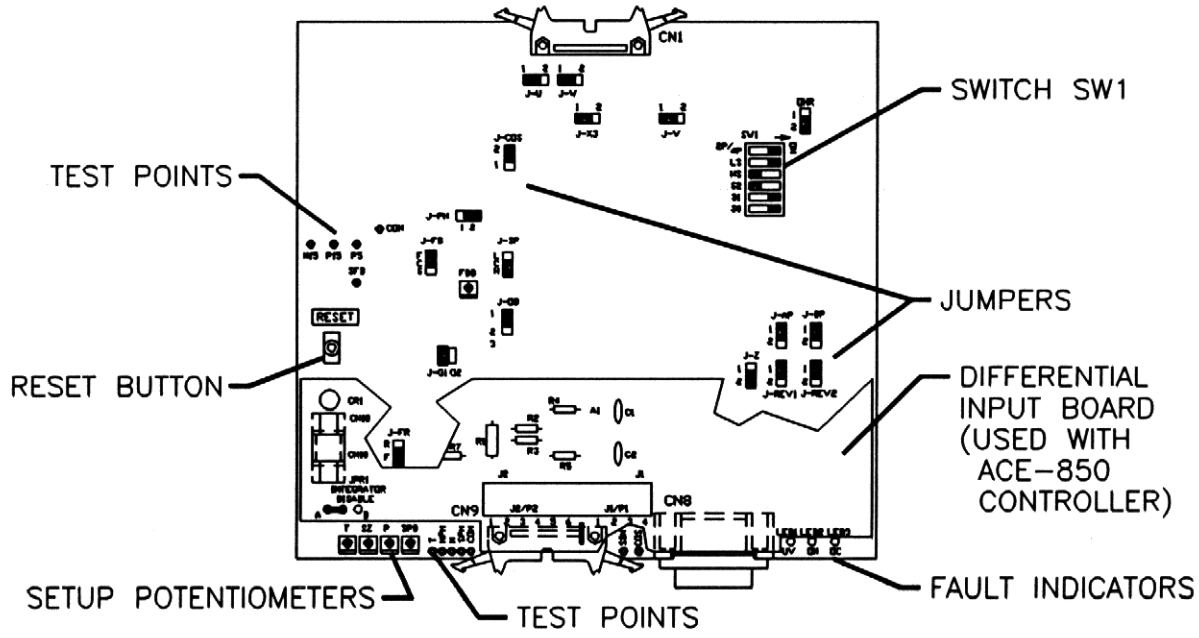


Figure 1.5 - Drive Circuit Board

"**Section 2 - Installation**" and "**Appendix D - Drive Setups**" for additional information on the setup potentiometers.)

6. FAULT LEDS: The FAULT LEDs are a series of three LEDs used for troubleshooting purposes. If a fault occurs, the combination of which LEDs are illuminated, and whether they are steady or flashing, will indicate the type of fault which has occurred. (Refer to "**Section 4 - Maintenance**" for details on the FAULT LEDs.)

1.3.2.1 Transformer

The Series 5 PWRPAK™s use a variety of isolation transformers to match the load requirements of the various package configurations and available prime supply voltages.. Each of the transformers supplies 230 VAC output to the power supply. They also have additional taps for 207 VAC and 253 VAC outputs (± 10%) which can be used when the supply voltage is too high or too low. Refer to **Appendix F** for dimensions, specifications, and wiring configurations for the transformers.

NOTES

1.4 SPECIFICATIONS

Most specifications for the various motion devices are contained in the appropriate appendices at the end of this manual. This section includes some general information which is applicable to the entire series. Refer to **"Appendix B - MDPAK™ Specifications"** and **"Appendix E - PWRPAK™ Specifications"** for detailed information.

NOTE

Any MDPAK™ or PWRPAK™ specification data shown in this section should be considered as reference only. Refer to Appendix B and Appendix E for current information specifications on each of the Motor/Drive packages and Power Supply Packages respectively.

1.4.1 GENERAL

AMBIENT OPERATING TEMPERATURE	Motor: -10 to 40°C Drive: 0 to 50°C
MOTOR INSULATION CLASS:	Class F - Maximum 100°C rise on motor windings
MOTOR ENCLOSURE:	Totally enclosed, non-ventilated
MOTOR SPEED/POSITION SENSOR:	Two-phase brushless resolver
POSITION FEEDBACK SIGNAL:	Simulated encoder (A/B quadrature with marker). 5 VDC dual differential line drives.
MAIN BUS POWER:	220 VAC ±7%, 3ϕ, 50/60 Hz
CONTROL POWER:	220 VAC ±7%, 3ϕ, 50/60 Hz

1.4.2 MDPAK™ SPECIFICATIONS

Series 5 Motor/Drive Package specifications are included in **Appendix B**. The list of materials includes the motor part number, the drive part number, the drive setup drawing number, and the manual part number. The MDPAK™ specifications are included in a separate chart in **Appendix B**. Motor dimensions and connections and drive dimensions are contained in the drawings in **Appendix C**. Drive setups are included in **Appendix D**.

Read the motor number, drive number, and drive setup for the specific MDPAK™ from the list of materials in **Appendix B**. To determine mounting dimensions, refer to the motor and drive with the designated part numbers in the dimension charts in **Appendix C**. To determine proper drive setup, refer to the appropriate drawing in **Appendix D**.

The Speed/Torque curve included on the MDPAK™ Specifications sheet (refer to **Figure 1.6**) is representative of the performance characteristics of the Motor/Drive Package (as opposed to just the motor or just the drive). The package must operate within the limits of this curve to prevent possible damage to the motor or drive. In addition, the rms torque value for the various motor accelerations, decelerations, and steady states will be limited to the T_r value on the curve. The specification chart lists the key Motor/Drive Package specifications as derived from the Speed/Torque curve.

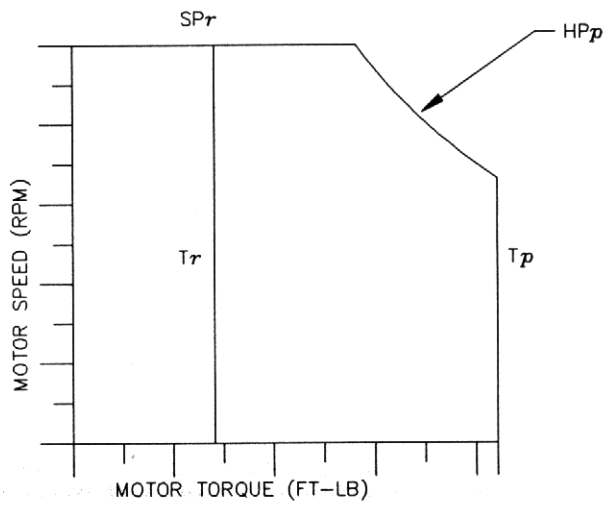


Figure 1.6
MDPAK™ Speed/Torque Curve

NOTE

Each Setup Drawing for the MDPAKs specifies the appropriate speed and torque measurements at the test points.

1.4.3 PWRPAK™ SPECIFICATIONS

Series 5 Power Supply Package specifications are included in **Appendix E**. The list of materials includes the transformer part number and the manual part number. The PWRPAK™ specifications are included in a separate chart in **Appendix E**. Transformer dimensions and electrical connections are contained in the drawings in **Appendix F**.

Read the transformer number for the specific PWRPAK™ from the list of materials in **Appendix E** and note whether it is panel-mounted or free-standing. To determine mounting dimensions and electrical connections, refer to the designated transformer in the appropriate dimension chart in **Appendix F**.

SECTION 2 – INSTALLATION

The various components which make up the Series 5 Motor/Drive Packages and Power Supply Packages may be supplied as loose components, as assembled systems, or as a combination of each. This manual assumes that all components have been supplied as individual, unmounted components.

2.1 MOUNTING

CAUTION

ALL MDPAK™ AND PWRPAK™ COMPONENTS MUST BE MOUNTED IN ENCLOSURES WHICH ARE SUITABLE TO PROTECT THE COMPONENTS FROM THE SURROUNDING ENVIRONMENT. THERE MUST BE ADEQUATE AIR FLOW TO PREVENT OVERHEATING.

2.1.1 DRIVES

Mounting dimensions for the drives are shown in **Appendix C**. Each drive has a set of cooling fins protruding from the rear of the enclosure. It will be necessary to fabricate a mounting bracket for the drive to hold it away from the mounting surface. Refer to **Appendix C** for the cutout size and mounting hole locations for each of the drives.

NOTE

Mounting Brackets are available from Industrial Indexing Systems, Inc. for mounting the Series 5 MDPAK™ drives (refer to Appendix C).

Separate each drive from any adjoining drives by a space of 2" (50.8 mm). Allow at least 4" (101.6 mm) clearance above and below the cabinets for air flow and wiring. Allow at least 1" (25.4 mm) between the back of the cooling fin and any mounting surface.

1. Determine the mounting dimensions for each drive. (Refer to **Appendix D** for mounting dimensions of Series 5 drives.)

2. Fabricate a mounting bracket for the drive which will allow adequate clearances or obtain a mounting bracket from Industrial Indexing Systems, Inc.

3. Provide the appropriate hardware to mount the drive mounting brackets. Make sure the support is adequate for the total weight of the drive.

4. Mount each of the drives. Make sure each unit is securely attached and adequately supported.

2.1.2 TRANSFORMER

Mounting dimensions for the transformers used with Series 5 PWRPAK™s are shown in **Appendix F**. A typical mounting pattern for a free-standing transformer is shown in **Figure 2.1**.

1. Lay out the mounting location.

2. Provide the appropriate holes and hardware to mount the transformer. Make sure the support is adequate for the weight of the transformer.

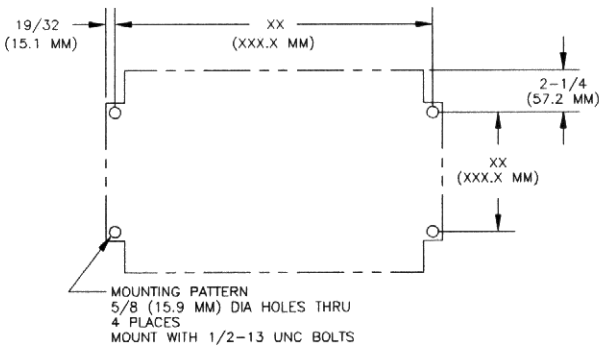


Figure 2.1
Typical Transformer Mounting Pattern

2.1.3 MOTOR

CAUTION

DO NOT DISASSEMBLE THE MOTOR. UNAUTHORIZED DISASSEMBLY MAY CAUSE SERIOUS REDUCTION IN PERFORMANCE AND WILL NULLIFY THE WARRANTY.

CAUTION

WHEN MOUNTING MOTORS, MAKE SURE THE MOTOR IS PROPERLY ALIGNED. IT MUST BE MOUNTED SQUARELY SO THE FACE IS FLUSH AGAINST THE MOUNTING SURFACE. THE SHAFT MUST NOT BE TWISTED OR BOUND IN ANY WAY. THE SYSTEM MUST NOT SUBJECT THE MOTOR TO IMPACT LOADS. COMPLETE SYSTEM INSTALLATION, WIRING, AND TESTING BEFORE THE LOAD IS ATTACHED TO THE MOTOR SHAFT.

Motor mounting will depend on the application and the system being indexed. All Series 5 brushless motors are designed for front face mounting (refer to **Appendix C**).

1. Lay out the mounting holes for the motor and attach the motor to the desired mount.

2. Attach the load to the motor shaft.

2.2 ELECTRICAL CONNECTIONS

WARNING

DO NOT TURN ON ANY POWER TO THE SYSTEM UNTIL ALL ELECTRICAL CONNECTIONS HAVE BEEN COMPLETED.

The Series 5 Motor/Drive Packages and Power Supply Packages are frequently installed as part of a larger electrical control system. The indexing system may utilize a variety of controllers. Therefore, the electrical connections discussed in this section cannot cover all possible variations of system wiring and will be restricted to the electrical connections between the MDPAK™ and PWRPAK™ when used with any of the ACE-850, MSC-850, or MM-10-T controllers. Pertinent information for other necessary connections is provided, but specific connections are not shown.

Figure 2.2 shows typical system component interconnections when used with the ACE-850/MSC-850 controller. **Figure 2.3** shows typical system component interconnections when used with the MM-10-T controller. Note that the interconnections for use with the ACE-850/MSC-850 require the addition of the AC-100041 differential input board and the AC-100057 connector interface. The interconnections for use with the MM-10-T controller require an AC-100056 connector interface. Details of each of these circuit boards are provided in **Appendix C.**

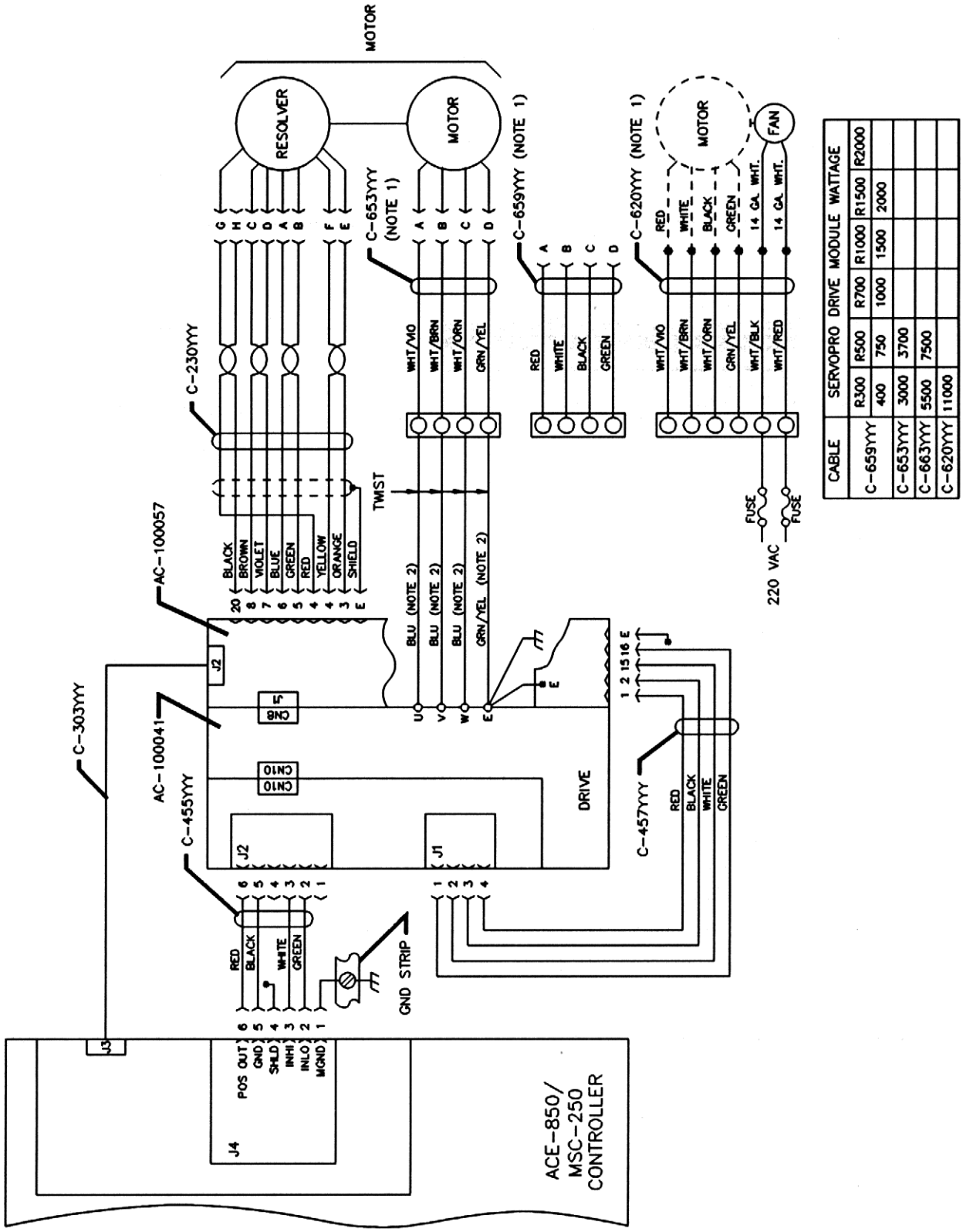
Terminal identities are given on the interconnection drawings where they tend to be the same on all Series 5 components. Terminal identities included on any system drawings or documentation supersede any terminal identities included in this manual. Please note when C-303YYY (see Appendix G) exceeds 5 feet in length, use alternate cable configuration in Figure 2.9.

2.2.1 DRIVE CONNECTIONS

The cable numbers on **Figure 2.2** and **Figure 2.3** are for specific Industrial Indexing Systems' cables used with Series 5 components. (The 'yyy' which makes up the last three places of the cable number is the length of the cable in feet.) Drawings for each of these cables are contained in **Appendix G.**

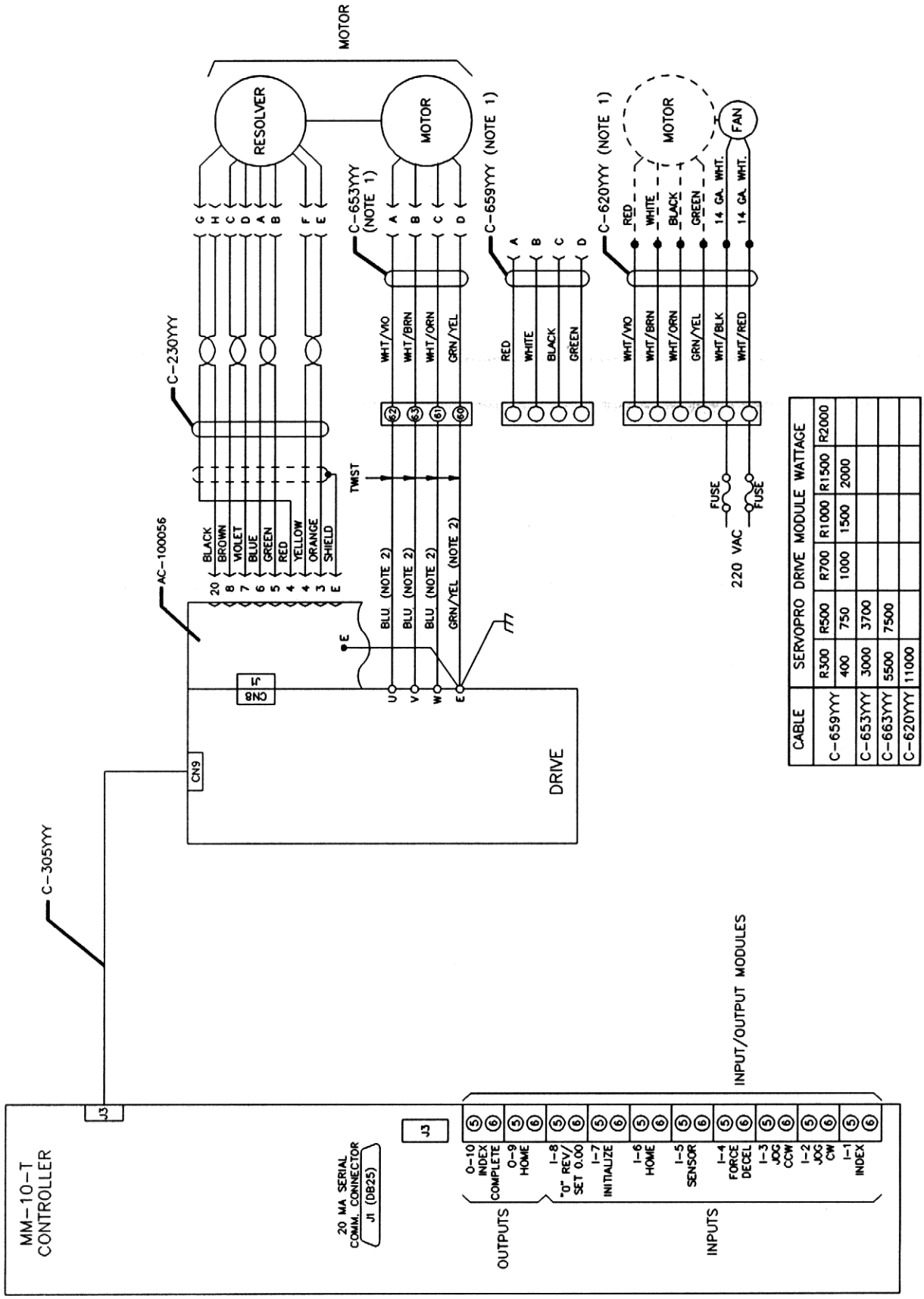
CAUTION

FOR PROPER OPERATION, THE CONTROLLER MUST BE WITHIN 5' OF THE DRIVE AND THE DRIVE MUST BE WITHIN 100' OF THE MOTOR.



CABLE	SERVOPRO DRIVE MODULE WATTAGE					
C-659YYY	R300	R500	R700	R1000	R1500	R2000
	400	750	1000	1500	2000	
C-653YYY	3000	3700				
C-663YYY	5500	7500				
C-620YYY	11000					

Figure 2.2 - Indexing System Interconnections with ACE-850/MSC-250 Controller



CABLE	SERVOPRO DRIVE MODULE WATTAGE						
	R300	R500	R700	R1000	R1500	R2000	
C-659YYY	400	750	1000	1500	2000		
C-653YYY	3000	3700					
C-663YYY	5500	7500					
C-620YYY	11000						

Figure 2.3 - Indexing System Interconnections with MM-10-T Controller

2.2.1.1 Connections With ACE-850/MSC-250 Controller

1. If not assembled at the factory, mount the AC-100041 differential input board to the drive using the mounting hardware attached to the board.

2. Plug connector J1 on the AC-100057 connector interface board to connector CN8 on the drive. Attach the ground connector to the "E" terminal.

3. Attach the encoder cable (C-303yyy) from the controller to the drive. Make sure both connectors are properly seated. [**LIMIT = 5'**]

4. Attach the command cable (C-455yyy) from the controller to connector J2 on the differential input board. Make sure both connectors are properly seated. [**LIMIT = 5'**]

5. Attach the command cable (C-457yyy) from connector J1 on the differential input board to the four pin connector on the drive end of cable C-455yyy. Make sure all pins and the connector are properly seated.

2.2.1.2 Connections With MM-10-T Controller

1. Plug connector J1 on the AC-100056 connector interface board to connector CN8 on the drive. Attach the ground connector to the "E" terminal.

2. Attach the encoder cable (C-305yyy) from the controller to the drive. Make sure both connectors are properly seated. [**LIMIT = 5'**]

2.2.1.3 Connections to the Motor

1. Attach the resolver cable (C-230yyy) from the drive to the motor resolver connector. Make sure both connectors are properly seated. [**LIMIT = 100'**]

Motor cables C-653yyy, C-659yyy, and C-663yyy have connectors at the motor end only. The other end should be wired to a terminal strip to allow the proper distribution of the wires from the motor. The four wires carry the three-phase power and ground from the drive to the motor.

The motor cable used will depend on the size of the MDPAK™ package. Motor cable C-659YYY is used for applications with drive modules of 2,000 watts or less. Motor cable C-653YYY is used for applications with drive modules of 3,000 watts and 3,700 watts. Motor cable C-663YYY is used for applications with drive modules of 5,500 watts and 7,500 watts. Motor cable C-620YYY is used for applications with drive modules of 11,000 watts.

2. Provide a four-terminal terminal strip for connection of the motor cable.

3. Connect terminals U, V, AND W on the drive to the terminal strip using appropriately sized blue wires for terminals U, V, and W and green wire for terminal E. Twist the wires together.

4. Attach the four wires from the non-connector end of the motor cable (C-653yyy or C-659yyy) to the terminal strip. Make sure they are attached to the proper terminals (refer to **Figure 2.2**).

5. Attach the connector-end of the motor cable (C-653yyy or C-659yyy) to the motor connector.

2.2.2 TRANSFORMER CONNECTIONS

CAUTION

ALL TRANSFORMERS USED WITH SERIES 5 POWER SUPPLY PACKAGES MUST BE HEAVY-DUTY, ISOLATION, THREE-PHASE TRANSFORMERS.

The transformers used with Series 5 Power Supply Packages are special heavy-duty isolation transformers designed not to lower the output voltage under high load conditions. They will accept 230 VAC/3ϕ/60 Hz or 460 VAC/3ϕ/60 Hz , delta-connected, primary input power. They have three sets of wye-connected, secondary output power taps — 207 VAC, 230 VAC, and 253 VAC (230 VAC ± 10%). These taps allow modification of the voltage input to the drives. The 253 VAC taps would be used when low plant distribution voltage or excessive power drain from the drives results in a low input voltage. 207 VAC taps are used when the input voltage is constantly high.

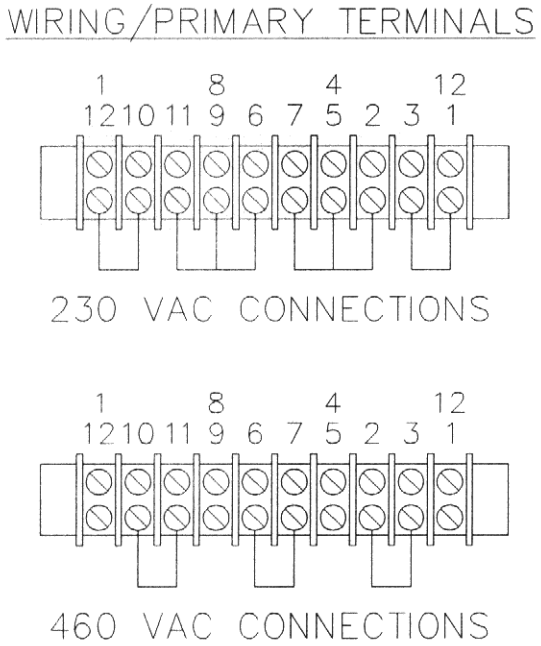


Figure 2.4
Transformer Primary Connections

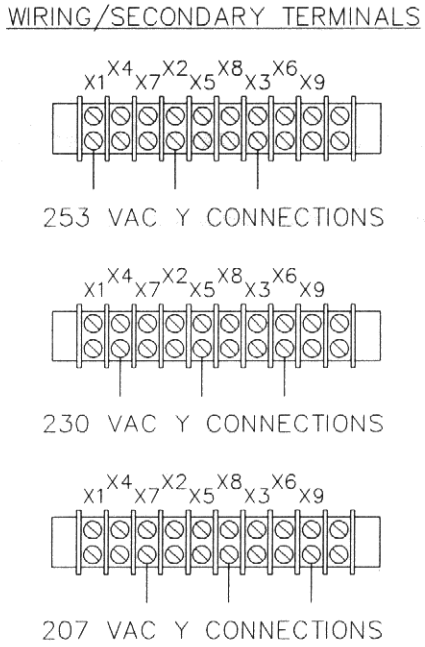


Figure 2.5
Transformer Secondary Connections

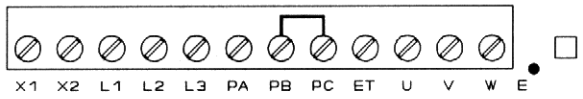


Figure 2.6
Input Terminals
Drives Less Than or Equal To 1000 Watts

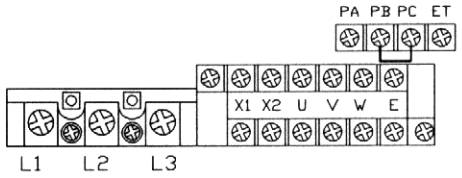


Figure 2.7
Input Terminals
Drives Greater Than 1000 Watts

The Series 5 drives each have two voltage inputs. The main supply voltage is three-phase, 230 VAC; the control voltage is single-phase, 230 VAC. (Both voltages can be taken from the same transformer secondary taps.)

The control voltage connects to terminals "X1" and "X2" on the drive input. The main supply power connects to terminals "L1", "L2", and "L3". (Refer to **Figure 2.6** and **Figure 2.7**.) Both the control voltage and the main supply voltage must be connected to the drive and the drive must be grounded for proper operation.

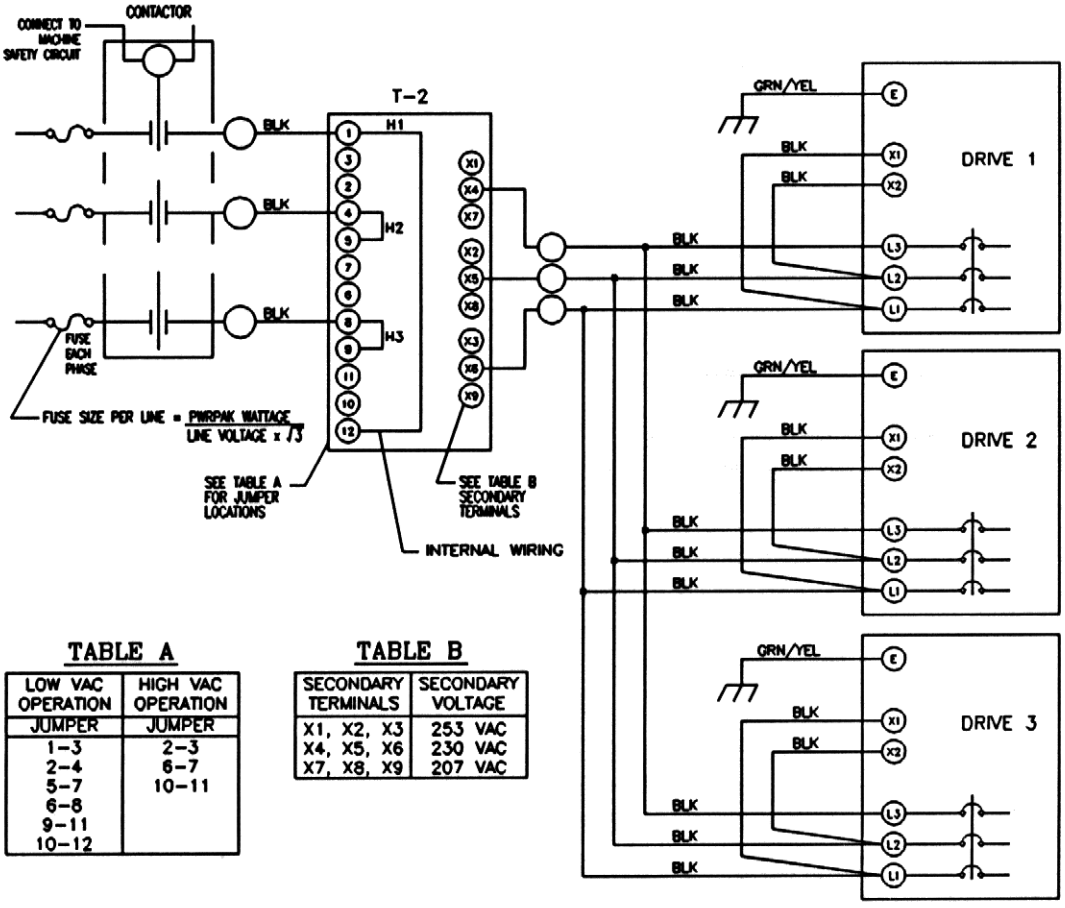


TABLE A

LOW VAC OPERATION	HIGH VAC OPERATION
JUMPER	JUMPER
1-3	2-3
2-4	6-7
5-7	10-11
6-8	
9-11	
10-12	

TABLE B

SECONDARY TERMINALS	SECONDARY VOLTAGE
X1, X2, X3	253 VAC
X4, X5, X6	230 VAC
X7, X8, X9	207 VAC

Figure 2.8 - Power Connections to Multiple Drives

CAUTION

THE SERIES 5 DRIVE IS DESIGNED FOR 220 VAC INPUT VOLTAGE. CONTACT THE INDUSTRIAL INDEXING SYSTEMS INTEGRATED TECHNICAL SERVICES DEPARTMENT FOR ADVICE BEFORE USING THE 207 VAC OR 253 VAC SECONDARY TAPS ON THE TRANSFORMER.

WARNING

OBSERVE ALL FEDERAL, STATE, AND LOCAL ELECTRICAL CODES WHEN INSTALLING THE PRIME SUPPLY POWER TO THE TRANSFORMER. DO NOT TURN ON THE ELECTRICAL DISCONNECT UNTIL ALL WIRING IS COMPLETE.

1. Connect the 230 VAC secondary terminals from the transformer to the input power terminals (L1, L2, L3) on the power supply using black wires. When the transformer is being connected to multiple drives, the input wires to the drives should be connected as shown in **Figure 2.8**.

2. Connect the 230 VAC secondary terminals from the transformer to the control power terminals (X1, X2) on the power supply using appropriately sized black wires. When the transformer is being connected to multiple drives, the input wires to the drives should be connected as shown in **Figure 2.8**.

3. Connect the input power from the plant distribution system to the transformer primary connections using black wires. Provide a separate fused disconnect for the supply voltage.

2.2.3 GROUND CONNECTIONS

CAUTION

THE SERIES 5 MOTION DEVICES REQUIRE VERY SPECIFIC GROUNDING CONNECTIONS. CAREFULLY FOLLOW ALL PROCEDURES IN THIS SECTION BEFORE ATTEMPTING TO OPERATE THE INDEXING SYSTEM.

1. Provide an electrical-ground terminal strip for grounding of all related systems.

2. Connect the electrical-ground terminal strip to electrical ground using cable sized for the entire load.

3. Connect the ground terminal ("E") from the drive to the electrical-ground terminal strip using appropriately sized green wire.

4. Connect the ground wire from the controller to the electrical ground terminal strip.

NOTE

Previously, the ground terminal ("E") on the drive should have been connected to the terminal strip used for the drive end of motor cable C-620yyy, C-653yyy, or C-659yyy (refer to Paragraph 2.2.1) using green wire twisted with the blue power wires. Also make sure that the ground wire from the AC-100057 or AC-100056 connector interface has been connected to ground terminal ("E") on the drive.

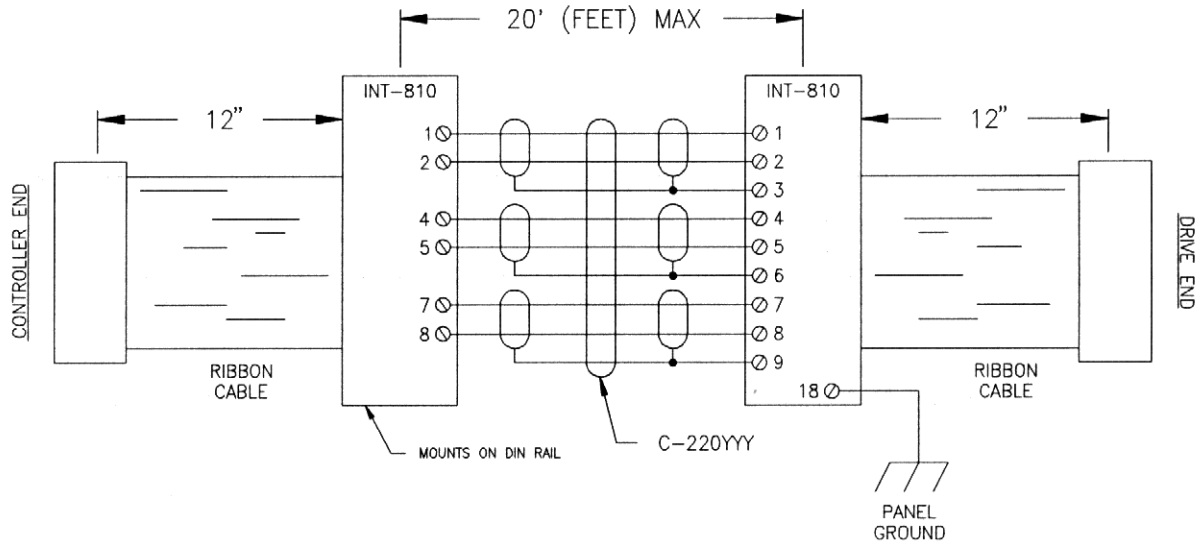
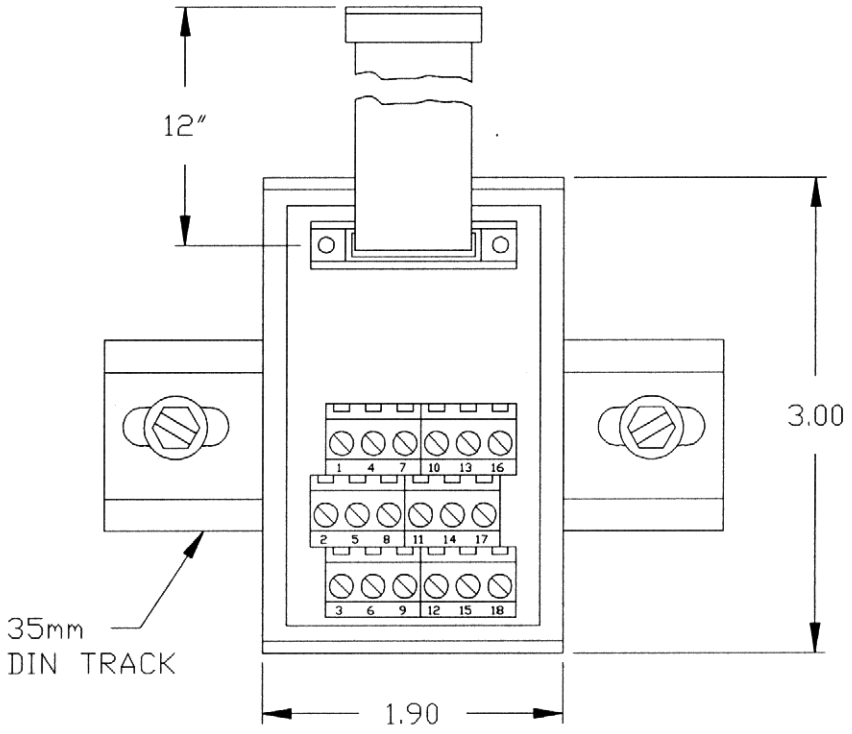


Figure 2.9 - C-220YYY Connections

(Use in place of C-303YYY when C-303YYY exceeds 5 feet in length)



INT-810 Pin Connections and Dimensions

SECTION 3 – CONTROLS AND OPERATION

NOTE

The majority of system controls for an indexing system come from the controller. Refer to the appropriate instruction manual for additional control information relating to the overall indexing system.

CAUTION

ALTHOUGH SYSTEMS FROM INDUSTRIAL INDEXING SYSTEMS ARE CHECKED AT THE FACTORY PRIOR TO SHIPPING, ALWAYS VERIFY THE DRIVE SETUP PRIOR TO USE OF ANY MDPAK™ OR PWRPAK™.

3.1 DRIVE SETUP

Each drive must be setup to match a specific motor assembly. This is accomplished with a series of jumpers on the drive circuit board (refer to **Figure 3.1**). The setup for the specific MDPAK™ must be verified before operating the drive.

1. Refer to the List of Materials for the specific MDPAK being used (**Appendix B**) and identify the proper setup drawing.

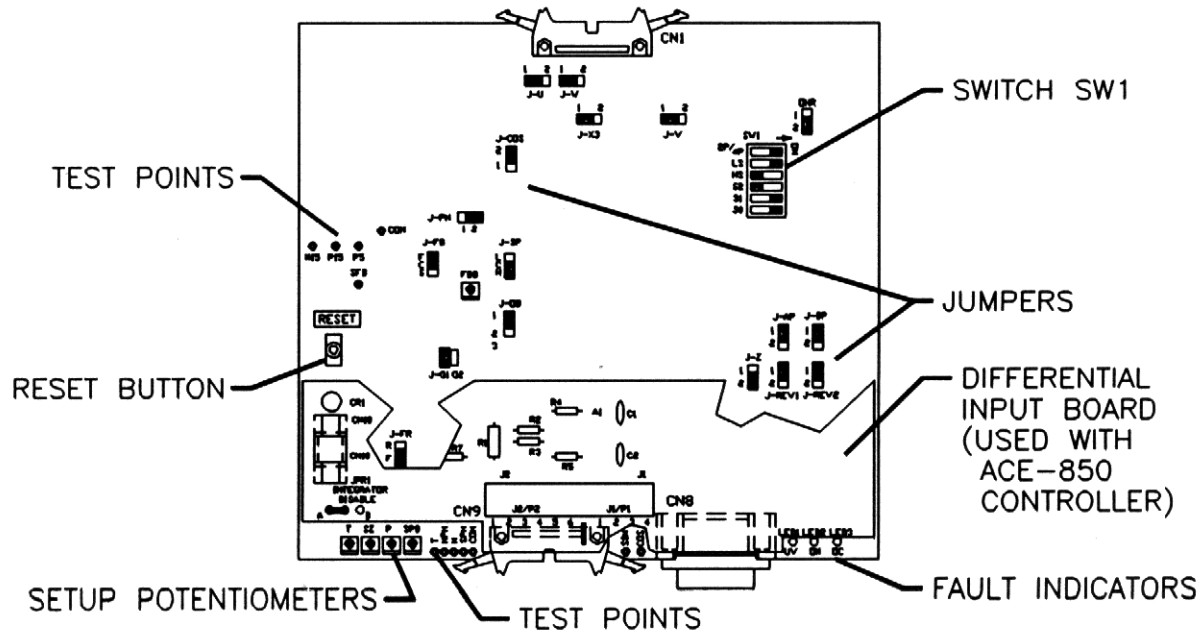


Figure 3.1 - Drive Circuit Board

CAUTION

THE SETUP DRAWINGS IN APPENDIX E ARE SUBJECT TO CHANGE. ALWAYS VERIFY WITH THE FACTORY THAT THE LATEST REVISION OF THE SETUP DRAWING IS BEING USED WHEN INSTALLING NEW OR REPLACEMENT DRIVES.

2. Refer to the proper setup drawing (**Appendix E**). Carefully check the position of each jumper on the circuit board against the drawing. Correct the position of any jumpers which do not match the drawing. (**Table 3.1** gives a description of the function for each jumper. This information is included for reference only.)

Table 3.1 - Drive Circuit Board Jumper Definitions

JUMPER	SETUP FUNCTION
J-FR	Speed Reference Polarity
J-REV1	Phase Relation of Encoder Output
J-REV2	Phase Relation of Encoder Output
J-AP	Optional Pulse Rate with Optional PCB
J-BP	Optional Pulse Rate with Optional PCB
J-Z	"Z" Marker Output
J-G1	Coarse Integral Gain Adjustment
J-G2	Coarse Integral Gain Adjustment
J-FB	Speed Feedback Select
J-SP	Speed Range Select
J-COS	Resolver Type
J-PH	Resolver Type
J-U	Current Control Gain Select
J-V	Current Control Gain Select
J-W	Current Control Gain Select
J-X3	PWM Gate Signal
J-OD	Gate Delay Time
J-OHR	Overheat Fault Detection

3. Carefully check the position of each DIP switch position of switch SW1. Correct the position of any switch positions which do not match the drawing.

3.2 OPERATION

Under normal operating conditions, the drive is operated from the controller.

1. Turn power on to the drive and the controller. Industrial Indexing Systems' controllers provide a one second delay before enabling the drive.

CAUTION

IF CONTROLLER POWER IS APPLIED BEFORE DRIVE POWER, A MINIMUM 1 SECOND DELAY MUST BE PROVIDED BETWEEN DRIVE POWER APPLICATION AND DRIVE ENABLING.

The drive receives signals from the resolver as the motor shaft turns. It converts these into a signal duplicating a quadrature shaft encoder signal (two bit streams 90° out-of-phase and a marker bit once per revolution). This signal is sent to the controller while the motor and drive are operating.

WARNING

OPENING THE DRIVE ENCLOSURE WITH POWER ON EXPOSES PERSONNEL TO POTENTIALLY HAZARDOUS VOLTAGES. "POWER-ON" MAINTENANCE SHOULD ONLY BE PERFORMED BY TRAINED PERSONNEL FOLLOWING PROPER SAFETY PROCEDURES.

If a fault should occur, the drive will shut down and the appropriate FAULT LEDs will illuminate.

NOTE

When a fault occurs, check the FAULT indicator LEDs before turning off system power. Turning the control power off will reset the fault indication.

1. To reset a fault indication, turn power OFF to the controller.
2. Correct the cause of the fault.
3. Allow the drive to cool down.
4. Turn power ON to the controller.

OR

1. If it is necessary to check on the cause of the fault, open the enclosure door.

2. Observe the LEDs to determine which are illuminated and whether they are steady of flashing. Refer to **"Section 4 - Maintenance"** for a description of the faults indicated by the LEDs.

3. Correct the cause of the fault.

CAUTION

IF AN OVERLOAD OCCURS, ALLOW TIME FOR THE TRANSISTORS TO COOL BEFORE RESETTING THE DRIVE. IF THE CAUSE OF THE FAULT STILL EXISTS AND THE DRIVE IS RESET WHILE THE TRANSISTORS ARE ALREADY HOT, THEY COULD BE DAMAGED.

4. Press the RESET button on the circuit board.

5. Close the enclosure cover.

Two test points ("T" and "N") are provided on the circuit board (refer to **Figure 3.2**). These can be used to verify proper operation of the drive. When the test points are measured to common ("COM"), they will indicate the speed and torque as shown on the individual Setup Drawings in **Appendix D**. These values relate as follows:

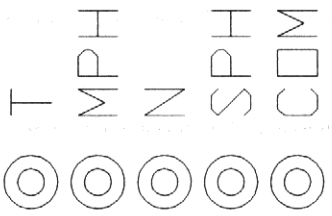


Figure 3.2
Drive Test Points

Torque (T): 3.33 VDC = 100%

Speed (N): 6.66 VDC = 1000 RPM (1500 Rated)
3.33 VDC = 1000 RPM (3000 Rated)
2.22 VDC = 1000 RPM (4500 Rated)

SECTION 4 – MAINTENANCE

The Industrial Indexing Systems Series 5 Motor/Drive Packages and Power Supply Packages are designed to provide reliable service with minimum down time and maintenance. In case of failure, the system is designed for replacement of an entire component. It is recommended that an inventory of spare parts be maintained for the system.

NOTE

To prevent system problems, inspect the system frequently to make sure all connections are tight. Also check for motor vibration and overheating.

4.1 FAULT INDICATIONS

Three FAULT Indicator LEDs (refer to **Figure 4.1**), located at the lower right of the drive circuit board, indicate types of faults which occur with the Motor/Drive Package. Once illuminated, these LEDs will remain illuminated until reset by turning off the control voltage or by pressing the RESET button on the drive circuit board.

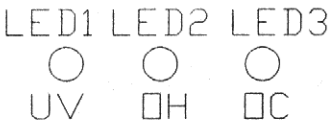


Figure 4.1
FAULT Indicator LEDs

Table 4.1 - Fault Indications

	FAULT TYPE	INDICATION
1.	Overload	OH Steady
2.	Overcurrent	OC Steady
3.	Overheat of Regeneration Resistor	OH Flashing
4.	Resolver Fault	OH & UV Flashing
5.	Undervoltage of Main DC Voltage OR Timing Error of Main Power	UV Flashing
6.	Overvoltage of Main DC Voltage	UV Steady
7.	Control Fuse Blown	Not Indicated

4.1.1 OVERLOAD

The "Overload" fault occurs when the drive is delivering RMS current in excess of the 100% current rating for the motor.

1. Check for obstructions to the motion which would cause frictional load.

2. Check the Duty Cycle for the machine to determine if it has been increased beyond the capability of the MDPAK™.

3. Attach an oscilloscope (or meter) to test point "T" (Torque).

   a. The signal will be somewhat noisy but should average **less than** 3.3 VDC (which indicates 100% current).

   b. The signal should be very low while the drive is enabled but under no load.

   c. If the drive is not enabled, the signal will read zero volts with no noise.

If the signal is very unstable, it is possible that the coupling between the motor and load is loose. It is also possible that the "P" gain setting on the drive has been changed.

If the signal steadily climbs to 10 VDC after the drive is enabled, there may be a problem with the Encoder Feedback signal to the controller, but this will usually show up as an error in the controller first. Also, switch SW1 may be set for a four-pole motor instead of an eight-pole motor.

4. Check all switch positions on DIP switch SW1. Verify the switch positions against the appropriate setup drawing.

5. Check the Resolver wiring. (Some resolver wiring errors will show as overloads instead of resolver faults.)

CAUTION

IF AN OVERLOAD FAULT OCCURS, ALLOW TIME FOR THE TRANSISTORS TO COOL BEFORE RESETTING THE DRIVE. IF THE CAUSE OF THE FAULT STILL EXISTS AND THE DRIVE IS RESET WHILE THE TRANSISTORS ARE ALREADY HOT, THEY COULD BE DAMAGED.

4.1.2 OVERCURRENT

The "Overcurrent" fault is the most serious indicated by the drive. It may indicate a blown power transistor or that the motor leads are shorted together. The drive will sense an instantaneous current output in excess of 500% and shut down the system before the drive is damaged.

The overcurrent fault might also be caused by a sudden impact to the load or a sudden stop. These could generate a very high current spike through the drive and cause the overcurrent fault.

If no wiring problem is found and the drive cannot be reset, the most likely problem is a blown transistor. The drive will have to be replaced.

CAUTION

IF AN OVERCURRENT FAULT OCCURS, ALLOW TIME FOR THE TRANSISTORS TO COOL BEFORE RESETTING THE DRIVE. IF THE CAUSE OF THE FAULT STILL EXISTS AND THE DRIVE IS RESET WHILE THE TRANSISTORS ARE ALREADY HOT, THEY COULD BE DAMAGED.

4.1.3 OVERHEAT

The "Overheat" fault occurs when the drive calculates that the regeneration braking resistor mounted on the drive heat sink (for excess power dissipation) is overheating. Power is dissipated through the regeneration resistor when the DC bus voltage exceeds 380 VDC. This normally occurs during rapid deceleration of the motor.

Overheating may be caused by repetitive starting and stopping of the motor within a short time span. However, an "Overload" error will usually occur first.

A more typical fault is a surge in the line voltage input to the drive. If this surges long enough, it will cause the bus voltage to increase above 380 VDC until the fault occurs. (This would require a AC line voltage in excess of 270 VAC.)

Another possible cause is a short in the power transistor used to turn the regeneration circuit on and off. This will short the regeneration resistor directly across the DC bus. This condition may not always cause an overheat fault. It will sometimes trip the circuit breaker or cause an overcurrent fault before the drive trips on an overheat fault.

4.1.4 RESOLVER FAULT

The resolver must be wired directly to the drive for the system to work properly. If any of the wires are loose or incorrectly connected, the "Resolver" fault will occur and the drive will shut down.

The resolver may also be faulty, but this is usually not the case. Most resolver faults occur at initial start-up due to faulty wiring. However, it is possible for the cable to become damaged during normal operations.

1. Check both connectors on the resolver cable. Make sure they are seated properly and that all wires are properly attached in the connector.

2. If no connector problems are observed, replace the resolver cable.

NOTE

Not all resolver faults are detected by the drive. Also, some resolver problems will be detected as overheat faults rather than resolver faults.

4.1.5 UNDERVOLTAGE

The "Undervoltage" fault occurs when the DC bus voltage falls below 250 VDC. This typically indicates that the three-phase line voltage input to the drive no longer exists.

1. Check the circuit breaker inside the drive. If the circuit breaker is tripped, determine the cause of the problem before resetting the breaker.

This fault will also occur if the drive is enabled too soon (less than one second) after the power is turned on to the drive.

2. Reset the fault and allow the drive to come up to operating voltage before attempting to enable the drive.

3. Check the input power supply to make sure that all three phases are present.

4.1.6 OVERVOLTAGE

The "Overvoltage" fault occurs when the DC bus voltage exceeds 385 VDC. This corresponds to a line voltage input of approximately 273 VAC.

1. Check the line voltage input from the transformer.

2. Check for excessive regeneration braking torque from the motor.

4.1.7 DRIVE ENABLE

There is a green indicating LED on the AC-100041 differential input board. This LED will come on whenever the ACE-850 controller has enabled the drive or is attempting to enable the drive. Use this LED to help isolate whether an enabling problem is due to the drive or controller.

4.2 TROUBLESHOOTING

WARNING

DISCONNECT ALL ELECTRICAL POWER AND FOLLOW PROPER LOCKOUT PROCEDURES BEFORE MAKING ANY ADJUSTMENTS OR REPAIRS.

NOTE

Check for fault indications before turning the control power off to the drive. All fault indications will reset when control power is turned off.

This section is designed to assist trained personnel in identifying and correcting system malfunctions. It is important to have a thorough knowledge of the equipment as found in this manual before attempting to use this troubleshooting guide. When a problem occurs, first read the appropriate sections of this manual to make sure that the components are installed properly and are being operated correctly. Follow the checks included in this manual, in sequence.

NOTE

Any indexing system also involves the system controller and any associated peripheral devices which will also affect the system performance. Refer to the instruction manuals for those components for additional troubleshooting information.

4.2.1 PRELIMINARY CHECKS

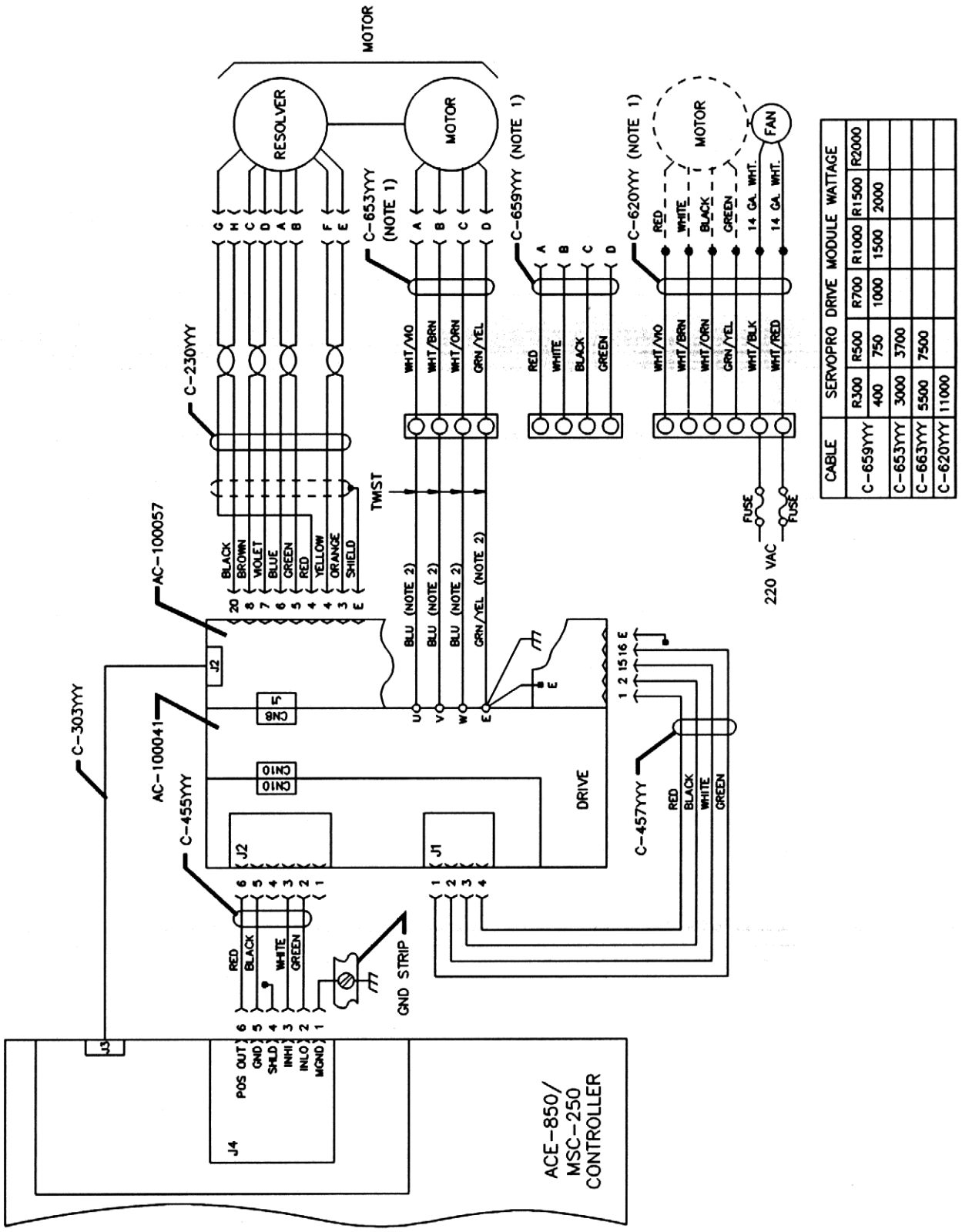
1. If this is an initial installation, check all installation procedures to make sure they have been followed properly.

2. Check the circuit breaker in the drive.

3. Check to make sure 115 VAC power is being supplied to the system controller. Check to make sure power plugs, if present, are securely inserted in their respective sockets and supply disconnects are turned on. Check all fuses.

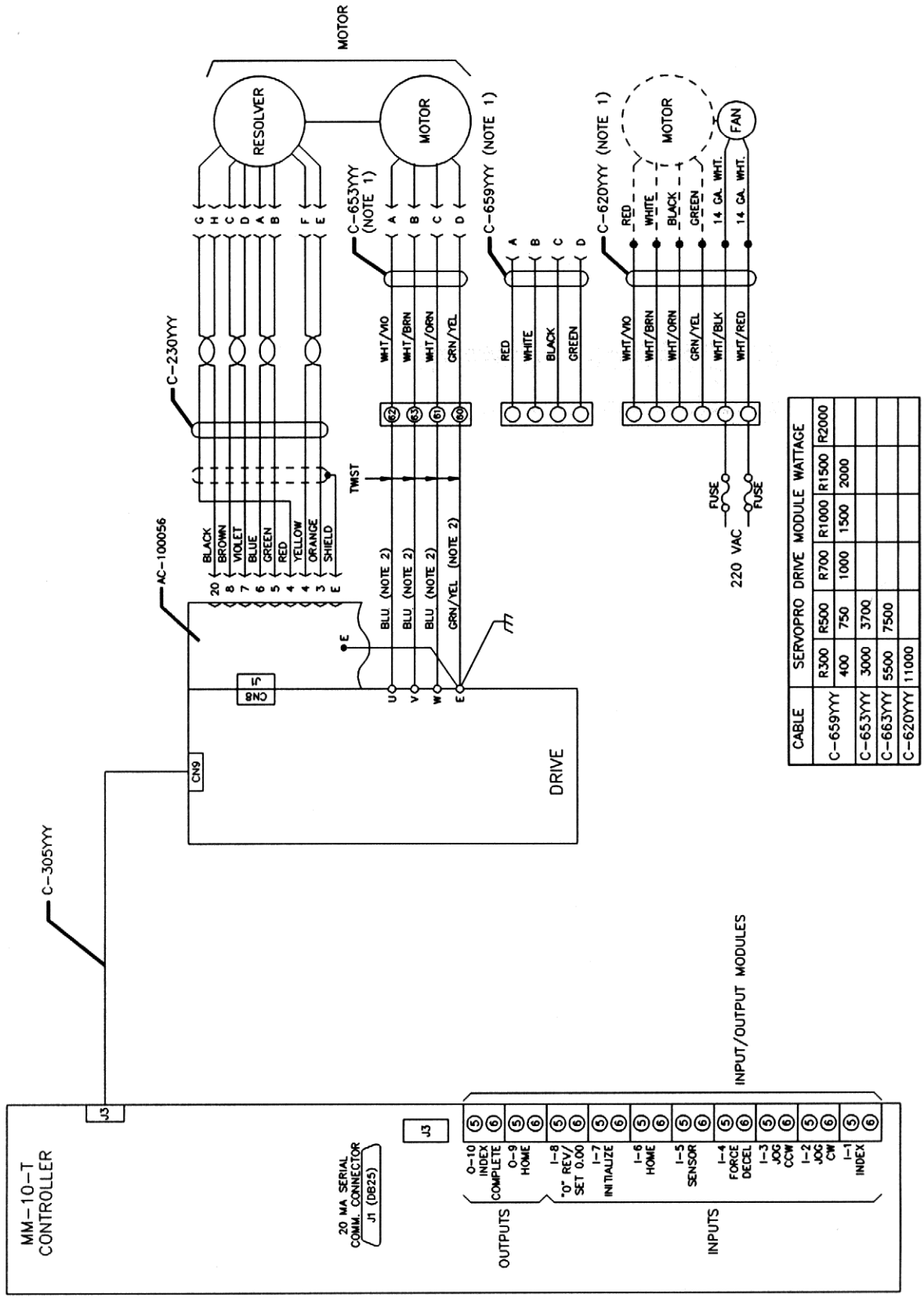
4. Check to make sure there are no fault indicators illuminated. Correct any indicated problems.

5. Make sure the drive and motor are correctly matched.



CABLE	SERVOPRO DRIVE MODULE WATTAGE						
C-659YYY	R300	R500	R700	R1000	R1500	R2000	
	400	750	1000	1500	2000		
C-653YYY	3000	3700					
C-663YYY	5500	7500					
C-620YYY	11000						

Figure 4.2 - Typical System Electrical Connections With ACE-850/MSC-250 Controller



CABLE	SERVOPRO DRIVE MODULE WATTAGE						
C-659YYY	R300	R500	R700	R1000	R1500	R2000	
	400	750	1000	1500	2000		
C-653YYY	3000	3700					
C-663YYY	5500	7500					
C-620YYY	11000						

Figure 4.3 - Typical System Electrical Connections With MM-10-T Controller

6. Make sure the machine is not jammed or otherwise mechanically preventing the indexing system from operating.

7. Check the placement of all jumpers and DIP switch positions on the drive circuit board. Refer to the appropriate setup drawing in **Appendix E**.

8. Check for loose or broken wires.

9. If there are no fault indications, check the line voltage input and verify that there is control voltage at terminals X1 and X2. Also check the following test points (to signal common):

   a. P15 = +15 VDC
   b. N15 = -15 VDC
   c. P5 = +5 VDC

10. Check the DC bus voltage level (bus bars across the output transistors). The voltage should be 310 VDC ±7%.

11. Physically check circuit board components looking for burned, broken, or otherwise damaged components.

If the motor is not responding smoothly, the type of problem can indicate the area of the problem. Use the following guides for directing system checks.

MOTOR DOES NOT RUN

a. Check that there is power on the DC bus.

b. Check to make sure there are no fault indicators illuminated. Correct any indicated problems and reset the fault by turning the drive power OFF and then ON again.

c. With all power off, check all fuses.

d. With all power off, check all resolver, motor, and command cable connections to make sure they are secure.

MOTOR RUNS ERRATICALLY OR IS UNSTABLE

a. With all power off, check all cable connections to make sure they are secure.

b. Check to make sure the brushless motor is correctly phased.

c. Check for correct motor/drive setup (refer to **Appendix D**).

d. Check to make sure the motor loading has not changed. Look for possible binding or jamming in the system.

MOTOR HAS LITTLE OR NO TORQUE

a. Check to make sure resolver signals are present.

b. Check to make sure there are no fault indicators illuminated. Correct any indicated problems and reset the fault by turning the drive power OFF and then ON again.

c. Check to make sure all power voltages are present.

4.2.2 SYSTEM TEST/VELOCITY LOOP

The velocity loop test removes the controller from the loop for the purpose of testing the motor and drive. In this test, the drive is manually enabled and a velocity command voltage is applied to the drive by means of a Volt Ohm Meter (V.O.M.) command input. The procedures are slightly different for systems operating with an ACE-850 controller and an MM-10-T controller.

WARNING

THIS TEST CAUSES THE MOTOR TO TURN. MAKE SURE THAT THE MECHANICAL LOAD IS DISCONNECTED, OR WILL ACCEPT MOVEMENT IN BOTH DIRECTIONS WITHOUT DAMAGE TO THE EQUIPMENT, AND THAT ALL PERSONNEL ARE CLEAR BEFORE STARTING THIS TEST.

4.2.2.1 System With ACE-850/MSC-250 Controller

1. Remove system power.

2. Remove the drive connector from the ACE-850/MSC-250 controller.

3. Using a short jumper wire, temporarily short together the "INLO" (green wire) and "INHI" (white wire) terminals on the drive connector. This step causes the drive (amplifier) to turn "On" manually.

4. Apply system power. The motor should be stationary and should resist any attempt to turn the motor shaft.

NOTE

Since this is a feedback system, there will always be some slight drift to the motor shaft when it is tested in this manner. However, the motor will not be free to be turned by hand.

5. Set a V.O.M. for use as an ohmmeter using the R × 1 resistance scale. Note that alternatively a diode tester on a Digital Volt Meter will provide a comprerable signal.

6. Connect the positive meter lead (red wire) to the "POS" or "POS OUT" drive connector terminal and the negative meter lead (black wire) to the "GND" drive connector terminal. This applies voltage (approximately 0.5 volts) into the drive input acting as a velocity command.

RESULT: **The motor should accelerate sharply to a controlled speed in a clockwise direction and decelerate sharply when either meter lead is removed.**

7. Reverse the meter leads to the "POS" and "GND" drive connector terminals. This changes polarity of the velocity command.

RESULT: **The motor should accelerate sharply to a controlled speed in a counterclockwise direction and decelerate sharply when either meter lead is removed.**

8. If all tests pass, the velocity loop is functioning correctly.

9. Remove all temporary jumpers, replace all disconnected wires, and connect the drive connector to the controller.

Items to check if test fails:

a. Troubleshooting of position loop.
b. Input voltages.
c. Motor armature wiring and polarity.
d. Reference Voltages (refer to the Controller Instruction Manual).

4.2.2.2 System With MM-10-T Controller

1. Remove system power.

2. Remove the connector at the controller end of command cable C-305yyy.

3. Using a short jumper wire, temporarily short together the "INLO" (TP 1-16) and "INHI" (TP 1-15) test points on the connector interface (AC-100056) (refer to **Figure 4.4**). This step causes the drive (amplifier) to turn "On" manually.

4. Apply system power. The motor should be stationary and should resist any attempt to turn the motor shaft.

NOTE

Since this is a feedback system, there will always be some slight drift to the motor shaft when it is tested in this manner. However, the motor will not be free to be turned by hand.

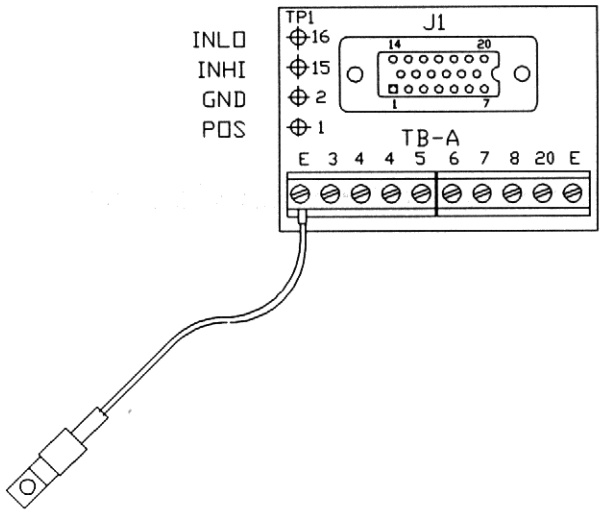


Figure 4.4
AC-100056 Connector Interface Test Points

5. Set a V.O.M. for use as an ohmmeter using the R × 1 resistance scale.

6. Connect the positive meter lead (red wire) to the "POS" test point (TP 1-1) on the connector interface (AC-100056) and the negative meter lead (black wire) to the "GND" test point (TP 1-2). This applies voltage (approximately 0.5 volts) into the drive input acting as a velocity command.

RESULT: **The motor should accelerate sharply to a controlled speed in a clockwise direction and decelerate sharply when either meter lead is removed.**

7. Reverse the meter leads to the "POS" and "GND" test points. This changes polarity of the velocity command.

RESULT: **The motor should accelerate sharply to a controlled speed in a counterclockwise direction and decelerate sharply when either meter lead is removed.**

8. If all tests pass, the velocity loop is functioning correctly.

9. Remove all temporary jumpers, replace all disconnected wires, and connect the drive connector to the controller.

Items to check if test fails:

a. Troubleshooting of position loop.
b. Power supply voltages.
c. Motor armature wiring and polarity.

4.2.3 POWER CHECKS

1. With system power on, verify the following voltages at the drive circuit board terminals:

   a. 220 VAC ±7% at L1 to L2
   b. 220 VAC ±7% at L2 to L3
   c. 220 VAC ±7% at L1 to L3
   d. 220 VAC ±7% at X1 to X2

2. Failure of any of the voltages in Step 1 indicates inadequate power to the drive. Check all fuses, circuit breakers, and wiring. Check the transformer input and output voltages.

4.2.4 MOTOR CHECKS

A brushless motor has no brushes or tachometer feedback. It is, therefore, difficult to determine if a motor has failed using only a V.O.M. Use the following checks to verify the motor condition.

1. Remove all system electrical power.

2. Remove the motor connector from the motor.

3. Check the resistance of all connector points. All points — except "D" — should have a resistance to ground greater than 10,000 ohms.

4. Check the motor cable for possible short circuits or broken (open) wires.

5. Check the resistance of terminals U, V, and W on the drive. These points should have a resistance to ground greater than 10,000 ohms. These points should be checked with both polarities of the V.O.M. If the test fails, replace the drive.

6. Short all phases of the winding and rotate the motor shaft by hand. There should be a firm, smooth movement of the shaft. If this test fails, it may indicate a shorted or open winding.

7. Open all phases of the winding and rotate the motor shaft by hand. The movement should be easier than in Step 6, but the motor shaft should still move smoothly. If this test fails, it again may indicate a shorted or open winding.

4.2.5 POSITION LOOP TEST

The position loop test is used to verify that the controller and feedback device (resolver) are functioning properly. The controller and feedback device are placed in a condition where the feedback-device signals are fed back to the controller. As the feedback device is rotated, a corresponding voltage can be measured at the test points on the controller. Refer to the instructions in the controller instruction manual.

NOTES

APPENDIX A
GLOSSARY

Brushless: A type of direct-current-excited synchronous motor that utilizes a field-excitation system which eliminates the need for collector rings and brushes.

Closed Loop: A regulating device in which the actuator position is sensed, and a signal proportional to this position (feedback position) is compared with a signal proportional to the desired actuator position (command position). The difference between these signals is the error signal. The error signal causes a change in the actuator so as to force this difference to be zero.

Controller: The device which receives data from various input devices and issues commands to the drive.

Daisy Chain: A means of connecting devices by buses which transmit in both directions simultaneously.

Encoder: A converter in which the exact angular position of a shaft is sensed and converted to digital form.

Feedback Device: Device which monitors shaft position by sending signals to the controller as the shaft rotates. Series 5 systems use a resolver as a feedback device.

Index: To move the motor shaft an incremental distance from the current position.

LED: Light-Emitting Diode. Also known as solid-state lamp. A semiconductor diode that converts electric energy to light.

MDPAK™: Industrial Indexing Systems Motor/Drive Package

Optically Isolated: Indicates an I/O which uses a coupling device in which a light-emitting diode, energized by an input signal, is optically coupled to a photodetector.

PLC: Programmable Logic Controller.

Programmable Logic Controller: An electronic device that scans on/off type inputs and controls on/off type outputs. The relationship between the inputs and outputs are programmable by the user.

PWRPAK™: Industrial Indexing Systems Power Supply Package

Quadrature: When relating to a shaft encoder, indicates that there are two oscillating outputs whose frequencies are 90° out of phase.

Regeneration Circuit: The circuit which causes the excess system energy to be directed to the regeneration resistor.

Regeneration Resistor: The resistor used by the system power supply to dissipate energy when the system motor is decelerating.

Resolver: A type of feedback device which converts mechanical position into an electrical signal. A resolver is a variable transformer that divides the impressed AC signal into a sine and cosine output signal. The phase of these two signals represent the absolute position of the resolver shaft.

Transformer: An electrical component used to convert electrical energy from one or more alternating-currrent circuits to one or more others by magnetic induction.

APPENDIX B
MDPAK™ SPECIFICATIONS

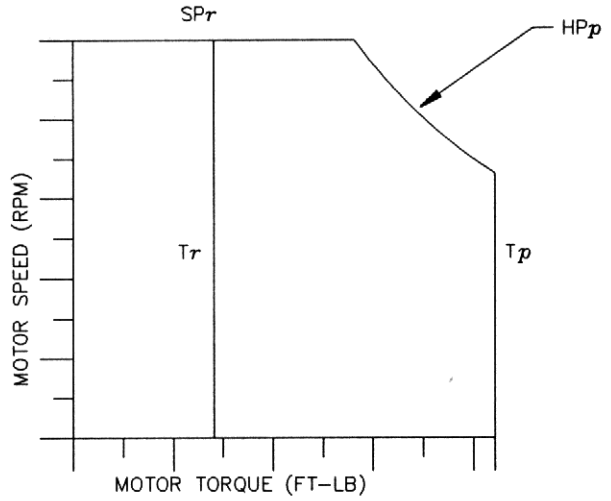
MDPAK™ List of Materials

MDPAK™ Specifications

MDPAK™ LIST OF MATERIALS

DESCRIPTION	MOTOR	DRIVE	SETUP PROCEDURE	MANUAL
MDPAK5-R300	MA-0300R000	RAD02-R300	SU-043011	IB-14B005
MDPAK5-400	RA22L2-0400R	RAD02-F400	SU-043005	IB-14B005
MDPAK5-R500	MA-0500R000	RAD02-R500	SU-043012	IB-14B005
MDPAK5-R700	MA-0700R000	RAD02-R700	SU-043013	IB-14B005
MDPAK5-750	RA22L2-0750R	RAD02-F750	SU-043007	IB-14B005
MDPAK5-R1000	MA-1000R000	RAD02-R1000	SU-043014	IB-14B005
MDPAK5-1000	RA22L2-1000R	RAD02-F1000	SU-043002	IB-14B005
MDPAK5-R1500	MA-1500R000	RAD02-R1500	SU-043015	IB-14B005
MDPAK5-1500	RA22L2-1500R	RAD02-F1500	SU-043003	IB-14B005
MDPAK5-R2000	MA-2000R000	RAD02-R2000	SU-043016	IB-14B005
MDPAK5-2000	RA22L2-2000R	RAD02-F2000	SU-043010	IB-14B005
MDPAK5-3000	RA22L2-3000R	RAD02-F3000	SU-043004	IB-14B005
MDPAK5-3700	RA22L2-3700R	RAD02-F3700	SU-043009	IB-14B005
MDPAK5-5500	RA22L2-5500R	RAD02-F5500	SU-043006	IB-14B005
MDPAK5-7500	RA22L2-7500R	RAD02-F7500	SU-043008	IB-14B005
MDPAK5-11000	RA22L2-11000R	RADO2-F11000	SU-043017	IB-14B005

MDPAK™ SPECIFICATIONS



DESCRIPTION	RATED SPEED SP_r (RPM)	RATED TORQUE T_r (Ft-Lb)	PEAK TORQUE T_p (Ft-Lb)	PEAK HORSE-POWER HP_p (Hp)	ROTOR INERTIA J_m (Ft-Lb-Sec^2)	INPUT POWER W (Watts)
MDPAK5-R300	3400	.64	2.11	1.36	0.000059	300
MDPAK5-400	2250	1.40	4.20	1.80	0.00029	400
MDPAK5-R500	3200	1.06	3.53	2.15	0.000076	500
MDPAK5-R700	3200	1.48	4.93	3.00	0.00023	700
MDPAK5-750	2250	2.64	7.90	3.40	0.00061	750
MDPAK5-R1000	3200	2.16	7.05	4.30	0.00029	1000
MDPAK5-1000	2100	3.52	10.56	4.03	0.00208	1000
MDPAK5-R1500	3200	3.18	10.58	6.45	0.00061	1500
MDPAK5-1500	2100	5.73	15.80	5.71	0.00292	1500
MDPAK5-R2000	3200	4.23	14.08	8.58	0.00085	2000
MDPAK5-2000	2200	7.05	21.20	8.47	0.00467	2000
MDPAK5-3000	1500	14.08	42.25	8.04	0.00633	3000
MDPAK5-3700	1500	17.33	52.00	9.90	0.00808	3700
MDPAK5-5500	1700	25.83	51.67	12.79	0.02280	5500
MDPAK5-7500	1700	35.25	70.50	17.45	0.02950	7500
MDPAK5-11000	1500	51.7	103.40	27.00	0.02960	11000

NOTES

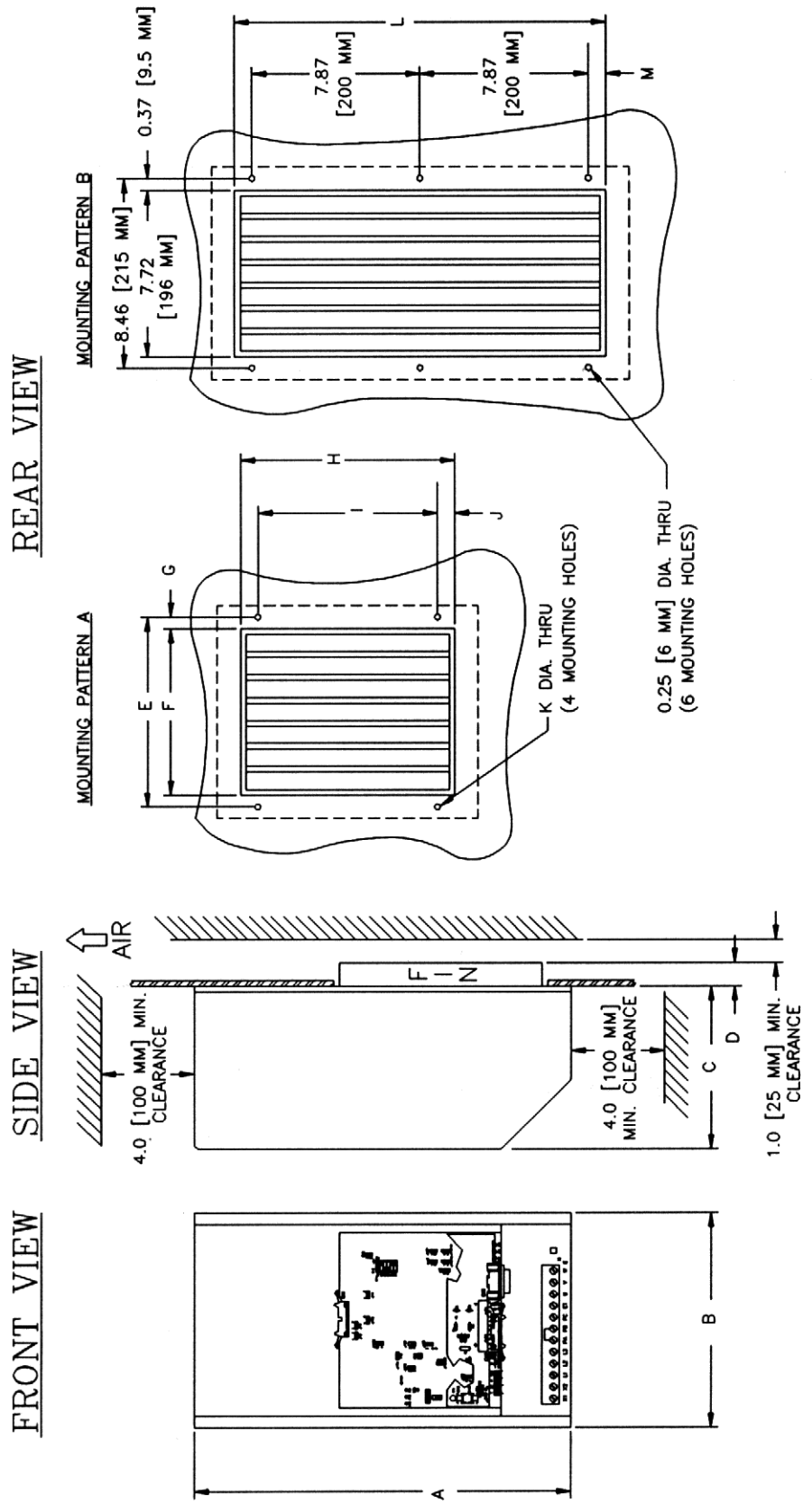
APPENDIX C
MDPAK™ DIMENSIONS AND CONNECTIONS

MDPAK™ Drive Dimensions

MOTOR Dimensions and Connections

DRAWING NUMBER	DESCRIPTION
AC-100030	Mounting Bracket
AC-100049	Mounting Bracket
AC-100041	Differential Input Board
AC-100056	Connector Interface Board
AC-100057	Connector Interface Board

MDPAK™ DRIVE DIMENSIONS

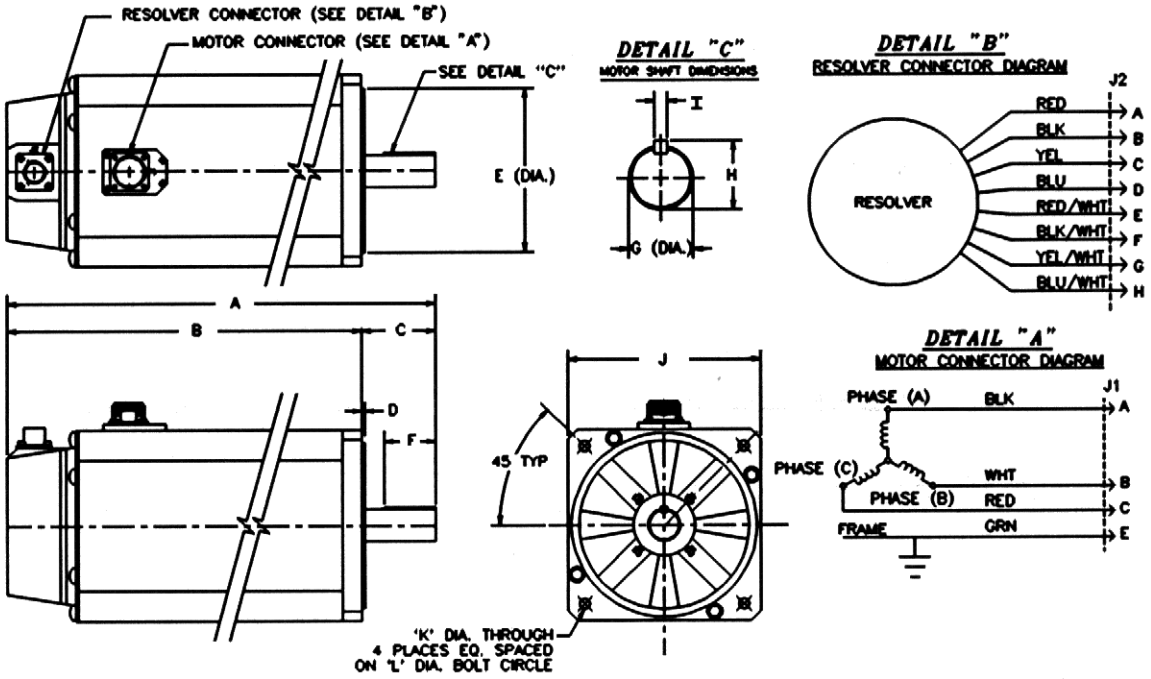


MDPAK™ DRIVE DIMENSIONS

DESCRIPTION	MOUNTING PATTERN	A	B	C	D	E	F	G	H	I	J	K	L	M
RAD02-R300	A	11.82 (300)	9.06 (230)	6.85 (174)	0.83 (21)	8.46 (215)	7.40 (188)	0.53 (13.5)	9.29 (236)	7.87 (200)	0.71 (18)	0.25 (6)	N/A	N/A
RAD02-F400	A	11.82 (300)	9.06 (230)	6.85 (174)	0.83 (21)	8.46 (215)	7.40 (188)	0.53 (13.5)	9.29 (236)	7.87 (200)	0.71 (18)	0.25 (6)	N/A	N/A
RAD02-R500	A	11.82 (300)	9.06 (230)	6.85 (174)	0.83 (21)	8.46 (215)	7.40 (188)	0.53 (13.5)	9.29 (236)	7.87 (200)	0.71 (18)	0.25 (6)	N/A	N/A
RAD02-R700	A	11.82 (300)	9.06 (230)	6.85 (174)	0.83 (21)	8.46 (215)	7.40 (188)	0.53 (13.5)	9.29 (236)	7.87 (200)	0.71 (18)	0.25 (6)	N/A	N/A
RAD02-F750	A	11.82 (300)	9.06 (230)	6.85 (174)	0.83 (21)	8.46 (215)	7.40 (188)	0.53 (13.5)	9.29 (236)	7.87 (200)	0.71 (18)	0.25 (6)	N/A	N/A
RAD02-R1000	A	11.82 (300)	9.06 (230)	6.85 (174)	0.83 (21)	8.46 (215)	7.40 (188)	0.53 (13.5)	9.29 (236)	7.87 (200)	0.71 (18)	0.25 (6)	N/A	N/A
RAD02-F1000	A	11.82 (300)	9.06 (230)	6.85 (174)	0.83 (21)	8.46 (215)	7.40 (188)	0.53 (13.5)	9.29 (236)	7.87 (200)	0.71 (18)	0.25 (6)	N/A	N/A
RAD02-R1500	B	18.10 (460)	9.06 (230)	6.81 (173)	2.64 (67)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16.7 (424)	0.47 (12)
RAD02-F1500	B	18.10 (460)	9.06 (230)	6.81 (173)	2.64 (67)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16.7 (424)	0.47 (12)
RAD02-R2000	B	18.10 (460)	9.06 (230)	6.81 (173)	2.64 (67)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16.7 (424)	0.47 (12)
RAD02-F2000	B	18.10 (460)	9.06 (230)	6.81 (173)	2.64 (67)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16.7 (424)	0.47 (12)
RAD02-F3000	B	18.10 (460)	9.06 (230)	6.81 (173)	2.64 (67)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16.7 (424)	0.47 (12)
RAD02-F3700	B	18.10 (460)	9.06 (230)	6.81 (173)	2.64 (67)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16.7 (424)	0.47 (12)
RAD02-F5500	B	22.44 (570)	9.06 (230)	8.38 (213)	2.64 (67)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20.95 (532)	0.20 (5)
RAD02-F7500	B	22.44 (570)	9.06 (230)	8.38 (213)	2.64 (67)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20.95 (532)	0.20 (5)
RAD02-F11000	A	22.44 (570)	11.81 (300)	11.02 (280)	0 (0)	7.87 (200)	N/A	N/A	N/A	21.65 (550)	0.39 (10)	0.39 (10)	N/A	N/A

DIMENSIONS = INCHES (MILLIMETERS)

MOTOR DIMENSIONS AND CONNECTIONS



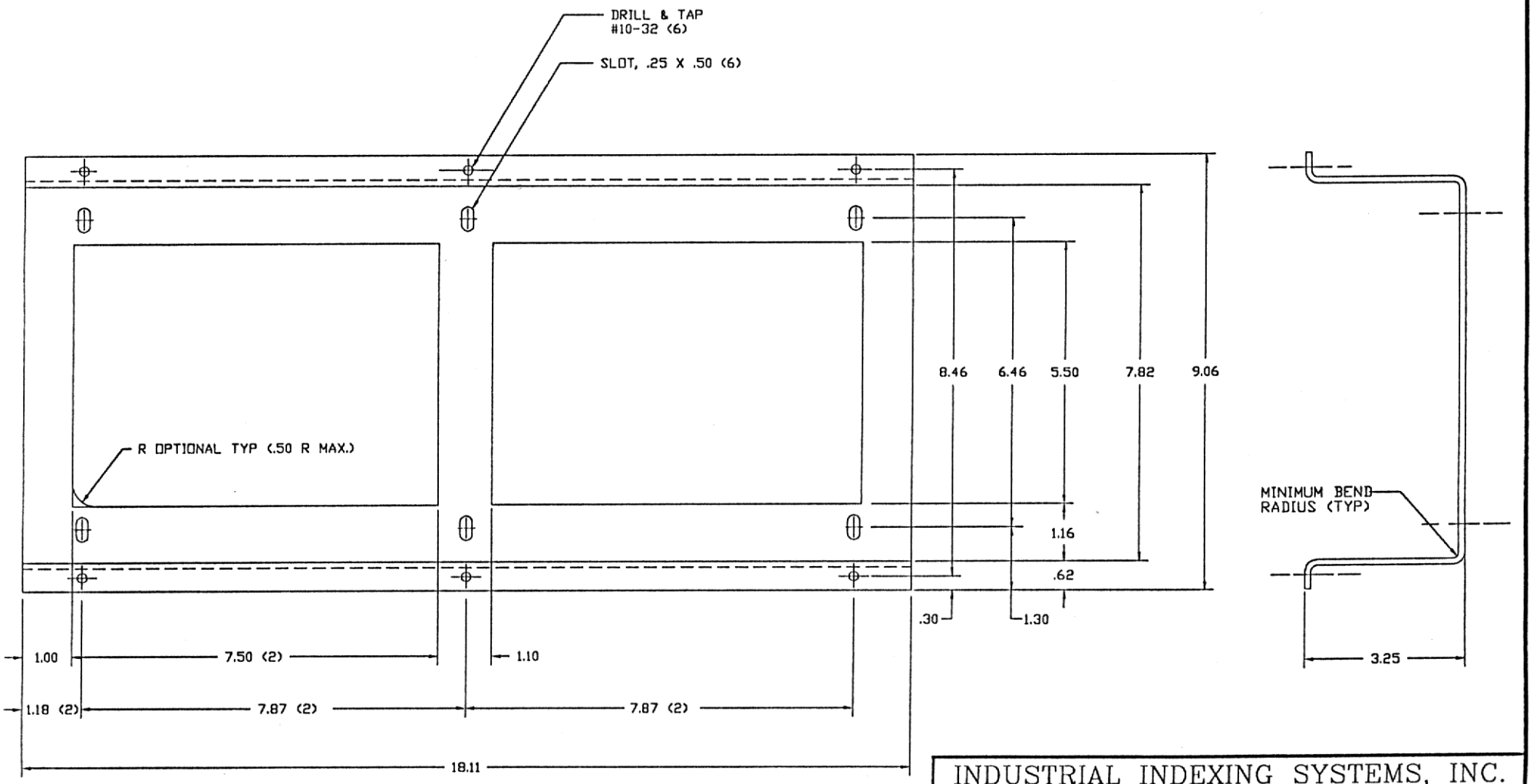
MOTOR NUMBER	A	B	C	D	E	F	G	H	I	J	K	L	WEIGHT
MA-0300R000	7.87 (200)	7.28 (185)	1.38 (35)	.12 (3)	2.76 (70)	N/A	.551 (14)	N/A	N/A	3.16 (80)	.217 (5.5)	3.54 (90)	7.50 LBS.
RA22L2-0400R	9.84 (250)	8.47 (215)	1.38 (35)	.16 (4)	4.33 (110)	.98 (25)	.630 (16)	.709 (18)	.197 (5)	4.72 (120)	.354 (9)	5.12 (130)	17.00 LBS
MA-0500R000	9.64 (245)	8.27 (210)	1.38 (35)	.12 (3)	3.15 (80)	N/A	.551 (14)	N/A	N/A	3.39 (86)	.260 (6.6)	3.94 (100)	11.70 LBS.
MA-0700R000	8.66 (220)	7.28 (185)	1.38 (35)	.16 (4)	4.33 (110)	.98 (25)	.630 (16)	.709 (18)	.197 (5)	4.72 (120)	.354 (9)	5.12 (130)	13.60 LBS.
RA22L2-0750R	11.22 (285)	9.45 (240)	1.77 (45)	.16 (4)	4.33 (110)	1.26 (32)	(.866 (22)	.984 (25)	.315 (8)	5.13 (130)	.354 (9)	5.71 (145)	25.00 LBS.
MA-1000R000	9.45 (240)	8.08 (205)	1.38 (35)	.16 (4)	4.33 (110)	.98 (25)	.630 (16)	.709 (18)	.197 (5)	4.72 (120)	.354 (9)	5.12 (130)	16.30 LBS.
RA22L2-1000R	13.19 (335)	11.03 (280)	2.17 (55)	.16 (4)	5.12 (130)	1.57 (40)	1.102 (28)	1.220 (31)	.315 (8)	5.91 (150)	.433 (11)	6.50 (165)	38.00 LBS.
MA-1500R000	10.83 (275)	9.06 (230)	1.77 (45)	.16 (4)	4.33 (110)	1.26 (32)	(.866 (22)	.984 (25)	.315 (8)	5.13 (130)	.354 (9)	5.71 (145)	26.00 LBS.
RA22L2-1500R	14.77 (375)	12.59 (320)	2.17 (55)	.16 (4)	5.12 (130)	1.57 (40)	1.102 (28)	1.220 (31)	.315 (8)	5.91 (150)	.433 (11)	6.50 (165)	50.00 LBS.
MA-2000R000	12.20 (310)	10.44 (265)	1.77 (45)	.16 (4)	4.33 (110)	1.26 (32)	(.866 (22)	.984 (25)	.315 (8)	5.13 (130)	.433 (11)	5.71 (145)	33.00 LBS.
RA22L2-2000R	15.94 (405)	13.00 (330)	2.95 (75)	.16 (4)	4.50 (114)	2.36 (60)	1.26 (32)	1.38 (35)	.394 (10)	7.09 (180)	.532 (13.5)	7.87 (200)	66.00 LBS.
RA22L2-3000R	18.16 (465)	15.36 (390)	2.95 (75)	.16 (4)	4.50 (114)	2.36 (60)	1.26 (32)	1.38 (35)	.394 (10)	7.09 (180)	.532 (13.5)	7.87 (200)	82.00 LBS.
RA22L2-3700R	20.28 (515)	17.33 (440)	2.95 (75)	.16 (4)	4.50 (114)	2.36 (60)	1.26 (32)	1.38 (35)	.394 (10)	7.09 (180)	.532 (13.5)	7.87 (200)	102.00 LBS.
RA22L2-5500R	21.02 (535)	18.11 (460)	2.95 (75)	.16 (4)	7.87 (200)	2.36 (60)	1.496 (38)	1.614 (41)	.472 (12)	8.66 (220)	.551 (14)	9.25 (235)	151.00 LBS.
RA22L2-7500R	24.22 (615)	21.27 (540)	2.95 (75)	.16 (4)	7.87 (200)	2.36 (60)	1.496 (38)	1.614 (41)	.472 (12)	8.66 (220)	.551 (14)	9.25 (235)	186.00 LBS.
RA22L2-11000R	27.81 (705)	24.79 (630)	2.95 (75)	.16 (4)	7.87 (200)	2.36 (60)	1.496 (38)	1.614 (41)	.472 (12)	9.44 (240)	.551 (14)	9.25 (235)	198.00 LBS.

DIMENSIONS = INCHES
(MILLIMETERS)

DATE	SYM	REVISION RECORD	DRN	CHK

NOTES:

1. MATERIAL: .12 THICK MILD STEEL



INDUSTRIAL INDEXING SYSTEMS, INC.			
TOLERANCES (EXCEPT AS NOTED)	DRAWN BY: JTE	DATE: 3/19/90	
	APPROVED:	DATE:	
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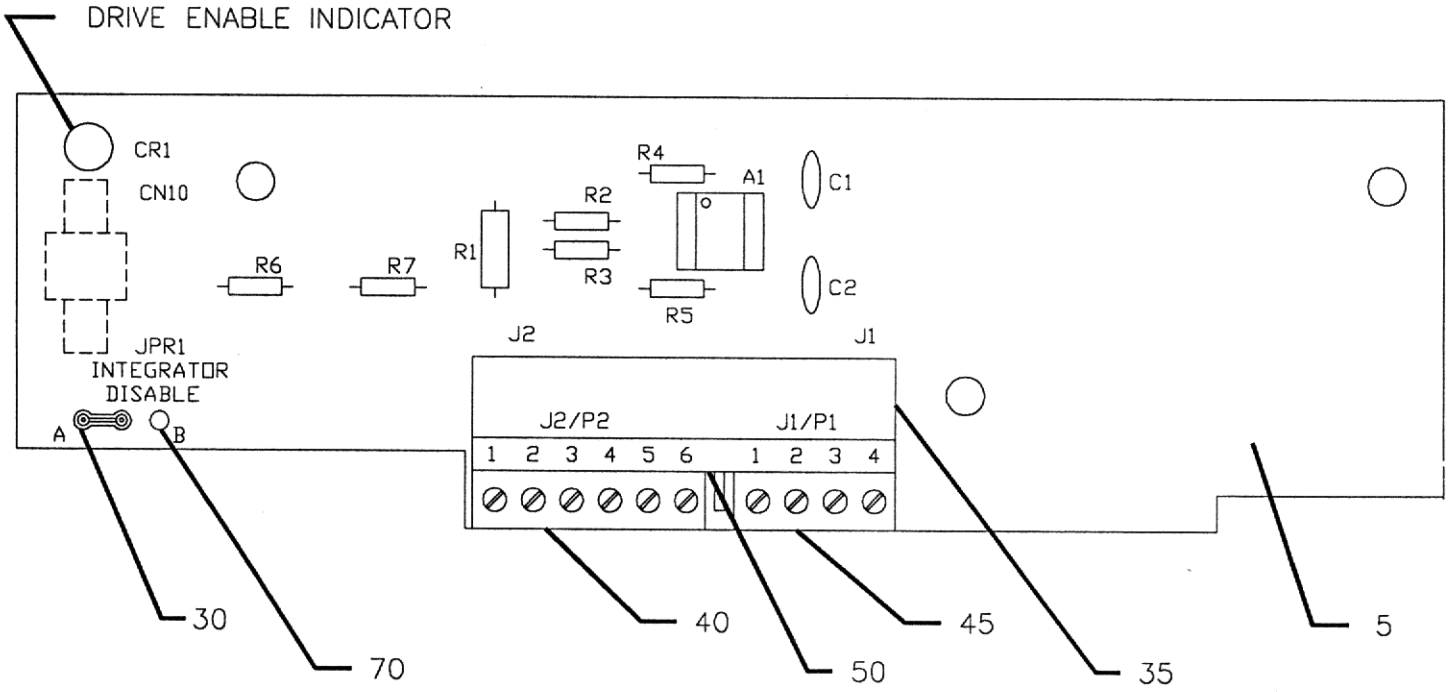
.XXX ±.005	SHEET NO.: 1 OF 1	DRAWING NO.: AC-100030	
ANGULAR ±30'			

DATE	SYM	REVISION RECORD	DRN	CHK



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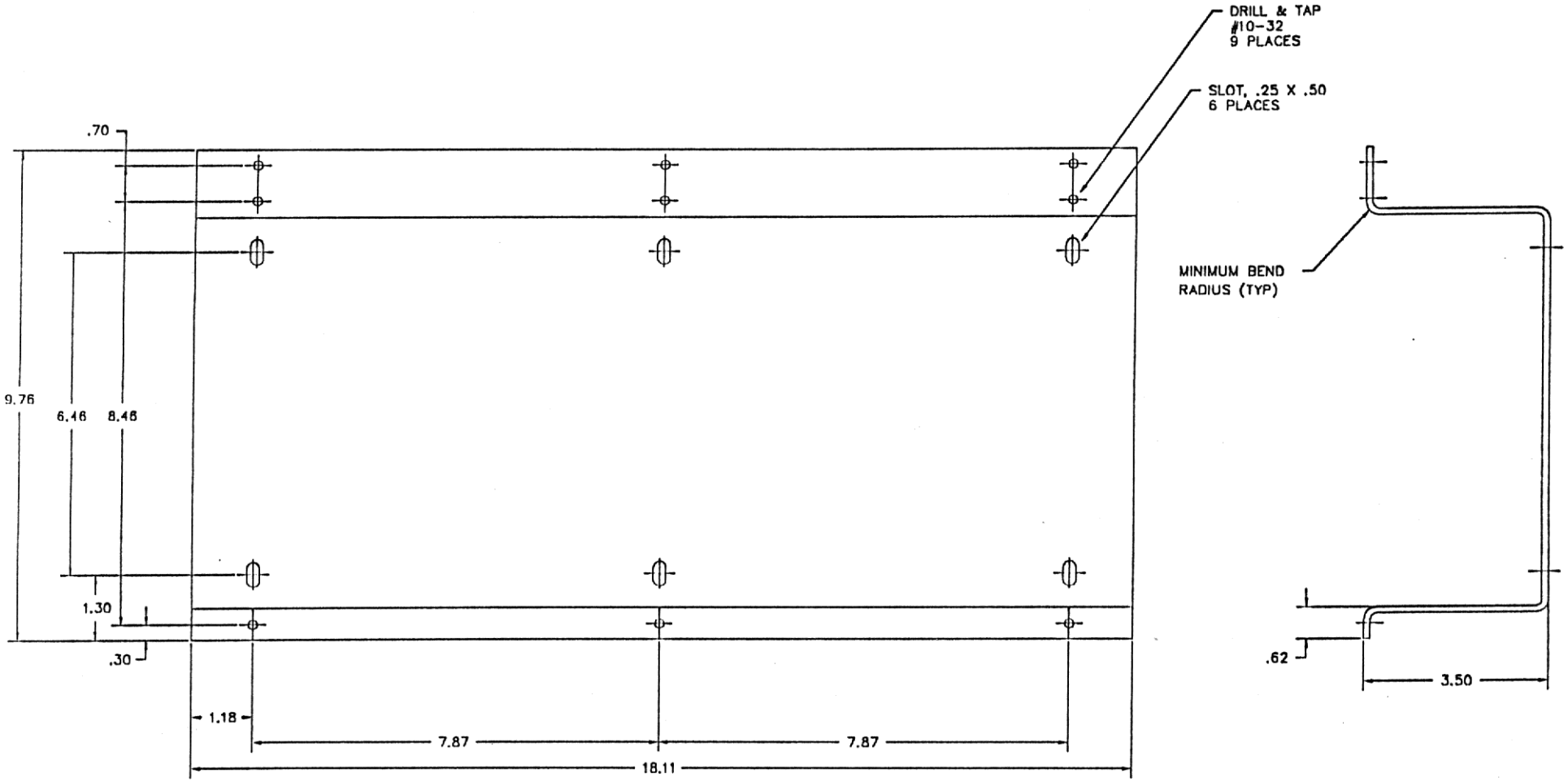
.XXX ±.005	SCALE: NONE	TITLE: DIFFERENTIAL INPUT BOARD	
ANGULAR ±30'	SHEET NO.: 1 OF 1	DRAWING NO.: AC-100041	

DATE	SYM	REVISION RECORD	DRN	CHK



INDUSTRIAL INDEXING SYSTEMS, INC.			
TOLERANCES (EXCEPT AS NOTED)	DRAWN BY: JTE	DATE: 3/19/90	
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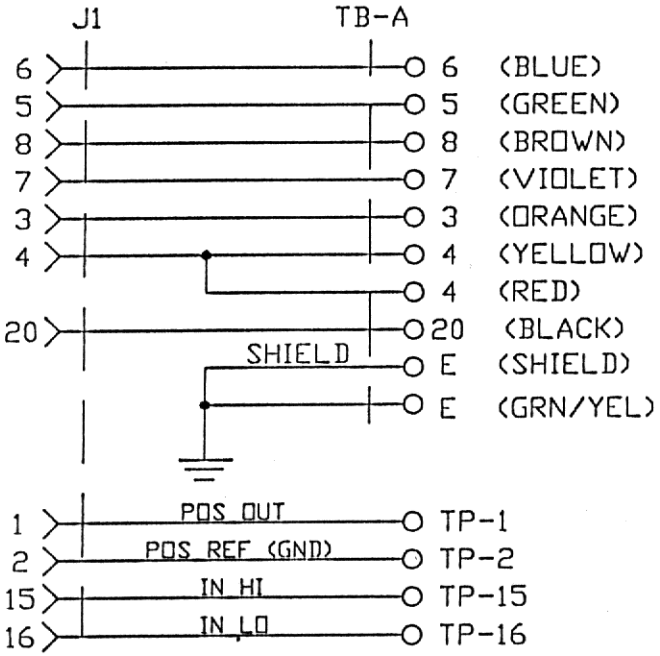
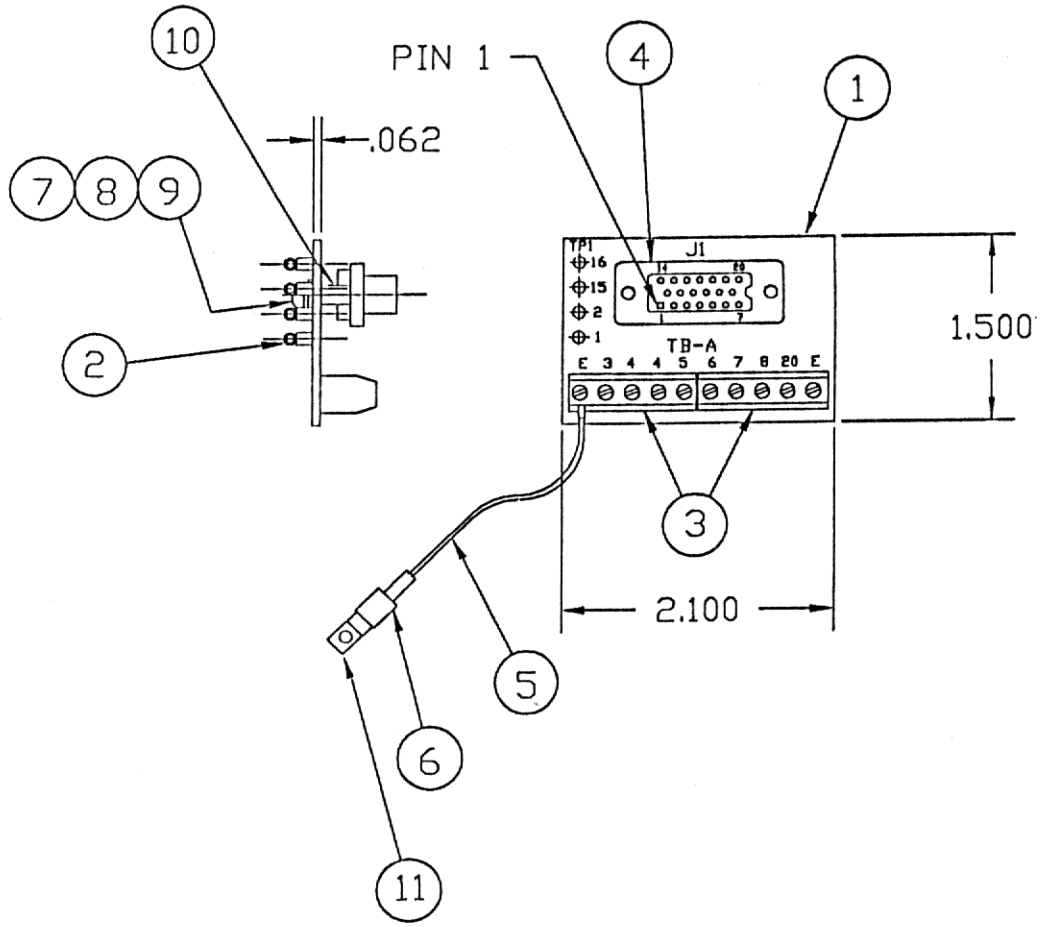
ANGULAR ±30'	SHEET NO.: 1 OF 1	DRAWING NO.: AC-100049	

DATE	SYM	REVISION RECORD	DRN	CHK





INDUSTRIAL INDEXING SYSTEMS, INC.			
TOLERANCES (EXCEPT AS NOTED)	DRAWN BY: JTE	DATE: 3/21/90	
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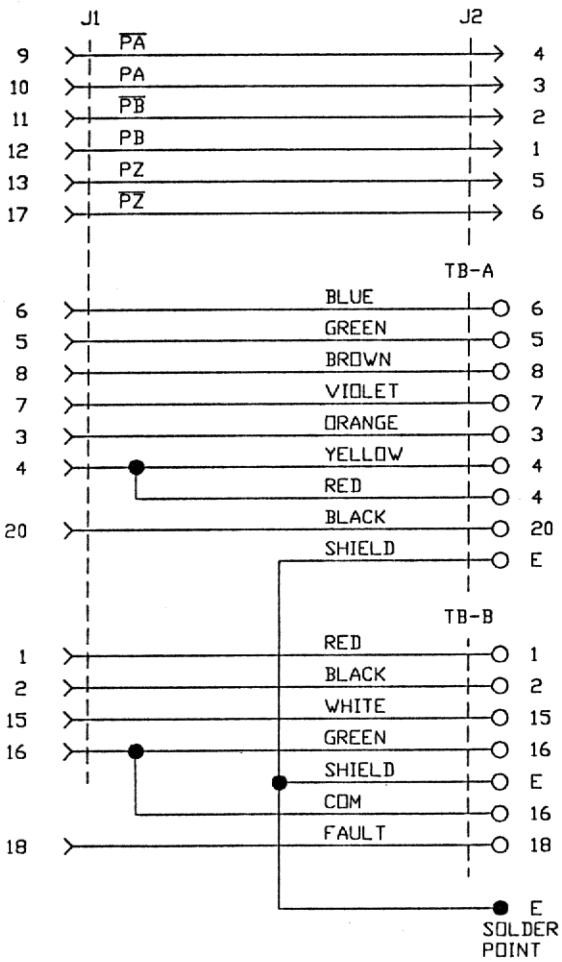
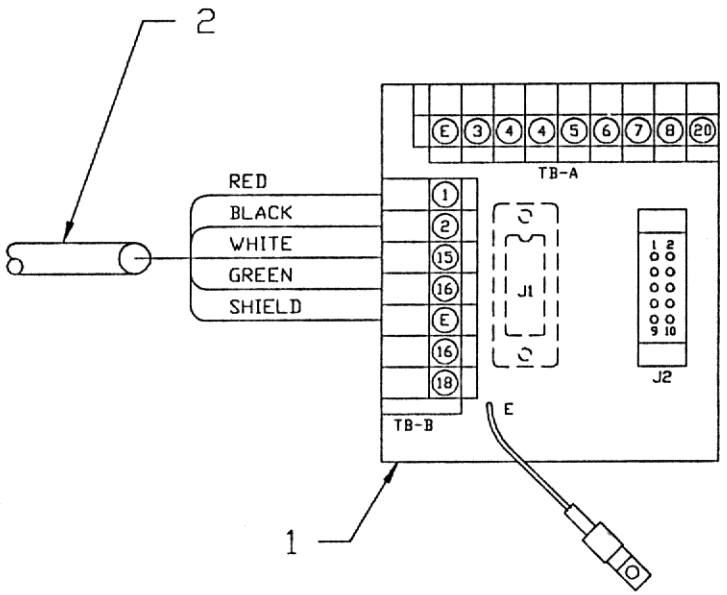
.XXX ±.005	SCALE: NONE	TITLE: CONNECTOR INTERFACE	
ANGULAR ±30'	SHEET NO.: 1 OF 1	DRAWING NO.: AC-100056	

DATE	SYM	REVISION RECORD	DRN	CHK





INDUSTRIAL INDEXING SYSTEMS, INC.			
TOLERANCES (EXCEPT AS NOTED)	DRAWN BY: JTE	DATE: 3/24/90	
	APPROVED:	DATE:	
.XX ±.010	SCALE: NONE	TITLE: CONNECTOR INTERFACE	
.XXX ±.005			
ANGULAR ±30'	SHEET NO.: 1 OF 1	DRAWING NO.: AC-100057	

NOTES

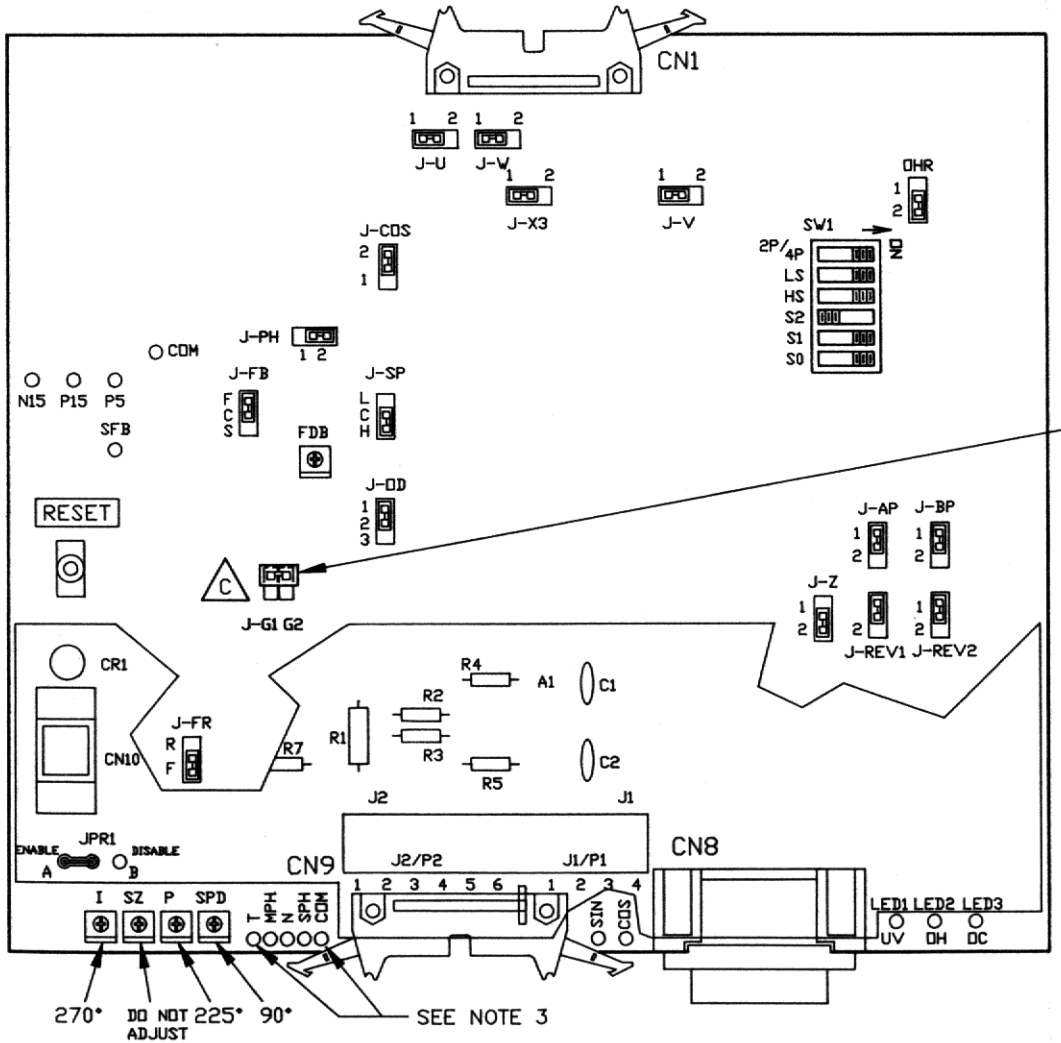
APPENDIX D
DRIVE SETUPS

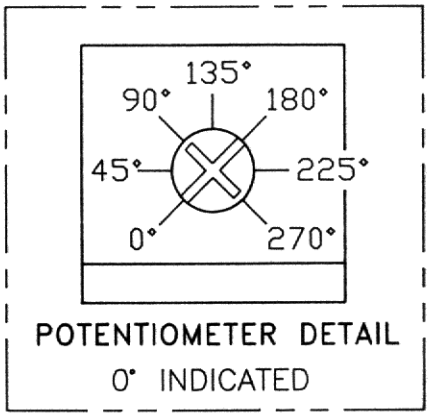
DRAWING NUMBER	DESCRIPTION
SU-043002	Drive Setup, 1000W
SU-043003	Drive Setup, 1500W
SU-043004	Drive Setup, 3000W
SU-043005	Drive Setup, 400W
SU-043006	Drive Setup, 5500W
SU-043007	Drive Setup, 750W
SU-043008	Drive Setup, 7500W
SU-043009	Drive Setup, 3700W
SU-043010	Drive Setup, 2000W
SU-043011	Drive Setup, R300W
SU-043012	Drive Setup, R500W
SU-043013	Drive Setup, R700W
SU-043016	Drive Setup, R2000W

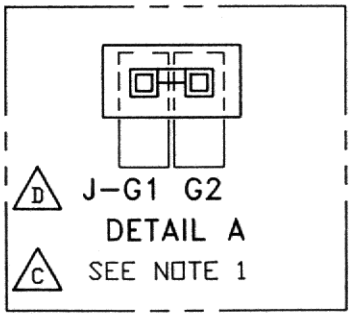
NOTES:

1. JUMPER NOT REQUIRED FOR THIS SETUP. PLACE JUMPER PER J-G1 G2 DETAIL A (C)
2. SLIGHT ADJUSTMENT OF THE "I" AND "P" POTS MAY BE REQUIRED FOR OPTIMUM PERFORMANCE.
3. TEST POINTS:
   T TO COM: 3.33 VDC = 3.52 FT.LB.
   POS OUT TO GND ON CONTROLLER
   8v DC ±2.5% AT 2100 RPM ADJUST USING 'FDB' POT.

DATE	SYM	REVISION RECORD	DR	CK	CK
27SEP90	A	ECN 90-198	EB	DBS	
30SEP93	B	ECN 93-295	MC	EB	WS
02JUN94	C	ECN 94-119	DD	EB	RB
12JAN96	D	ECN 95-292	CWB	CB	KS







SETUP FOR MDPAK5-1000

INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924-9181 FAX: (716) 924-2169

CHECKED BY: E. Baier	DATE: 9/27/90
APPROVED BY: D.B.S.	DATE: 9/27/90
APPROVED BY:	DATE:
MATERIAL: ----------	
FINISH: ----------	

TITLE: DRIVE SETUP

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)
TOLERANCES
X.X± ------
X.XX± ------
X.XXX± ----
ANGULAR ± ---

DRAWN BY: CAD
AutoCAD FILE LOCATION: Q:\DFTG\IB\IB14B005\

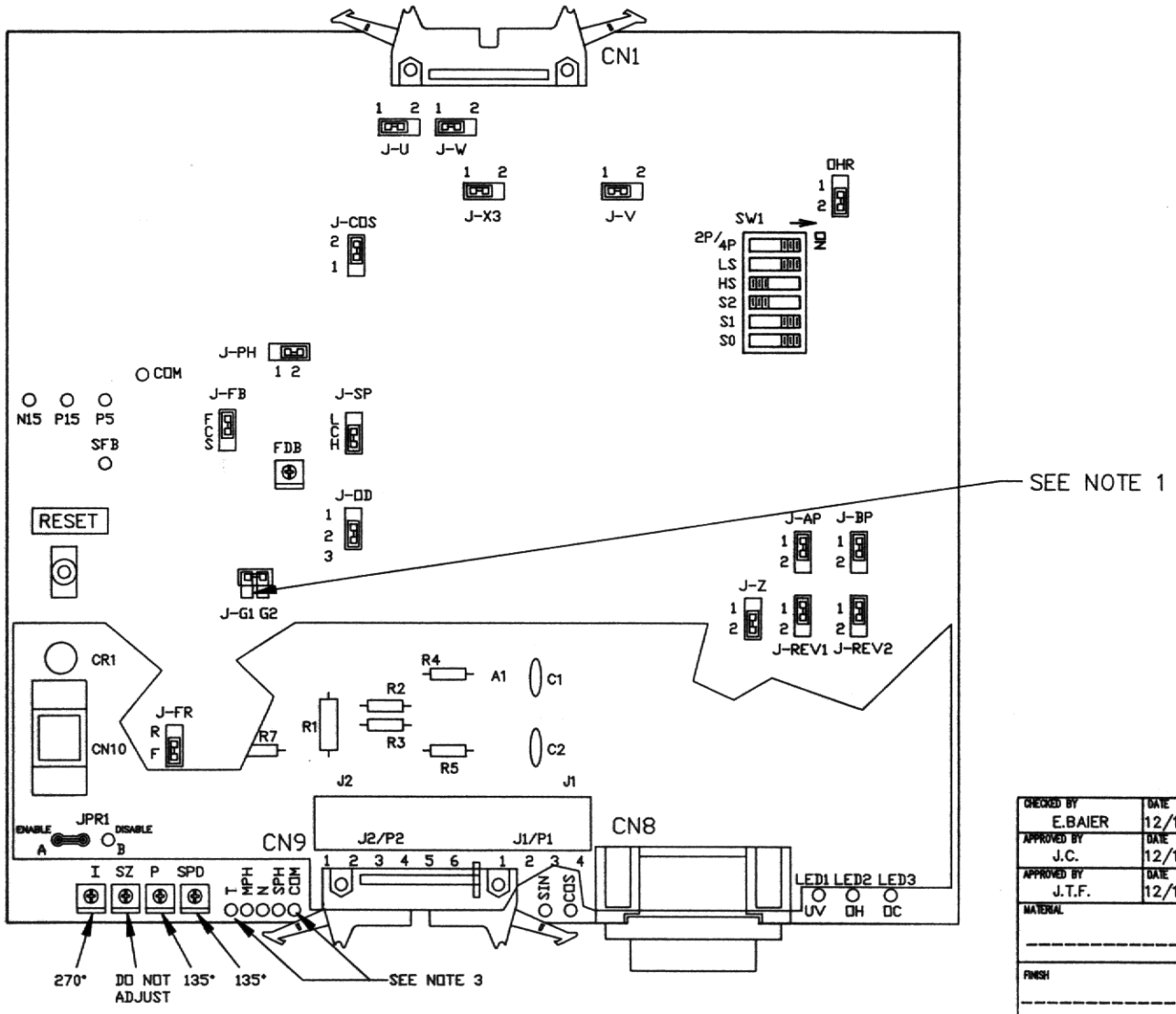
DRAWING NUMBER: SU-043002

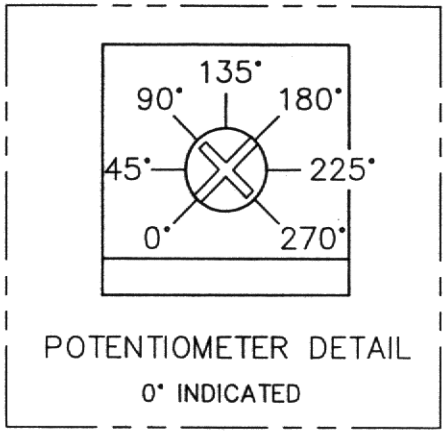
SIZE	DATE	SCALE	SHEET NO.	REVISION
B	9/21/93	-----	1 OF 1	D

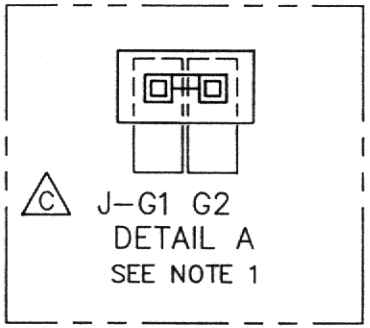
NOTES:

1. JUMPER NOT REQUIRED FOR THIS SETUP. PLACE JUMPER PER J-G1 G2 DETAIL A.
2. SLIGHT ADJUSTMENT OF THE "I" AND "P" POTS MAY BE REQUIRED FOR OPTIMUM PERFORMANCE.
3. TEST POINTS:
   T TO COM: 3.33VDC = 5.73 FT.LB.
   POS OUT TO GND ON CONTROLLER
   8V DC ±2.5% AT 2100 RPM ADJUST USING 'FDB' POT.

DATE	SYM	REVISION RECORD	DR	CK	CK
17DEC90	A	ECN 90-257	EB	JC	JTF
30SEP93	B	ECN 93-295	MC	EB	WES
12JAN96	C	ECN 95-292	CWB	BB	KS







SETUP FOR MDPAK5-1500

INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924-9181 FAX: (716) 924-2169

CHECKED BY	E.BAIER
DATE	12/17/90
APPROVED BY	J.C.
DATE	12/17/90
APPROVED BY	J.T.F.
DATE	12/17/90
MATERIAL	----------
FINISH	----------

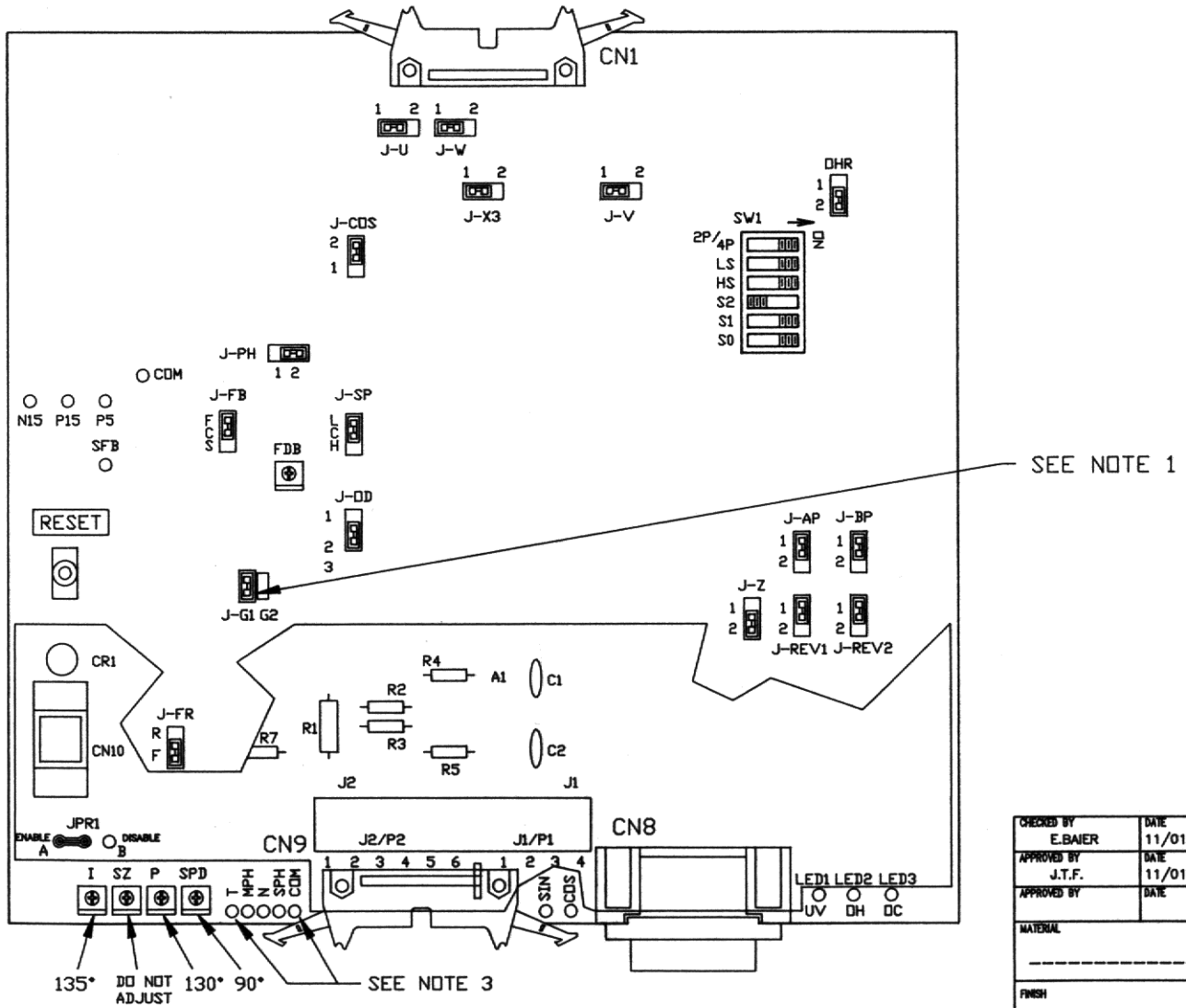
TITLE: DRIVE SETUP

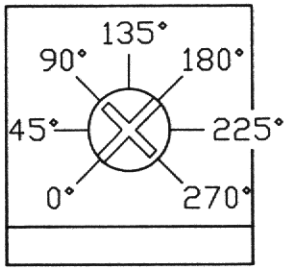
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)	
TOLERANCES	
X.X± ----	ANGULAR ± ----
X.XX± ----	
X.XXX± ----	
DRAWN BY	CAD
AutoCAD FILE LOCATION	Q:\DFTG\IB\IB14B005\
DRAWING NUMBER	SU-043003
B	
DATE	21SEP93
SCALE	----
SHEET NO.	1 OF 1
REVISION	C

NOTES:

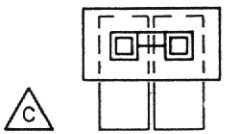
1. LOW INERTIA – JUMPER IN J–G1 POSITION.
   HIGH INERTIA – SEE J–G1 G2 DETAIL A.
2. SLIGHT ADJUSTMENT OF THE "I" AND "P" POTS MAY BE REQUIRED FOR OPTIMUM PERFORMANCE.
3. TEST POINTS:
   T TO COM: 3.33VDC = 14.08 FT.LB.
   POS OUT TO GND ON CONTROLLER
   8V DC ±2.5% AT 1500 RPM ADJUST USING 'FDB' POT.

DATE	SYM	REVISION RECORD	DR	CK	CK
01NOV90	A	ECN 90–225	EB	JTF	
30SEP93	B	ECN 93–295	MC	EB	WES
15JAN96	C	ECN 95–292	CWB	GG	RS





POTENTIOMETER DETAIL
0° INDICATED



J–G1 G2
DETAIL A
HIGH INERTIA SETTING
SEE NOTE 1

SETUP FOR MDPAK5–3000

INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924–9181 FAX: (716) 924–2169

CHECKED BY	DATE
E.BAIER	11/01/90
APPROVED BY	DATE
J.T.F.	11/01/90
APPROVED BY	DATE
MATERIAL	

FINISH	

TITLE: DRIVE SETUP

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)
TOLERANCES
X.X± ----
X.XX± ----
X.XXX± ----
ANGULAR ± ----

DRAWN BY: CAD
AutoCAD FILE LOCATION: Q:\DFTG\IB\IB14B005\

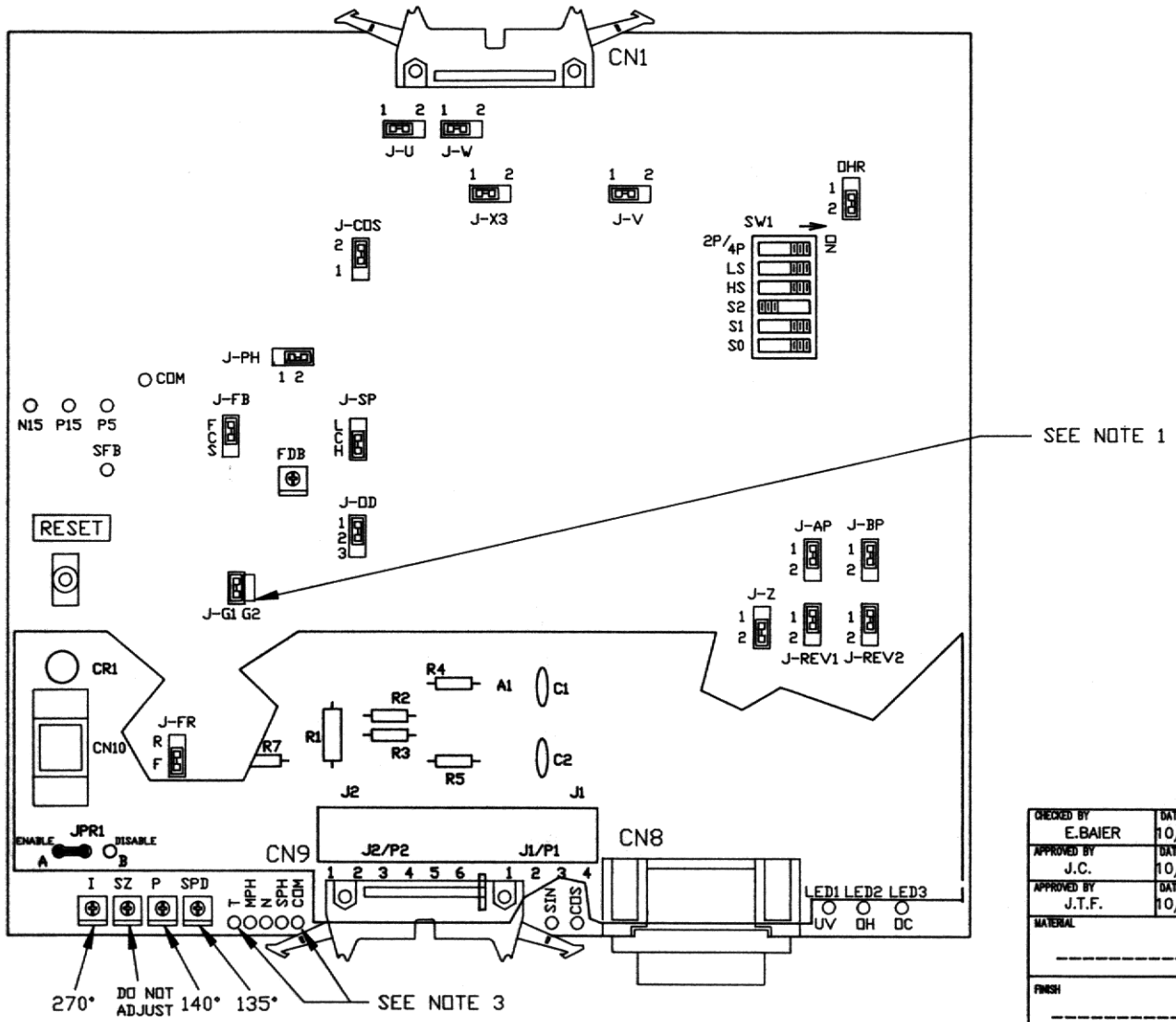
DRAWING NUMBER: SU–043004

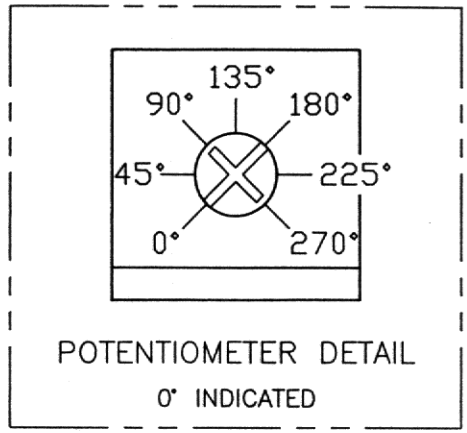
B	DATE	SCALE	SHEET NO.	REVISION
	21SEP93	----	1 OF 1	C

NOTES:

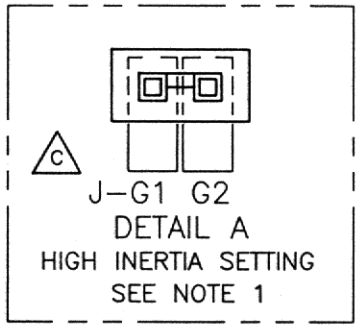
1. LOW INERTIA – JUMPER IN J–G1 POSITION
   HIGH INERTIA – SEE J–G1 G2 DETAIL A.
2. SLIGHT ADJUSTMENT OF THE "I" AND "P" POTS MAY BE REQUIRED FOR OPTIMUM PERFORMANCE.
3. TEST POINTS:
   T TO COM: 3.33 VDC = 1.40 FT/LBS.
   POS OUT TO GND ON CONTROLLER.
   8v DC ±2.5% AT 2250 RPM ADJUST USING 'FDP' POT.

DATE	SYM	REVISION RECORD	DR	CK	CK
10/19/90	A	ECN 90–214	EB	JC	JTF
9/30/93	B	ECN 93–295	MC	EB	WES
1/15/96	C	ECN 95–292	CWB	KS	GS





POTENTIOMETER DETAIL
0° INDICATED



J–G1 G2
DETAIL A
HIGH INERTIA SETTING
SEE NOTE 1

SETUP FOR MDPAK5–400

INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924–9181 FAX: (716) 924–2169

CHECKED BY	E.BAIER
DATE	10/19/90
APPROVED BY	J.C.
DATE	10/19/90
APPROVED BY	J.T.F.
DATE	10/19/90
MATERIAL	----------
FINISH	----------

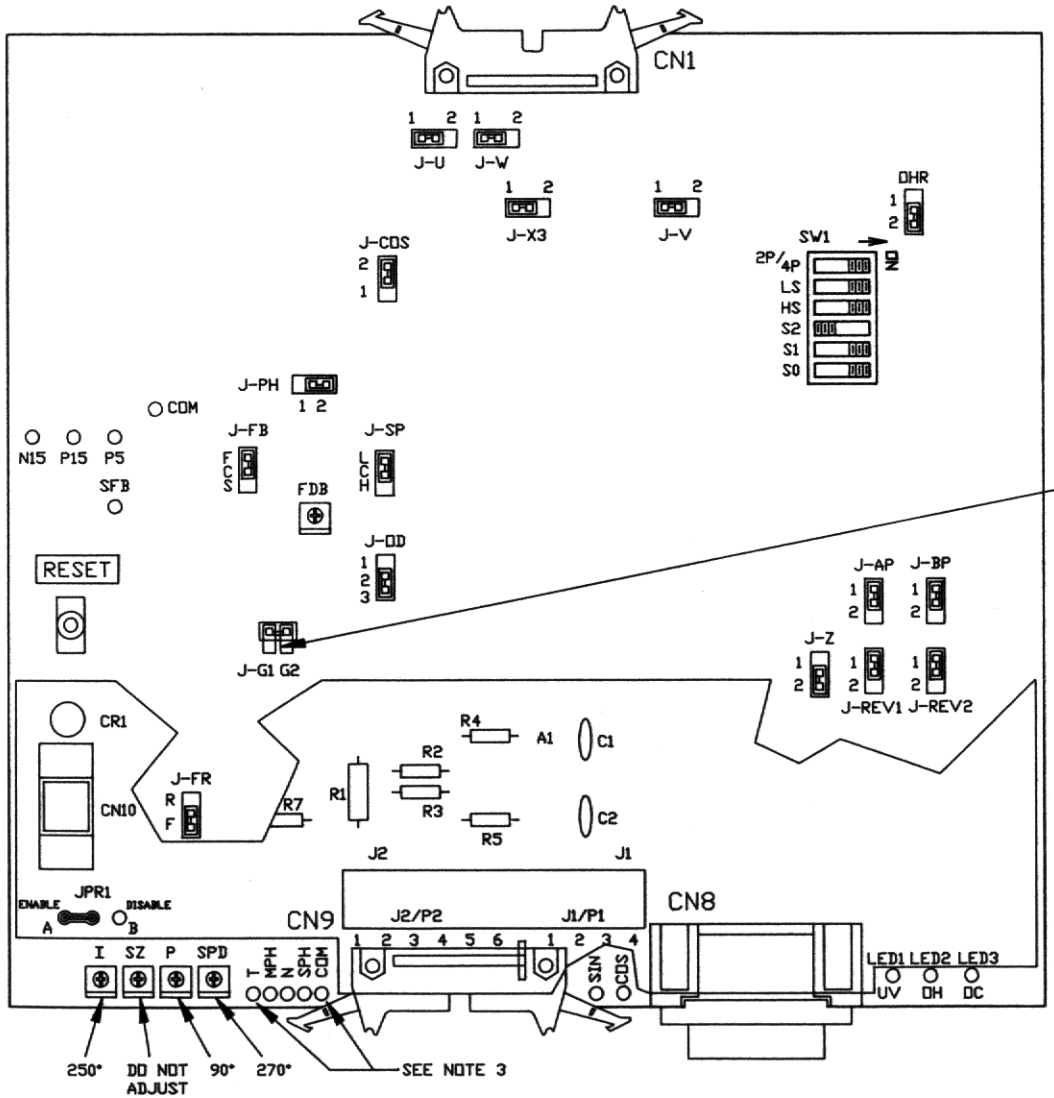
TITLE: DRIVE SETUP

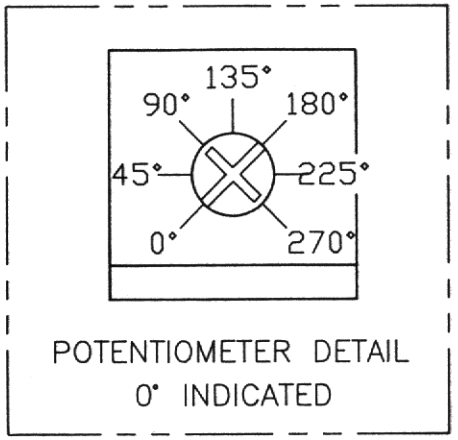
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)	
TOLERANCES	
X.X± ----	ANGULAR ± ----
X.XX± ----	
X.XXX± ----	
DRAWN BY	CAD
AutoCAD FILE LOCATION	Q:\DFTG\IB\IB14B005\
DRAWING NUMBER	SU–043005
B	
DATE	9/21/93
SCALE	----
SHEET NO.	1 OF 1
REVISION	C

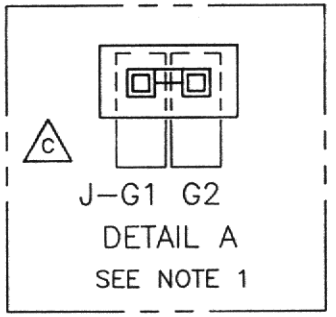
NOTES:

1. JUMPER NOT REQUIRED FOR THIS SETUP. PLACE JUMPER PER J-G1 G2 DETAIL A.
2. SLIGHT ADJUSTMENT OF THE "I" AND "P" POTS MAY BE REQUIRED FOR OPTIMUM PERFORMANCE.
3. TEST POINTS:
   T TO COM: 3.33VDC = 25.83 FT/LB.
   POS OUT TO GND ON CONTROLLER.
   8v DC ±2.5% AT 1700 RPM ADJUST USING 'FDB' POT.

DATE	SYM	REVISION RECORD	DR	CK	CK
12/17/90	A	ECN 90-257	EB	WK	JTF
9/30/93	B	ECN 93-295	MC	EB	WES
1/16/96	C	ECN 95-292	CWB	EB	KS







SETUP FOR MDPAK5-5500

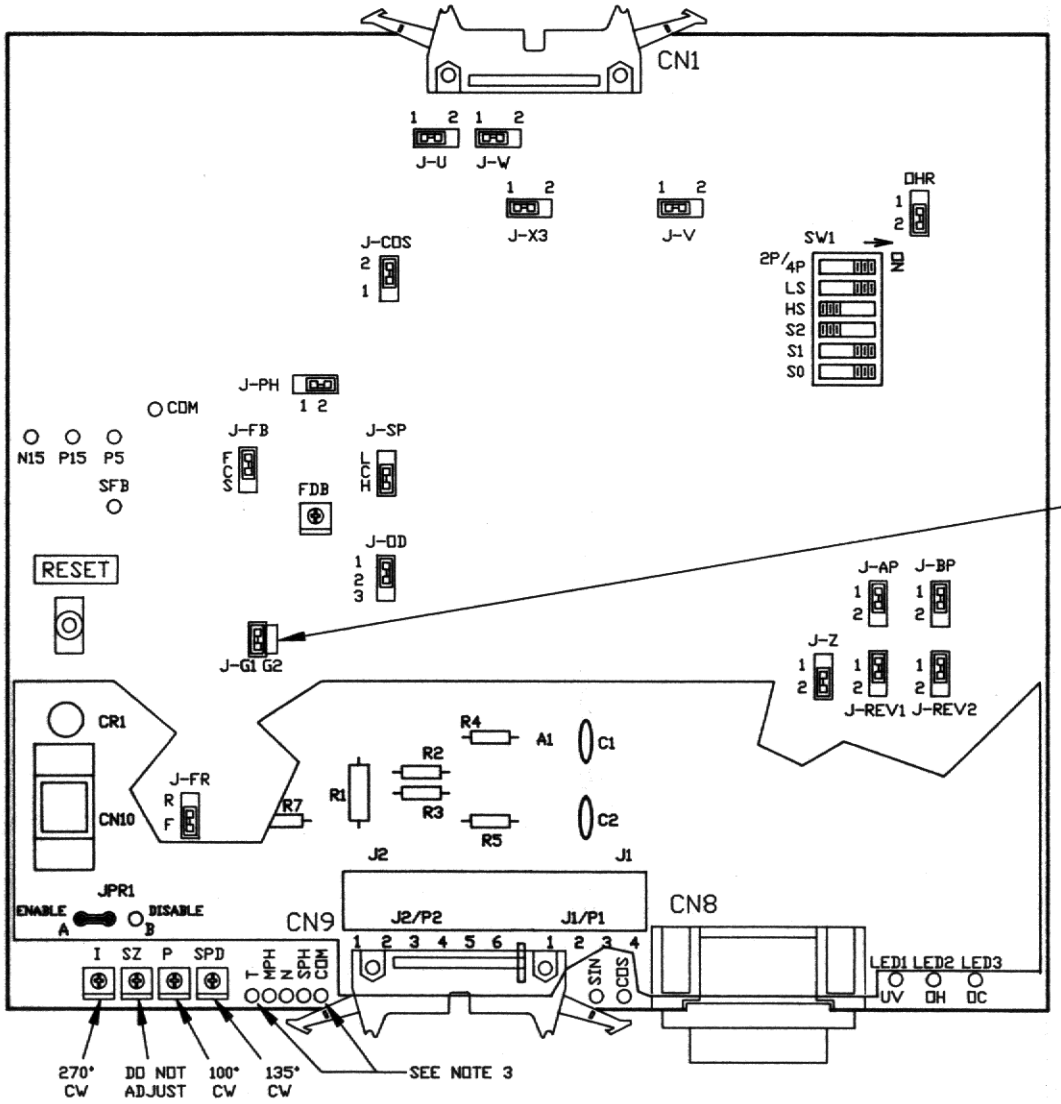
INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924-9181 FAX: (716) 924-2169

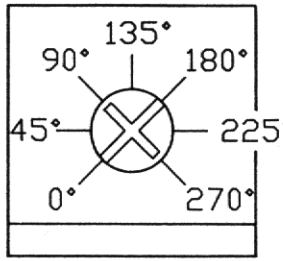
CHECKED BY	E.BAIER
DATE	12/17/90
APPROVED BY	W.K.
DATE	12/17/90
APPROVED BY	J.T.F.
DATE	12/17/90
MATERIAL	----------
FINISH	----------
TITLE	DRIVE SETUP
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)	
TOLERANCES	X.X± ---- X.XX± ---- X.XXX± ---- ANGULAR ± ----
DRAWN BY	CAD
AutoCAD FILE LOCATION	Q:\DFTG\IB\IB14B005\
DRAWING NUMBER	SU-043006
B	DATE 9/21/93 SCALE ----
SHEET NO.	1 OF 1
REVISION	C

NOTES:

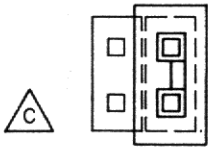
1. LOW INERTIA – JUMPER IN J–G1 POSITION
   HIGH INERTIA – SEE J–G1 G2 DETAIL A
2. SLIGHT ADJUSTMENT OF THE "I" AND "P" POTS MAY BE REQUIRED FOR OPTIMUM PERFORMANCE.
3. TEST POINTS:
   T TO COM: 3.33 VDC = 2.64 FT/LBS
   POS OUT TO GND ON CONTROLLER.
   8v DC ±2.5% AT 2250 RPM ADJUST USING 'FDB POT.

DATE	SYM	REVISION RECORD	DR	CK	CK
2/20/91	A	ECN 91–0022	EB	JC	JTF
9/30/93	B	ECN 93–0295	MC	EB	WES
1/16/96	C	ECN 95–292	CWB	[illegible]	KS





POTENTIOMETER DETAIL
0° INDICATED



J–G1 G2
DETAIL A
HIGH INERTIA SETTING
SEE NOTE 1

SETUP FOR MDPAK5–750

INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924–9181 FAX: (716) 924–2169

CHECKED BY E.BAIER	DATE 2/20/91
APPROVED BY J.C.	DATE 2/20/91
APPROVED BY J.T.F.	DATE 2/20/91
MATERIAL ----------	
FINISH ----------	

TITLE: DRIVE SETUP

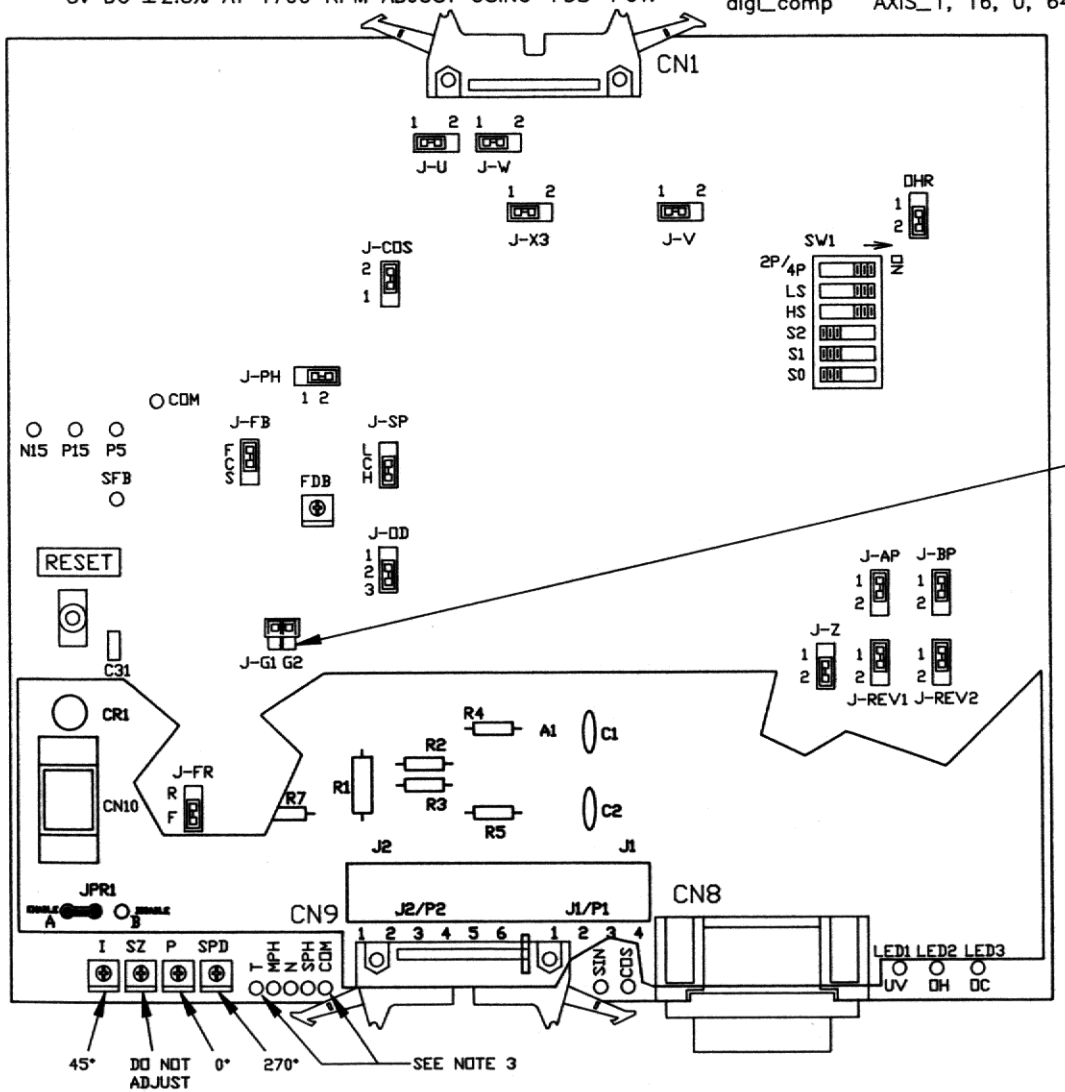
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)	DRAWN BY CAD		DRAWING NUMBER SU–043007
TOLERANCES: X.X± ---- X.XX± ---- X.XXX± ---- ANGULAR ± ----	AutoCAD FILE LOCATION Q:\DFTG\IB\IB14B005\		
	B	DATE 9/21/93	SCALE ----	SHEET NO. 1 OF 1	REVISION C

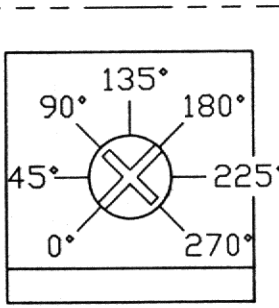
NOTES:

1. LOW INERTIA – JUMPER IN J–G1 POSITION.
   HIGH INERTIA – SEE J–G1 G2 DETAIL A
2. SLIGHT ADJUSTMENT OF THE "I" AND "P" POTS MAY BE REQUIRED FOR OPTIMUM PERFORMANCE.
3. TEST POINTS:
   T TO COM: 3.33VDC = 35.25 FT/LBS,
   POS OUT TO GND ON CONTROLLER.
   8v DC ±2.5% AT 1700 RPM ADJUST USING 'FDB' POT.
4. THE DIGI_COMP INSTRUCTION MUST BE USED IN AN INITIALIZATION ROUTINE OF THE MACROPROGRAM. THE GAIN SHOULD BE SET TO: 0, THE INTEGRAL SET TO: 0 AND THE DAMP SET TO: 64.

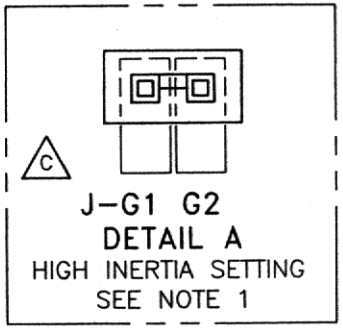
DIGI_COMP AXIS NUMBER, GAIN, INTEGRAL, DAMP
EXAMPLE:
digi_comp AXIS_1, 16, 0, 64

DATE	SYM	REVISION RECORD	DR	CK	CK
3/27/91	A	ECN 91–0033	EB	JC	
9/30/93	B	ECN 93–0295	MC	EB	WES
1/16/96	C	ECN 95–292	CWB	KB	KS





POTENTIOMETER DETAIL
0° INDICATED



J–G1 G2
DETAIL A
HIGH INERTIA SETTING
SEE NOTE 1

SETUP FOR MDPAK5–7500

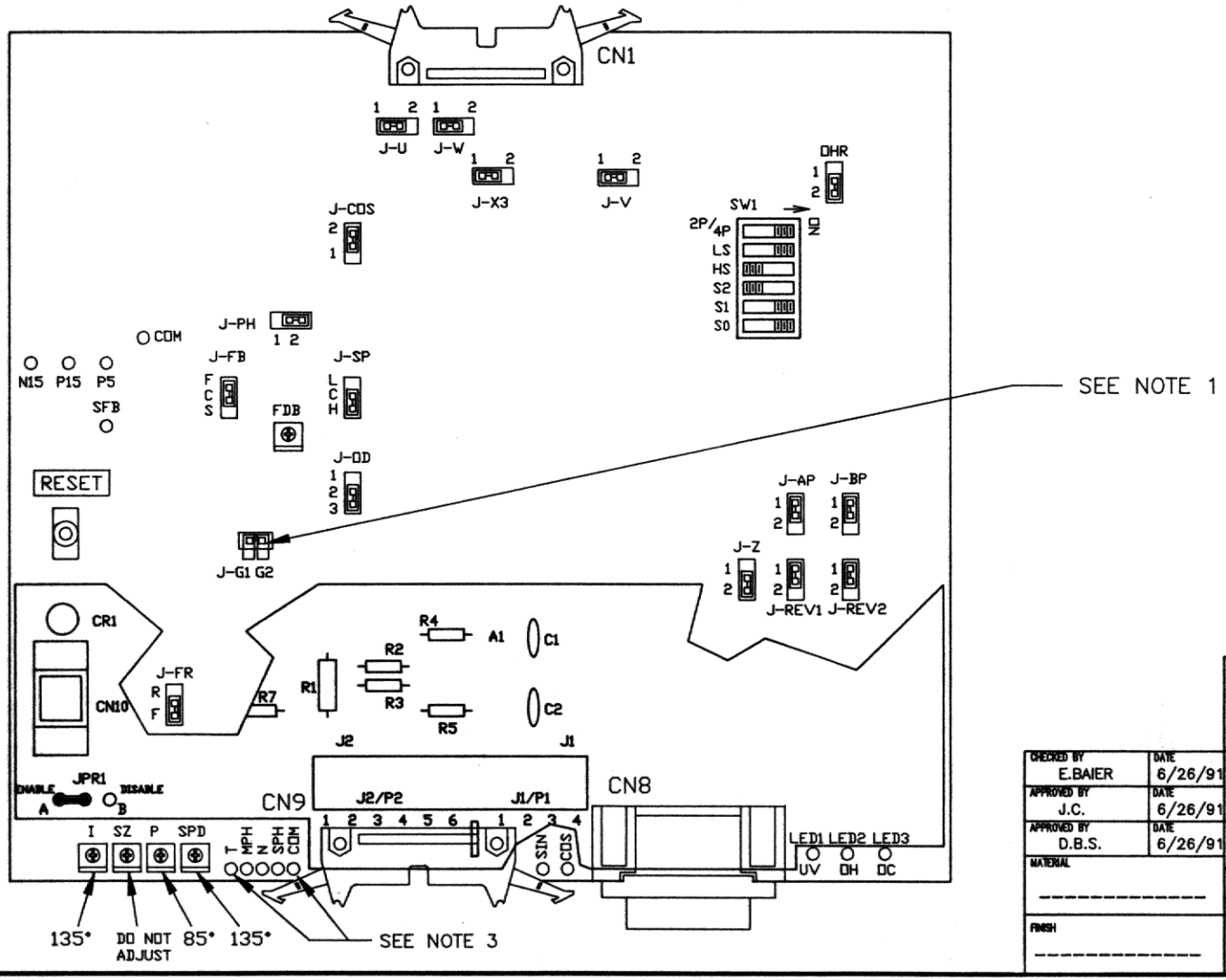
INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924–9181 FAX: (716) 924–2169

CHECKED BY	E.BAIER
DATE	3/27/91
APPROVED BY	J.C.
DATE	3/27/91
APPROVED BY	
DATE	
MATERIAL	----------
FINISH	----------
TITLE	DRIVE SETUP
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)	
TOLERANCES	X.X± ---- X.XX± ---- X.XXX± ---- ANGULAR ± ----
DRAWN BY	CAD
AutoCAD FILE LOCATION	Q:\DFTG\IB\IB14B005\
DRAWING NUMBER	SU–043008
B	DATE 9/21/93 SCALE ----
SHEET NO.	1 OF 1
REVISION	C

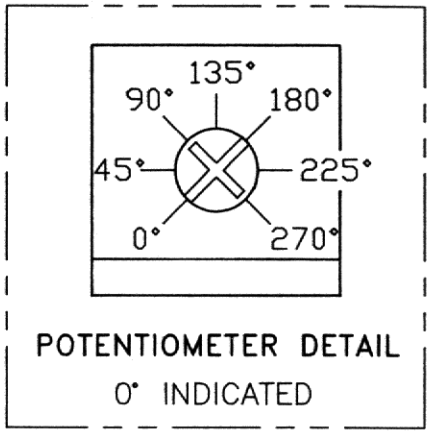
NOTES:

1. JUMPER J-G1, G2 IN NETURAL POSITION FOR ALL INERTIA SETTINGS, SEE DETAIL A.
2. SLIGHT ADJUSTMENT OF THE "I" AND "P" POTS MAY BE REQUIRED FOR OPTIMUM PERFORMANCE.
3. TEST POINTS:
   T: 3.33 VDC = 17.33 FT/LBS,
   POS OUT TO GND ON CONTROLLER.
   8v DC ±2.5% AT 1500 RPM ADJUST USING 'FDB' POT.

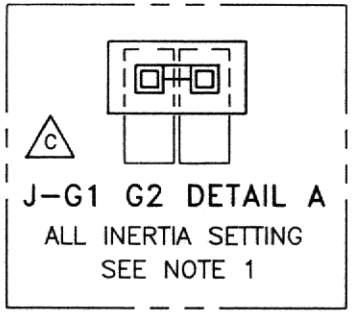
DATE	SYM	REVISION RECORD	DR	CK	CK
6/26/91	A	ECN 91-083	EB	JC	DBS
9/30/93	B	ECN 91-295	MC	EB	WES
1/17/96	C	ECN 95-292	CWB	WB	KS



SEE NOTE 1



POTENTIOMETER DETAIL
0° INDICATED



J-G1 G2 DETAIL A
ALL INERTIA SETTING
SEE NOTE 1

SETUP FOR MDPAK5-3700

INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924-9181 FAX: (716) 924-2169

CHECKED BY E.BAIER	DATE 6/26/91
APPROVED BY J.C.	DATE 6/26/91
APPROVED BY D.B.S.	DATE 6/26/91
MATERIAL ----------	
FINISH ----------	

TITLE: DRIVE SETUP

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)
TOLERANCES: X.X± ---- ANGULAR ± ----
X.XX± ----
X.XXX± ----

DRAWN BY: CAD
AutoCAD FILE LOCATION: Q:\DFTG\IB\IB14B005\

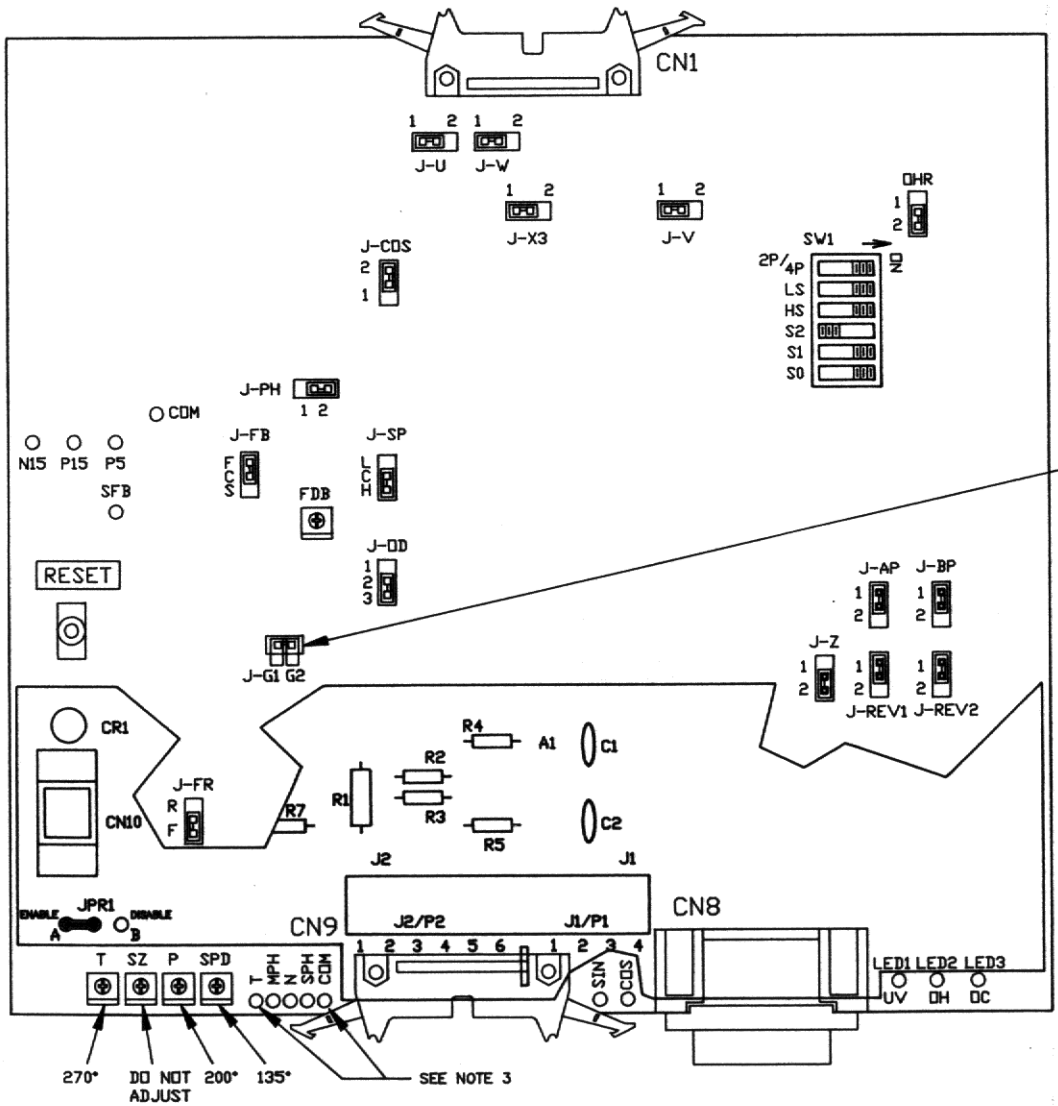
DRAWING NUMBER: SU-043009

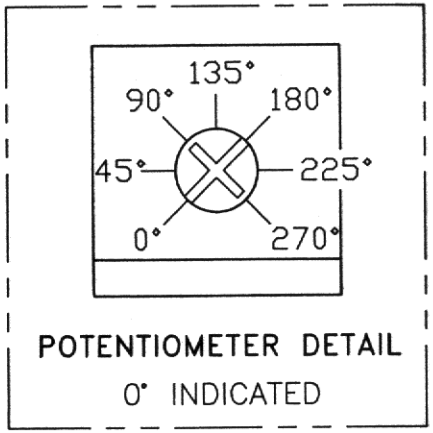
B | DATE 9/21/93 | SCALE ---- | SHEET NO. 1 OF 1 | REVISION C

NOTES:

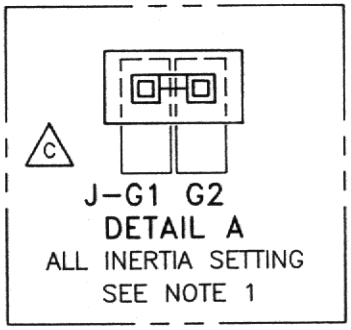
1. JUMPER J-G1 G2 IN NEUTRAL POSITION FOR ALL INERTIA SETTINGS. SEE DETAIL A.
2. SLIGHT ADJUSTMENT OF THE "I" AND "P" POTS MAY BE REQUIRED FOR OPTIMUM PERFORMANCE.
3. TEST POINTS:
   T TO COM: 3.33 VDC = 7.05 FT/LBS,
   POS OUT TO GND ON CONTROLLER.
   8v DC ±2.5% AT 2200 RPM ADJUST USING 'FDB' POT.

DATE	SYM	REVISION RECORD	DR	CK	CK
9/27/90	A	ECN 90-197	EB	DBS	
9/27/93	B	ECN 93-295	MC	EB	WES
1/17/96	C	ECN 95-292	CWB	[illegible]	KS





POTENTIOMETER DETAIL
0° INDICATED



J-G1 G2
DETAIL A
ALL INERTIA SETTING
SEE NOTE 1

SETUP FOR MDPAK5-2000

INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924-9181 FAX: (716) 924-2169

CHECKED BY	DATE
E.BAIER	9/27/90
APPROVED BY	DATE
D.B.S.	9/27/90
APPROVED BY	DATE

TITLE: DRIVE SETUP

MATERIAL: ----------

FINISH: ----------

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)

TOLERANCES: X.X± ---- X.XX± ---- X.XXX± ----

ANGULAR: ± ----

DRAWN BY: CAD

AutoCAD FILE LOCATION: Q:\DFTG\IB\IB14B005\

B | DATE: 9/21/93 | SCALE: ----

DRAWING NUMBER: SU-043010

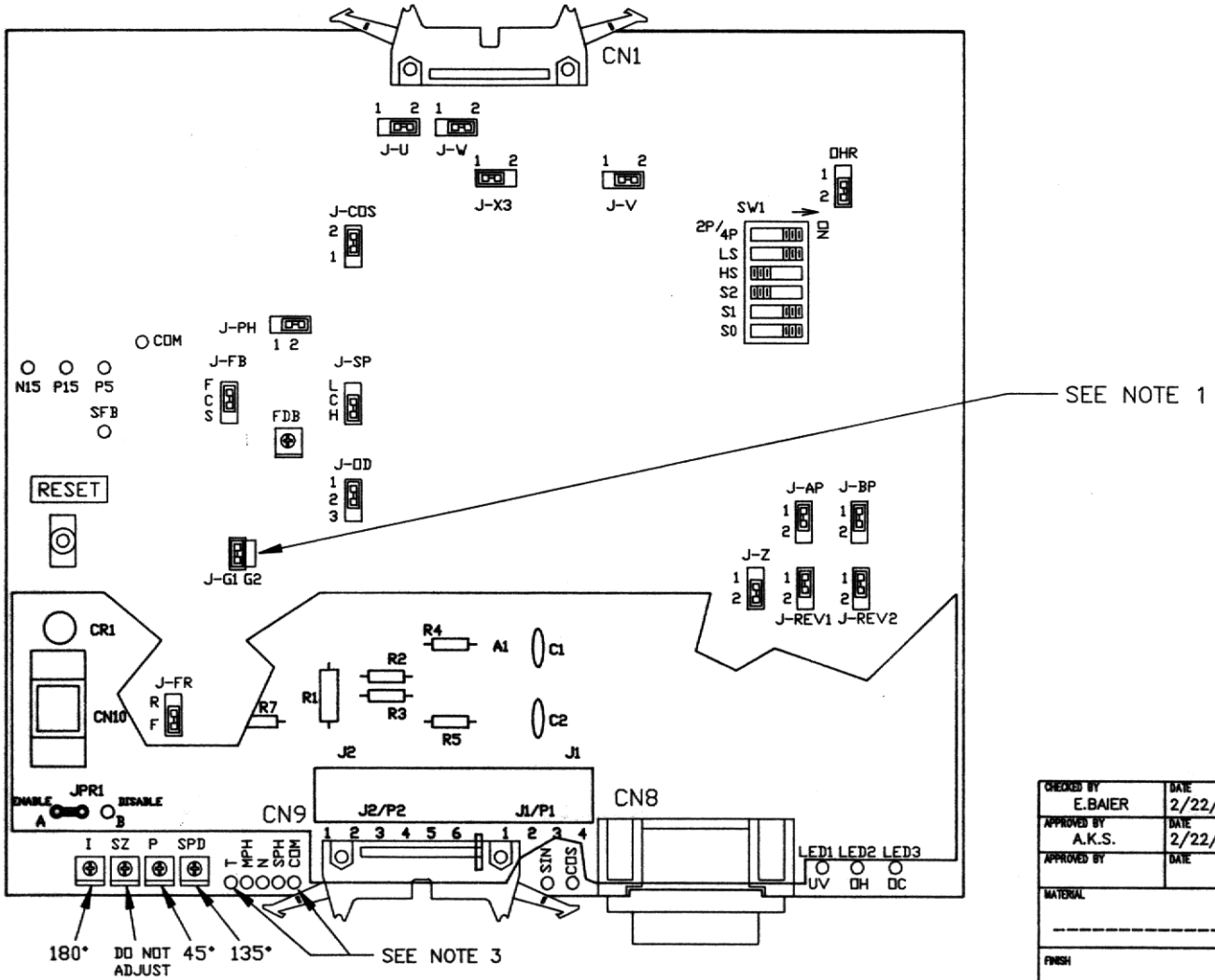
SHEET NO.: 1 OF 1

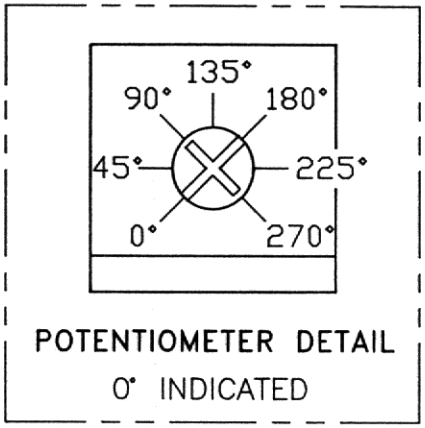
REVISION: C

NOTES:

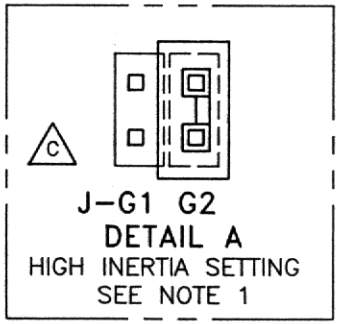
1. LOW INERTIA – JUMPER IN J–G1 POSITION
   HIGH INERTIA – SEE J–G1 G2 DETAIL A
2. SLIGHT ADJUSTMENT OF THE "I" AND "P" POTS MAY BE REQUIRED FOR OPTIMUM PERFORMANCE.
3. TEST POINTS:
   T TO COM: 3.33 VDC = 0.64 FT/LB
   POS OUT TO GND ON CONTROLLER
   8v DC ±2.5% AT 3400 RPM ADJUST USING 'FDB' POT.

DATE	SYM	REVISION RECORD	DR	CK	CK
2/24/93	A	ECN 93–058	ME	EB	
9/30/93	B	ECN 93–295	MC	EB	WES
1/17/96	C	ECN 95–292	CWB	ES	





POTENTIOMETER DETAIL
0° INDICATED



J–G1 G2
DETAIL A
HIGH INERTIA SETTING
SEE NOTE 1

SETUP FOR MDPAK5–R300

INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924–9181 FAX: (716) 924–2169

CHECKED BY: E.BAIER	DATE: 2/22/93
APPROVED BY: A.K.S.	DATE: 2/22/93
APPROVED BY:	DATE:
MATERIAL: ----------	
FINISH: ----------	

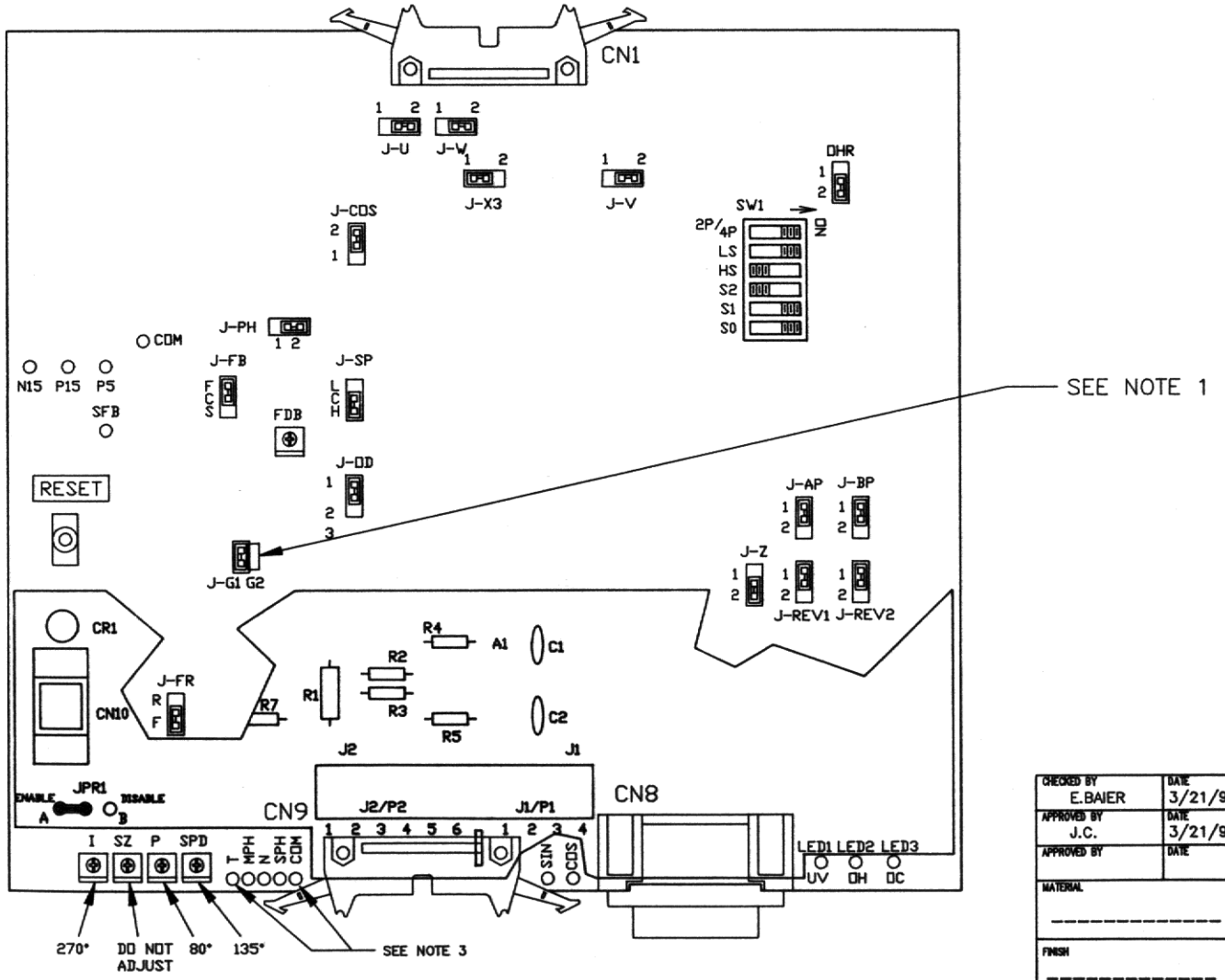
TITLE: DRIVE SETUP

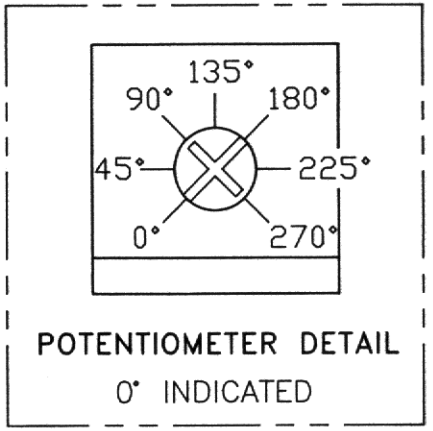
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)	DRAWN BY: CAD		DRAWING NUMBER: SU–043011
TOLERANCES: X.X± ---- ANGULAR ± ---- X.XX± ---- X.XXX± ----	AutoCAD FILE LOCATION: Q:\DFTG\IB\IB14B005\		
	B	DATE: 9/21/93	SCALE: ----
		SHEET NO.: 1 OF 1	REVISION: C

NOTES:

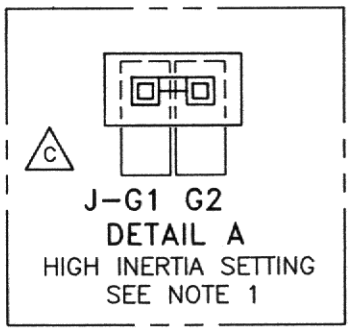
1. LOW INERTIA – JUMPER IN J–G1 POSITION
   HIGH INERTIA – SEE J–G1 G2 DETAIL A
2. SLIGHT ADJUSTMENT OF THE "I" AND "P" POTS MAY BE REQUIRED FOR OPTIMUM PERFORMANCE.
3. TEST POINTS:
   T TO COM: 3.33VDC = 1.06 FT/LBS.
   POS OUT TO GND ON CONTROLLER
   8v DC ±2.5% AT 3200 RPM ADJUST USING 'FDB' POT.

DATE	SYM	REVISION RECORD	DR	CK	CK
3/21/91	A	ECN 91–031	EB	JC	
9/30/93	B	ECN 93–295	MC	EB	WES
1/17/96	C	ECN 95–292	CWB	KS	RS





POTENTIOMETER DETAIL
0° INDICATED



J–G1 G2
DETAIL A
HIGH INERTIA SETTING
SEE NOTE 1

SETUP FOR MDPAK5–R500

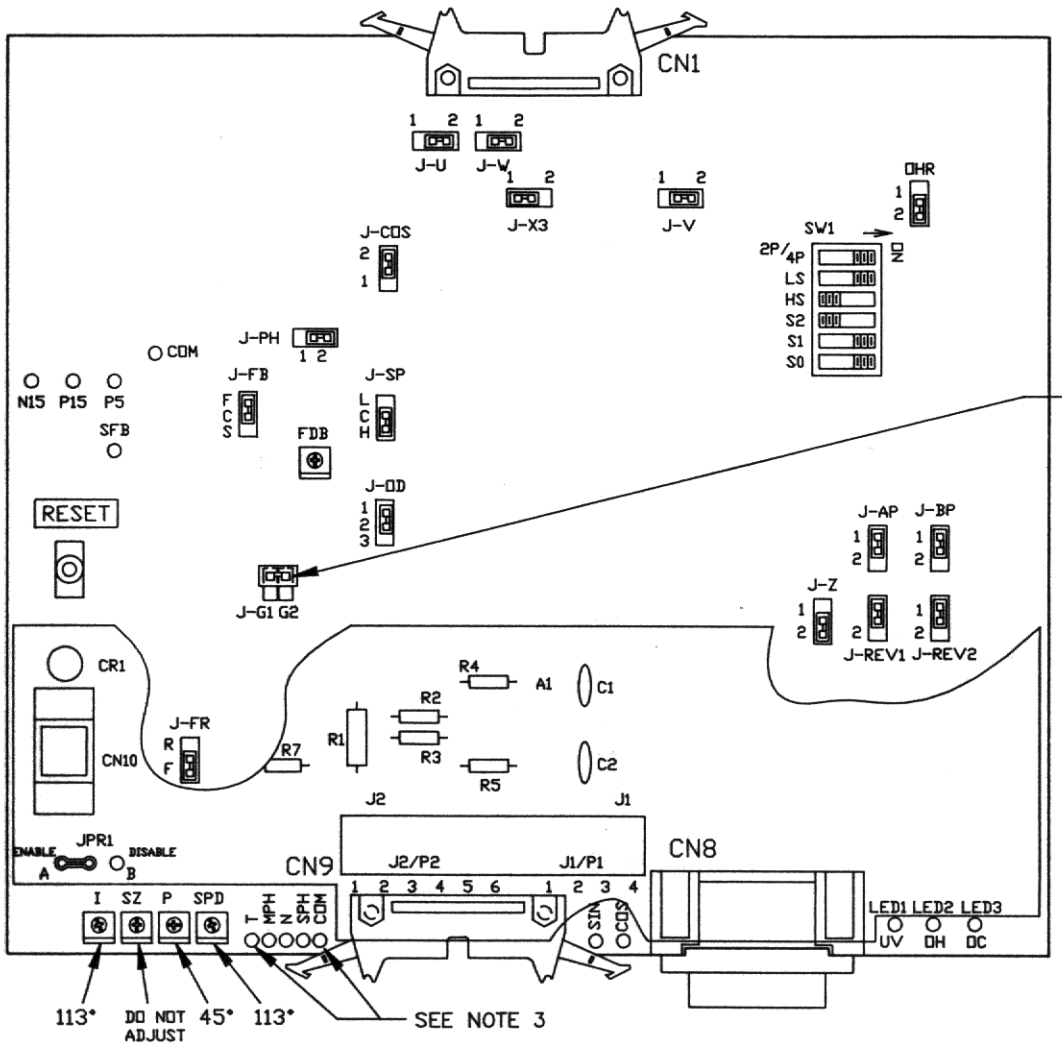
INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924–9181 FAX: (716) 924–2169

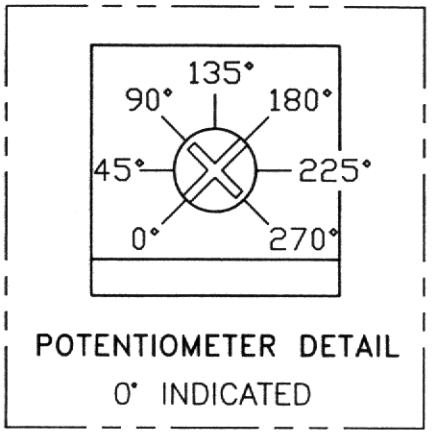
CHECKED BY: E.BAIER	DATE: 3/21/91
APPROVED BY: J.C.	DATE: 3/21/91
APPROVED BY:	DATE:
MATERIAL: ----------	
FINISH: ----------	
TITLE: DRIVE SETUP	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)	DRAWN BY: CAD
TOLERANCES: X.X± ---- X.XX± ---- X.XXX± ---- ANGULAR ± ----	AutoCAD FILE LOCATION: Q:\DFTG\IB\IB14B005\
B	DATE: 9/21/93 SCALE: ----
DRAWING NUMBER: SU–043012	SHEET NO.: 1 OF 1 REVISION: C

NOTES:

1. JUMPER J-G1, G2 IN NEUTRAL POSITION. FOR ALL INERTIA SETTINGS SEE DETAIL A.
2. SLIGHT ADJUSTMENT OF THE "I" AND "P" POTS MAY BE REQUIRED FOR OPTIMUM PERFORMANCE.
3. TEST POINTS:
   T TO COM: 3.33 VDC = 1.48 FT.LB.
   POS OUT TO GND ON THE CONTROLLER.
   8v DC ±2.5% AT 3200 RPM ADJUST USING 'FDB' POT.

DATE	SYM	REVISION RECORD	DR	CK	CK
23NOV94	0	ECN 94-304	DAD		
1/17/96	A	ECN 95-292	CWB	RB	KS





POTENTIOMETER DETAIL
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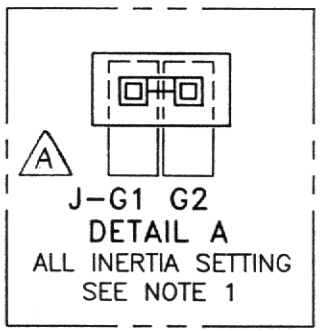


J-G1 G2
DETAIL A
ALL INERTIA SETTING
SEE NOTE 1

SETUP FOR MDPAK5-R700

INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924-9181 FAX: (716) 924-2169

CHECKED BY	DATE
APPROVED BY	DATE
APPROVED BY	DATE
MATERIAL	-----
FINISH	-----

TITLE: DRIVE SETUP

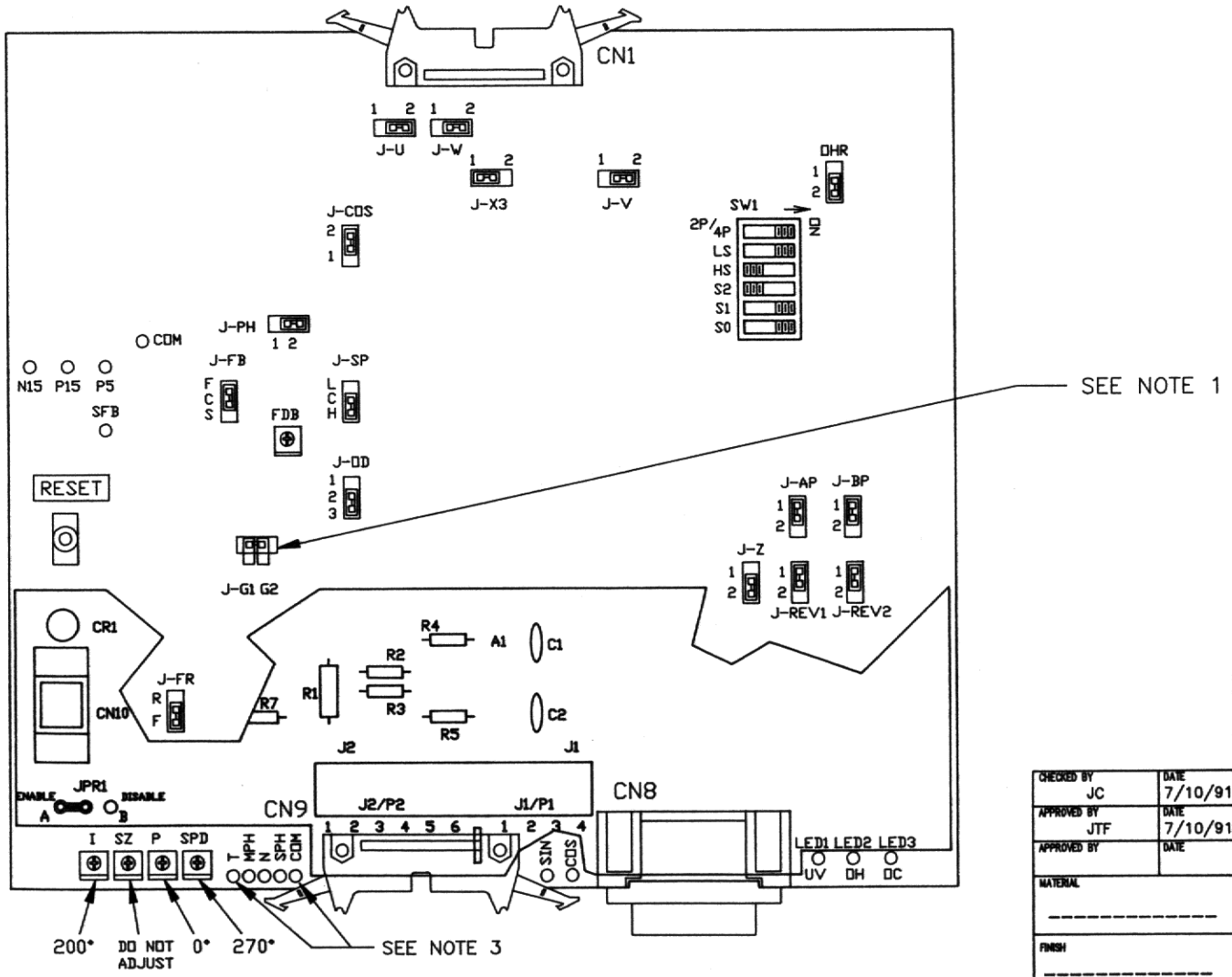
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)
TOLERANCES
X.X± ----- ANGULAR ± --
X.XX± ---
X.XXX± ---

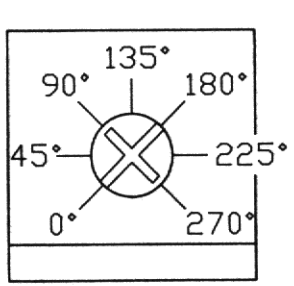
DRAWN BY: DAD
AutoCAD FILE LOCATION: Q:\DFTG\IB\IB14B005\
DRAWING NUMBER: SU-043013
B | DATE: 23NOV94 | SCALE: ----- | SHEET NO.: 1 OF 1 | REVISION: A

NOTES:

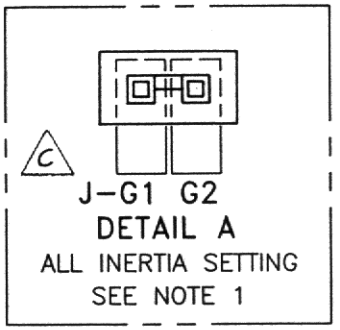
1. JUMPER J-G1 G2 IN NEUTRAL POSITION FOR ALL INERTIA SETTINGS. SEE DETAIL A.
2. SLIGHT ADJUSTMENT OF THE "I" AND "P" POTS MAY BE REQUIRED FOR OPTIMUM PERFORMANCE.
3. TEST POINTS:
   - T: 3.33 VDC = 4.23 FT/LBS.
   - N: 8v DC ±2.5% AT 3200 RPM ADJUST USING 'FDB' POT.

DATE	SYM	REVISION RECORD	DR	CK	CK
7/10/91	A	ECN 91-068	EB	JC	JTF
9/4/91	B	ECN 91-111	EB	RB	JC
1/18/95	C	ECN 95-292	CWB	RB	KS





POTENTIOMETER DETAIL
0° INDICATED



J-G1 G2
DETAIL A
ALL INERTIA SETTING
SEE NOTE 1

SETUP FOR MDPAK5-R2000

INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924-9181 FAX: (716) 924-2189

CHECKED BY: JC	DATE: 7/10/91
APPROVED BY: JTF	DATE: 7/10/91
APPROVED BY:	DATE:
MATERIAL: ----------	
FINISH: ----------	

TITLE: DRIVE SETUP

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)	DRAWN BY: CAD
TOLERANCES: X.X± ---- X.XX± ---- X.XXX± ---- ANGULAR ± ----	AutoCAD FILE LOCATION: Q:\DFTG\IB\IB148005\
B	DATE: 7/10/91
SCALE: ----	SHEET NO.: 1 OF 1

DRAWING NUMBER: SU-043016
REVISION: C

NOTES

APPENDIX E
PWRPAK™ SPECIFICATIONS

PWRPAK™ List of Materials

PWRPAK™ Specifications

PWRPAK™ LIST OF MATERIALS

DESCRIPTION	TRANSFORMER	MANUAL
PWRPAK5-1000	T-300/3-3	IB-14B005
PWRPAK5-1500	T-300/5-3	IB-14B005
PWRPAK5-2200	T-300/7.5-3	IB-14B005
PWRPAK5-2250	TE-300/7.5-3	IB-14B005
PWRPAK5-4500	TE-300/15-3	IB-14B005
PWRPAK5-9000	TE-300/30-3	IB-14B005
PWRPAK5-15000	TE-300/58-3	IB-14B005
PWRPAK5-22500	TE-300/75-3	IB-14B005
PWRPAK5-28500	TE-300/95-3	IB-14B005

PWRPAK™ SPECIFICATIONS

TRANSFORMER	OUTPUT POWER (Watts)	INPUT PHASES	PM*	FS*	PRIMARY TERMINAL CURRENT (Amps)		SECONDARY TERMINAL CURRENT (Amps)		
					230 VAC	460 VAC	253 VAC	230 VAC	207 VAC
T-300/3-3	1000	3	X		3	6	3	3	3
T-300/5-3	1500	3	X		5	2.5	5	5	5
T-300/7.5-3	2200	3	X		7.5	3.7	7.5	7.5	7.5
TE-300/7.5-3	2250	3		X	7.5	3.7	6.8	7.5	8.3
TE-300/15-3	4500	3		X	15	7.5	13.7	15	16.7
TE-300/30-3	9000	3		X	30	15	27.4	30	33.5
TE-300/58-3	15000	3		X	57.7	28.8	52.5	57.7	64.1
TE-300/75-3	22500	3		X	67.7	33.9	61.6	67.8	75.3
TE-300/95-3	28500	3		X	95	47.5	86.4	95	105

*NOTE: PM = Panel Mount, FS = Free-standing

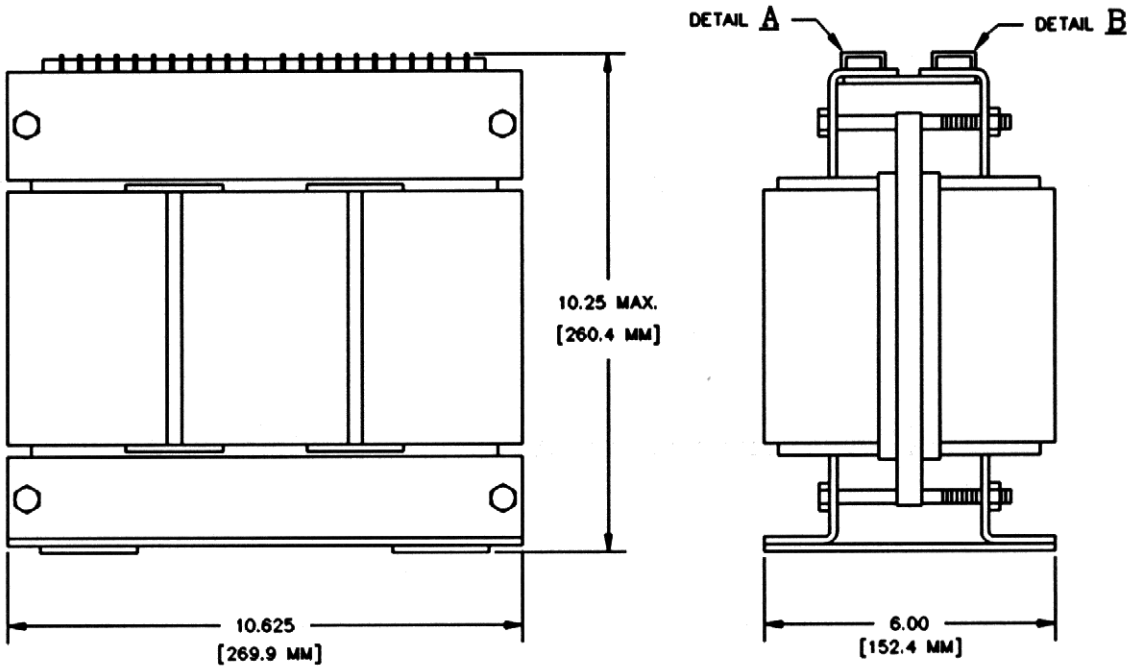
NOTES

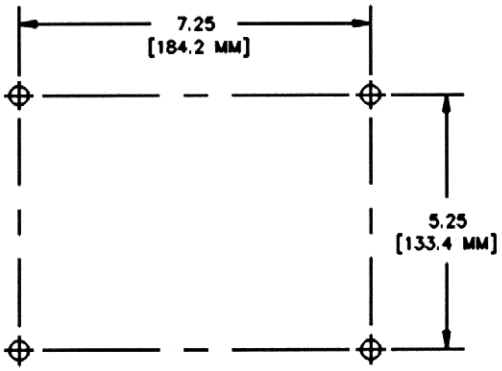
APPENDIX F
PWRPAK™ DIMENSIONS AND CONNECTIONS

Panel-mount Transformer Dimensions and Connections

Free-standing Transformer Dimensions and Connections

PANEL-MOUNT TRANSFORMER DIMENSIONS AND CONNECTIONS



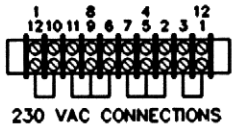


MOUNTING PATTERN

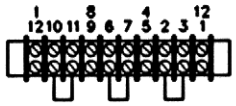
.625 [15.9 MM] DIA. THRU (4 PLACES)
USE 3/8-16 UNC MOUNTING HARDWARE

DETAIL A

WIRING/PRIMARY TERMINALS



230 VAC CONNECTIONS

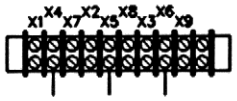


460 VAC CONNECTIONS

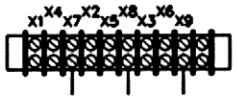
DETAIL B

WIRING/SECONDARY TERMINALS

253 VAC Y CONNECTIONS



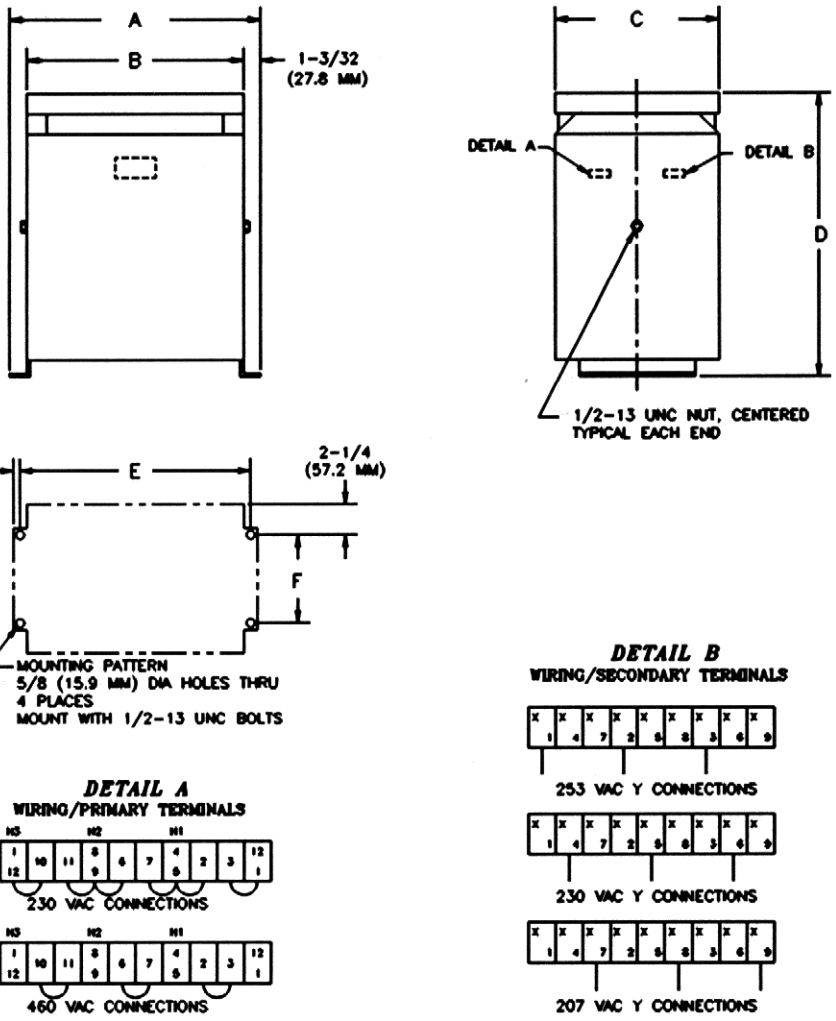
230 VAC Y CONNECTIONS



207 VAC Y CONNECTIONS

TRANSFORMER	FREQ. (HZ)	PHASE	OUTPUT POWER (WATTS)	TEMP. RISE (°C)	WEIGHT (LBS.)
T-300/3-3	60	3	1000	150	80
T-300/5-3	60	3	1500	150	80
T-300/7.5-3	60	3	2200	150	80

FREE-STANDING TRANSFORMER DIMENSIONS AND CONNECTIONS



TRANSFORMER	FREQ. (HZ)	PHASE	OUTPUT POWER (WATTS)	TEMP. RISE (°C)	WEIGHT (LBS.)	A	B	C	D	E	F
TE-300/7.5-3	60	3	2250	150	110	18.19 (462)	16.00 (406)	8.00 (203)	21.00 (533)	17.00 (432)	3.50 (89)
TE-300/15-3	60	3	4500	150	125	18.19 (462)	16.00 (406)	8.00 (203)	21.00 (533)	17.00 (432)	3.50 (89)
TE-300/30-3	60	3	9000	150	175	22.19 (564)	20.00 (508)	12.00 (305)	21.00 (533)	21.00 (533)	7.50 (191)
TE-300/58-3	60	3	15000	150	216	28.19 (716)	26.00 (660)	16.00 (406)	27.00 (686)	27.00 (686)	11.50 (292)
TE-300/75-3	60	3	22500	150	400	28.19 (716)	26.00 (660)	16.00 (406)	27.00 (686)	27.00 (686)	11.50 (292)
TE-300/95-3	60	3	28500	150	400	28.19 (716)	26.00 (660)	16.00 (406)	27.00 (686)	27.00 (686)	11.50 (292)

DIMENSIONS = INCHES
(MILLIMETERS)

NOTES

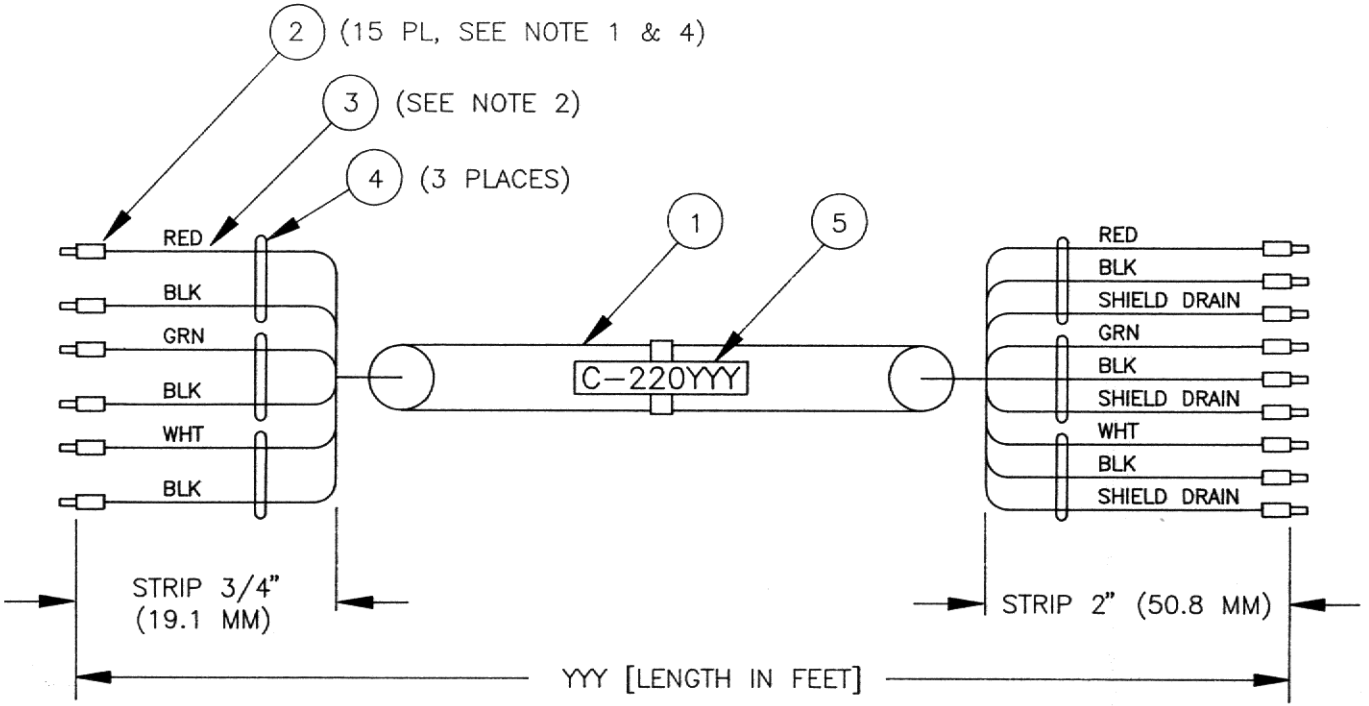
APPENDIX G
CONNECTING CABLES

DRAWING NUMBER	DESCRIPTION
C-220YYY	Resolver Cable
C-230YYY	Resolver Cable
C-303YYY	Encoder Cable
C-305YYY	Encoder Cable
C-455YYY	Command Cable
C-457YYY	Command Cable
C-620YYY	Motor Cable
C-653YYY	Motor Cable
C-659YYY	Motor Cable

NOTES:

1. ALTERNATE CONSTRUCTION: STRIP AND TIN 1/4" (6.4 MM)
2. HEAT SHRINK TUBING [ITEM 3] OVER FOIL END (6 PLACES)
3. HEAT SHRINK TUBING [ITEM 3] OVER SPIDER JOINT (6 PLACES)
4. CRIMP FURRELS USING WEIDMULLER CRIMP TOOL PZ4 OF EQUIVALENT

DATE	SYM	REVISION RECORD	DR	CK	CK
6/29/93	A	ECN 93-131	DAD	WJ	



INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924-9181 FAX: (716) 924-2169

CHECKED BY	DATE
APPROVED BY ELS	DATE 01/86
APPROVED BY	DATE
MATERIAL ----------	
FINISH ----------	

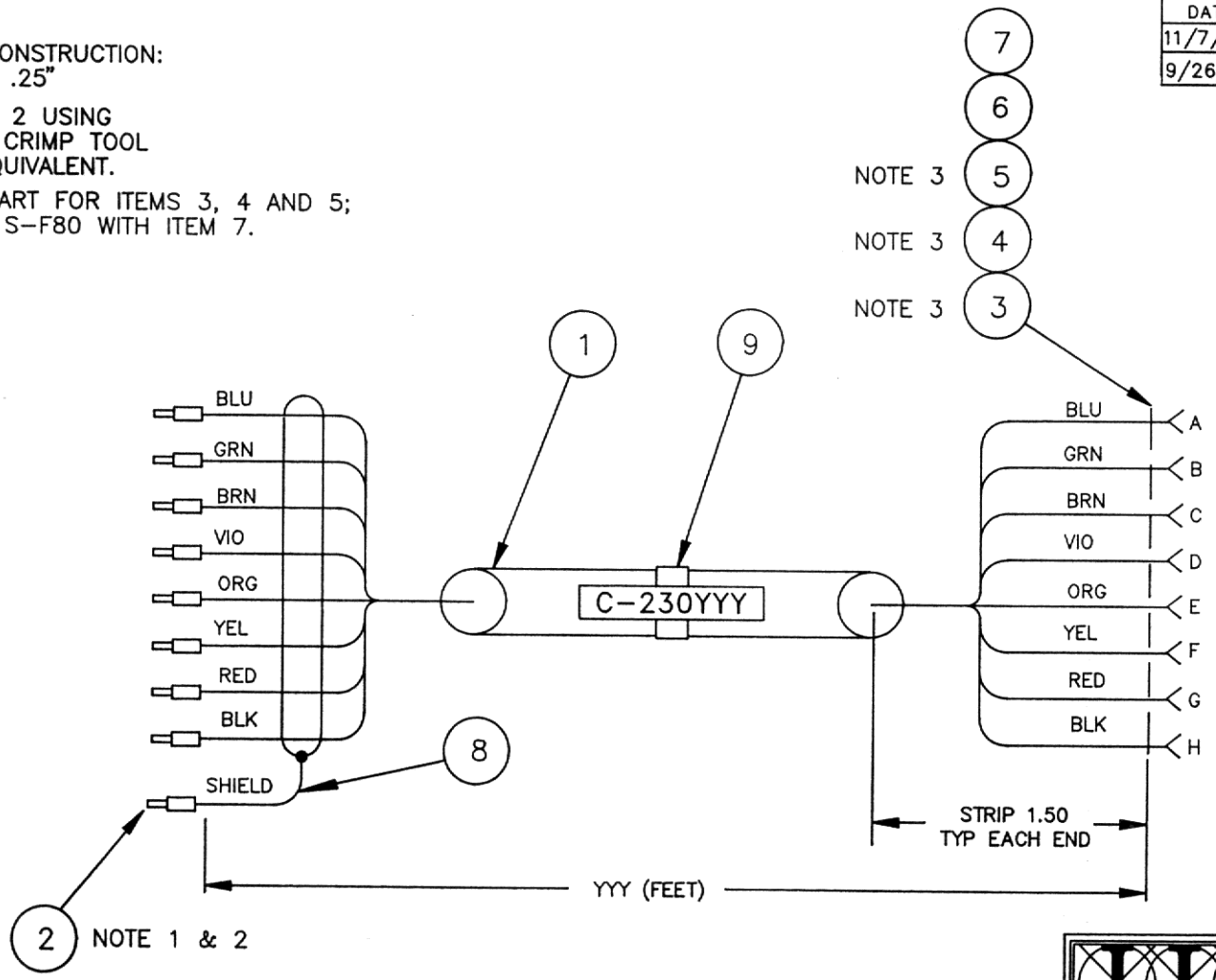
TITLE: CABLE, RESOLVER

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)	DRAWN BY DAD		DRAWING NUMBER C-220YYY
TOLERANCES	AutoCAD FILE LOCATION		
X.X± --- ANGULAR X.XX± .01 ± --- X.XXX± .005	B	DATE 01/30/86 SCALE ---	SHEET NO. 1 OF 1 REVISION A

NOTES:

1. ALTERNATE CONSTRUCTION: STRIP & TIN .25"
2. INSTALL ITEM 2 USING WEIDMULLER CRIMP TOOL PZ-4 OR EQUIVALENT.
3. ALTERNATE PART FOR ITEMS 3, 4 AND 5; CA3106E18-1S-F80 WITH ITEM 7.

DATE	SYM	REVISION RECORD	DR	CK	CK
11/7/90	A	ECN-90-0226	EB	JTF	JC
9/26/93	B	ECN-93-0267	EB	EB	WS



INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924-9181 FAX: (716) 924-2169

CHECKED BY J.T.F.	DATE 11/90
APPROVED BY J.C.	DATE 11/90
APPROVED BY WEA	DATE 11/93
MATERIAL ----------	
FINISH ----------	

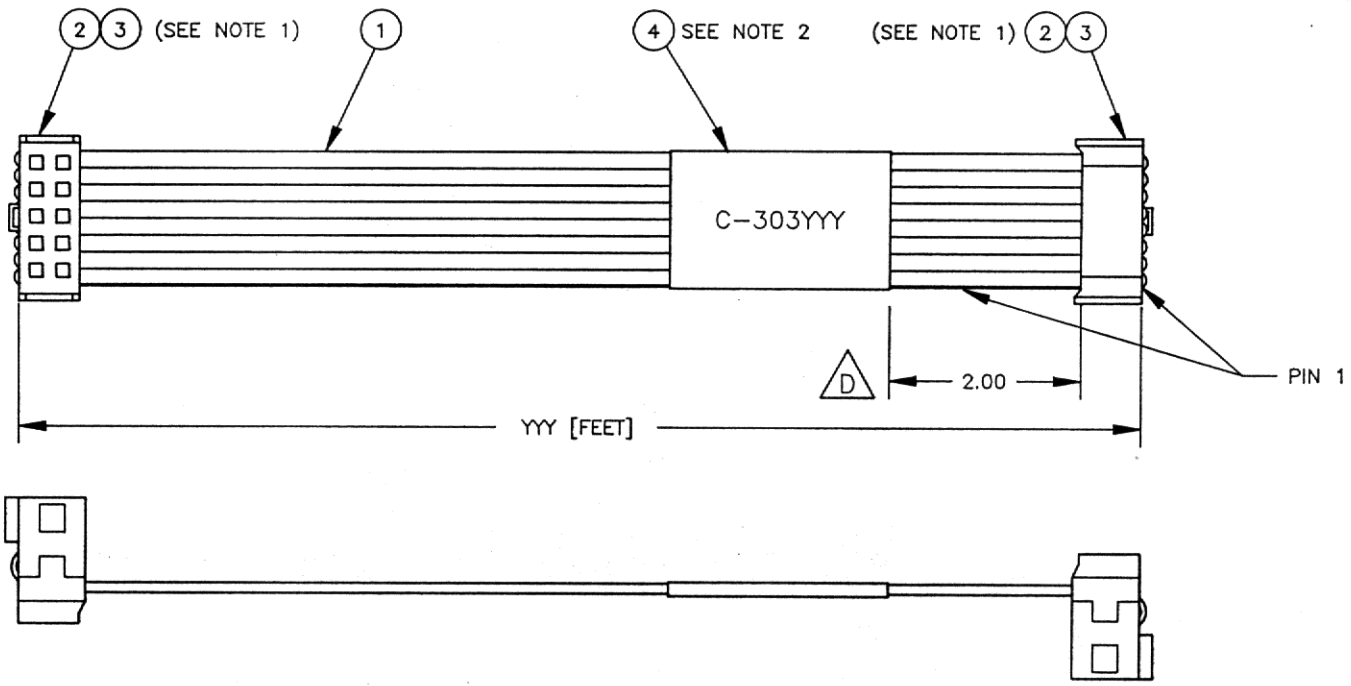
TITLE: CABLE, RESOLVER

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)	DRAWN BY BAIER			DRAWING NUMBER	
TOLERANCES	AutoCAD FILE LOCATION G:\CAD\CABLES\C-2XX\			C-230YYY	
X.X± ----- ANGULAR ± --	B	DATE 11/7/90	SCALE ----	SHEET NO. 1 OF 1	REVISION B
X.XX± ----					
X.XXX± --					

NOTES:

1. INSTALL ITEM 2 USING ROBINSON NUGENT CABLING TOOL CT-1 OR EQUIVALENT
2. MARK ITEM 4 WITH CABLE NUMBER AND LOCATE APPROXIMATELY WHERE SHOWN. (D)

DATE	SYM	REVISION RECORD	DR	CK	CK
5/89	A	ECN 89-0107	EB	CE	
8/89	B	ECN 89-0022	DD	CE	
6/93	C	ECN 93-131	EB	WES	
3/95	D	ECN 95-060	EB	WS	



INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924-9181 FAX: (716) 924-2169

CHECKED BY WEA	DATE 5/12/95
APPROVED BY W.E.S.	DATE 7/21/94
APPROVED BY	DATE
MATERIAL ----------	
FINISH ----------	

TITLE: CABLE, ENCODER

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)
TOLERANCES
X.X± ---- ANGULAR ± ---
X.XX± 0.01
X.XXX± 0.005

DRAWN BY BAIER
AutoCAD FILE LOCATION G:\CABLES\

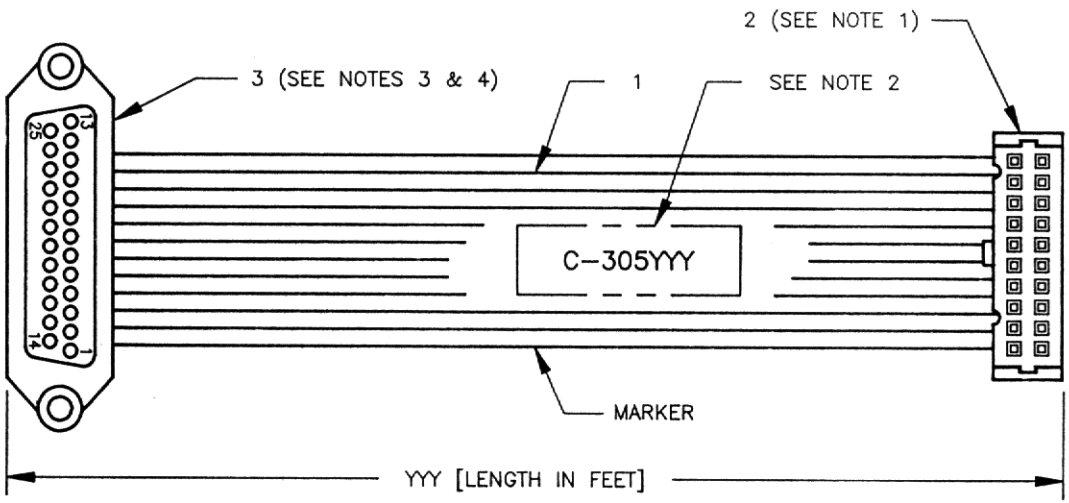
DRAWING NUMBER C-303YYY

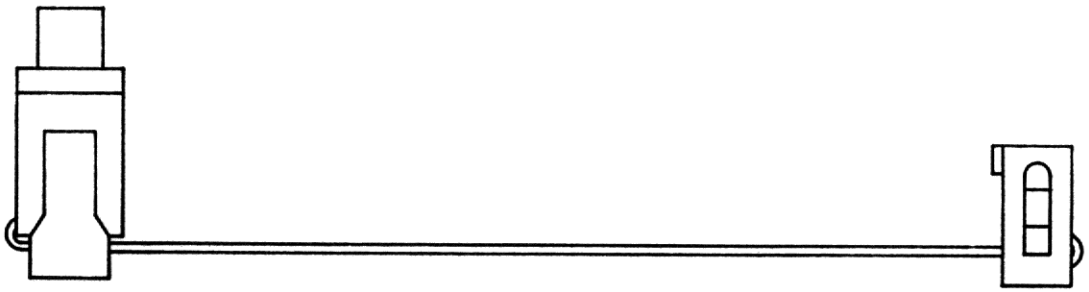
B | DATE 6/21/93 | SCALE ---- | SHEET NO. 1 OF 1 | REVISION D

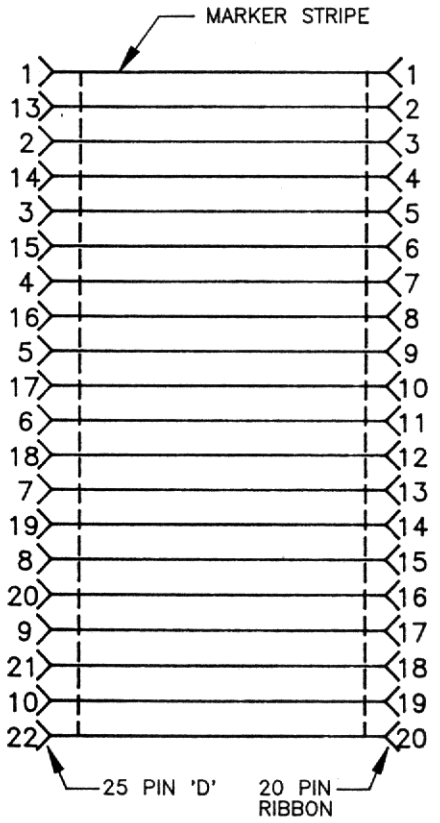
NOTES:

1. INSTALL ITEM 2 USING ROBINSON NUGENT CABLING TOOL CT-1 OR EQUIVALENT
2. MARK CABLE NUMBER IN AREA SHOWN USING PERMANENT INK MARKER OR EQUIVALENT
3. INSTALL 20-CONDUCTOR RIBBON CABLE IN 25-CONDUCTOR CONNECTOR SUCH THAT PIN 1 IS COMMON AS SHOWN. NO CONNECTION AT PINS 11, 12, 13, 24 & 25
4. INSTALL ITEM 3 USING T & B CABLING TOOL 779-2100 OR EQUIVALENT

DATE	SYM	REVISION RECORD	DR	CK	CK
6/23/93	A	ECN-93-131	EB	WE	







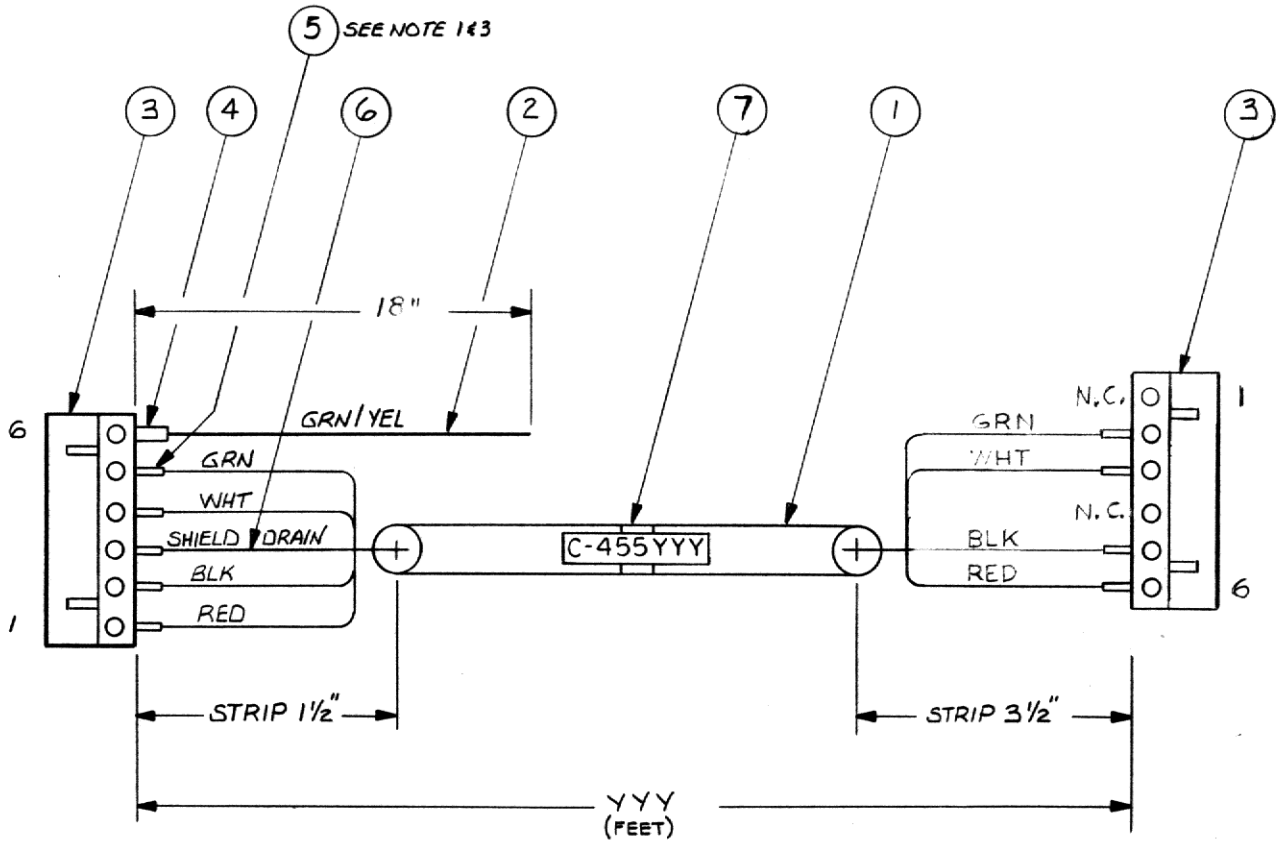
INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
VICTOR, NEW YORK 14564
(716) 924-9181 FAX: (716) 924-2169

CHECKED BY: D.DAUNCE	DATE: 8/89
APPROVED BY: C.M.E.	DATE: 8/89
APPROVED BY:	DATE:
MATERIAL: ----------	
FINISH: ----------	

TITLE: CABLE, ENCODER

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)	DRAWN BY: BAIER		DRAWING NUMBER: C-305YYY
TOLERANCES: X.X± ------- ANGULAR ± ---	AutoCAD FILE LOCATION: G:\CAD\CABLES\		
X.XX± 0.01	B	DATE:	SCALE: ----
X.XXX± 0.005			SHEET NO.: 1 OF 1 / REVISION: A

DATE	SYM	REVISION RECORD	DR.	CK
10/19	A	SEE DCN-89-0161	R.T.	



NOTES:

1) ALTERNATE CONSTRUCTION STRIP & TIN 1/4".
2) PIN NO'S. FOR REF. ONLY.
3) CRIMP FERRULES USING WEIDMULLER CRIMP TOOL PZ-4 OR EQUIVALENT.

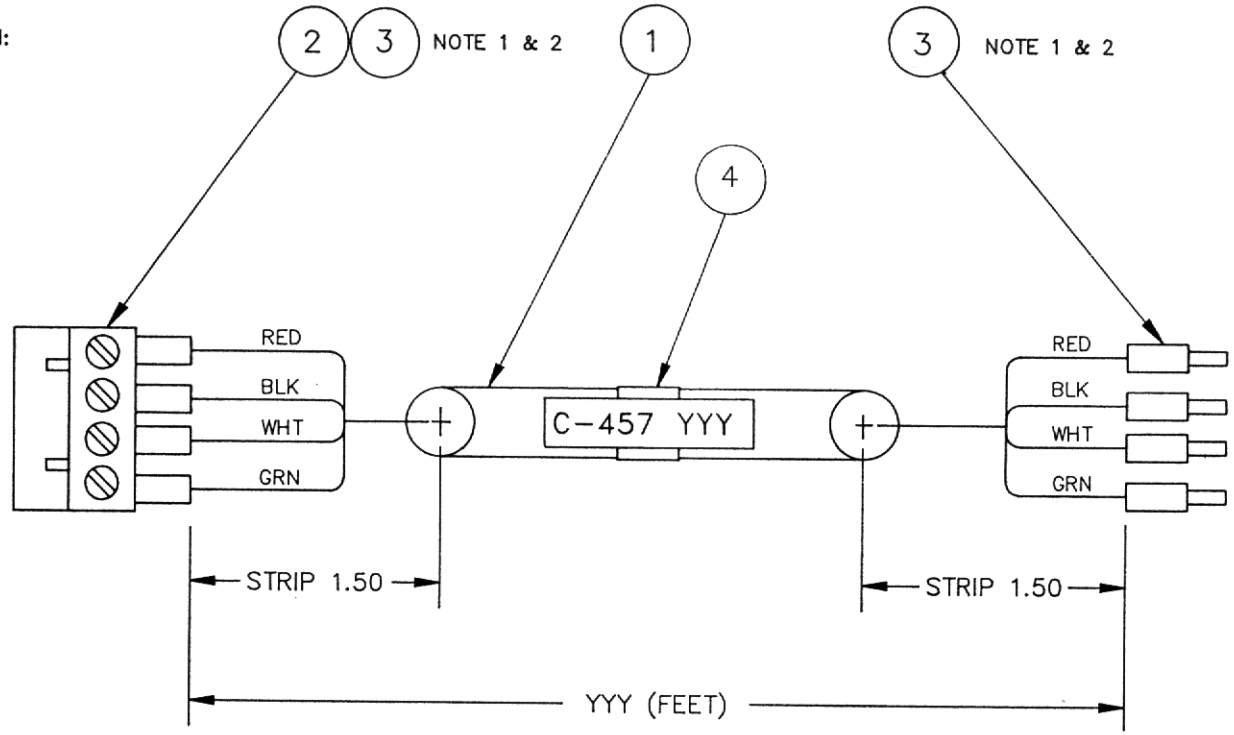
TOLERANCES (EXCEPT AS NOTED)	Industrial Indexing Systems		
DECIMAL ± ——		SCALE ——	DRAWN BY E.BAIER
			APPROVED BY
FRACTIONAL ± ——	TITLE CABLE, COMMAND		
ANGULAR ± ——	DATE 3-28-89	DRAWING NUMBER C-455YYY	

BRUNING 40-22 61035

NOTES:

1. INSTALL ITEM 3 USING WEIDMULLER CRIMP TOOL PZ-4 OR EQUIVALENT.
2. ALTERNATE CONSTRUCTION: STRIP & TIN .25"

DATE	SYM	REVISION RECORD	DR	CK	CK
01/10/91	A	ECN-90-237	EB	JC	
01/7/94	B	ECN-93-423	EB	WS	



INDUSTRIAL INDEXING SYSTEMS, Inc.
626 FISHERS RUN
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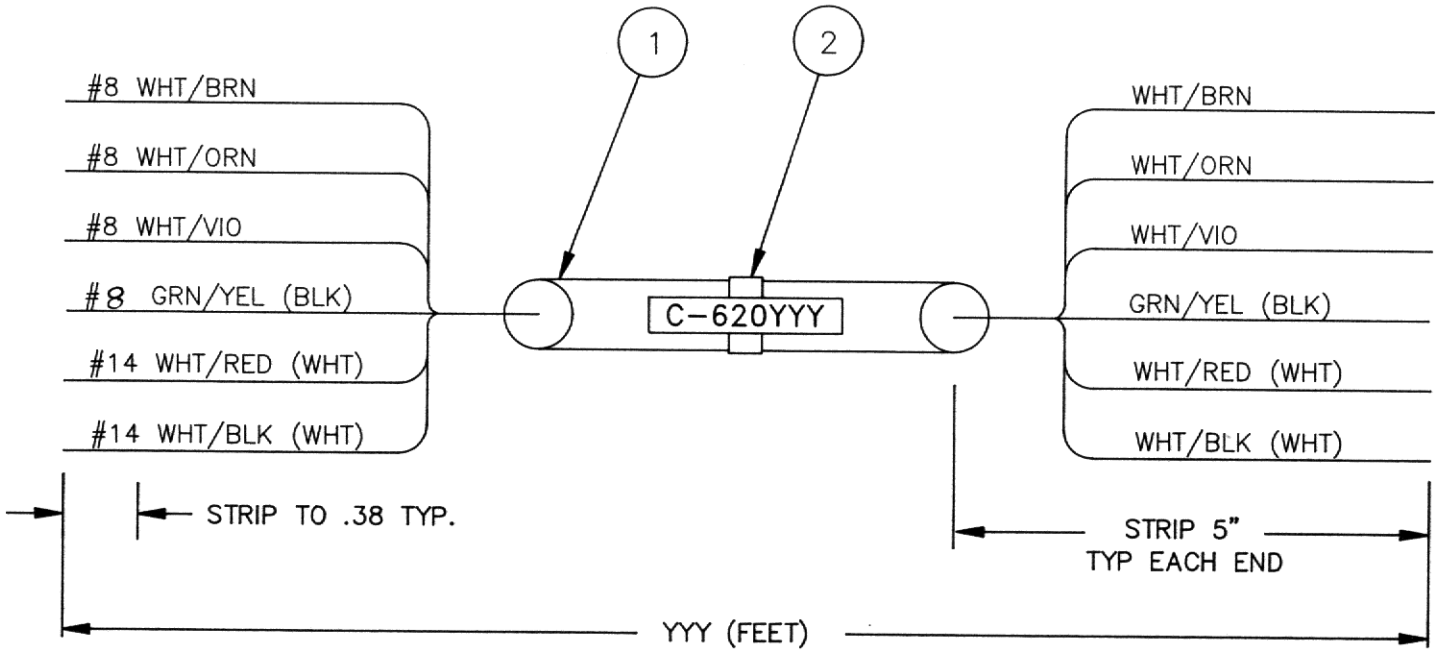
(716) 924-9181 FAX: (716) 924-2169

CHECKED BY / DATE	
APPROVED BY / DATE	
APPROVED BY / DATE	
MATERIAL	----------
FINISH	----------
TITLE	CABLE, COMMAND
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)	
TOLERANCES	X.X± ----- X.XX± ---- X.XXX± --- ANGULAR ± ---
DRAWN BY	CAD/BAIER
AutoCAD FILE LOCATION	G:\CAD\CABLES\C-4XX
DRAWING NUMBER	C-457YYY
B / DATE	01/10/91
SCALE	---
SHEET NO.	1 OF 1
REVISION	B

DATE	SYM	REVISION RECORD	DR	CK	CK
01/9/87	A	ECN-87-0004	RT	WK	
10/88	B	ECN-88-0163	DD	SB	
9/29/93	C	ECN-93-0267	MC	SB	WE



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CHECKED BY W.K.	DATE 1/87
APPROVED BY S.B.	DATE 10/88
APPROVED BY WE	DATE 11/93
MATERIAL ----------	
FINISH ----------	

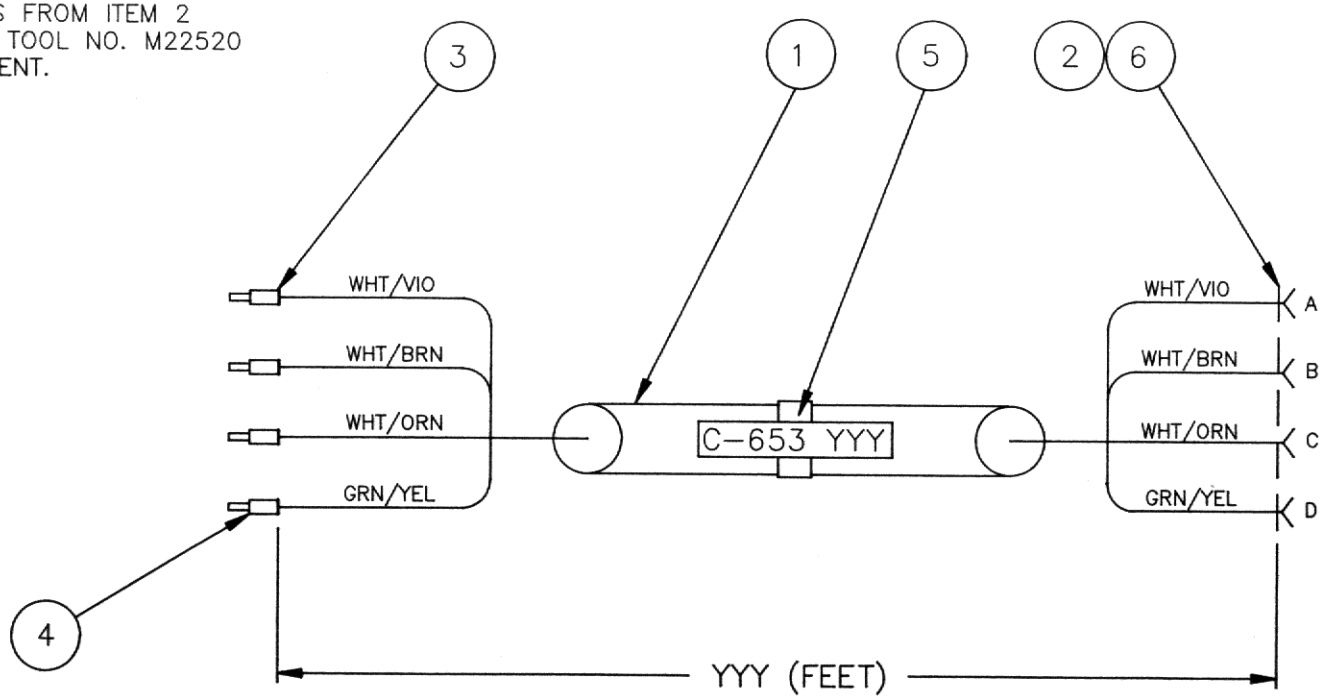
TITLE: CABLE, MOTOR

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)	DRAWN BY RT		DRAWING NUMBER C-620YYY
TOLERANCES: X.X± ----- ANGULAR ± --- ; X.XX± ----- ; X.XXX± ---	AutoCAD FILE LOCATION G:\CAD\CABLES		
B	DATE 1/9/87	SCALE ----	SHEET NO. 1 OF 1 / REVISION C

NOTES:

1. INSTALL ITEMS 3 & 4 USING WEIDMULLER CRIMP TOOL PZ-4 OR EQUIVALENT.
2. ALTERNATE CONSTRUCTION: STRIP & TIN .25"
3. INSTALL PINS FROM ITEM 2 USING DMC TOOL NO. M22520 OR EQUIVALENT.

DATE	SYM	REVISION RECORD	DR	CK	CK
8/14/90	A	ECN-89-0195	EB	JC	JF
9/29/93	B	ECN-93-0267	MC	EB	WE



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CHECKED BY J.C.	DATE 8/90
APPROVED BY J.T.F.	DATE 8/90
APPROVED BY WE	DATE 11/22/97
MATERIAL ----------	
FINISH ----------	

TITLE: CABLE-MOTOR

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)

TOLERANCES: X.X± ----- ANGULAR ± ---; X.XX± ---; X.XXX± ---

DRAWN BY: E. BAIER

AutoCAD FILE LOCATION: G:\CAD\CABLES

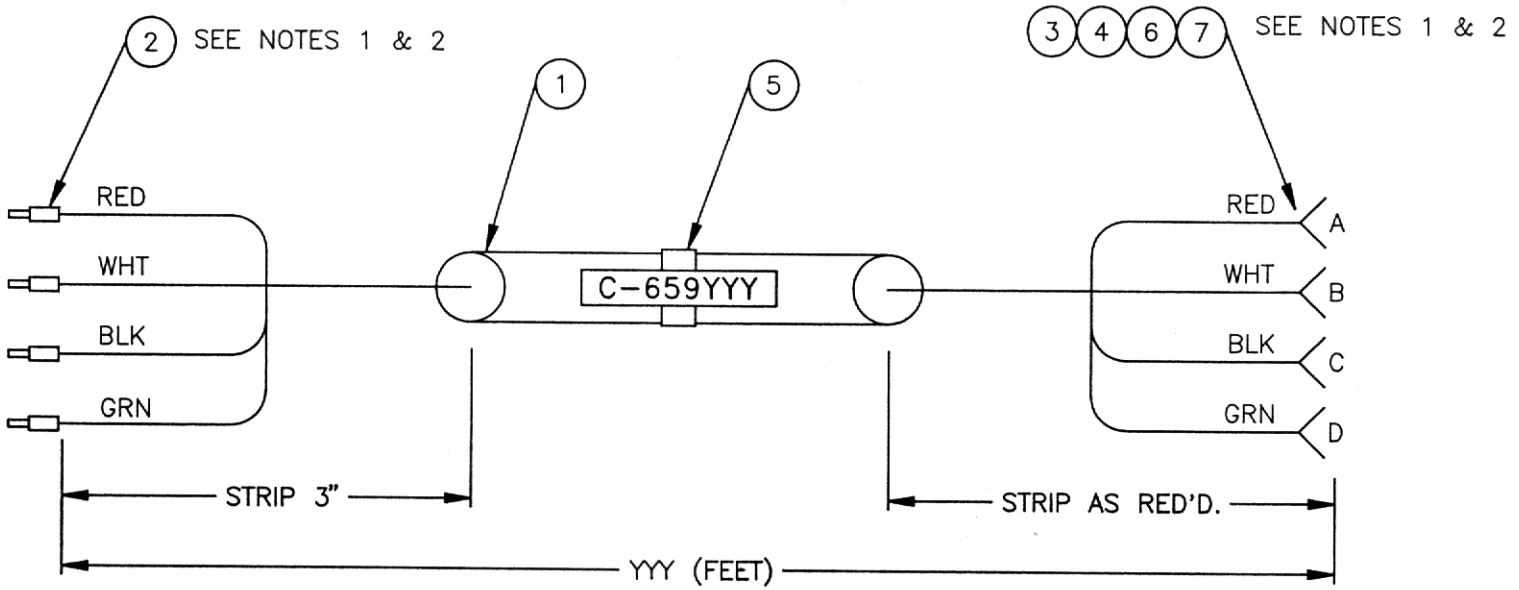
DRAWING NUMBER: C-653YYY

B | DATE 8/15/90 | SCALE --- | SHEET NO. 1 OF 1 | REVISION B

NOTES:

1. INSTALL ITEM 2 USING WEIDMULLER CRIMP TOOL PZ-4 OR EQUIVALENT.
2. ALTERNATE CONSTRUCTION STRIP & TIN .25"

DATE	SYM	REVISION RECORD	DR	CK	CK
12/18/90	A	ECN-90-0221	ME	JTF	
9/29/93	B	ECN-93-0267	MC	[illegible]	[illegible]



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CHECKED BY	E.B.
DATE	12/90
APPROVED BY	J.T.F.
DATE	12/90
APPROVED BY	WEI
DATE	11/93
MATERIAL	---------
FINISH	---------
TITLE	COMMAND CABLE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES (mm)	
TOLERANCES	X.X± ----- X.XX± ---- X.XXX± --- ANGULAR ± ---
DRAWN BY	MIKE E.
AutoCAD FILE LOCATION	G:\CAD\CABLES
DRAWING NUMBER	C-659YYY
B	
DATE	12/18/90
SCALE	----
SHEET NO.	1 OF 1
REVISION	B

NOTES

INDUSTRIAL INDEXING SYSTEMS, INC.
SERIES 5 MOTOR/DRIVE PACKAGES SUMMARY

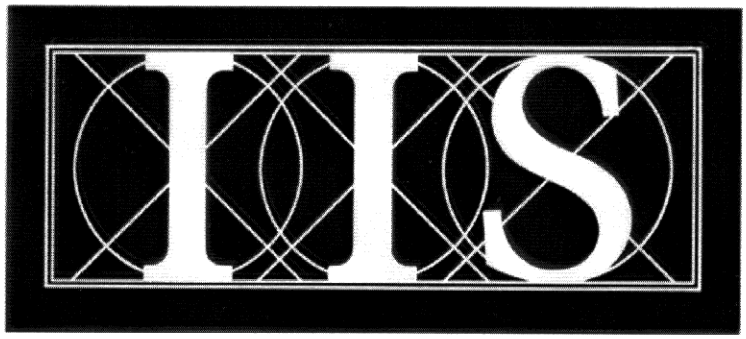
MOTOR DRIVE PART NUMBER	DRIVE NUMBER	MOTOR ASSEMBLY	RATED SPEED (RPM)	RATED TORQUE (LB-FT)	PEAK TORQUE (LB-FT)	PEAK HP	ROTOR INERTIA (LB-FT-SEC^2)	INPUT POWER (WATTS)
MDPAK5-400	RAD02-2009E400	RA22L2-0400R	2250	1.4	4.20	1.80	0.00029	400
MDPAK5-750	RAD02-2017E750	RA22L2-0750R	2250	2.6	7.90	3.40	0.00061	750
MDPAK5-1000	RAD02-2017E1000	RA22L2-1000R	2100	3.5	10.56	4.03	0.00208	1000
MDPAK5-1500	RAD02-2027E1500	RA22L2-1500R	2100	5.7	15.80	5.71	0.00292	1500
MDPAK5-2000	RAD02-2061E2000	RA22L2-2000R	2200	7.0	21.20	8.47	0.00467	2000
MDPAK5-3000	RAD02-2061E3000	RA22L2-3000R	1500	14.0	42.25	8.04	0.00633	3000
MDPAK5-3700	RAD02-2061E3700	RA22L2-3700R	1500	17.3	52.00	9.90	0.00808	3700
MDPAK5-5500	RAD02-2100E5500	RA22L2-5500R	1700	25.8	51.67	12.79	0.02280	5500
MDPAK5-7500	RADO2-2100E7500	RA22L2-7500R	1700	35.2	70.50	17.45	0.02950	7500

MOTOR DRIVE PART NUMBER	DRIVE SIZE (INCHES)			MOTOR SIZE (INCHES [MM])		MOTOR	WEIGHT (LBS)
	HEIGHT	WIDTH	DEPTH	LENGTH	DIAMETER	SHAFT LENGTH x DIAMETER	
MDPAK5-400	11.82	9.06	7.68	8.46	4.72 SQ.	1.18 x .63 [16]	17.00
MDPAK5-750	11.82	9.06	7.68	9.45	5.12 SQ.	1.57 x .87 [22]	25.00
MDPAK5-1000	11.82	9.06	7.68	11.02	5.91 SQ.	1.97 x 1.10 [28]	38.00
MDPAK5-1500	18.10	9.06	9.45	12.60	5.91 SQ.	1.97 x 1.10 [28]	50.00
MDPAK5-2000	18.10	9.06	9.45	13.00	7.09 SQ.	2.76 x 1.26 [32]	66.00
MDPAK5-3000	18.10	9.06	9.45	15.35	7.09 SQ.	2.76 x 1.26 [32]	82.00
MDPAK5-3700	18.10	9.06	9.45	17.32	7.09 SQ.	2.76 x 1.26 [32]	102.00
MDPAK5-5500	22.44	9.06	11.00	18.11	8.66 SQ.	2.76 x 1.50 [38]	151.00
MDPAK5-7500	22.44	9.06	11.00	21.26	8.66 SQ.	2.76 x 1.50 [38]	186.00

INDUSTRIAL INDEXING SYSTEMS, INC.
SERIES 5 POWER SUPPLY PACKAGES SUMMARY

POWER SUPPLY PART NUMBER	OUTPUT POWER (WATTS)	NO. OF AXES	INPUT PHASES	POWER SUPPLY SIZE (INCHES)			TRANSFORMER SIZE (INCHES)			ENCL. PANEL MOUNT	FREE STANDING
				HEIGHT	WIDTH	DEPTH	HEIGHT	WIDTH	DEPTH		
PWRPAK5-1000	1000	N/A	3	N/A	N/A	N/A	11.00	11.00	6.00	X	
PWRPAK5-1500	1500	N/A	3	N/A	N/A	N/A	11.00	11.00	6.00	X	
PWRPAK5-2200	2200	N/A	3	N/A	N/A	N/A	11.00	11.00	6.00	X	
PWRPAK5-2250	2250	N/A	3	N/A	N/A	N/A	21.00	16.00	8.00		X
PWRPAK5-4500	4500	N/A	3	N/A	N/A	N/A	21.00	16.00	8.00		X
PWRPAK5-9000	9000	N/A	3	N/A	N/A	N/A	21.00	20.00	12.00		X
PWRPAK5-15000	15000	N/A	3	N/A	N/A	N/A	27.00	26.00	16.00		X
PWRPAK5-22500	22500	N/A	3	N/A	N/A	N/A	27.00	26.00	16.00		X

IB-14B005



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