MagneTek

DSD 406 / DSD 412
Technical Manual

Revision History

The following table shows all pages that have been revised since the first issue of this manual.

Revision Date	Affected Pages
4/15/94	Initial
3/21/96	Overall revision

Related Documents List

The following publications provide additional information on the DSD 406 / 412 drives. Each is available from MagneTek.

- PCDU Guide TM 6305

Additional copies of this manual can also be ordered by specifying the DSD 406 / 412 Product Guide (TM 6107).

Warranty

Standard products manufactured by MagneTek are warranted to be free from defects in workmanship and material for a period of one year from date of shipment and any products which are defective in workmanship or material will be repaired or replaced, at MagneTek's option, at no charge to the Buyer. Final determination as to whether a product is actually defective rests with MagneTek. The obligation of MagneTek hereunder shall be limited solely to repair or replace, at MagneTek's discretion, products that fall within the foregoing limitations, and shall be conditioned upon receipt by MagneTek of written notice of any alleged defects or deficiency promptly after discovery and within the warranty period, and in the case of components or units purchased by MagneTek, the obligations of MagneTek shall not exceed the settlement that MagneTek is able to obtain from the supplier thereof. No products shall be returned to MagneTek without its prior consent. Products which MagneTek consents to have returned shall be shipped prepaid f.o.b. MagneTek's factory. MagneTek cannot assume responsibility or accept invoices for unauthorized repairs to its components, even though defective. The life of the products of MagneTek depends, to a large extent, upon the usage thereof, and MAGNETEK MAKES NO WARRANTY AS TO FITNESS OF ITS PRODUCTS FOR THE SPECIFIC APPLICATIONS BY THE BUYER NOR AS TO PERIOD OF SERVICE UNLESS MAGNETEK SPECIFICALLY AGREES OTHERWISE IN WRITING AFTER THE PROPOSED USAGE HAS BEEN MADE KNOWN TO IT.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE AND BUYER HEREBY WAIVES ANY AND ALL CLAIMS THEREFORE.

Limitation of Liability

IN NO EVENT SHALL MAGNETEK BE LIABLE FOR LOSS OF PROFIT, INDIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES WHETHER ARISING OUT OF WARRANTY, BREACH OF CONTRACT OR TORT.

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How To Use This Manual

MagneTek has made this product guide an easy to use reference. To help you use this manual, we have provided the following guides:

- The top of each page has an identification of the section. For example, notice that at the top of this page **Introduction 1** appears. This identifies the page as part of Section 1, Introduction. There are four sections in this manual: Introduction, Installation and Start-Up, Operation and Maintenance.

- Each section is organized into one or more major subject headings. These are the main topics covered in that section. You will recognize major subject headings by their distinctive appearances. The next line illustrates an example:

Controls and Indicators

This is an example of a major subject heading from Section 3.

Each major subject heading may have one or more minor topics that are covered. The next line illustrates an example:

Status LEDs

This is a minor topic covered under “Controls and Indicators.”

Each minor topic may have one or more descriptive headings. These identify items covered within the minor topic. The next line illustrates an example:

Ready

This is a descriptive heading covered under “Status LEDs.”

At the bottom of each page is the name of the first major subject heading covered on that page. The page number and revision date are also included. For example, at the bottom of this page, the information indicates that “How to Use This Manual” is the first major subject heading. The revision date indicates the last date the page was changed in any way.

Using the information on the top of the page to find the section, the bottom of the page to find the major subject heading and the left margin to find the minor topics and descriptive headings, you can easily page through the manual to find the information you need.

A table of contents and index are also included. The Table of Contents can be used to locate sections and major topics. The Index is helpful in locating specific terms or topics. A glossary is provided to define terms which may be unfamiliar.

Safety Statements

In addition to notes, the following types of precautionary statements appear in this manual.

IMPORTANT

A statement of conditions which should be observed during drive setup or operation to ensure dependable service.

CAUTION

A statement of conditions which must be observed to prevent undesired equipment faults or degraded drive system performance.

WARNING

A statement of conditions which MUST BE OBSERVED to prevent personal injury or serious equipment damage.

How To Contact MagneTek

For additional information, contact any MagneTek Representative, or Authorized Distributor, or contact the DSD Technical Support Staff at:

MagneTek, Inc.
16555 West Ryerson Road
New Berlin, WI 53151

(800) 541-0939 (414) 782-0200
FAX: (414) 782-1283

DSD Drive Description

The **MicroTrac® DSD** is a complete digital system drive which provides individual drive and system control in one compact package. This manual describes two basic configurations, the DSD 406 (6SCR) Nonregenerative and the DSD 412 (12SCR) Regenerative. All descriptions pertain to both configurations unless specifically noted.

Regeneration Capability

The nature of an electric motor is such that, if more torque is applied to the motor by the load than is applied to the load by the motor, the motor will act as an electrical generator, producing an electrical current. This phenomenon, called regeneration, occurs anytime the speed of the motor is above the reference (or preset) speed, sometimes referred to as an "overhauling load" condition. A regenerative drive, such as the DSD 412, has the capability to feed the electrical power generated by the motor back into the supply mains. Also referred to as four-quadrant operation, it is this capability which requires that the DSD 412 contain a total of 12 SCRs, rather than the six included in the two-quadrant, Nonregenerative DSD 406.

Flexibility

The drive uses two microprocessors, one for the Power Conversion Unit circuitry, one for the Drive Control Unit circuitry, and is totally software configurable to the application through a high level language. This provides complete flexibility without having to make hardware adjustments. Interface to other equipment is provided with Local Input/Output (I/O) or a high speed Local Area Network. Use of the MicroTrac Local Area Network (LAN) means that a single coaxial cable eliminates multiple conductor cables and provides high noise immunity.

Control

Extensive diagnostics and setup capability are provided through two Control/Display Units. The Standard Control/Display Unit (SCDU) is mounted on the Drive Control PCB and consists of a 4-1/2 digit numeric LED display, four push buttons and LEDs. The SCDU can be used for all setup functions and many diagnostics. The Portable Control/Display Unit (PCDU) is an optional hand-held device that can be plugged into any DSD drive and used for all the same functions as the SCDU plus some advanced diagnostics. The PCDU has two lines of sixteen alphanumeric characters and a thirty-key keypad.

Accuracy

The distributed control architecture of the DSD systems means that each drive performs its own regulation calculations synchronized to a common high accuracy crystal master. Thus even minute crystal drift will not affect multiple drive tracking. This allows a DSD system to maintain the drift between sections at 0.00% steady state. The fully digital nature of the regulation means that an individual drive can maintain a 0.00% average difference between set and actual speed from no-load to full-load when using digital tachometer speed feedback. Digital setup and performance assure exact process line and finished product duplication shift to shift and month to month.

Useability

Speeds, tensions, ratios, draws, limits, ranges, alarms, and other control parameters can be set as percentages or exact numerical values. Parameters are entered and displayed in common understandable units. The drive can be completely setup prior to actual running and changes can be made during operation. Keypad entry of changed parameters, protected memory, and factory default values allow the operator to modify data with minimum risk to the process.

Characteristics

The DSD is available for general use as a complete panel mounted enclosed drive (NEMA 1 or NEMA 12).

Authorized system integrators can also purchase the drive as a power cube. The power cube is designed for mounting in a cabinet; space allowances for air circulation, additional components, outgoing terminals, and wire bends must be provided.

The enclosed drive consists of the DSD power cube mounted on a panel with a skirted NEMA 1 or NEMA 12 enclosure, with added fused control transformer for 115V supply, armature loop contactor, and field wiring terminals. An input circuit breaker with through-the-door operator is available as an option.

The DSD drive is designed to be connected to a three wire ungrounded power system, or a four wire grounded or ungrounded power system.

PAC Language Programming

All DSD drives are programmed using MagneTek's PAC language. The drive programming consists of two portions; the standard control programs shared by all DSD drives and the application specific programming which defines how the drive operates in the particular application. The latter portion of DSD drive programs are developed based on the PAC language, wherein different drive functions are represented by interconnected graphical symbols, called PAC blocks, much like an electronic schematic. This provides the ability to quickly modify programs, along with an assurance of program repeatability and stability.

Table 1. **Drive Ratings and Specifications**

Ratings	Protective Features
• 3.3 - 206 Amps • 3 Phase, 48-62 Hz • 1.0 Service Factor • 150% full load current for one minute • 200% full load current for 10 seconds	• Programmed memory protection • Self-protected control power supply • Fast phase-back of current before loop contactor opens • Contact interlock for E-Stop • I^2t motor overload protection • AC line current limiting fuses • DC bus fuse (DSD 412 only) • Instantaneous over-current protection • Phase loss protection • Input line monitoring • Phase sequence insensitive • dv/dt protection (snubbers) • 1400 Peak Reverse Voltage thyristors • Field current economizer and loss protection • Tachometer monitoring and loss protection • Heat sink thermostat • Automatic test of power circuit upon power-up • Control power supply loss detection • Isolated I/O and grounded electronics
Basic Drive Specifications	
• Full-wave six-pulse SCR control • Regulation (of set speed) to 0.00% with digital tachometer speed feedback • Current regulated shunt field • Capable of constant HP operation (requires tachometer) • Self-adapting to incoming line power of 230 or 460 VAC.	
Service Conditions	
• Line voltage 230 or 460 Vac, 3 phase, ±10% of nominal setting • 115 volt, 1 phase control power from separate source • Frequency 48-62 Hz • Incoming line impedance range 2%-10% of rated • Operating Temperature 0-45° C (55° C max at DSD chassis) • Altitude to 3300 feet above sea level • Relative Humidity 95% (noncondensing)	

System Considerations

In order to operate in a system application, the DSD drive may be used with other MagneTek devices with which it will communicate by means of the MicroTrac Local Area Network (LAN). Refer to Figure 1 for a typical DSD System.

Each of the following remote devices (board or assembly) is described in detail in a separate User Reference Sheet.

- **Remote Display Controller LAN Node PCB (RDC) –** This board provides a means for the DSD system to have system operating parameters displayed

at locations remote from the DSD drive. The RDC communicates with the drive through the LAN. A single RDC can support up to 31 Remote Display Units (RDUs). By means of a Portable Control/Display Unit (PCDU), the RDC allows the selected display for each RDU to be changed at anytime.

- **Remote Display Unit (RDU) –** Designed for mounting in a panel cutout, the RDU provides a two-line LED display (16 character alphanumeric, and 5-1/2 digit numeric). It constitutes a terminal with the information on its display transmitted to it by a Remote Display Controller LAN Node PCB (RDC).
- **Remote Keyboard Assembly –** Designed for mounting on a panel with or near a Remote Display Unit (RDU), the Remote Keyboard allows initiation of RDU display changes without the need for a Portable Control/Display Unit (PCDU) plugged into the Remote Display Controller LAN Node PCB (RDC).
- **Remote I/O [Input/Output] Controller LAN Node PCB (RIO) –** This board provides a means for the DSD system to have inputs or outputs at locations remote from the DSD drive. The RIO communicates with the drive through the LAN. A single RIO can support up to 6 Remote I/O boards, using any combination of the following three available types.
- **Remote Logic I/O PCB (LOGIO) –** This board provides isolated and non isolated remote logic signal input/output capability for the DSD system. It is connected to a Remote I/O Controller LAN Node PCB (RIO) for communication with the DSD drive.
- **Remote Analog I/O PCB (ANIO) –** This board provides isolated and non isolated remote analog signal input/output capability for the DSD system. It is connected to a Remote I/O Controller LAN Node PCB (RIO) for communication with the DSD drive.
- **Remote Thumbwheel Switch I/O PCB (TWIO) –** This board provides remote thumbwheel switch input/output capability for the DSD system. It can support up to 9 Thumbwheel Switch Assemblies. This board is connected to a Remote I/O Controller LAN Node PCB (RIO) for communication with the DSD drive.
- **Remote Programmable Logic Controller (PLC) Interface –** Available for PLCs from many major manufacturers. It allows bi-directional communication via the MicroTrac LAN between DSD drives and the PLC. Both logic and numeric data can be transferred.
- **Remote Power Supply –** The Remote Power Supply produces control level voltages for use by a Remote LAN Node PCB or a Remote Display Unit.
- **Remote Serial Communication Controller LAN Node PCB (RSC) –** This board provides a means for the DSD system to have input from or output to other equipment that uses RS-232 serial communication. The RSC communicates with the DSD drive through the LAN.

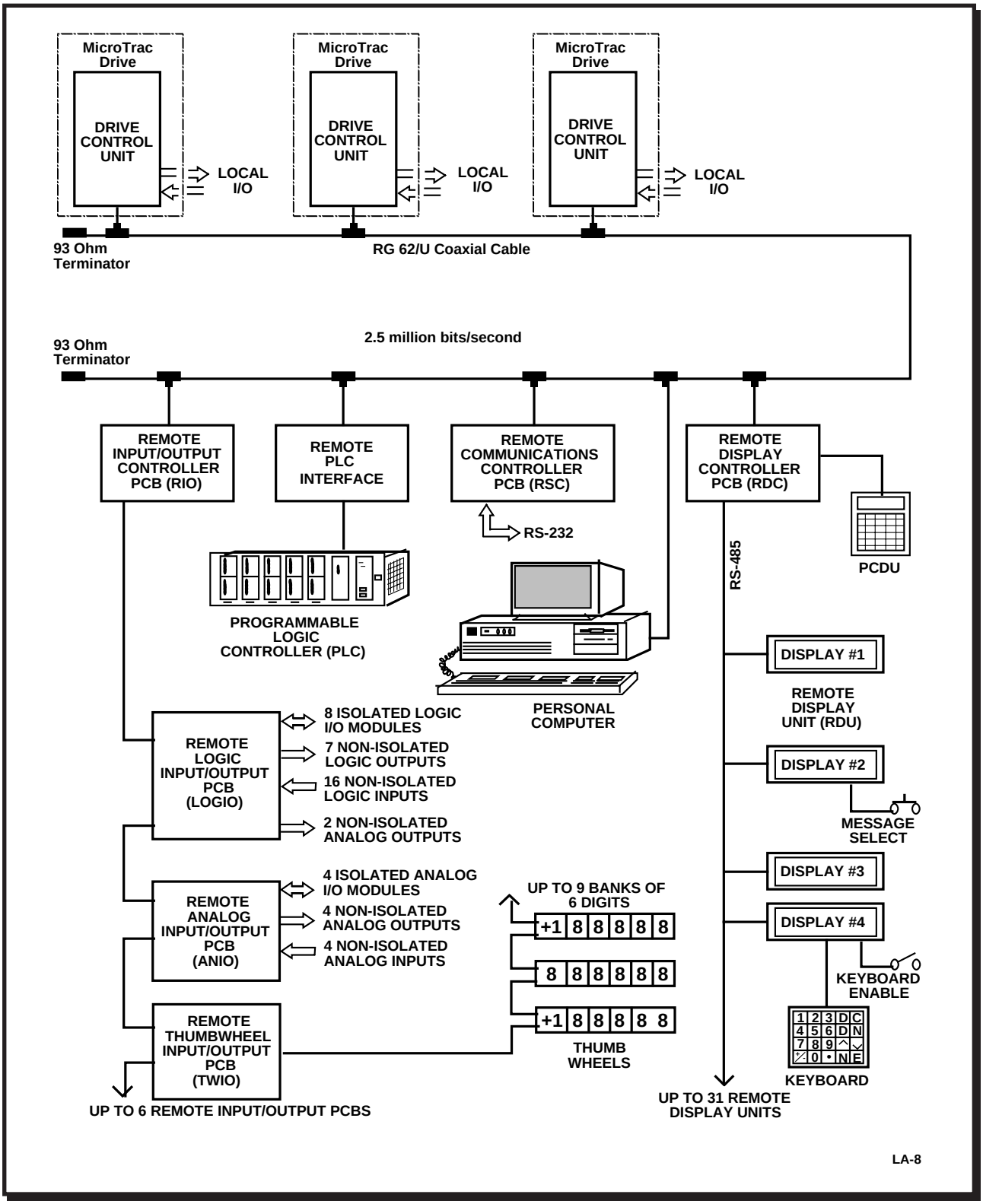


Figure 1. ***Typical MicroTrac DSD System Diagram***

The "Installation and Start-Up" section describes and illustrates the following:

- How to select the site to install your DSD drive.
- How to mount your DSD drive.
- How to connect your DSD drive to incoming power and the motor .
- How to start-up the system after it is installed.

Pre-Installation Considerations

The DSD drive is air cooled. The lowest HP rated units are cooled by convection; all other units are equipped with a fan to ensure adequate air flow. Select a site for installing the drive which is clean and well ventilated. Maintenance will be minimized if the drive is located in a clean atmosphere. The standard drive is designed for vertical mounting.

Receipt of Shipment

All equipment is fully tested at the factory. Any damage or shortages evident when the equipment is received must be reported immediately to the commercial carrier who transported the equipment. Assistance, if required, is available from your MagneTek representative. Always refer to the order number, equipment description, and serial number when contacting MagneTek.

Storage

For long periods of storage, equipment should be covered to prevent corrosion and should be placed in a clean, dry location. If possible, equipment should be stored in its original crating. Periodic inspection should be made to ensure that the equipment is dry and that no condensation has accumulated. The equipment warranty does not cover damage due to improper storage.

Unpacking

Remove the protective shipping material from around the equipment. Remove all packing material. Unbolt the equipment from its crate. Inspect for loose wiring. Make sure that all contact wedges and other shipping devices have been removed.

CAUTION

The DSD Drive Control PCB has electrostatic sensitive components. You must follow Electrostatic Discharge (ESD) procedures to protect the components.

Re-Packing

The drive should be bolted in a crate which provides at least 2 inches clearance. The drive should then be wrapped in polyethylene and covered with wax impregnated double walled # 350 corrugation and crated. Assistance, if required, is available from your MagneTek representative.

Physical Installation

Attach the drive to a cabinet panel or other vertical structure using the mounting holes provided at the back of the drive (refer to Figure 2, 3 or 3.1 for dimensions and mounting hole locations). Allow six inches top and bottom and two inches at sides for free air circulation. For either style, hinged door swing-out clearance is the same as the width dimension. Ensure that the unit is level.

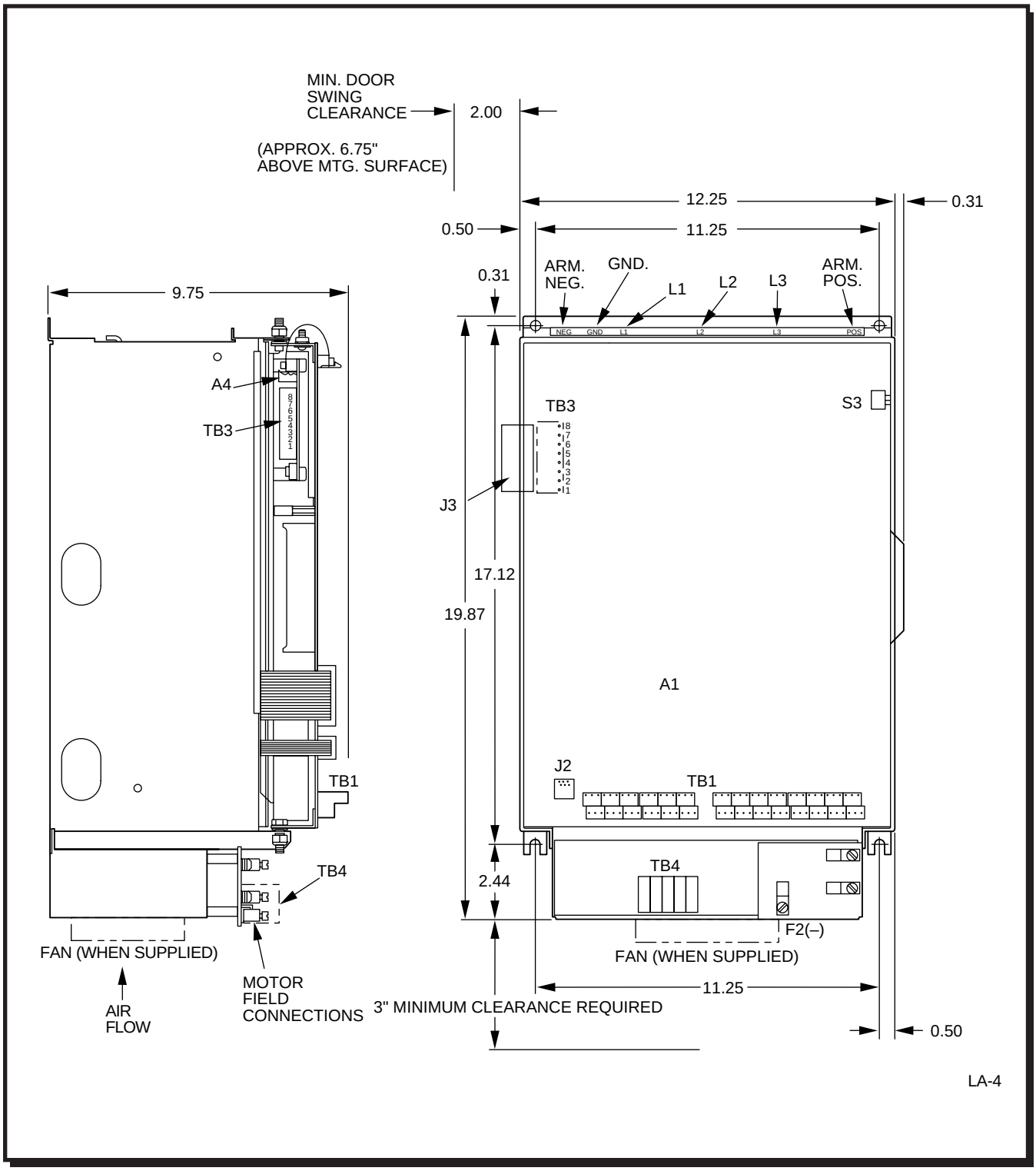


Figure 2. ***Dimensions and Mounting Holes***
DSD 406/412
1-60 Hp Versions

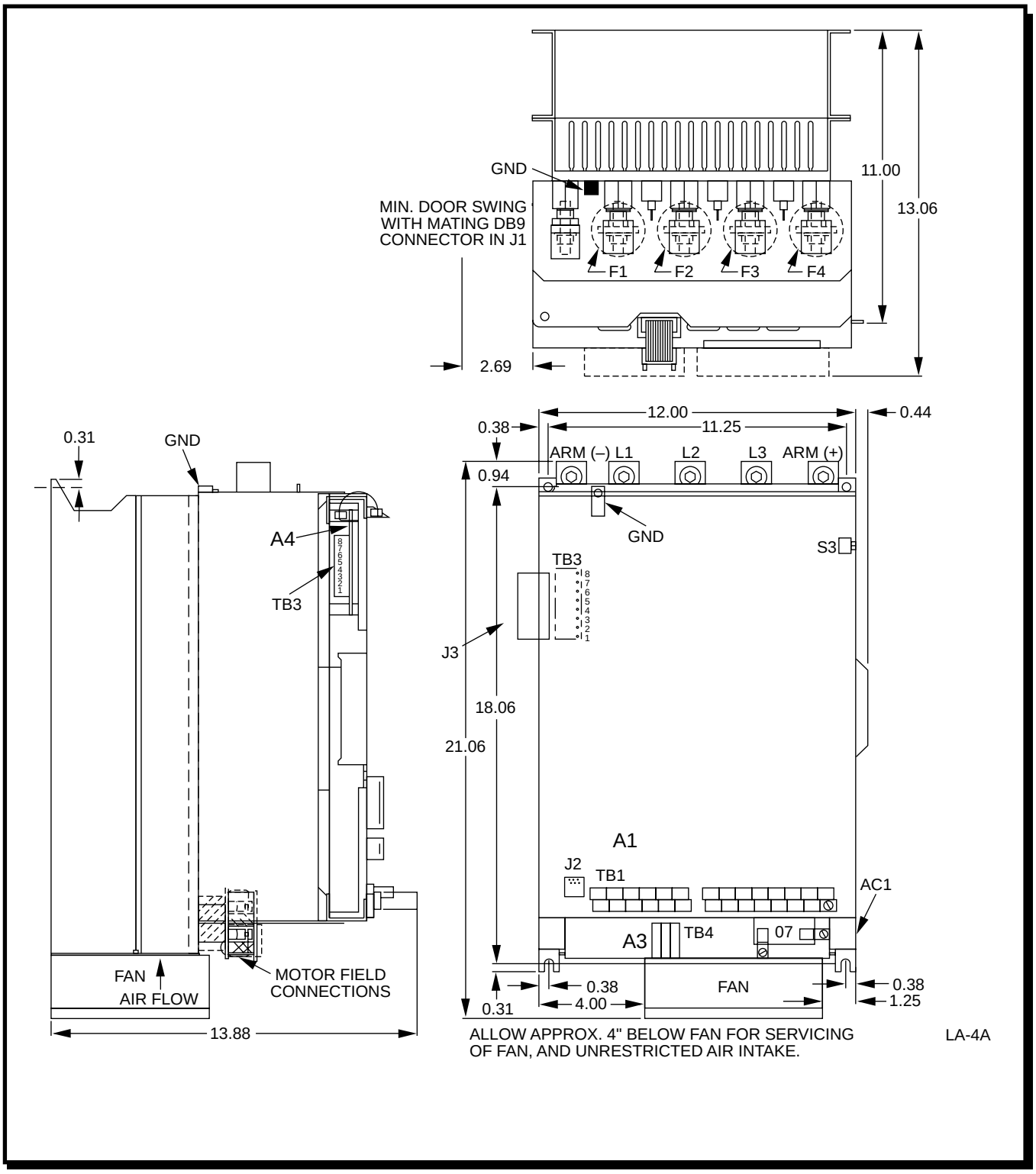


Figure 3. ***Dimensions and Mounting Holes***
DSD 406/412
75 - 125 Hp Versions

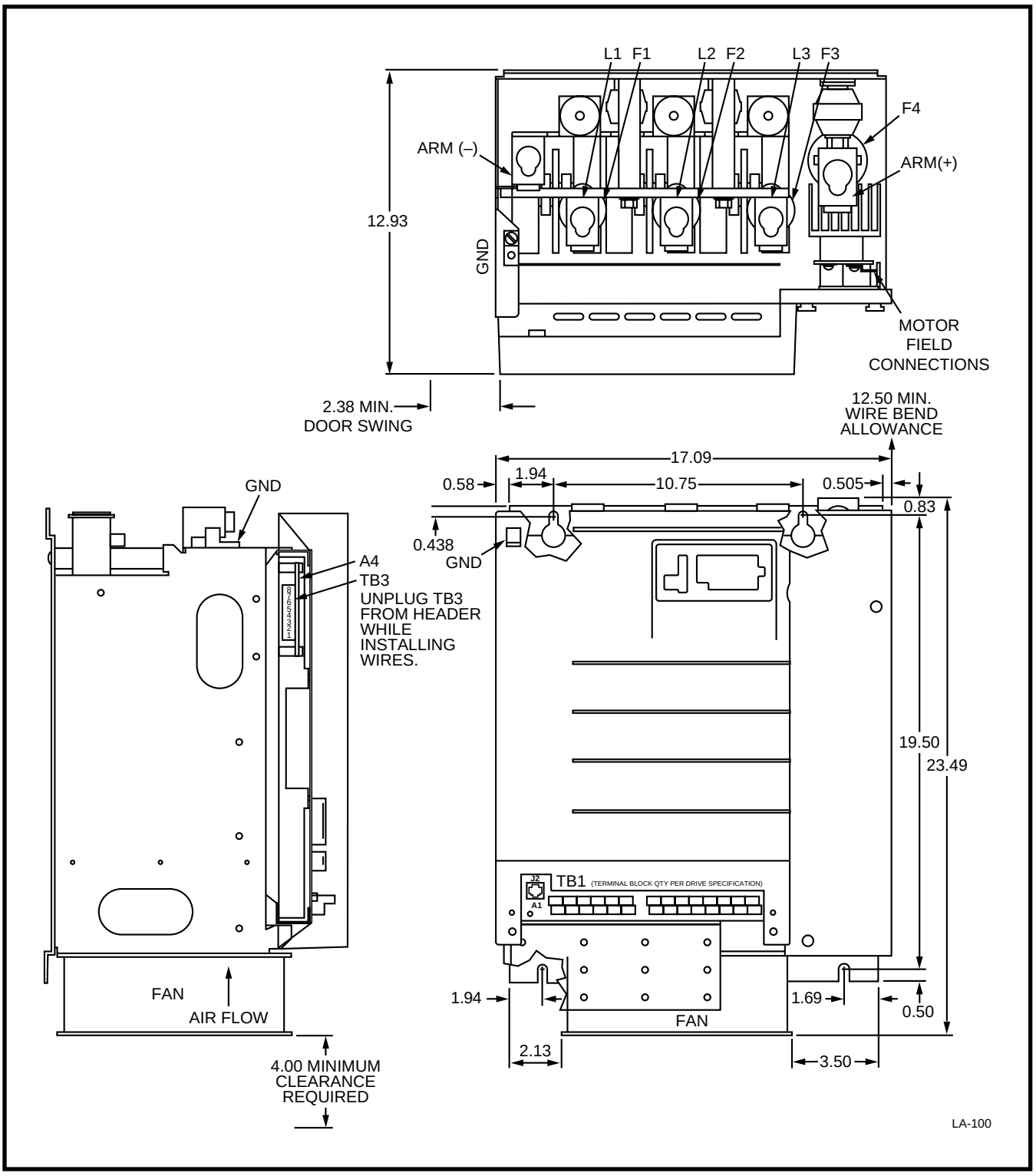


Figure 3.1. ***Dimensions and Mounting Holes***
DSD 412
150-200 Hp Versions

Electrical Hook-Up

Ensure that wire size and disconnect devices conform to the installation contractor's drawings and to all applicable codes.

- Although the three phase input power line is fuse protected internal to the drive, it is recommended to provide branch circuit protection by means of a circuit breaker in accordance with the National Electrical Code, local codes and with a rating of not less than 5,000 rms Symmetrical Amperes and 600 Volts for 2 to 25 Hp rated drives or 10,000 rms Symmetrical Amperes and 600 volts for 30 to 60 Hp rated drives.

- Electronic overload protection is provided as part of the standard DSD product. It si electronically timed and will shut down the drive along a time/output current curve which provides shutdown at 60 seconds at 150% or 10 seconds at 200% of rated output current. An overload relay may be added external to the drive in accordance with the National Electrical Code and local codes for additional protection.

- Main Circuit Input/Output Wire Sizing:

  L1-3: Using 600V vinyl-sheathed wire per the following table.

Drive Hp	Recommended Wire Gauge (Copper Only)		Torque (in-lbs)
	60°C	75°C	
2	14	14	35
3	14	14	35
5	14	14	35
7	8	10	40 - 35 *
10	8	10	40 - 35 *
15	6	8	45 - 40 *
20	6	8	45 - 40 *
25	4	4	45
30	4	4	45
40		1	150
50		1	150
60		1/0	180
75		3/0	250
100		3/0	250
125		250 MCM	325
150		600 MCM	375
200		600 MCM	375

* Torque per wire gauge.

ARM (–): Using 600V vinyl-sheathed wire per the following table.

Drive Hp	Recommended Wire Gauge (Copper Only)			Torque (in-lbs)
	60°C	75°C	90°C	
2	14	14		35
3	14	14		35
5	14	14		35
7	6	8		45 - 40 *
10	6	8		45 - 40 *
15	4	4		45
20	4	4		45
25		3		50
30		3		50
40		1/0		50
50		1/0		50
60		3/0		50
75		250 MCM		325
100		250 MCM		325
125		350 MCM		325
150		500 MCM		375
200			750 MCM	375

* Torque per wire gauge.

ARM (+): Using 600V vinyl-sheathed wire per the following table.

Drive Hp	Recommended Wire Gauge (Copper Only)			Torque (in-lbs)
	60°C	75°C	90°C	
2	14	14		35
3	14	14		35
5	14	14		35
7	6	8		45 - 40 *
10	6	8		45 - 40 *
15	4	4		45
20	4	4		45
25		3		50
30		3		50
40		1/0		180
50		1/0		180
60		3/0		250
75		250 MCM		325
100		250 MCM		325
125		350 MCM		325
150		500 MCM		375
200			700 MCM	375

* Torque per wire gauge.

- Field Current Wire Sizing: The recommended conductor for field current ratings between 10.0 Ampere and 16.0 Ampere is 12 AWG. The recommended conductor for field current ratings below 10.0 AMpere is 14 AWG. use 600 V vinyl-sheathed 105°C wire or equivalent. The recommended torques on the field lugs for 14-10 AWG is 25 in-lbs.

- GND: Recommended conductor size, 2 AWG 600 V vinyl-sheathed for COPPER wire, 1/0 AWG 600 V vinyl-sheathed for ALUMINUM OR COPPER CLAD ALUMINUM wire. Recommended torque on the GND lug is 50 in-lbs.

- Control Wire Sizing:

  TB1: Recommended conductor size, 22-18 AWG 300 V 105°C vinyl-sheathed wire. Recommended torque is 3.4 in-lbs.

  TB3: Recommended conductor size, < 12 AWG 300 V 105°C vinyl-sheathed wire. Recommended torque is 5 in-lbs.

  TB1: Recommended conductor size, 14 AWG 300 V 105°C vinyl-sheathed wire. Recommended torque is 3.4 in-lbs.

Observe the following when wiring:

- Separate the leads used for speed reference, feedback, and other low level signals from those used for the motor armature, field and AC power. Do not run these two groups in the same conduit or wire trough.

- Provide shielded and twisted leads as indicated on the Schematic and/or Interconnection Diagrams. Connect all shields on shielded wire to system common (not ground) on one end only. Twisted shielded pair wire should be used for long runs. (Refer to Figure 4 for proper cable preparation.)

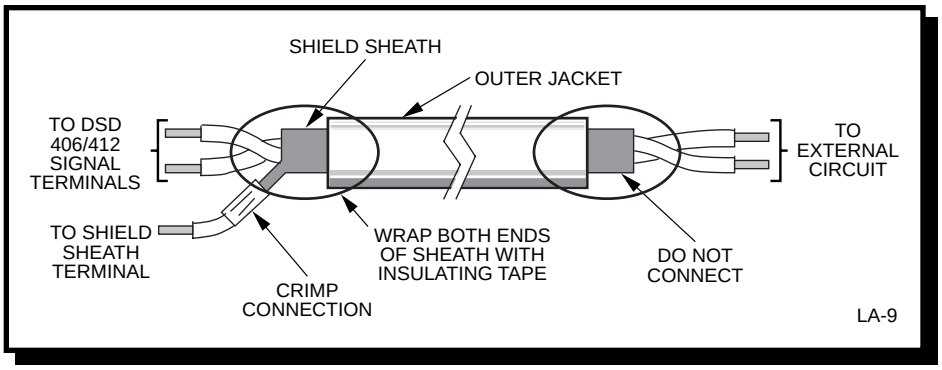


Figure 4. ***Shield Sheath Termination***

- If the DSD drive is being used in a system application, use a BNC "T" connector to connect LAN (Local Area Network) coaxial cable to J3 on the DSD Drive Control PCB.

- The coaxial cable must ultimately be terminated at both ends by a 93 ohm termination resistor. (MagneTek part number 05P00034-0586)

For a NEMA 1 or open panel mounted drive, refer to the equipment Interconnection Diagram for detailed wiring information.

WARNING

The external COAST STOP circuit shown on the Schematic Diagram MUST BE WIRED to the drive as a safety consideration in case of microprocessor failure.

If only a power cube was ordered, the following connections need to be made (refer to Figures 5 and 6 for location of terminating points on drives rated up to 330 Amps):

- ❑ On units rated at 206A armature current (206A Iarm) or less, connect the three phases of the line from the load side of the isolation transformer or input circuit breaker to fuses F1, F2, and F3 (marked L1, L2, and L3). (Refer to Figure 5.) Phase rotation is not important.

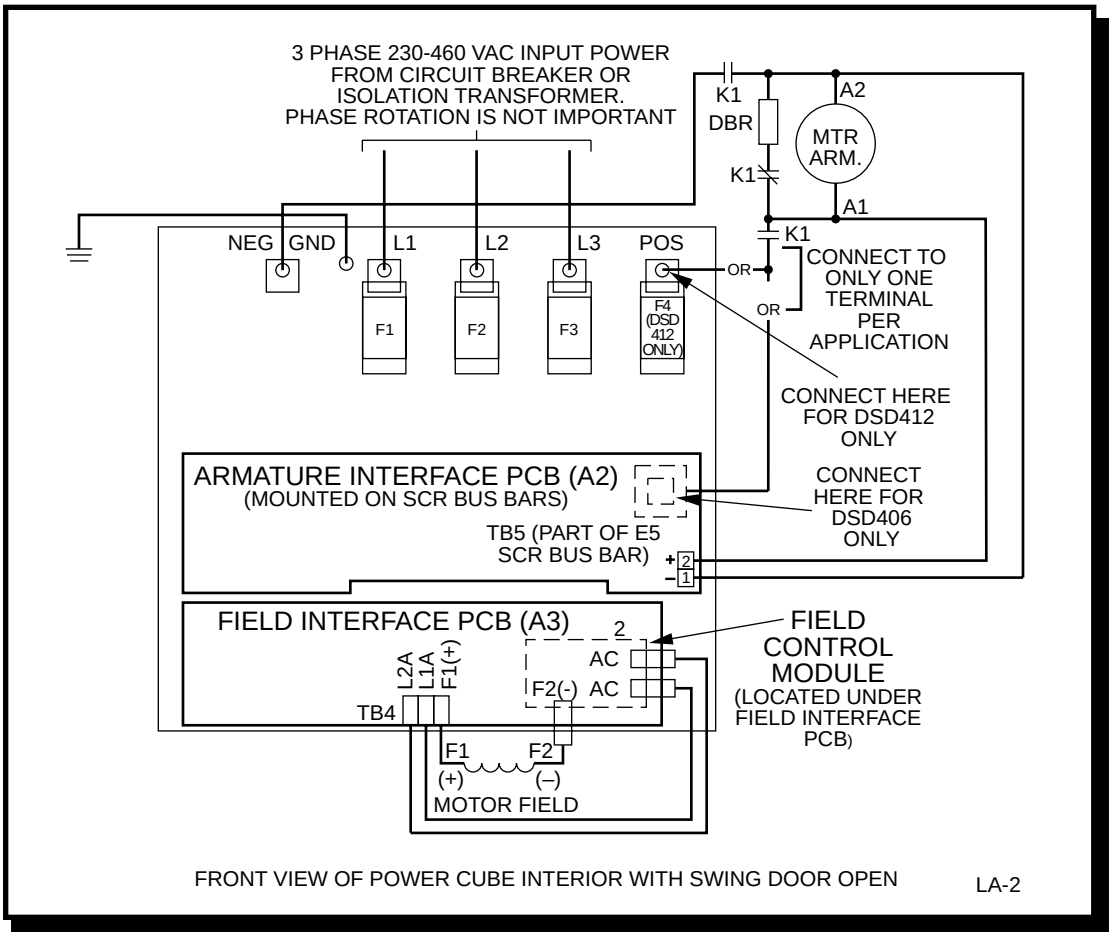


Figure 5. ***Basic Connections for DSD Power Cube – Ratings up to 206 Amps***

- ❑ On units rated 206A Iarm or less, connect the motor armature A1 lead through contactor N.O. contact to fuse F4 (in a DSD 412) or terminal E5 (in a DSD 406). (Refer to Figure 5.)

- ❑ On units rated at 206A Iarm or less, connect the motor armature A2 lead through armature contactor N.O. contact to terminal 'NEG'. (Refer to Figure 5.)

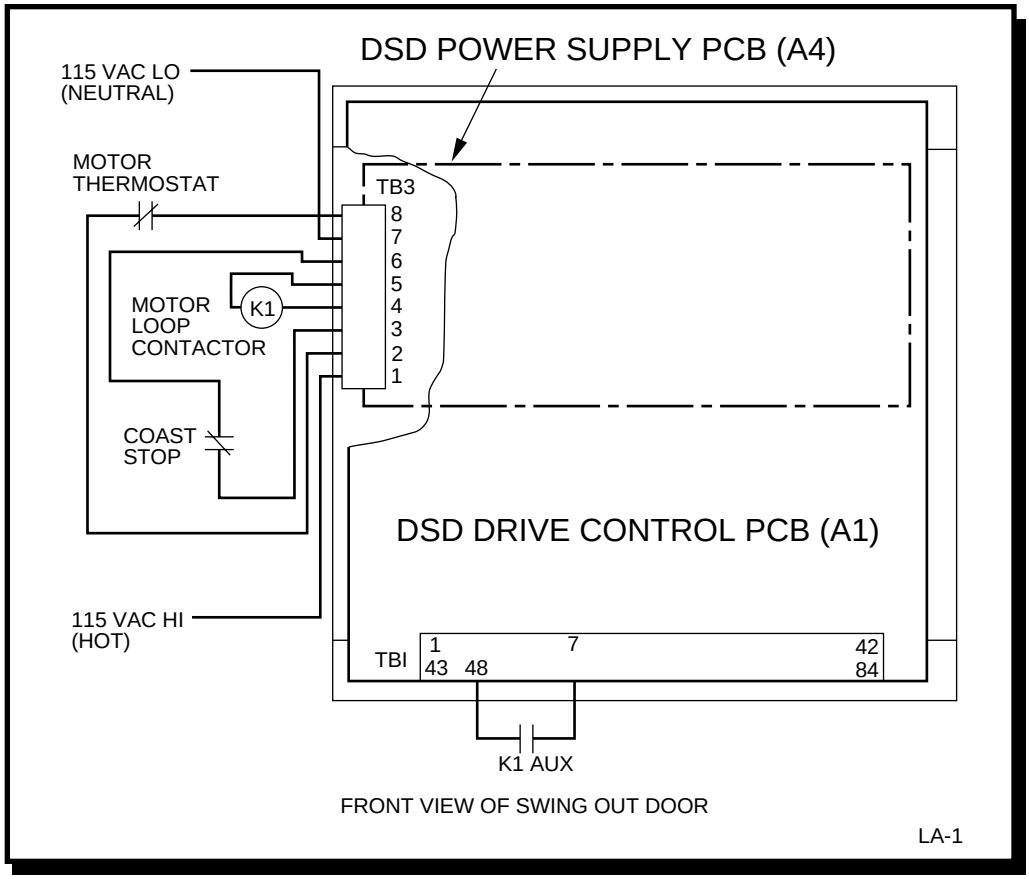


Figure 6. ***Connections to TB3 and TB1 DSD Power Cube – Ratings up to 206 Amps***

- ❑ On units rated at 206A or less, connect the motor field lead F1 (+) to A3TB4(F1+), and motor field lead F2 (-) to Field Control Module (F2–). (Refer to Figure 5.)

- ❑ On units rated at 206A Iarm or less, connect armature voltage sensing lead (A1) to Armature Interface PCB(A2) TB5-2(+), and connect armature voltage sensing lead (A2) to Armature Interface PCB TB5-1(–). (Refer to Figure 5.)

- ❑ Connect 115 VAC control power to the DSD Power Supply PCB(A4), TB3-1 (Hot) and (A4)TB3-7 (Neutral). This source must be rated at 250 VA or greater. (Refer to Figure 6.)

- ❑ Connect the armature (motor loop) contactor coil to DSD Power Supply PCB, (A4)TB3-4 and (A4)TB3-5. (Refer to Figure 6.)

- ❑ An auxiliary 10ma, 24VDC, low power, normally open (N.O.) contact from the armature (motor loop) contactor must be connected to DSD Drive Control PCB, (A1)TB1-48 and (A1)TB1-7, for the drive to operate. (Refer to Figure 6.)

- ❑ The Coast Stop push button (maintained, 10ma, 24VDC, low power), MUST BE CONNECTED to the DSD Power Supply PCB, (A4)TB3-3 and (A4) TB3-6. (Refer to Figure 6.)

- ❑ Connect a grounding wire from the ground pole to the ground terminal provided. The ground terminal is marked GND, and is located near the power input and output terminals.

- ❑ Where several units are used side by side, all units should be grounded directly to the ground pole. However, it is permissible to connect all the ground terminals in series and ground only one unit to the ground pole (refer to Figure 7). DO NOT FORM A LOOP WITH THE GROUND WIRES.

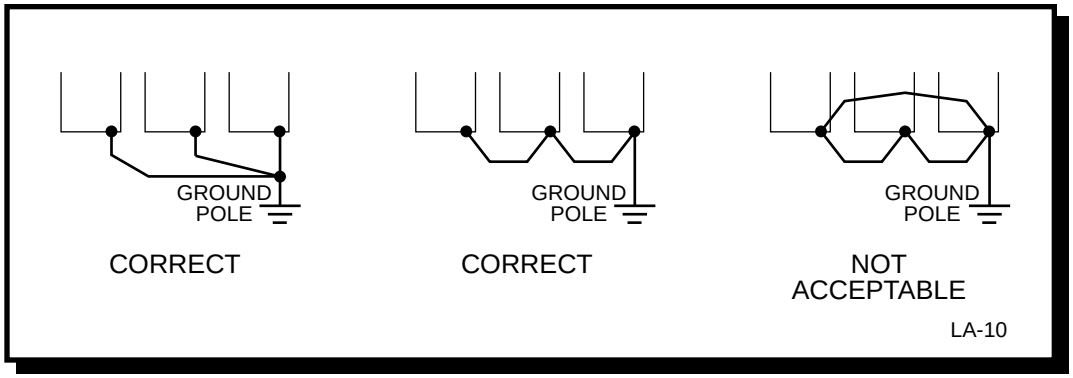


Figure 7. ***Grounding of Multiple Units***

- ❑ If dynamic braking resistors (DBR) are to be used, connect across motor armature in series with loop contactor N.C. contact. (See Figure 5.)

Use of An Analog Tachometer

The DSD 406 / 412 has provisions for an analog tachometer input at TB1 terminals 22 and 23. Either a DC or AC tachometer may be used as selected in the PAC program. The hardware circuitry is designed for 75-120 volts DC or 50-85 volts AC of nominal input at rated top speed. For best performance, it is recommended that a 50 volts per 1,000 rpm DC tachometer be used with 1750 or 2300 rpm motors.

CAUTION

The analog tachometer input channel may saturate if input voltages exceed 150 volts DC or 106 volts AC at terminal 23. This may cause loss of drive control and a drive speed run-away or component damage.

If higher tachometer voltages are required, add an external resistor in series with the tachometer wiring signal at terminal 23. Use 107 Kohms (±1%, 1/2 watt) for each additional 100 volts expected signal. [For example, add a 107 Kohm, 1%, 1/2 watt resistor in series with the tachometer wire at terminal 23 if a 100 volts per 1,000 rpm DC tach is used with 1750 or 2300 rpm motors.]

Pre-Power Check

IMPORTANT

In order to produce output to a motor, the power cube may also need input and output signal connections for Local I/O. See Schematic and/or Interconnection Diagrams for specific connections.

CAUTION

To prevent damage to the drive, the following checks must be performed before applying the input power.

- ❑ Inspect all equipment for signs of damage, loose connections, or other related problem areas.
- ❑ Ensure the three phase line voltage is within +10% of the nominal input voltage range of 230/460 VAC. Also verify that frequency is correct for the drive system. Note that the drive is not sensitive to phase sequence. Input power specifications are contained on the drive nameplate or the drive system Schematic Diagram.
- ❑ Remove all shipping devices and relay wedges. Manually operate all contactors and relays to ensure that they move freely.

Drive Start-Up

❑ Ensure that all electrical connections are secure.

❑ Ensure that all transformers are connected for proper voltage according to the drive system Schematic Diagram.

❑ Attach a DVM across the 115 VAC control power, at transformer T1 secondary terminals X1 and X2.

❑ Apply the three phase power and verify that the control power is between 103 VAC and 126 VAC as read on the DVM. Then press the RESET push button on the front of the power cube, and observe the “Drive power-up sequence” as described below.

NOTE: The "Drive Power-Up Sequence" is also described in the Operation section of this manual under “Start-Up Operation”. If using upload/download capabilities, please refer to DSD 406/412 Upload/Download procedure in the Operation section.

❑ The “Drive Power-Up Sequence” can be observed by monitoring the Standard Control/Display Unit (SCDU) on the front of the power cube.

❶ First, all of the segments on the digital LED display and all of the LEDs will light for about one second.

❷ Then the LEDs and display extinguish and the drive will perform internal checks.

❸ If the drive passes the self-test, then the READY LED will light and the SCDU will display 'P-UP' to indicate a proper power-up.

Displays other than those mentioned above may occur. If abnormal display conditions occur, the following actions maybe necessary to correct the situation:

- If no digits or LEDs ever light up, check for proper voltage between the 115 VAC control power lines, or for blown 115 VAC control power fuses, or for a defective control voltage power supply in the power cube.
- If horizontal segment(s) of the SCDU display are lit, then one or more phases of the three phase power are missing. Check the three phase power fuses. See Section 3, Start-Up Operation, for more detailed information about this test.

- If the FAULT LED lights and a fault code appears on the SCDU, then refer to the Fault/Error Codes List in Section 4, Maintenance, to see what caused the fault and to find the correct solution. A fault code is the letter 'F' followed by a number representing the fault. See Section 3, Operation, for more detailed information about fault reporting and clearing.

- If the SCDU displays '**Prot**', then the initial checks found that the protected non-volatile RAM (NVRAM) has not been initialized. Move the **NVRAM PROTECTION** switch to "OFF" in order to allow the CPU to initialize the NVRAM with preprogrammed default values. Notice that the **NVRAM UNPROTECTED** LED is now lit to indicate the **NVRAM PROTECTION** switch position. Next, press the **RESET** push button. The drive will go through its power up sequence again; however, this time it will initialize the protected NVRAM. After the power up sequence has finished, return the **NVRAM PROTECTION** switch to "ON" in order to assure protection of this memory area. Notice that the **NVRAM UNPROTECTED** LED is now turned off.

Parameter Verification

❑ On drives with fans, verify that the fans are working.

When the **READY** LED on the SCDU is lit, all the selectable parameter data should be verified for the proper values as follows. See the PCDU Guide for information on verifying and entering parameter values on a PCDU:

❑ VERIFY OR CHANGE EACH PARAMETER VALUE for the particular application and motor involved.

❑ PCU DIAGNOSTICS (function # 998) should now be performed to verify armature and field circuitry.

❑ SELF-TUNE (PCU Parameter Measurement) (function # 997) should be performed before the drive is “RUN”. This gives the drive various motor parameters essential for optimal operation. NVRAM protection must be off to store parameters.

❑ SELF-TUNE SELECT (Function # *) should be turned on for optimal operation. (* Check the PAC diagram for correct function number.)

❑ STORE PARAMETERS, (function # 994) so that power can be removed and reapplied without losing the entered parameters. Remember that NVRAM protection must be OFF to store parameters.

❑ Operate drive, using external control signal inputs shown on the system schematic.

The “Operation” Section describes and illustrates the following:

- Operator’s controls and indicators.
- Steps you need to follow to start-up your DSD drive.
- Types of parameters that can be entered after start-up.
- Types of monitor functions available after start-up.
- Upload/Download of Programs or Parameters procedure.
- How to access error and fault lists and clear them.
- How to access non-volatile “RAM”.
- How to reload the default functions.
- Self-tuning feature.

Controls and Indicators

The upper right corner of the power cube cover contains the operator controls and indicators of the SCDU. Figure 8 identifies these operator components. Although accessible with the cover in place, all of these components are part of the DSD Drive Control PCB.

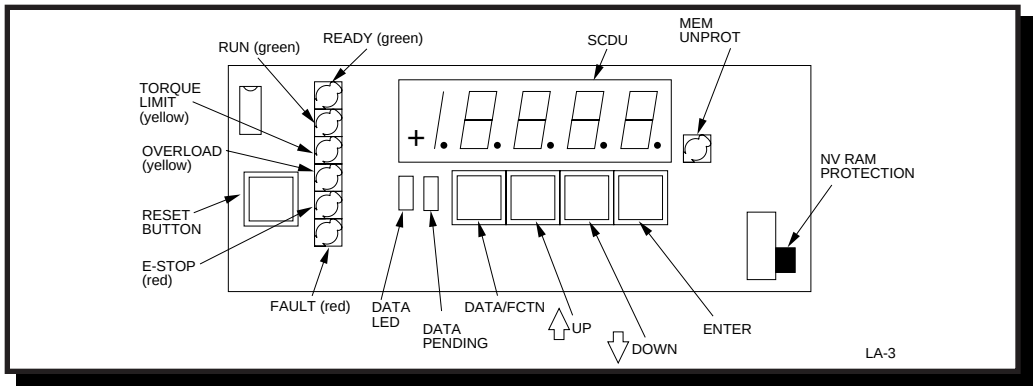


Figure 8. ***Operator Controls and Indicators***

RESET Button

Pressing the reset button causes the drive to clear faults, or in some cases to reset the drive, depending on the context.

Status LEDs

To the right of the **RESET** button is a vertical strip of six light emitting diodes (LEDs):

All status LEDs are under the control of the application specific software. However, the following descriptions indicate typical uses for the LEDs. The PAC diagram for this drive must be consulted to determine the actual meaning for each LED.

Ready Indicates that the drive is ready to operate.

Run DC loop contactor is closed and drive is controlling motor speed.

Torque Limit Drive is demanding armature current at or above the preset current limits.

Overload Current exceeded safe levels for too long and drive was stopped to protect the motor.

E-Stop Drive contactor safety interlock is detected as open. Drive will not run when this light is on.

Fault Indicates that a declared drive fault exists. The Fault/Error Code List defines what conditions the drive will recognize as faults.

IMPORTANT

Clearing a Fault from the Fault List is NOT THE SAME as resetting the fault. Some faults are transient in nature and require no further action after clearing the fault from the Fault List. Others require some additional positive action to allow the drive to continue to run. See the Fault/Error Code List for further details.

Standard Control/Display Unit (SCDU)

The major part of the SCDU is a 4-1/2 digit numeric LED display. Each of its four full digits can display the values of 0 to 9 plus limited alphabetic characters. The so-called half digit can display only the value “1” and a plus or minus sign. Below the numeric LED, is a single indicator and four push buttons. The four push buttons (**DATA/FCTN**, ⇑ [UP], ⇓ [DOWN], and **ENTER**) are used to operate the SCDU.

Non-Volatile “RAM” Protection

Next to the numeric displays of the SCDU is a red LED labeled **MEM UNPROT**. This LED is lit when the “protected” portion of the non-volatile random access memory (NVRAM) can be written to. Protection of the NVRAM is determined by the switch labeled **NVRAM PROTECTION**. When this switch is in the "ON" position, the **MEM UNPROT** LED is off and the protected portion of the NVRAM can not be written to. This prevents setup parameters and other important constants from being accidentally erased or changed. When these parameters need to be changed the switch can be moved to the "OFF" position, removing the write protection and causing the **MEM UNPROT** LED to be lit.

CAUTION

The NVRAM PROTECTION switch should be left in the "ON" position to protect the NVRAM during the critical power-up and power-down periods.

Portable Control/Display Unit Connection

The optional Portable Control/Display Unit (PCDU) plugs into a telephone-style jack at the bottom left of the DSD Drive Control PCB (accessible through a cutout at the bottom left of the front cover). If your unit is equipped with this option, refer to the PCDU guide provided with the unit for operating procedures.

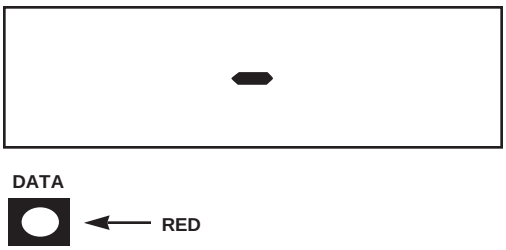
Start-Up Operation

❑ When power is first applied to the drive, all of the segments on the 4-1/2 digit display will turn on briefly in order to show that all are functioning:

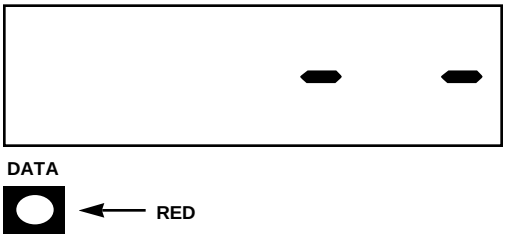
❑ After this lamp test is completed, an internal check is made to determine if the NVRAM chips have ever been used before, or if the EPROMs are the same as before power-down. If not, the drive software will attempt to load the defaults into the NVRAM chips. The SCDU displays the word '**Prot'** if the **NVRAM PROTECTION** switch is in the "ON" position; this prevents NVRAM updates:

If the display shows '**Prot**', it is necessary to move the **NVRAM PROTECTION** switch to the "OFF" position and press the **RESET** button in order to load defaults into NVRAM and restart the drive. Then set the **NVRAM PROTECTION** switch back to "ON". This message will only happen when the drive is powered up for the very first time or if the software in the drive or the NVRAM chips are changed.

❑ After the LED lamp test has completed, the drive software will now perform a fuse test on each of the three line fuses. If any power conversion fuse is open, the SCDU will indicate this on its display as follows:

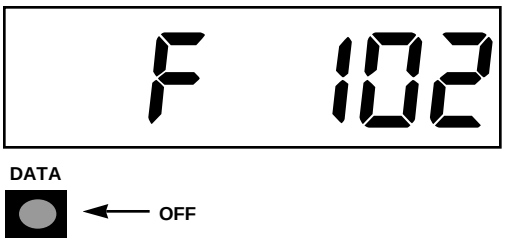


If two fuses are blown, the SCDU display will be:

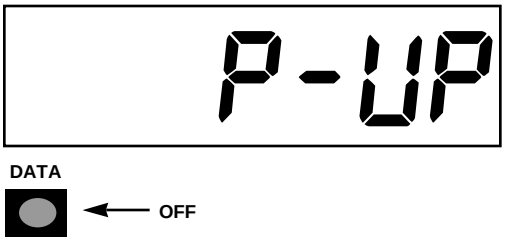


The drive will not operate unless all three line fuses are functional. If the SCDU indicates a bad fuse, power must be removed from the drive, the fuse replaced and power reapplied.

- After the drive has performed all three tests (lamp test, "RAM" test, and fuse test), the SCDU displays one of two final messages. If there are any faults present at this time, the SCDU will display a Fault code. The display will be similar to:



  where the leading 'F' indicates a fault and the 3 digits following the 'F' indicate the fault number. If however, there are no faults present, the SCDU displays the normal power-up message:



This 'P-UP' display will remain on the SCDU until a key is pressed or a fault occurs.

General Operation

After the drive has powered up and the SCDU display is showing 'P-UP' or a fault number, it can be used to enter new parameters, monitor drive operation, and/or perform certain drive diagnostics. Every operation that the SCDU can perform is called a 'function'. There may be up to 1000 functions defined.

The function codes between # 000 and # 999 are grouped as follows:

Table 2. **# Function Code Descriptions**

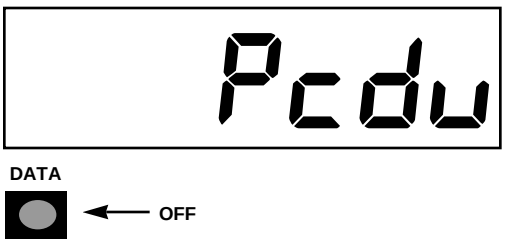
Function #	Description
# 000	Reserved for the Fault Display/Clear Function
# 001 - 299	PAC dependent Parameter Mode (Settable Parameters)
# 600 - 799	PAC dependent Monitor Mode (View Only Values)
# 800 - 899	Reserved for Advanced Fault/Error Routines
# 900 - 999	Reserved for Diagnostic/Test Routines

Function Levels

All SCDU functions have at least 2 levels and some functions use 3 levels. The data indicator below the lower left corner of the 4-1/2 digit display is used to indicate which level of a particular function the SCDU is currently at. The top level of the SCDU operation is called the "Function" level. The data indicator is off when the SCDU is in the "Function" level. The ⇑ or ⇓ keys are used to select a function number to be accessed while at this level. The ⇑ key increments the function number in the display while the ⇓ key decrements it. The SCDU will ramp the displayed function number when the ⇑ or ⇓ key is pressed and held for 1/2 second or longer.

DATA/FCTN Key

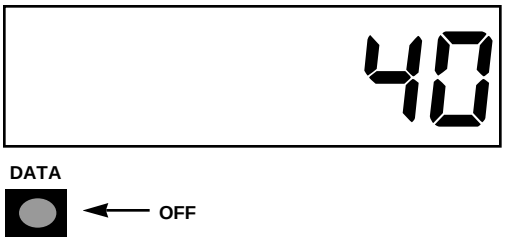
The **DATA/FCTN** key is used to toggle between the “Data” level and the “Function” level. Press the **DATA/FCTN** key when the desired function number is in the display. At this point, the SCDU leaves the "Function" level and enters the "Data" level. Note that the data indicator is now GREEN. This operation is consistent for every function on the SCDU, although the data actually displayed while the indicator is GREEN is function-number specific. Examples of every type of SCDU function are given in subsequent sections. All function numbers are the same for both the SCDU and the PCDU (Portable Control/Display Unit). (See the “PCDU Guide” for steps required for PCDU function entry.) There are some functions, however, that can only be performed with the PCDU. When such a function number is selected on the SCDU and the **DATA/FCTN** key is pressed, the SCDU’s display will change to:



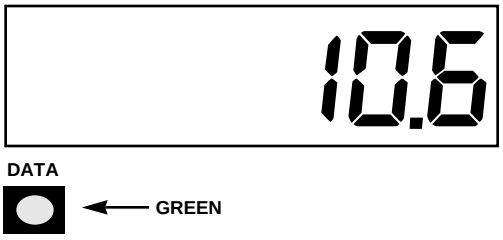
Parameter Functions

SCDU functions # 001 through # 299 inclusive are used to modify and/or display setup points that the drive needs for operation. Items that would typically fall into this category are functions such as Accel Times, Regulator Gains, Rated Speed and any other parameter that has been previously programmed in the PAC diagram for the drive. The following steps show how to modify a given parameter via the SCDU display.

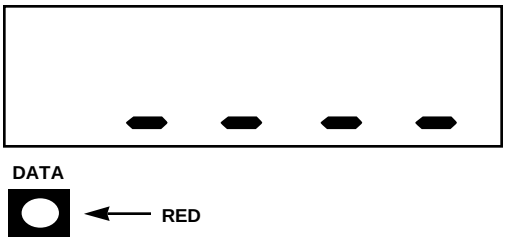
❑ Use the ⇑ and ⇓ keys to select the function number (between # 001 and # 299) to be accessed. The data indicator is turned off during this step. In the example below, function # 040 is chosen:



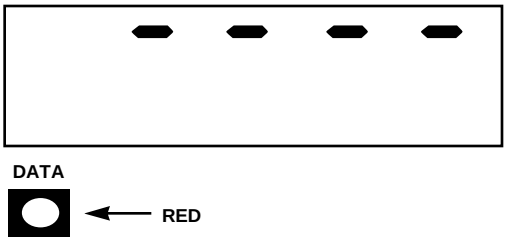
❑ Press the **DATA/FCTN** key to enter the "Data" level for this function number. The data indicator is GREEN to verify that the number being shown is the current actual value for this parameter. For example, if function # 040 is currently set for a value of 10.6, it will be displayed as follows:



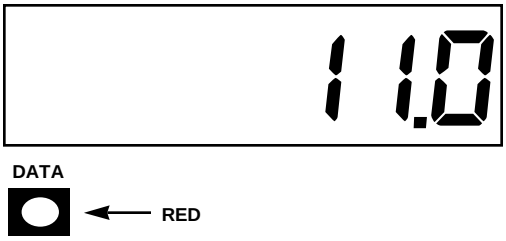
❑ Use the ⇑ and ⇓ keys to ramp the number in the SCDU display to the desired value. Note that the data indicator is RED to verify that the value being displayed is NOT the actual value, but rather is in the process of being changed. Each parameter has an upper and lower limit depending on the PAC diagram. The following display will occur when the lower limit is exceeded:



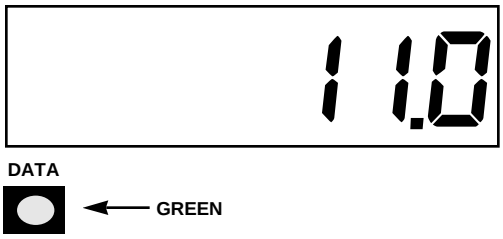
❶ Similarly, if the upper limit is exceeded, the SCDU displays:



❷ The SCDU display will increment from '10.6' to '11.0' if the ⇑ key is pressed 4 times:



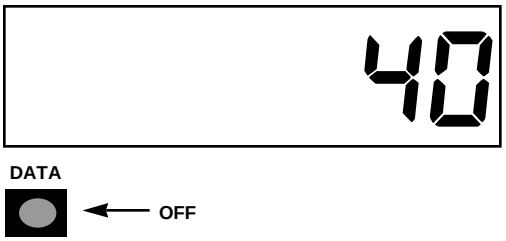
❑ Press the **ENTER** key to transfer the value in the SCDU display to the actual value used by the drive. Note that the data indicator will change back to GREEN to indicate that this value is now the actual value for this parameter:



If the **ENTER** key is pressed while the display is indicating that the upper or lower limit has been exceeded, the display will change to the appropriate limit value and the LED will change to GREEN.

The **DATA/FCTN** key can be pressed any time before the **ENTER** key is pressed, to cancel the changes and return to the initial value.

❑ Press the **DATA/FCTN** key to put the SCDU back into the "Function" level. As with the example above, the SCDU display will be:



All changes made become active values upon pressing the **ENTER** key. They remain active until the next reset, or until the drive is powered down.

When the drive is reset or powered up the value reverts to the value stored in NVRAM. If changes are to be permanent, use function # 994 (described later) to save the changed value in NVRAM.

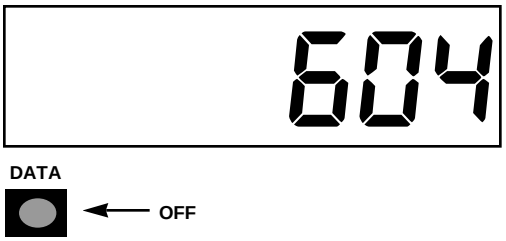
Due to PAC programming considerations it may be possible to access a value which cannot be changed. In this case the CDU function will proceed as described until the **ENTER** key is pressed to change the value. In this case the value will simply ignore any requested changes and remain the same.

Monitor Functions

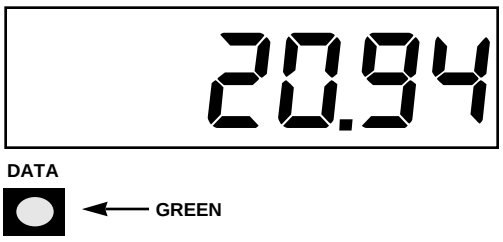
SCDU functions # 600 through # 799 inclusive are used to monitor those values that cannot be directly changed by the operator. Items that would typically fall into this category are Speed Feedback, Armature Current and Armature Voltage.

To view one of these values, it must have been previously programmed in the PAC Diagram for the drive. The following steps show how to display a given value on the SCDU display.

❑ Use the ⇑ and ⇓ keys to select the function number (between # 600 and # 799) to be accessed. The data indicator is turned off during this step. For example, if function # 604 is selected, the SCDU display will be:



❑ Press the **DATA/FCTN** key to enter the "Data" level for this function number. The data indicator is GREEN to indicate that actual data is currently being viewed. If the data for function # 604 is currently at 20.94 for example, the SCDU display will change to:



The SCDU's display is updated immediately if the value for the selected function changes.

NOTE: Values displayed with these function numbers cannot be modified.

Upload/ Download of Programs or Parameters (T992)

The "Upload / Download of Programs or Parameters" Section describes and illustrates the following:

- What is upload / download.
- General upload / download procedures.
- How to upload program into a new Flash ROM chip.
- How to upload a program.
- How to download a program.
- How to upload parameters.
- How to download parameters.

Upload/ Download Introduction and Definitions

The DSD 406 / 412 have the ability to pass program and parameter information between the drive's memory and a computer with a serial port. The direction of data flow is defined as **Upload** (from the computer to the drive) or **Download** (from the drive to the computer). Figure 9 shows the electrical connections required to connect the serial port of the DSD 406 / 412 to the serial port (COM1 or COM2) of an IBM PC compatible computer. The PC utilized must have a serial port and disk drive.

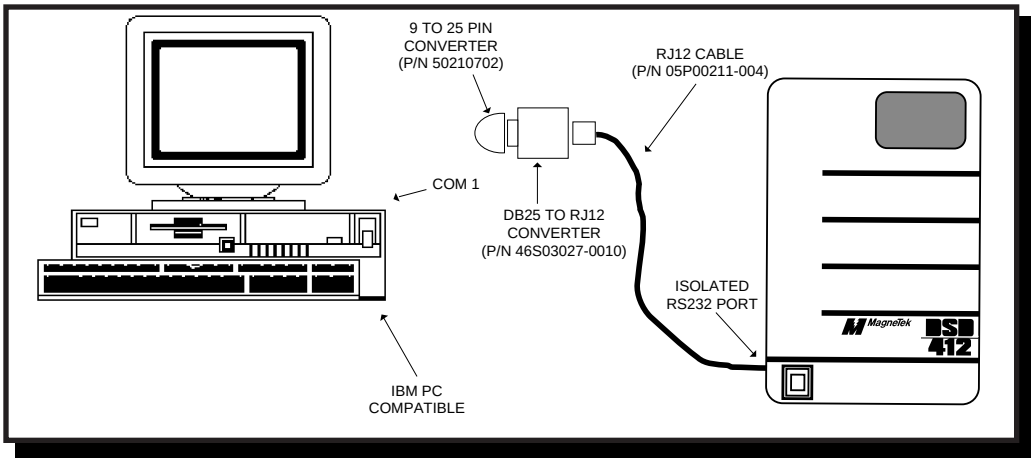


Figure 9: ***DSD 406/412 to IBM PC Compatible Computer Interconnect Diagram***

In addition to the electrical connections, a serial communications program must be used by the computer to access data through the serial port. The serial port communications program must support Y Modem Batch file transfer protocol (i.e. Qmodem).

The default data bit, stop bit and parity values of the drive are “8”, “1” and “NO”, respectively. These settings can not be changed. The Y Modem Batch file transfer is the only protocol available for communicating with the DSD 406/412.

CAUTION

The communications software must be set up to match the baud rate of the drive.

In uploading and downloading files, the drive behaves like a bulletin board service to the PC. A file upload means that a file is sent from the PC to the drive. A file download means that a file is sent from the drive to the PC.

Communications Program Set-up

protocol:	**Y Modem Batch**
parity:	**NO**
data:	**8**
stop:	**1**
speed:	**9600** or **19200**

There are two file types associated with upload and download. The PAC program file (i.e. the .PRG file) contains the executable instructions that determine the application characteristics of the drive. The parameter file is the file of all the parameter settings of a drive at the time the .PAR file was captured.

- **Program upload** is the process of a computer sending a new PAC program (i.e. the .PRG file) to a DSD 406/412 through the drive’s serial port. This process may be required when, upon application of power, the drive finds the PAC program loaded into memory is invalid. This process may also be used when it is desired to change the PAC program from what was previously loaded. Some of the steps shown below are skipped when the PAC program in memory is found to be invalid.

- **Program download** is the process of the DSD 406/412 drive sending the PAC program (i.e. the .PRG file) through the drive’s serial port to a computer. This process can be used for memory backup.

- **Parameter upload** is the process of a computer sending all settable parameters (i.e. the .PAR file) to a DSD 406/412 drive. This process can be used to set up the drive with a set of tuned constants.

- **Parameter download** is the process of the DSD 406/412 drive sending all of its settable parameter values (i.e. the .PAR file) to a computer. This process can be used for memory backup. A parameter download is the only data transfer process that can occur while the drive is running a motor.

NOTE

The DSD 406 / 412 can not be running a motor while uploading parameters or a program. It cannot also be running a motor if a program download is occurring. The PAC program stops execution during this time.

CAUTION

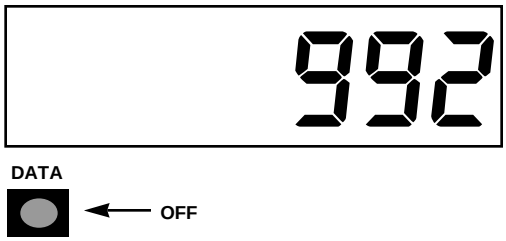
The **NVRAM PROTECTION** switch needs to be in the "OFF" position to perform an upload.
The **MEM UNPROT** light will also need to be lit.

General Upload/ Download Procedures

To perform an upload or download use function # 992. This will allow you to upload or download PAC programs and parameters. The following steps explaining how to perform these operations from the Command/Display Unit, SCDU, resident on the drive:

❑ Check to verify the **DATA PENDING** light is "OFF". If not, press the **DATA/FCTN** key.

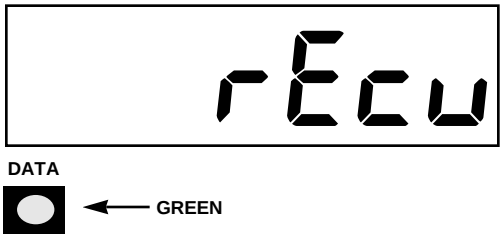
❑ Use the ⇑ and ⇓ keys to select function # 992. The display will show the function number.



❑ Press the **DATA/FCTN** key. At this point the **DATA/FCTN** key, the ⇑ key and the ⇓ key may be pressed.

- Press the **DATA/FCTN** key to return to the function entry mode without performing any data transfers.

- Press the ⇑ key to select an upload operation.

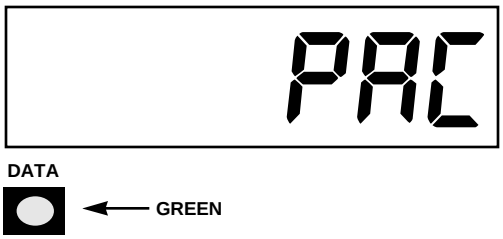


- Press the ⇓ key to select a download operation.

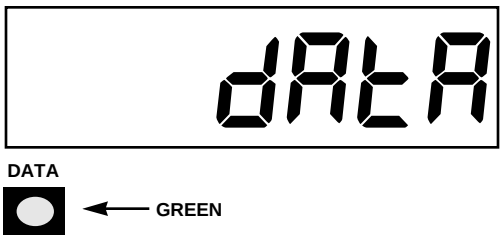
❑ Press the **ENTER** key to accept the Upload or Download selection. At this point the **DATA/FCTN** key, the ⇑ key, and the ⇓ key may be pressed.

- Press the **DATA/FCTN** key to return to the function entry mode without performing any data transfers.

- Press the ⇑ key to select transfer of the program.



- Press the ⇓ key to select transfer of the parameters.



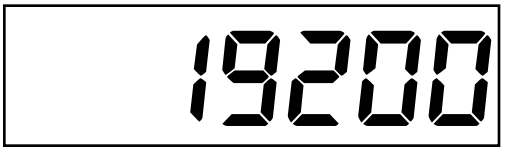
❑ Press **ENTER** to accept the given action.

Upload Procedure for a New Flash ROM Chip

The DSD 406/412 will automatically go into the upload/download function # 992, on power up of a drive without DCU software or replacement of a Flash ROM chip. The default baud rate of 19,200 will be displayed.

WARNING

After putting in a new Flash ROM chip and 19,200 baud is not displayed on the SCDU, contact MagneTek for assistance.



❑ Use the ⇓ key to select the another baud rate if your terminal does not support 19,200 baud. This will decrease the baud rate. The ⇑ key is not applicable here since 19,200 is the maximum baud rate.

CAUTION

The communications software must be set up to match the baud rate of the drive.

❑ Press the **ENTER** key to accept the displayed baud rate. The DSD 406/412 will begin to initiate transfer sequence.

CAUTION

When the program transfer begins it must be completed.

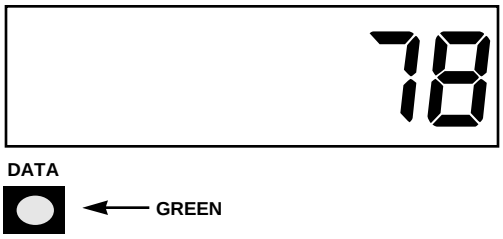
A message will appear explaining that permanent storage memory is being erased.

A message will appear explaining that the DSD 406/412 is attempting to start the program transfer.

At this time, the DSD 406/412 is waiting to communicate with the PC. You will see the LED's on drive scroll upward to indicate it is ready to upload. Y Modem protocol will be sent to the serial port in the form of a 'C' character indicating that the transfer can start.

Initiate a Y Modem Batch file transfer from the PC (i.e. for Q modem users, press the **PgUp** key for an upload and select the Y Modem batch mode).

When transfer begins, a message will appear showing how much of the transfer has already taken place. For a baud rate of 19,200, the transfer will take approximately five minutes. The completion percentage number counts as more data is transferred.



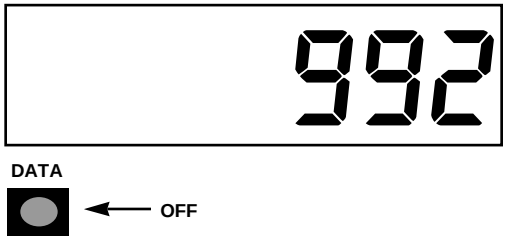
The LED's will continue to scroll upward until the upload is complete.

When the upload finishes, the drive resets itself, runs an internal check, and then executes the PAC program.

Program Upload

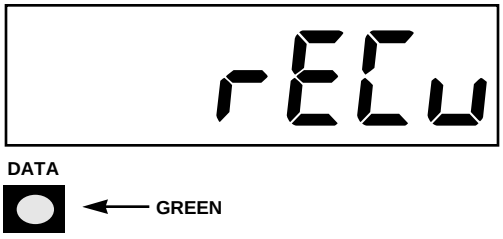
❑ Check to verify that the **DATA PENDING** light is "OFF". If not, press the **DATA/FCTN** key.

❑ Use the ⇑ and ⇓ keys to select function # 992. The display will show the function number.



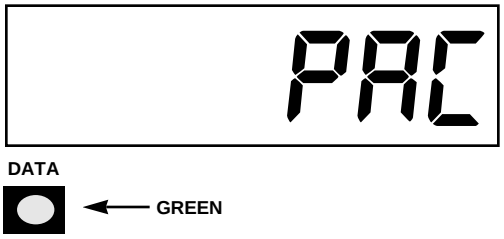
❑ Press the **DATA/FCTN** key.

❑ Press the ⇑ key to select an upload operation.



❑ Press the **ENTER** key to accept the Upload selection.

❑ Press the ⇑ key to select transfer of the program.



CAUTION

When the program transfer begins, it must be completed because the existing program is erased.

❑ Use the **DATA/FCTN** key to exit out of the program upload without performing any data transfers.

❑ Press the **ENTER** key to accept the transfer of the program.

The current baud rate will be displayed.

❑ Use the ⇓ key to select the another baud rate.

❑ Press the **ENTER** key to accept the displayed baud rate. The DSD 406/412 will begin to initiate transfer sequence.

A message will appear explaining that permanent storage memory is being erased.

A message will appear explaining that the DSD 406/412 is attempting to start the program transfer.

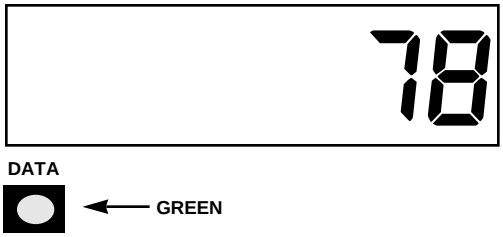
At this time, the DSD 406/412 is waiting to communicate with the PC. You will see the LED's on drive scroll upward to indicate it is ready to upload. Y Modem protocol will be sent to the serial port in the form of a 'C' character indicating that the transfer can start.

CAUTION

The communications software must be set up to match the baud rate of the drive.

Initiate a Y Modem Batch file transfer from the PC (i.e. for Qmodem users, press the **PgUp** key for an upload and select the Y Modem batch mode).

When transfer begins, a message will appear showing how much of the transfer has already taken place. For a baud rate of 19,200, the transfer will take approximately five minutes. The completion percentage number counts as more data is transferred.



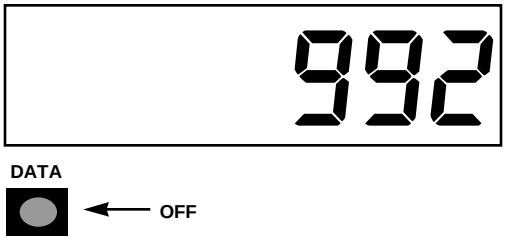
The LEDs will continue to scroll upward until the transfer is complete.

When the upload finishes, the drive resets itself, runs an internal check, and then executes the PAC program.

Program Download

❑ Check to verify that the **DATA PENDING** light is "OFF". Press the **DATA/FCTN** key.

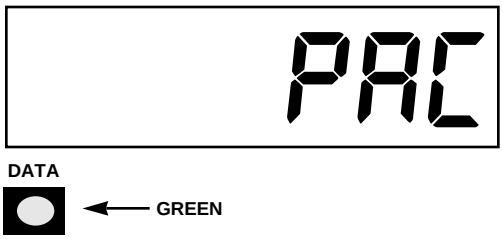
❑ Use the ⇑ and ⇓ keys to select function # 992. The display will show the function number.



❑ Press the **DATA/FCTN** key.

❑ Press the **ENTER** key to accept the Download selection.

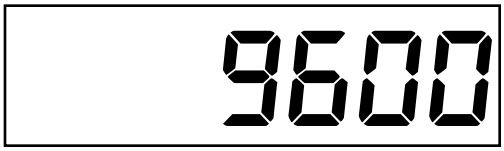
❑ Press the ⇑ key to select transfer of the program.



❑ Use the **DATA/FCTN** key to exit out of the program download without performing any data transfers.

❑ Press the **ENTER** key to accept the transfer of the program.

The current baud rate will be displayed.



❑ Use the ⇓ key to select the another baud rate if your terminal does not support 9,600 baud. The maximum baud rate for a download is 9,600.

CAUTION

The maximum baud rate is different from a program download.

❑ Press the **ENTER** key to accept the displayed baud rate. The DSD 406/412 will begin to initiate transfer sequence.

CAUTION

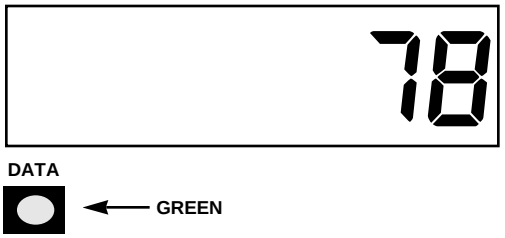
File can not already exist in directory you are trying to download to.

Initiate a Y Modem Batch file transfer from the PC (i.e. for Qmodem users, press the **PgDn** key for a download and select the Y Modem batch mode).

NOTE

The downloaded program is already named in the PAC program.

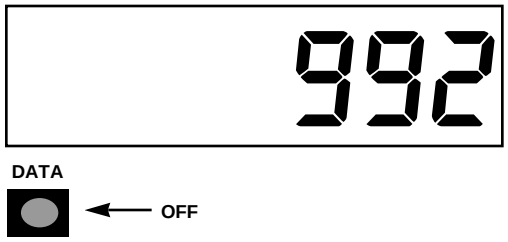
At this time, the DSD 406/412 is waiting to communicate with the PC. When the transfer begins, a message will appear showing how much of the transfer has taken place. The completion percentage number counts as more data is transferred. This transfer should take ten minutes at 9,600 baud.



Parameter Upload

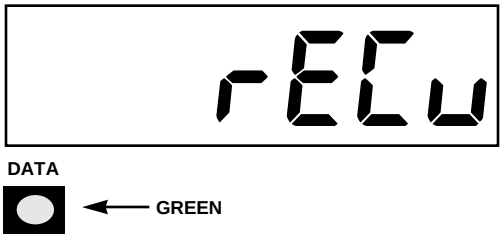
❑ Check to verify the **DATA PENDING** light is "OFF". If not, press the **DATA/FCTN** key.

❑ Use the ⇑ and ⇓ keys to select function # 992. The display will show the function number.

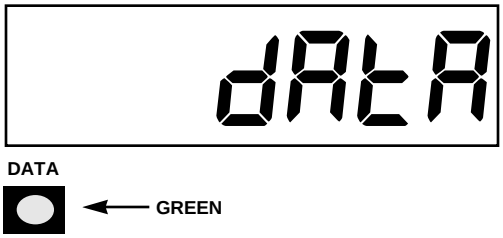


❑ Press the **DATA/FCTN** key.

❑ Press the ⇑ key to select an upload operation.



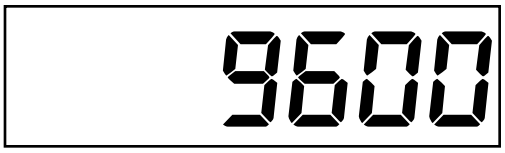
❑ Press the **ENTER** key to accept the Upload selection.



❑ Use the **DATA/FCTN** key to exit out of the parameter upload without performing any data transfers.

❑ Press **ENTER** to accept the transfer of the parameters.

The current baud rate will be displayed.



❑ Use the ⇓ key to select the another baud rate if your terminal does not support 9,600 baud. The maximum baud rate for a download is 9,600.

CAUTION

The maximum baud rate is different from a program download.

❑ Press the **ENTER** key to accept the displayed baud rate. The DSD 406/412 will begin to initiate transfer sequence.

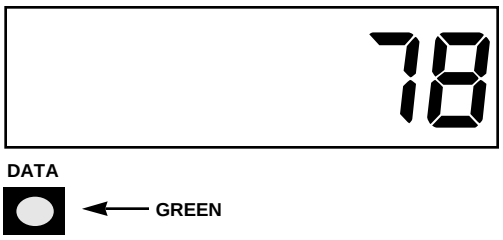
CAUTION

The communications software must be set up to match the baud rate of the drive.

Initiate a Y Modem Batch file transfer from the PC (i.e. for Qmodem users, press the **PgUp** key for an upload and select the Y Modem batch mode).

At this time, the DSD 406/412 is waiting to communicate with the PC. When the transfer begins, a message will appear showing how much of

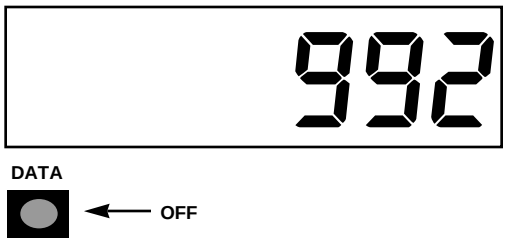
the transfer has already taken place. For a baud rate of 9,600, the transfer will take approximately thirty seconds. The completion percentage number counts as more data is transferred.



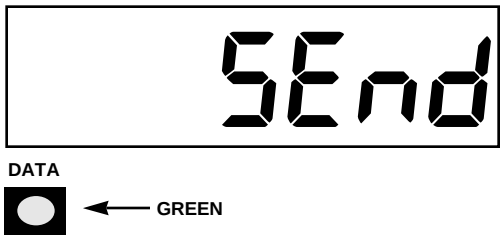
Parameter Download

❑ Check to verify the **DATA PENDING** light is "OFF". If not, press the **DATA/FCTN** key

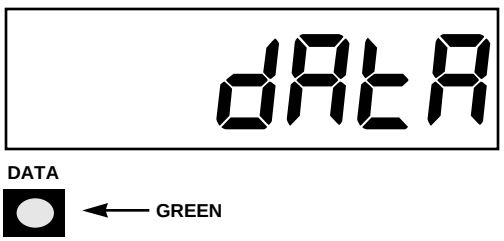
❑ Use the ⇑ and ⇓ keys to select function # 992. The display will show the function number.



❑ Press the **DATA/FCTN** key.



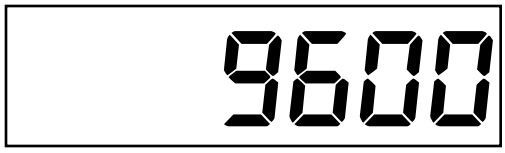
❑ Press the **ENTER** key to accept the Download selection.



❑ Use the **DATA/FCTN** key to exit out of the parameter download without performing any data transfers.

❑ Press **ENTER** to accept the transfer of the parameters.

The current baud rate will be displayed.



❑ Use the ⇓ key to select the another baud rate if your terminal does not support 9,600 baud. The maximum baud rate for a download is 9,600.

CAUTION

The maximum baud rate is different from a program download.

❑ Press the **ENTER** key to accept the displayed baud rate. The DSD 406/412 will begin to initiate transfer sequence.

CAUTION

The communications software must be set up to match the baud rate of the drive.

Initiate a Y Modem Batch file transfer from the PC (i.e. for Qmodem users, press the **PgDn** key for a download and select the Y Modem batch mode). The PAC program will assign a name to the downloaded file.

At this time, the DSD 406/412 is waiting to communicate with the PC. When the transfer begins, a message will appear showing how much of the transfer has already taken place. The completion percentage number counts as more data is transferred. This transfer should take approximately thirty seconds at 9,600 baud.

Error Handling/ Reporting

The drive has two methods available to report errors. Each error condition may utilize ONE OR BOTH OR NEITHER of the reporting methods.

The most conventional method is called 'fault recording'. If this method is enabled for a particular error, the red **FAULT** LED and a unique fault code number will appear on the SCDU at the moment the error occurs. Each occurrence of a fault is recorded in an area in "RAM" called the Fault List. The Fault List stores the first 16 faults to occur after the drive is powered up, meaning it will contain the 16 "oldest" faults. Recording of faults stops as soon as the 16th fault occurs. This list is erased when the drive is powered down or reset. Whether the drive stops or continues to run is dependent on the way the particular fault is implemented within the PAC diagram. Most standard faults are set up so that the drive will stop if a fault occurs.

The second method for error handling is called 'error recording'. Error recording differs from fault recording in three respects:

❶ The error condition will not be shown on the SCDU or the red **FAULT** LED.

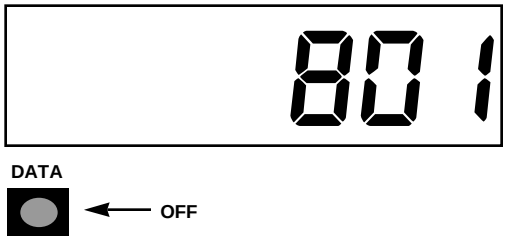
❷ The error list stores the last errors to occur, meaning it will contain the 16 most recent errors. Each new error over-writes the oldest error in the list.

❸ This list is maintained in battery-backed-up "RAM" and is retained when the drive is powered down or reset.

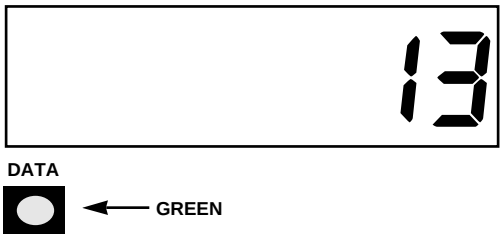
Again, the action taken by the drive when an error occurs depends on how the particular error is implemented within the PAC Diagram.

Function # 801 is used to display or alter the Error Disposition List. This list can be consulted at any time to determine whether a particular condition should be reported as an error, a fault, or both. The process for changing the entry in the disposition list for a particular condition using the SCDU is as follows:

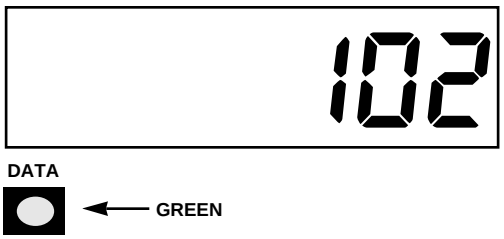
❑ Use the ⇑ and ⇓ keys to select function # 801 from the function level. The data indicator is off during this step.



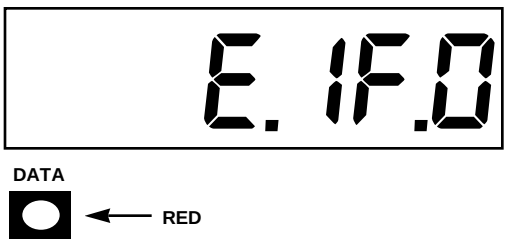
❑ Press the **DATA/FCTN** key to enter the "Data" level for function # 801. The data indicator is GREEN and the error code last modified with function # 801 will be in the SCDU display. The SCDU displays error code # 13 (illegal instruction) initially after power up:



❑ Use the ⇑ and ⇓ keys to select the error code entry in the Disposition List that is about to changed/viewed. For example, if the disposition for error code # 102 (Numeric Underflow) is to be modified, press the ⇑ key until the SCDU display changes to:

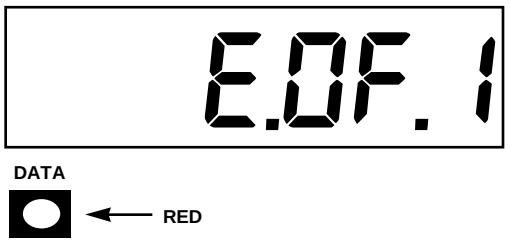


❑ Press the **ENTER** key when the desired error code is displayed on the SCDU. The data indicator changes from GREEN to RED, and the SCDU display changes as well to a format of '**E**.x**F**.y'. The '**E**' and '**F**' are abbreviations for Error and Fault respectively. The 'x' and 'y' will be either '1' or '0' to indicate which list will record the error. For example, if the display is '**E.1F.1**', the error is recorded in both lists. If the display is '**E.0F.1**', the error is recorded in the fault list, but not in the error list. If the display is '**E.0F.0**', neither list records the error. In the example above, the factory set default disposition for a Numeric Underflow (code # 102) is to record the error in the Error List, but not in the Fault List. In this case, the SCDU display is:



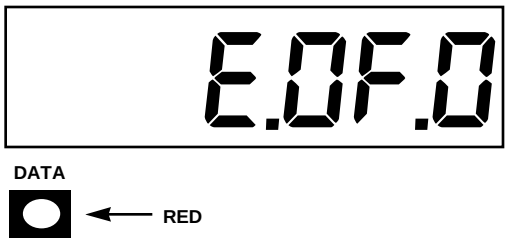
❑ Press either the ⇑ or ⇓ keys repeatedly to change the numbers after the 'E' and '**F**' from '**1**' to '**0**' and vice-versa. Starting from no declarations, the displays are: '**E.0F.0**', '**E.0F.1**', '**E.1F.0**', and '**E.1F.1**'. For example, if the disposition for this error should be changed so that it is NOT recorded in either the Fault or Error list.

❶ Press the ⇓ key once so the display changes to:



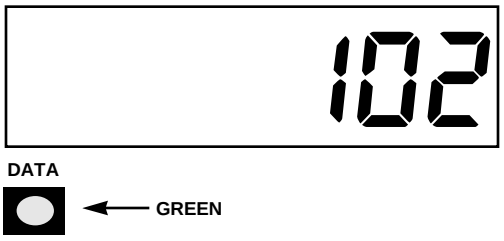
This display indicates that the Numeric Underflow error will now be recorded in the Fault List, but not in the Error List.

❷ Pressing the ⇓ key once more will change the display to:



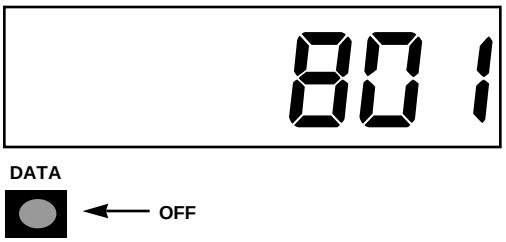
This is the desired status for the new disposition of the Numeric Underflow error, which is to not report it to either the Fault or Error List.

❑ Press the **ENTER** key when the new disposition code is in the display. At this point, the data indicator changes from RED to GREEN, and the SCDU displays the error code again:



❑ The ⇑ and ⇓ keys will now be used to select which error code is being modified.

When all changes in the Error Disposition List are finished, the **DATA/FCTN** key will exit back to the function level:

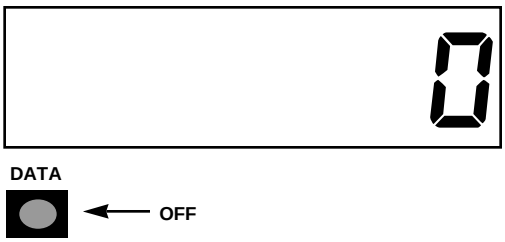


Fault Display/Clear

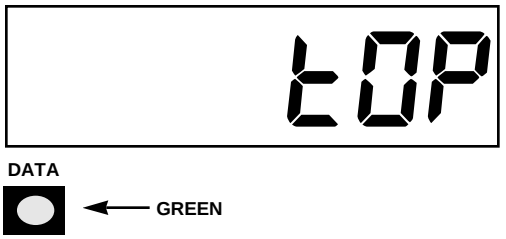
The drive stores the first 16 faults that have been reported to the Fault List. Once the Fault List is filled with 16 faults, it will not accept any more entries. The data in this buffer is not retained when the power is lost. Each time a fault condition occurs, and its entry in the Disposition List is set to allow recording in the Fault List, that new fault is placed on the list.

Function # 000 is reserved for viewing the Fault List. Each fault in the Fault List can be shown on the SCDU display and optionally cleared. The steps to view the Fault List are as follows:

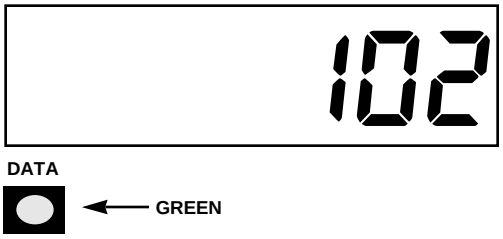
❑ Use the ⇑ and ⇓ keys to select function # 000. The data indicator is off during this step. Note that this function can be accessed simply by pressing the ⇑ key once if the SCDU display is '**P-UP**'.



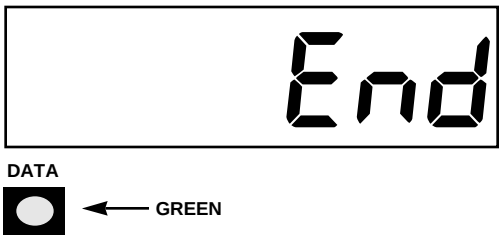
❑ Press the **DATA/FCTN** key to enter the "Data" level for this function. The data indicator is GREEN to indicate that the fault codes currently in the Fault List are being displayed. The very first display at this point is the word '**TOP**':



❑ To view the first fault on the list, press the ⇓ key. If there is a Numeric Underflow fault on the Fault List, for example, the SCDU display will change to:



❑ The contents of the Fault List may be examined by using the ⇑ and ⇓ keys. The first fault in the list is the first fault actually declared. When the first fault in the list is displayed, pressing the ⇓ key will cause the next fault to be displayed. Repeatedly pressing this key will move toward the end of the list. The SCDU displays the word 'End' after the last fault has been displayed:



Error Display

❑ When any fault other than the first fault is displayed, pressing the ⇓ key will cause the previous fault to be displayed.

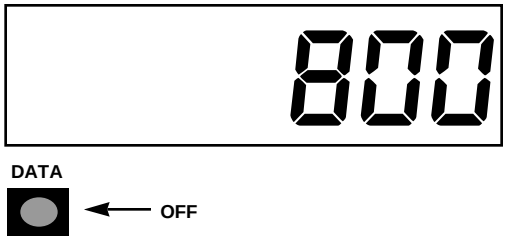
For example, if the 10th fault in the list was displayed, the end of the list ("End") could be reached by repeatedly pressing the ⇓ key, and the beginning of the list ("top") could be reached by repeatedly pressing the ⇑ key.

The drive is able to store the most recent 16 errors that have been reported to the Error List. This list is constantly updated, with the newest error overwriting the oldest in the list. This list is held in battery-backed-up "RAM" (NVRAM), so it is retained when power is lost. Each time an error condition occurs, and if its entry in the Disposition List is set to allow recording in the Error List, that new error is placed in the list. In addition to the error code, the Error List holds number of the PAC block that declared the error, and a time-stamp to indicate how much time has elapsed since the error occurred. This timer is only updated while power is applied to the drive. The time-stamp can only be viewed by the PCDU (see the PCDU Guide), but the PAC block number can be read by the SCDU.

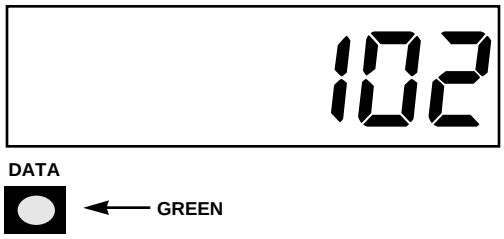
Function # 800 is reserved for viewing the Error List in NVRAM. The steps to view the Error List are as follows:

❑ Use the ⇑ and ⇓ keys to select function # 800. The data indicator is off during this step.

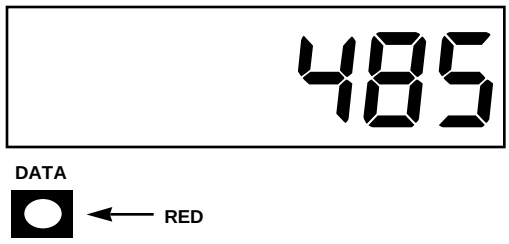
❑ Press the **DATA/FCTN** key to enter the "Data" level for the view error function.



❶ The data indicator is GREEN to indicate that an error code is currently being viewed. If the error in this slot is a Numeric Underflow for example, the SCDU will display:



❷ The number of the PAC block that declared this error can be viewed by pressing the **ENTER** key. If block 485 had declared the Numeric Underflow error, for example, the SCDU would change to:



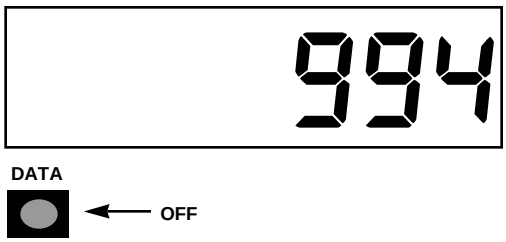
If the number displayed during this step is 0, the error was not declared by a PAC block, but rather by the Kernel of the DCU.

Other errors currently in the Error List can be viewed by pressing the **ENTER** key to display the Error Code again, then either the ⇑ or ⇓ key to move to the next or previous slot in the list. The procedure outlined above should be repeated as necessary to view the Error Code and PAC block number for other errors in the Error List.

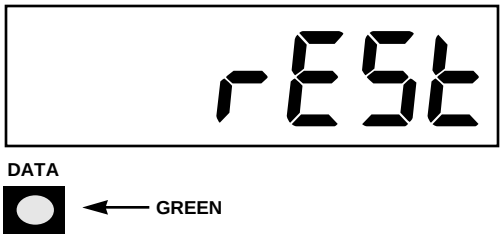
Non-Volatile "RAM"-Access

Every parameter that the drive uses has three separate areas in memory associated with it. There is a factory-set default value for each parameter which is stored in the read only EPROM chips. There is an area in the active "RAM" which the drive uses while it is running. There is also an area in NVRAM reserved for each parameter. The values in the NVRAM area are copied to the active "RAM" every time the drive is powered up . This split level approach makes it possible to return to the last set of 'stable' parameters in NVRAM if some errors are made during fine-tuning of the active drive parameters. Function # 994 is used to perform the transfer of data between the NVRAM and active parameter lists. The process for copying data to or from the NVRAM parameter list is as follows:

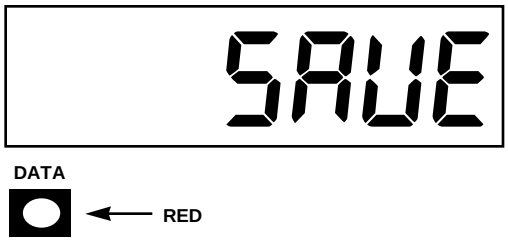
❑ Use the ⇑ and ⇓ keys to select function # 994 from the function level. The dual-colored LED is off during this step.



❑ Press the **DATA/FCTN** key to enter the "Data" level for function # 994. The data indicator is GREEN to indicate that this function is currently being accessed. It is possible to SAVE the current active parameters in "RAM" to the NVRAM parameter list, or to RESTORE the current parameters from the NVRAM parameter list to the active "RAM". Note that a RESTORE is the same operation that occurs inherently every time the drive is powered up. Upon entering the data level for this function, the SCDU displays:



❑ The ⇑ and ⇓ keys can be used to toggle between the above display, which indicates a pending RESTORE operation, and the following display, which indicates a pending SAVE:

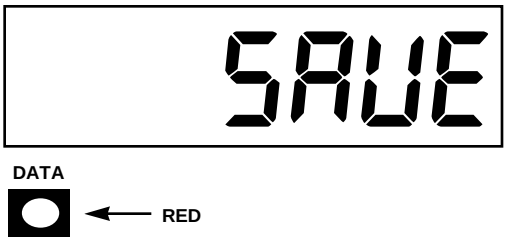


Note that as soon as either the ⇑ or ⇓ key is pressed, the data indicator will change to RED.

❑ Press the **ENTER** key to actually perform the transfer of data. If **ENTER** is pressed while '**SAVE**' is displayed, the SCDU display may change to:

This display means that the **NVRAM PROTECTION** switch is in the "ON" position preventing writes to the NVRAM. Move the switch to the "OFF" position, press the **DATA/FCTN** key, and start over from step #2. (See Figure 3 in Section 3, Controls and Indicators for the location of the **NVRAM PROTECTION** switch.)

During SAVE or RESTORE operation, the **DATA/FCTN**, ⇑ and ⇓, **ENTER** keys will not function. Functionality will resume when operation is complete.



IMPORTANT

During normal operation, and during drive power-up or -down, the NVRAM PROTECTION switch should ALWAYS be in the "OFF" position which prevents writes to the NVRAM.

Load Defaults Function

Every parameter in the drive has a factory-set default value that is loaded when the drive is powered up for the very first time. These default parameters may not be optimal values for the drive when actually running, but they will generally allow the drive to function. It is possible to reload these default parameters with function # 995 of the SCDU. A re-load of the defaults would generally be done when the drive is operating erratically and it is suspected that one or more parameters were improperly set and saved.

CAUTION

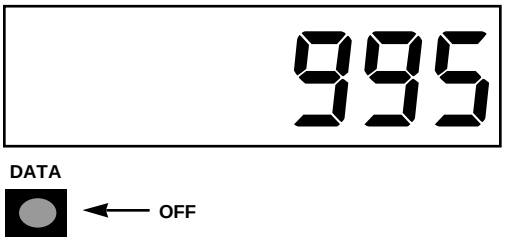
Use of the LOAD DEFAULTS function will overwrite EVERY parameter currently being used by the drive with the factory-set default for each parameter. There is no way to restore parameters to their previous value once this function is used.

CAUTION

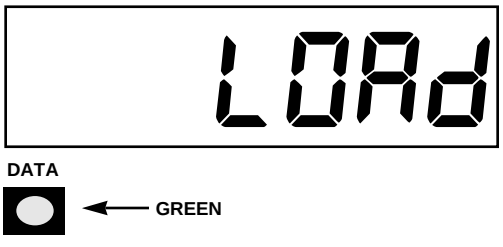
The NVRAM protection switch must be off and the drive must be in the stop condition.

Function # 995 is used to perform the transfer of data from the default parameter list to the ACTIVE “RAM” parameter list. The process for accessing the Load Defaults Function is as follows:

❑ Use the ⇑ and ⇓ keys to select function # 995 from the function level. The data indicator is off during this step.



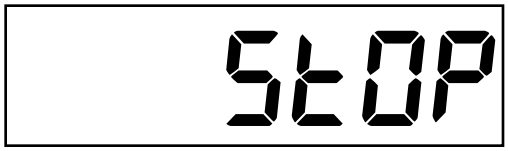
❑ Press the **DATA/FCTN** key to enter the "Data" level for function # 995. The data indicator is GREEN to indicate that this function is currently being accessed. The SCDU display may change to:



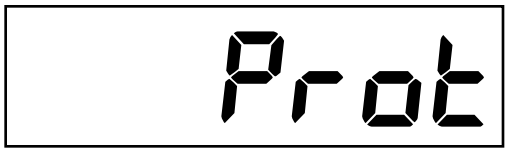
❑ Press the **ENTER** key to actually perform the Load Defaults transfer.

The drive will then do a complete reset and the program defaults are now loaded.

If the SCDU display does not change to LOAd, the following may display.



If the drive is still in a run condition: To correct, put the drive in a stop condition and press the DATA/FCTN key to continue with loading defaults.



If the NVRAM protection switch is “ON”: To correct, turn off the NVRAM protection switch and press the DATA/FCTN key to continue with loading defaults.

Self-Tune (PCU Parameter Measurement)

The DSD drive has a built-in current regulator SELF TUNING feature. When activated, this feature measures total motor armature circuit resistance, inductance including wiring, and the field L/R time constant. The drive then uses the measured value in conjunction with the parameter entered for “crossover frequency” to calculate integral and proportional gains for the current regulator and to set the field regulator gains properly. After running the PCU Parameter Measurement function, the values for armature resistance and armature inductance are stored in NVRAM. Note that the NVRAM protection must be turned “OFF” so that the results can be stored. It is possible to override the values dynamically calculated for armature resistance and inductance values by disabling the “USE SELF-TUNE” item in the parameter menu.

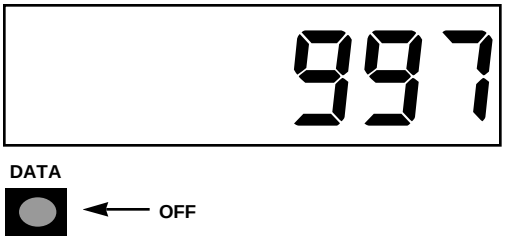
The dynamically calculated values are used if “USE SELF-TUNE” is set to “ON” while the manually entered values are used if this item is set to “OFF”.

WARNING

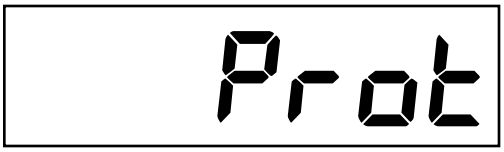
Armature current is circulated through the armature circuit during parts of the PCU Parameter Measurement function. The PCU will reduce the field current to zero on motors with a shunt field in order to minimize motor rotation. However, a PERMANENT MAGNET motor must have its shaft locked mechanically prior to running the PCU Parameter Measurement routine. If the PCU detects significant motor voltage during the test, the PCU parameter measurement function will abort.

The process for accessing the PCU PARAMETER MEASUREMENT function is as follows:

❑ Use the ⇑ and ⇓ keys to select function # 997 from the function level. The data indicator is turned off during this step.

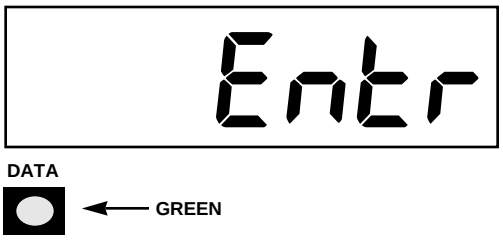


❑ Press the **DATA/FCTN** key to enter the "Data" level for function # 997. The data indicator will be GREEN to indicate that this function is currently being accessed. The SCDU displays the word '**Prot**' if the **NVRAM PROTECTION** switch is in the position that will not allow any updates to the NVRAM:

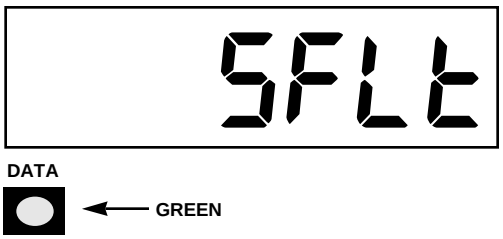


If the 'Prot' message appears, press the DATA/FCTN key to return to the "Function" level, move the NVRAM PROTECTION switch to the "OFF" position, and press the **DATA/FCTN** key again. The SCDU will jump to the 'Entr' message (below) if the NVRAM PROTECTION switch is in the correct position upon entering this function.

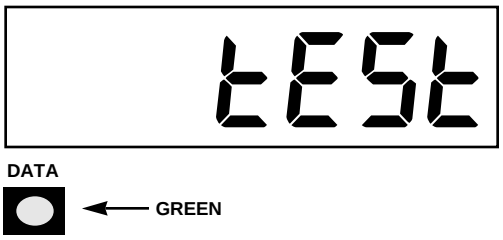
The SCDU displays the word 'Entr' to prompt the user to press the **ENTER** key as further confirmation that the PCU parameter measurement function is about to be performed:



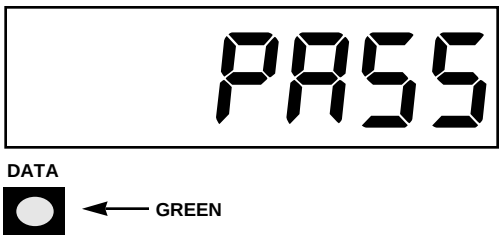
❑ Press the **ENTER** key to actually start the PCU Parameter Measurement function. The PCU will not begin the measurement routine if a SEVERE PCU FAULT exists. The PCU will declare a SEVERE FAULT under several conditions including an IST fault, power supply failure, loss of line synchronization, low line, or DCU failure. If a SEVERE FAULT exists when the PCU starts the parameter measurements, the SCDU displays:



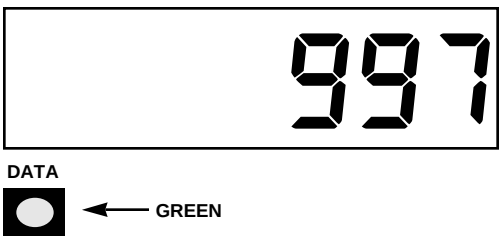
❑ Severe faults can only be cleared by cycling power to the drive and replacing the bad component if applicable. The SCDU displays the word ‘tESt’ while it is performing the parameter measurements if there were no SEVERE FAULTS when the **ENTER** key was pressed:



❑ Upon completion of the measurement, the SCDU will indicate the status of the test. If an error occurred, the SCDU will display an appropriate fault number. If all tests were completed properly, the SCDU displays ‘PASS’:



❑ When testing is complete, press the **DATA/FCTN** key to exit the PCU parameter measurement routine and return to the "Function" level. The SCDU displays:



The “Maintenance” Section describes and illustrates the following procedures:

- Preventive Maintenance
- PCU Diagnostics
- Troubleshooting Guide
- Replacement Procedures for fuses, DSD Drive Control PCB, Armature Interface PCB, fan, and power supply.

Preventive Maintenance

WARNING

Hazardous voltages may exist in the drive circuits even with drive circuit breaker in off position. Never attempt preventive maintenance unless incoming three-phase and control power is disconnected and locked out.

Preventive maintenance is primarily a matter of routine inspection and cleaning. The most important factors are that there is sufficient air flow to cool the drive and that vibration has not loosened any connections.

The DSD drive is designed to have sufficient air flow for long, reliable operation. Accumulated dust or dirt can reduce this air flow. Check and clean all fans, filters (if any), and the air flow across the heat sinks for dust or dirt at least once every three months. It may be necessary to do this more often if conditions are harsh dirty filters should be replaced.

If the drive is subjected to vibration, all mounting and electrical connections should be checked at three month intervals. Any loose hardware should be tightened.

Power Conversion Unit Diagnostics

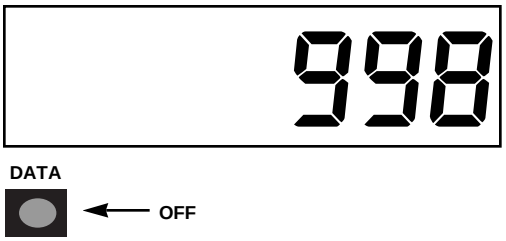
The drive has built-in diagnostic routines that can be performed via the SCDU. The PCU diagnostic routines are able to test for four failure modes. The first test checks the integrity of the three line fuses. Assuming the three line fuses are all OK, the PCU then performs a test for shorted SCRs/doubler packs. If this test indicates no shorted SCRs/doublers, the PCU then verifies that less than 5% of the value entered for "Rated Field Current" is attainable. The PCU then tests for open SCRs by passing current through the forward bridge followed by the reverse bridge, and finally checks polarity of voltage feedback. The result of the test is displayed on the SCDU after the test completes. The SCDU will light certain unique LED patterns on its display corresponding with the failure (see displays in the procedure that follows). The Fault Codes F910, F911, F912, and F917 will not appear on the SCDU if the Error Disposition List is programmed so that they are not reported to the Fault List (see "Error Handling/Reporting" in the Operation Section).

WARNING

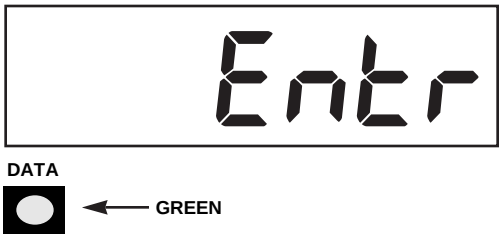
Armature current is circulated through the armature circuit during parts of the PCU diagnostics function. The PCU will reduce the field current to zero on motors with a shunt field in order to minimize motor rotation. However, a permanent magnet motor must have its shaft locked mechanically prior to running the PCU diagnostics routine. If the PCU detects significant motor voltage during the test, the PCU diagnostics function will abort.

The process for accessing the PCU diagnostics function is as follows:

❑ Use the ⇑ and ⇓ keys to select function # 998 from the function level. The DATA Indicator is off during this step.

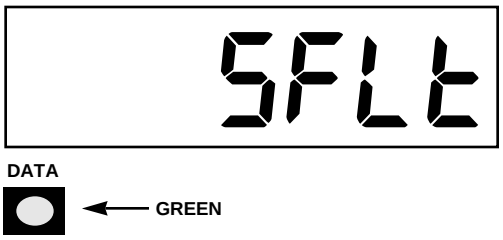


❑ Press the **DATA/FCTN** key to enter the "Data" level for function # 998. The DATA Indicator is GREEN to indicate that this function is currently being accessed. The SCDU prompts the user to press the **ENTER** key by displaying:



❑ Press the **ENTER** key to actually start the PCU diagnostics. While the PCU is performing the diagnostics test, the SCDU displays:

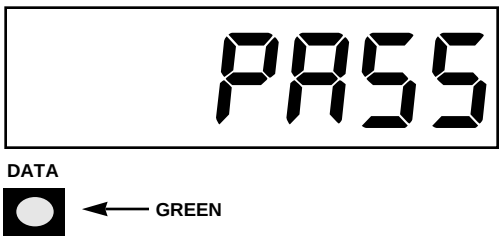
The PCU will not begin the diagnostic routines if a SEVERE PCU FAULT exists. The PCU will declare a SEVERE FAULT under several conditions including an IST fault, power supply failure, line sync loss, low line, or DCU failure. If a SEVERE FAULT exists when the PCU starts the diagnostic tests, the SCDU displays:



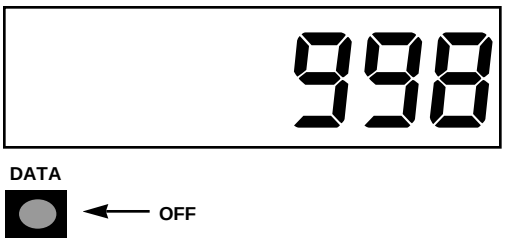
❶ Severe faults can only be cleared by pressing the **RESET** button on the Main CPU Control PCB or by cycling power to the drive.

❷ If the display stays on '**tESt**' and the contactor doesn't pick up, there is a fault in the motor field connections.

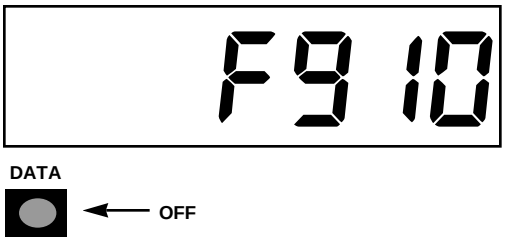
❸ There are 4 different kinds of displays possible on the SCDU after the PCU diagnostic routines complete. If all tests indicate that there are no failed power components (SCRs and fuses), the SCDU displays:



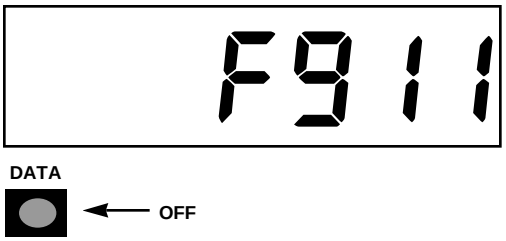
❑ Press the **DATA/FCTN** key to exit the PCU diagnostic routine and return to the "Function" level. The SCDU displays:



❶ If the PCU detects one or more open AC fuses, it displays the fault code for a blown fuse (**F910**):

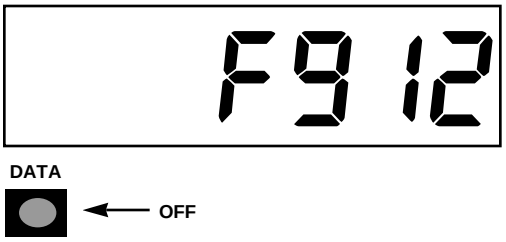


❷ If the PCU detects one or more shorted SCR/doubler packs, the SCDU displays the fault code for a shorted doubler (**F911**):



❑ Remove power from the drive, consult the Maintenance Guide, or call MagneTek for assistance, to replace the SCR(s) that are shorted, and perform this test again.

If the PCU detected one or more open SCR/doubler packs, the SCDU displays the fault code for an open SCR/doubler pack (**F912**):



❑ Remove power from the drive, consult the Maintenance Guide, or call MagneTek for assistance, to replace the SCR(s) that are open, and repeat this test until the SCDU displays the **'PASS'** massage.

Troubleshooting Guide

This section lists the fault and error codes along with their possible causes and corrective actions. The possible cause(s) are listed in order of most likely to least likely. The corrective actions are listed in order of simplest to most difficult to perform.

Use the procedures listed in Section 3, Operation, to display and clear the faults and errors listed in Table 3.

NOTES

- ● ..... Bulleted Faults/Errors require a microprocessor reboot. Press the RESET button located on the main PCB or remove and reapply 120VAC control power.

DCU ..... **(Drive Control Unit)** This is the microprocessor that primarily executes the PAC code. This code is customized to user applications.

PCU ..... **(Power Conversion Unit)** This is the microprocessor that primarily executes the standard code and controls the firing of the SCRs.

EPROM ... Type of memory chip, "Erasable Programmable Read Only Memory".

PAC ..... DSD custom software, "Programmable Application Control" language.

Table 3. **Troubleshooting Guide**

Fault/Error Code	Fault/Error Name	**Possible Causes** & Corrective Actions
P.L.	Control Power Loss	**120 VAC control power is not present.** ❶ Check any circuit breakers or fuses in this circuit. See "Replacing Fuse(s)"/ Maintenance Section. ❷ Check connection at J11. See "Connectors on Drive Control PCB"/ Maintenance Section.
– – – – – –	● Line Fuse(s) Open	**Each line indicates a blown fuse.** ❶ Check for blown fuses. See "Replacing Fuse(s)"/Maintenance Section. ❷ Check cable connection at J14. See "Connectors on Drive Control PCB"/ Maintenance Section. ❸ Check for proper 3 phase voltage applied.

Table 3. **Troubleshooting Guide – Continued**

Fault/Error Code	Fault/Error Name	**Possible Causes** & Corrective Actions
– – –	• Line Fuses Open	**Application of 120 VAC control power with 3 phase power off.** ❶ Remove 120 VAC control power and reapply after 3 phase power is present. ❷ New PCU EPROMs that allow control power to be applied without 3 phase present is available. Contact MagneTek.
13	• Bad Instruction	**Main PCB Hardware.** **Invalid DCU Instruction.** ❶ Unplug and reseat all cables and socketed devices. ❷ Replace main drive PCB. See "Replacing Drive Control PCB"/Maintenance Section. ❸ Electromagnetic noise near the drive's main PCB may be the cause. Record the situations during which this fault occurred. Eliminate noise.
14	• Exception Vector 10	
15	• Exception Vector 11	
16	• Privilege Violation	
17	DCU Divide By Zero	**Divide By Zero** ❶ If this fault occurs a few times on power-up, then it can be ignored if the drive is operating properly. The purpose of this fault is to assist in checking new code. Disable this unnecessary fault by using Function 801/See "Error Handling & Reporting"/Operation Section. Remove this fault from both the fault list and the error list. ❷ If this error occurs at times other than at power-up, or if the drive is not operating properly, then the drive's PAC code should be reviewed. The fault producing Block can be identified by accessing the Error or Fault List.
21	• Watchdog Trip	**Main PCB Hardware** ❶ Unplug and reseat all cables and socketed devices. ❷ Replace main drive PCB. See "Replacing Drive Control PCB"/Maintenance Section. ❸ Electromagnetic noise near the drive's main PCB may be the cause. Record the situations during which this fault occurred. Eliminate noise.

Table 3. **Troubleshooting Guide – Continued**

Fault/Error Code	Fault/Error Name	**Possible Causes** & Corrective Actions
22	DCU Reserved Interrupt	**Main PCB Hardware** ❶ Unplug and reseat all cables and socketed devices. ❷ Replace main drive PCB. See "Replacing Drive Control PCB"/Maintenance Section. ❸ Electromagnetic noise near the drive's main PCB may be the cause. Record the situations during which this fault occurred. Eliminate noise.
23	DCU Uninitialized Interrupt	
24	DCU Trace Exception	
25	DCU User Exception	
26	DCU Spurious Exception	
96	Web Break	**This fault is declared by the WEBB_0 PAC block. This is a backup level web break detection fault and is not capable of detecting all valid web breaks.** ❶ If an actual web break has not occurred, then the parameter for this fault may have to be adjusted. Functions 150, 151, and 152 are usually used to setup this fault.
97	Overspeed Trip	**This fault is declared by the TMON_0 PAC block.** ❶ Function 41, "Overspeed Trip", should normally be set to 110%. If this DC drive is used above base speed, then this overspeed trip point should be increased to allow for higher speeds. ❷ A tach loss could also cause this fault. Check that the tach signal is reaching the drive, that tach wiring is correct, and that the tach is not damaged, loose, or cracked. ❸ Noise on the tach wires or airborne noise near the Main PCB can cause this fault. Check that tach wiring does not run parallel to power wiring. Tach wires should be run with signal level wires only. ❹ A speed command that exceeds the tach overspeed setting can cause this fault. Reduce speed reference or increase overspeed setpoint. A trim to the speed reference could cause an overspeed. Check that speed trims are limited properly. ❺ An improperly tuned speed regulator can cause an overspeed. Check tuning.

Table 3. **Troubleshooting Guide – Continued**

Fault/Error Code	Fault/Error Name	**Possible Causes** & Corrective Actions
97 (continued)		❻ This fault could be caused by this motor being pulled along by the load. ❼ Try running this DC drive in voltage feedback to see if this fault still occurs.
98	Tach Loss Trip	**This fault is declared by the TMON_0 PAC block.** ❶ This fault may be set too sensitive. On a DC drive increase the setting of Function 42, "Volt Sense Level", to 20 and increase the setting of Function 43, "Tach Sense Level", to 15. ❷ Check tach wiring for loose or improper connections both at tach and at drive. ❸ Check for a loose, damaged, or slipping tach coupling. ❹ Try running this DC drive in voltage feedback to see if this fault still occurs.
99	Reverse Tachometer Connection	**This fault is declared by the TMON_0 PAC block.** ❶ Correct tach wiring at drive or at tach. ❷ Try running this DC drive in voltage feedback to see if this fault still occurs.
100	Not a Number	**PAC Block Math Error** ❶ If any of these faults occurs a few times on powerup, then it can be ignored if the drive is operating properly. The purpose of these faults is to assist in checking new code. Disable the unnecessary fault by using Function 801/See "Error Handling & Reporting"/Operation Section. Remove this fault from both the fault list and the error list. ❷ If any of these errors occur at times other than powerup, or if the drive is not operating properly, then the drive's PAC code should be reviewed. The fault producing Block can be identified by accessing the Error or Fault Lists.
101	Math Overflow	
102	Math Underflow	
103	Floating Point Divide By Zero	

Table 3. **Troubleshooting Guide – Continued**

Fault/Error Code	**Fault/Error Name**	**Possible Causes** & Corrective Actions
104	Sign Error in Speed Regulator	**Often caused by slipping nip or improper data entry to the drive.** ❶ Regulator settings need adjusting. ❷ Check all parameters and inputs against application limits.
110	Bad Thumbwheel Digit	**1. Thumbwheel switch connected directly to drive contains an invalid digit** **2. Selected bank of Thumbwheel switches is not present.** ❶ Check cables and connections. ❷ Check Bank Select jumper positions on the Thumbwheel Selector Switch Assemblies.
111	Missing Thumbwheel Switch	
113	• Missing PCU	**Hardware Failure in the Power Conversion Unit** ❶ Replace main drive PCB board. See "Replacing Drive Control PCB"/ Maintenance Section.
220	• 68K ROM Bus Error	**Hardware or Software Failure/Improper Addressing Attempted** ❶ Unplug and reseat all cables and socketed devices. ❷ Replace drive main PCB board. See "Replacing Drive Control PCB"/ Maintenance Section.
221	• 68K RAM Bus Error	
222	• 68K NVRAM Bus Error	
223	• 68K DPRAM Bus Error	
224	• LAN Bus Error	
232	• Unknown Bus Error	
240	• 68K ROM Address Error	
241	• 68K RAM Address Error	
242	• 68K NVRAM Address Error	
243	• 68K DPRAM Address Error	
244	• LAN Address Error	
252	• Unknown Address Error	

Table 3. **Troubleshooting Guide – Continued**

Fault/Error Code	Fault/Error Name	**Possible Causes** & Corrective Actions
260	Iteration Time-Out	**YMODEM transfer is stopped. The drive has tried to send or receive a character and failed to do so within a specific timeout period.** ❶ Verify that the serial cables are attached properly between the source PC and the drive. ❷ Verify that the PC has the correct serial communications settings for communications with a drive.
261	Out of Sequence	**YMODEM transfer is stopped. YMODEM protocol has been violated by an out of sequence block.** ❶ Cancel and try to start over again.
262	Byte Time Out	**YMODEM transfer is stopped.** Same corrective actions as 260.
263	Wrong File Type	**YMODEM transfer is stopped. The drive was sent a file whose file extension was not recognized. The drive will accept either a .PRG file or a .PAR file.** ❶ Cancel and try again with a valid file name.
264	Null Block Expected	**YMODEM transfer is stopped. The YMODEM protocol has been violated. A null block was expected but never received.** ❶ Re-initialize up load procedures on the YMODEM software and the drive and try again.
265	User Canceled	**YMODEM transfer is stopped. A user has aborted the file transfer from the PC.** ❶ Start again if desired.

Table 3. **Troubleshooting Guide – Continued**

Fault/Error Code	Fault/Error Name	**Possible Causes** & Corrective Actions
266	Unexpected Null Block	**YMODEM transfer is stopped. The YMODEM protocol has been violated. A null block was received but not expected.** ❶ Re-initialize up load procedures on the YMODEM software and the drive and try to start again.
267	Wrong S-Record Type	**YMODEM transfer is stopped. The program information data is corrupted.** ❶ Try again from backup file. ❷ Recompile PAC program.
268	Bad S-Record Check	
269	Bad S-Record End Record	
270	File Too Large	**YMODEM transfer is stopped. The file to be transmitted is too large to fit in drive's memory.** ❶ PAC program is too large. Redo, recompile and try again.
271	Wrong File Name	**YMODEM transfer is stopped. The parameter file sent does not belong to the drive.** ❶ Verify the file belongs to the drive and try again.
272	No Memory Here	**YMODEM transfer is stopped. The file attempted to write to non-existent memory.** ❶ Verify drive type in PAC file is correct. ❷ Replace drive PCB or flash ROM chips. See "Replacing Drive Control PCB"/ Maintenance Section.
273	NVRAM Protected	**YMODEM transfer is stopped. The NVRAM switch is set to write protect the NVRAMs.** ❶ Put the NVRAM Protection switch to the "off" position and retry transfer.
274	Motor Running	**YMODEM transfer is stopped. The motor was running during an operation that required the motor to be stopped.** ❶ Verify that the motor is not being pulled by its load. ❷ Stop motor and retry the transfer.

Table 3. **Troubleshooting Guide – Continued**

Fault/Error Code	Fault/Error Name	**Possible Causes** & Corrective Actions
274 (continued)		❸ If drive has failed to stop motor, replace main drive PCB board. See "Replacing Drive Control PCB"/Maintenance Section.
275	Not a Parameter File	**YMODEM transfer is stopped. The .PAR file is corrupt or not in the correct format to be a .PAR file.** ❶ Re-down load with backup .PAR file.
276	Flash RAM Program 00 Error	**YMODEM transfer is stopped. The .PRG file does not agree with the PROMs installed in the drive.** ❶ Replace Main drive PCB or flash ROM chips. See "Replacing Drive Control PCB"/Maintenance Section.
277	Flash RAM Program FF Error	
278	Flash RAM Verify Error	
290	Board Status Bus Error	
291	Board Control Bus Error	**CPU halted.** **Communications Failure**. ❶ Call MagneTek for field service assistance.
292	D/A 1 Bus Error	
293	D/A 2 Bus Error	
294	A/D Bus Error	
295	Clock Bus Error	
296	Tachometer Bus Error	
298	Expansion 2 Bus Error	
300	Board Status Address Error	
301	Board Control Address Error	
302	D/A 1 Address Error	
303	D/A 2 Address Error	
304	A/D Address Error	
305	Clock Address Error	
306	Tachometer Address Error	
307	Expansion 1 Address Error	
308	Expansion 2 Address Error	

Table 3. **Troubleshooting Guide – Continued**

Fault/Error Code	Fault/Error Name	**Possible Causes** & Corrective Actions
800	• LAN Hardware Error	**Local Area Network (LAN) Error** ❶ Check T connectors. ❷ Verify 93 ohm value for terminating resistors. ❸ Verify that cable lengths do not exceed recommended values. ❹ Verify that drive is properly grounded.
801	Maximum LAN Retries Exceeded Error	
802	Illegal LAN Message Type Error	
803	LAN Broadcast Message Missed Error	
804	LAN Directed Message Missed Error	
805	LAN-No Transmit Room	
806	LAN-No Receive Room	
900	PCU Loop Fault	**1. a. Coast Stop Circuit was opened.** **b. Contactor Failure (coil or interlock contact).** **2. Contact pilot relay failure.** ❶ Check coast stop circuit and repair. Check contactor and repair. ❷ Replace Power Supply. See "Replacing the Power Supply"/Maintenance Section.
901	Instantaneous Overcurrent Trip (IST)	**1. Short circuit in motor armature wiring.** **2. Poor current regulator tuning.** ❶ Check motor armature and repair as necessary. ❷ Check current regulator settings.
902	• Power Supply Fault	**1. Short circuit in remote power wiring:** **a. +5V to tachometer** **b. +24V to 24VDC logic** **c. +/–15V to Aux circuits** **2. Shorts on internal boards.** **3. Loss of 115 VAC power** **4. Failed power supply** (See Corrective Actions on next page)

Table 3. **Troubleshooting Guide – Continued**

Fault/Error Code	Fault/Error Name	**Possible Causes** & Corrective Actions
902 (continued)		❶ Check wiring and repair as necessary. ❷ Check boards for shorts and replace as necessary. ❸ a. Check output of 1PT b. Check and replace fuses as necessary. See "Replacing Fuse(s)"/Maintenance Section. c. Check wiring and repair as necessary. d. Check transformer and replace as necessary ❹ Replace DSD Power Supply. See "Replacing the Power Supply"/ Maintenance Section.
903	• Line Sync Loss Fault	**1. Excessively noisy or intermittent power connections.** **2. Faulty voltage dividers on Armature Interface PCB.** **3. Loss of 3 phase or 1 phase power.** ❶ Check power input for problems. ❷ Replace Armature Interface PCB. See "Replacing Armature Interface PCB"/Maintenance Section.
904	Low Line Fault	**1. Power line dips.** **a. 1 cycle below 50%.** **b. 2 cycles below 70%.** **c. 3 cycles below 80%.** **2. Loss of power fuse.** ❶ Check input power for problems. ❷ Check for blown fuses. See "Replacing Fuse(s)"/Maintenance Section.
905	Field Loss Fault	**1. Motor field or wiring open.** **2. a. Wrong trip level set.** **b. Field Economy set too low.** ❶ Check motor and wiring. ❷ a. Check trip level setting. b. Change economy setting as required.

Table 3. **Troubleshooting Guide – Continued**

Fault/Error Code	Fault/Error Name	**Possible Causes** & Corrective Actions
906	DCU Loss Fault	**1. Too much code in the faster scans and/or excessive DSD LAN traffic caused the PCU to run out of scan time.** **2. DCU microprocessor failure.** ❶ Reduce the number of LAN broadcasts or reduce the number of directed messages to this drive. ❷ PAC code might need to be revised in order to optimize the PAC execution time (contact Magnetek) ❸ Replace main PCB. See "Replacing Drive Control PCB"/Maintenance Section.
907	Thermistor Fault	**Thermistor on heat sink open or shorted.** ❶ Check connections. ❷ Check Thermistor with ohmmeter. ❸ Replace Thermistor.
908	Over Temperature Fault	**1. Too high ambient temperature.** **2. Clogged air filter in cabinet.** **3. Clogged heat sinks.** **4. Cooling fan failure.** ❶ Check for cause of increased ambient temperature. ❷ Clean heat sink fins. See "Preventive Maintenance". ❸ Check Cooling Fan. See "Replacing the Fan"/Maintenance Section.
909	Excessive Current Ripple Fault	**1. a. Loose connections in power circuit.** **b. Loose connections in gate leads or from DSD Drive Control PCB to Armature Interface PCB.** **2. a. Faulty Armature Interface PCB.** **b. Faulty DSD Control PCB.** **3. Poor current or speed regulator tuning.** ❶ Check all connections inside the power cube. ❷ Run self-diagnostics to check for bad SCRs.

Table 3. **Troubleshooting Guide – Continued**

Fault/Error Code	Fault/Error Name	**Possible Causes** & Corrective Actions
909 (continued)		❸ a. Replace Armature Interface PCB. See "Replacing Armature Interface PCB"/Maintenance Section. b. Replace main PCB. See "Replacing Drive Control PCB"/Maintenance Section.
910	• Blown Fuse Fault	**Main Fuses blown:** **1. Power Circuit problem; shorts or loose connections.** **2. Faulty SCR.** **3. Poor regulator tuning.** ❶ Check power circuit for shorts or loose connections and repair. ❷ Test for defective SCR(s) and replace as necessary. ❸ See "Replacing Fuse(s)"/Maintenance Section. **PERFORM THIS STEP LAST.**
911	• Shorted or leaky SCR	**1. Loose gate lead connector.** **2. Bad SCR.** **3. Faulty Armature PCB.** ❶ Replace faulty SCR. ❷ Replace Armature Interface PCB. See "Replacing Armature Interface PCB"/Maintenance Section.
912	• Open SCR Fault	
915	• Bad Set-Up Parameter Fault	**One or more of the drive's set-up parameters is not in the range of the HP selected:** • **Rated AC line volts setting is out of range.** • **Rated Motor Armature Volts setting is out of range.** • **Rated Load Current Setting is out of range.** • **Rated Source Frequency Setting is out of range.** • **Rated Field Current setting is out of range.** • **IST setting is too high.** ❶ Access the Fault or Error List to determine the faulty parameter(s), and the corresponding fault(s)/error(s).

Table 3. **Troubleshooting Guide – Continued**

Fault/Error Code	Fault/Error Name	**Possible Causes** & Corrective Actions
916	Forcing Fault	**No rotation was selected while the loop contactor was energized.** ❶ Stop drive and re-enter Forcing mode.
917	• Reverse Armature Voltage Connection Fault	**The polarity of the armature voltage feedback is reversed or missing.** ❶ Check polarity of wiring. ❷ Replace Armature Interface PCB. See "Replacing Armature Interface PCB"/ Maintenance Section.
918	IST Setting Error	**Setting for IST is above hardware limitations of approximately 325% of rated drive armature current.** ❶ Check setting and adjust as required.
919	Line Voltage Setting Error	**Setting for Rated Line Voltage is not within the acceptable range of 160-525 VAC or zero (which will allow the drive to decide if the input voltage is either 230 or 460 VAC).** ❶ Check setting and adjust as required.

Table 3. **Troubleshooting Guide – Continued**

Fault/Error Code	Fault/Error Name	**Possible Causes** & Corrective Actions
920	Load Voltage Setting Error	**Setting for Rated Armature Voltage is not within the acceptable range of 150-700 Vdc. If a setting of zero is selected, the drive will sense the line voltage and output a corresponding Armature Voltage.** ❶ Check setting and adjust as required.
921	Bridge Fault	**1. Connector J14 is out of place.** **2. Faulty Armature Interface PCB.** **3. Faulty DSD Drive Control PCB.** ❶ Verify J14 is in proper location. ❷ Replace Armature Interface PCB. See "Replacing the Armature Interface PCB"/ Maintenance Section. ❸ Replace Drive main PCB. See "Replacing DSD Drive Control PCB"/Maintenance Section.
922	Frequency Setting Error	**Setting for Source Frequency is not within the acceptable range of 48 to 62 Hz or zero (the drive will default to 60 Hz if zero is entered).** ❶ Check setting and adjust as required.
923	Load Current Setting Error	**Setting for Rated Armature Current is not within a range of 1/8 to 2 times the nominal bridge current rating.** ***Also see the possible causes for F921.*** ❶ Check setting and adjust as required.

Table 3. **Troubleshooting Guide – Continued**

Fault/Error Code	Fault/Error Name	**Possible Causes** & Corrective Actions
924	Field Current Setting Error	**Setting for Rated Field Current is not within a range based on the version of Field Interface PCB present in the power cube. See "Field Interface PCB Ratings"/ Maintenance Parts List.** ***Also see the possible causes for F925.*** ❶ Check setting and adjust as required.
925	Field Sense Resistor Fault	**1. Connector J13 is out of place.** **2. Faulty Field Interface PCB.** **3. Faulty DSD Drive Control PCB.** ❶ Verify J13 is in proper location. ❷ Replace Field Interface PCB. ❸ Replace Drive main PCB. See "Replacing DSD Drive Control PCB"/Maintenance Section.
926	PCU Watchdog Timeout Fault	**1. Problem with either hardware or software on the DSD Drive Control PCB.** **2. Ambient noise near the drive's main PCB.** ❶ Electromagnetic noise near the drive's main PCB may be the cause. Record the situations during which this fault occurred. Eliminate noise. ❷ Contact MagneTek for assistance.

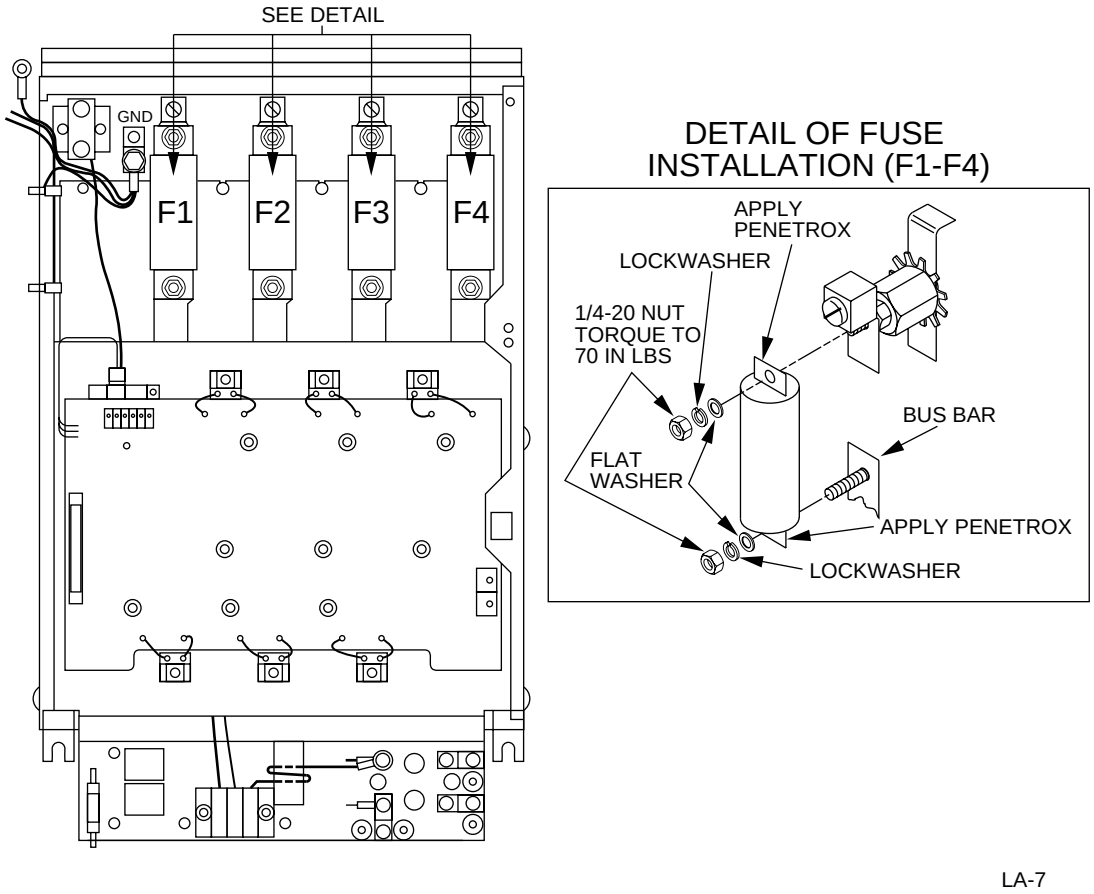


Figure 10. ***DSD Drive Fuse Replacement***

If you suspect that one of the fuses, the DSD Drive Control PCB, the fan, or the power supply needs to be replaced, follow the procedures in this section.

WARNING

Before performing any maintenance, disconnect all input and output power from the DSD drive.

Replacing Fuse(s)

To replace one or more fuses, follow this procedure:

- ❑ Disconnect all input and output power to the DSD drive.
- ❑ Pull the handle on the right side of the DSD Drive Control PCB (see Figure 11) towards you and swing the top chassis clear of the lower chassis.
- ❑ Remove both 1/4-20 hex nuts from the suspected fuse(s) (see Figure 10).
- ❑ Remove the lockwashers and flat washers (see Figure 10).
- ❑ Apply Penetrox or equivalent Copolymer oil (PN# 05G10017-001) to the surfaces between the fuses and the bus bar to ensure a good electrical connection.
- ❑ Replace flat washers, lockwashers, and hand tighten 1/4-20 nuts (see Figure 10.)
- ❑ Torque 1/4-20 nuts to 70 inch pounds.
- ❑ Close top chassis.
- ❑ Reconnect input and output power.
- ❑ See Section 3, Operation, for start-up procedure.

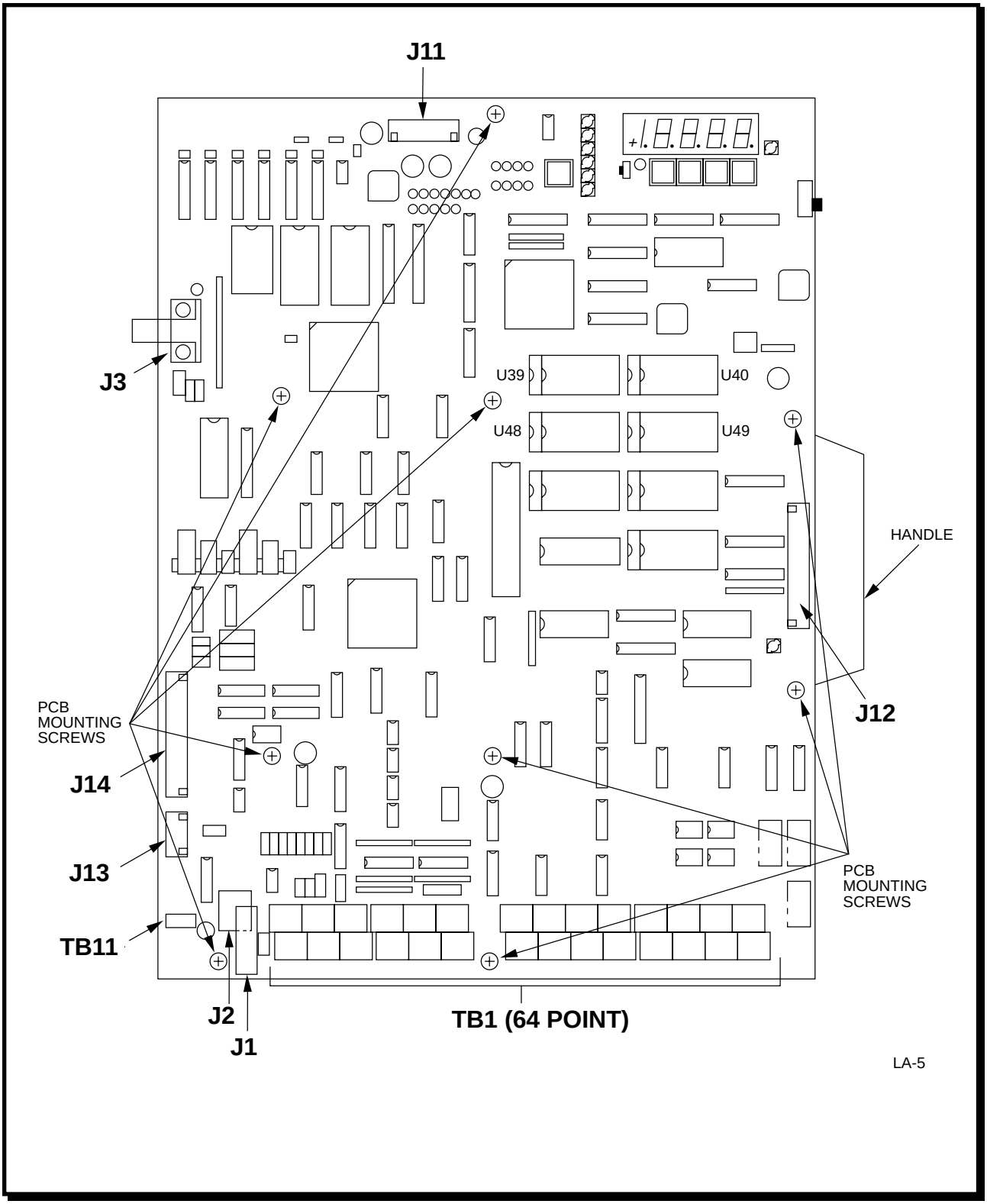


Figure 11. ***DSD Drive Control PCB***

Replacing DSD Drive Control PCB

CAUTION

The DSD Drive Control PCB has electrostatic sensitive components. You must follow Electrostatic Discharge (ESD) procedures to protect the components.

To replace the DSD Drive Control PCB, follow this procedure:

NOTE: You may need a helper to hold the PCB during replacement.

WARNING

Before performing any maintenance, disconnect all input and output power from the DSD drive.

❑ Remove all input and output power to the DSD drive.

❑ Note where all cables/wires are connected, especially those connected to TB1 (see Figure 11). Label any cables/wires, as necessary, to insure proper reinstallation.

Table 4. **Connectors on Drive Control PCB**

Connector	Type	Function
J1	DB-9	* RS422 Communications Port.
J2	RJ12 Connector	* RS 232 Port for Portable Control/ Display Unit (PCDU).
J3	BNC Connector	Optional LAN Connection.
J11	20 Pin Header	Power Supply, E-Stop, Motor Thermal Guard, Loop Contactor Control.
J12	40 Pin Header	Connector for auxiliary Interface Card (optional).
J13	10 Pin Header	Field Control.
J14	40 Pin Header	Armature Firing Control.
TB1	Screw Terminals (12 Gauge Wire)	Analog and Digital Local I/O.
TB11	Bare Screw Terminal	Earth Ground

* Either connector J1 or J2 will be present on the board.

- ❑ Remove cables/wires connected to J1, J2, J3, J11, J13, J14, TB1 and TB11 (see Figure 11).
- ❑ Remove flash RAM U39, U40, U48, and U49 to reinstall on new Board (see figure 11)
- ❑ Remove the nine mounting screws (see Figure 11).
- ❑ Remove the DSD Drive Controller PCB.
- ❑ Position the replacement DSD Drive Control PCB over the mounting holes.
- ❑ Fasten the nine PCB mounting screws.
- ❑ Replace cables/wires previously connected to J1, J2, J3, J11, J13, J14, TB1 and TB11.
- ❑ Reconnect input and output power.
- ❑ See Section 3, Operation, for start-up procedure.

Replacing the Fan

To replace the DSD Drive Fan, follow the procedure given for the HP of your DSD drive:

NOTE: Observe where all cables/wires are connected, to insure proper reinstallation.

DSD 406 or 412: 15-30 HP, 230V, 30-60 HP, 460V

- ❑ Disconnect all input and output power to the DSD drive.
- ❑ Remove four, #8-32 fan bracket mounting, screws from the DSD chassis as illustrated in Figure 12. Loosen, do not remove, two #8-32 positioning screws from top of fan mounting bracket as illustrated in Figure 12. Fan bracket can be removed from DSD chassis.
- ❑ Unplug cord assembly from connector on fan.
- ❑ Fan can be removed from bracket by unscrewing four #6-32 screws and locknuts. The #6-32 screws and locknuts mount both the fan and the fan guard to the fan bracket.
- ❑ Position new fan over the mounting holes on the inside of the fan bracket. Note air flow arrow. Position fan guard over mounting holes on the outside of the fan bracket and fasten with #6-32 screws and locknuts.
- ❑ Position fan bracket in a manner that the cord assembly can be plugged into the fan.
- ❑ Position fan bracket with the two position screws so the four, #8-32 fan bracket mounting, screws can be fastened. Refer to Figure 12.
- ❑ Reconnect input and output power.
- ❑ See Section 3, Operation, for start-up procedure.

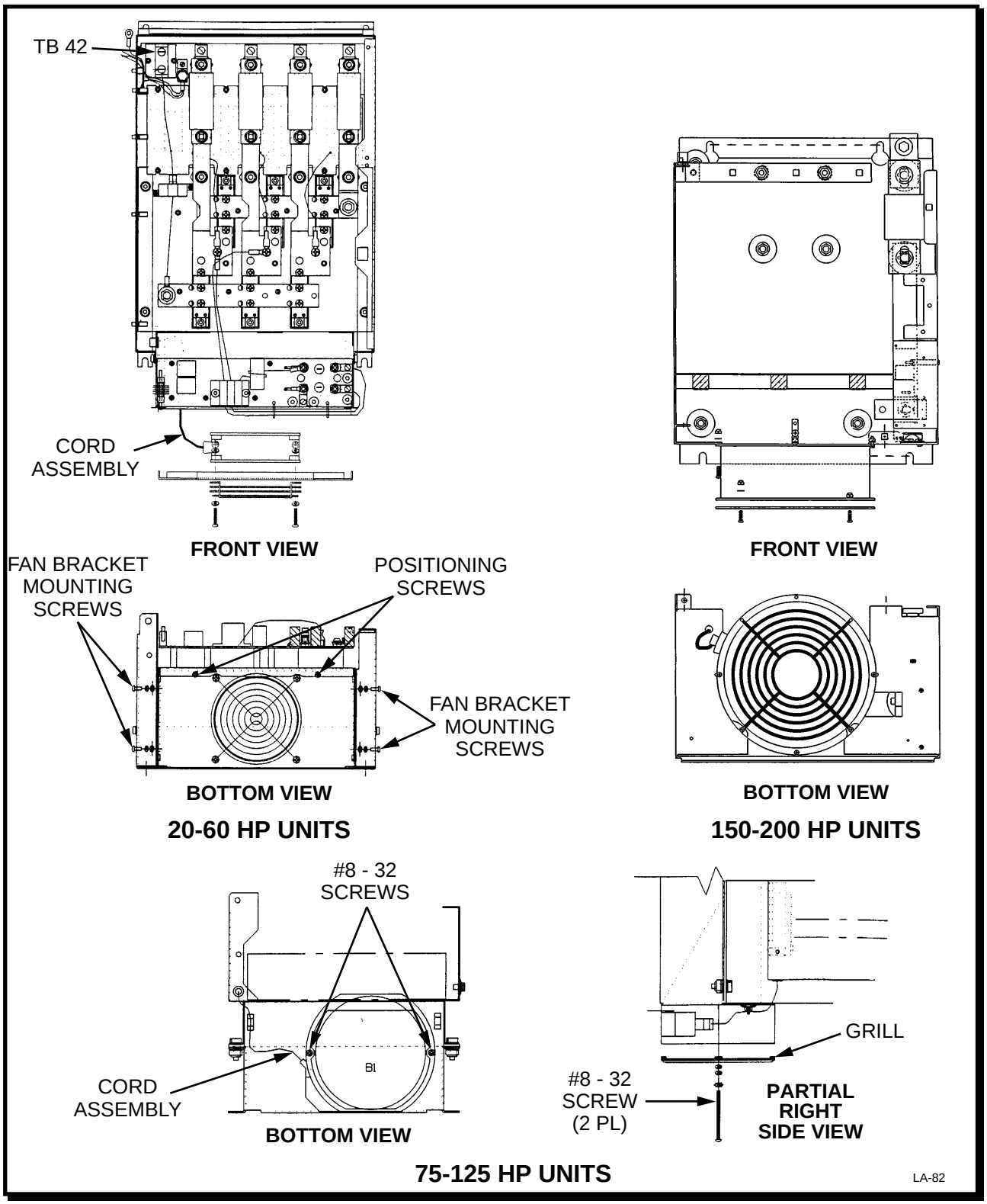


Figure 12. ***Replacing DSD Fan***

DSD 406 or 412: 40-60 HP, 230V, 75-125 HP, 460V

- ❑ Disconnect all input and output power to DSD drive.
- ❑ Remove grill and fan by unscrewing two #8-32 screws as illustrated in Figure 12. Be careful when removing fan as cord assembly will be plugged into fan.
- ❑ Unplug cord assembly from fan.
- ❑ Plug cord assembly into new fan.
- ❑ Fit two #8-32 screws, with star washers and split washers, through grill and new fan, as illustrated in Figure 12. Note air flow arrow. Position fan over mounting holes and tighten the screws.
- ❑ Reconnect input and output power.
- ❑ See Section 3, Operation, for start-up procedure.

DSD 412 only: 75-100 HP, 230V, 150-200 HP, 460V

- ❑ Disconnect all input and output power to DSD drive.
- ❑ Remove grill by unscrewing four #8-32 screws and locknuts.
- ❑ Remove fan by unscrewing five #8-32 screws and locknuts.
- ❑ Unplug cord assembly from fan.
- ❑ Plug cord assembly into new fan.
- ❑ Position new fan over mounting holes and reinstall the five #8-32 screws and locknuts. Note the air flow arrow.
- ❑ Position fan grill over new fan and reinstall the four #8-32 screws and locknuts.
- ❑ Reconnect input and output power.
- ❑ See Section 3, Operation, for start-up procedure.

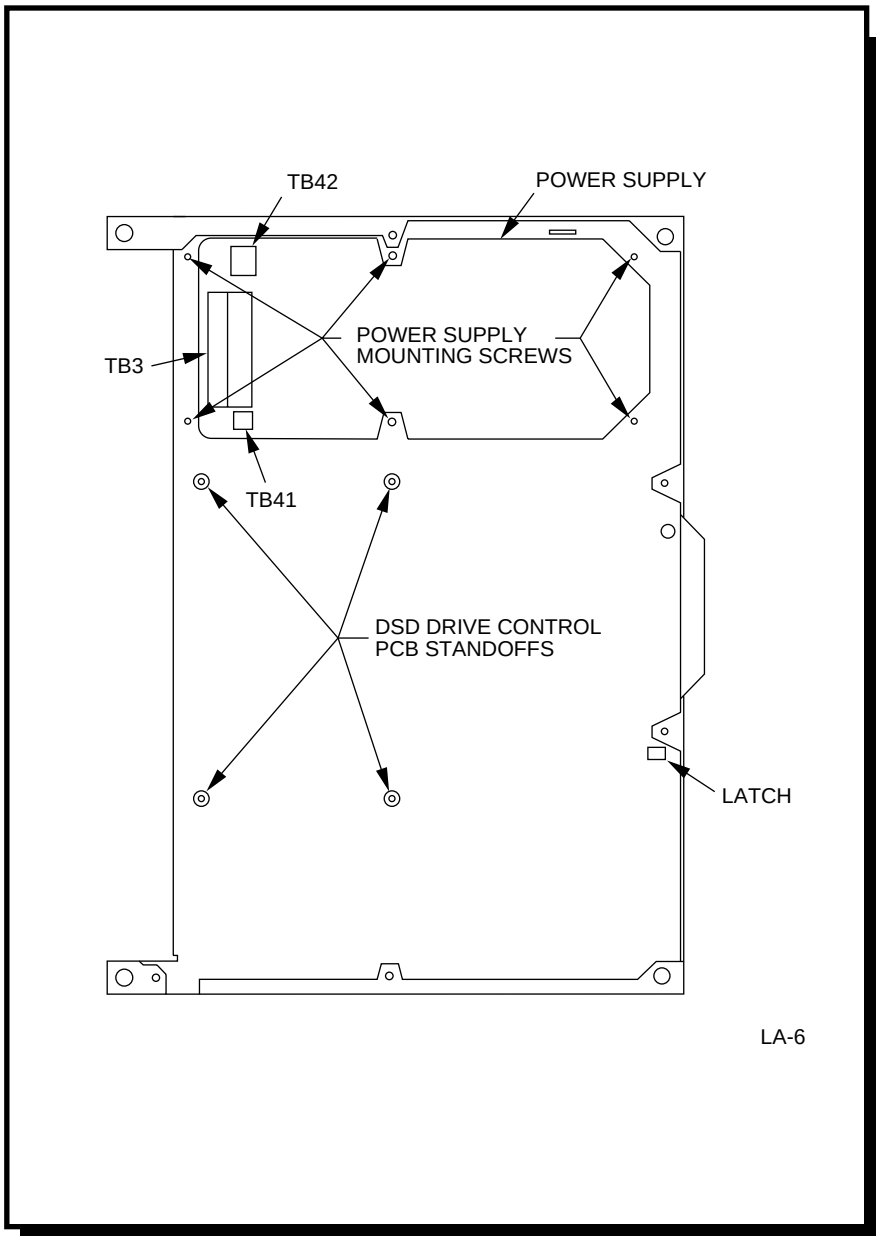


Figure 13. ***DSD Power Supply Replacement***

Replacing the Power Supply

To replace the DSD power supply, follow this procedure.

CAUTION

The DSD Drive Control PCB has electrostatic sensitive components. You must follow Electrostatic Discharge (ESD) procedures to protect the components.

WARNING

Before performing any maintenance, disconnect all input and output power from the DSD drive.

- ❑ Disconnect all input and output power from the DSD drive.
- ❑ Remove the DSD Drive Control PCB (see previous procedure).
- ❑ Note which cables/wires are connected to TB3, TB41, and TB42 on the DSD Power Supply (see Figure 13). Label any cables/wires, as necessary, to insure proper reinstallation.
- ❑ Remove cables/wires from TB3, TB41, and TB42.
- ❑ Remove six mounting screws (see Figure 13).
- ❑ Place new power supply on mounting holes.
- ❑ Fasten the six power supply mounting screws.
- ❑ Connect cables/wires to TB3, TB41, and TB42.
- ❑ Replace DSD Drive Control PCB.
- ❑ Reconnect input and output power.
- ❑ See Section 3, Operation, for start-up procedure.

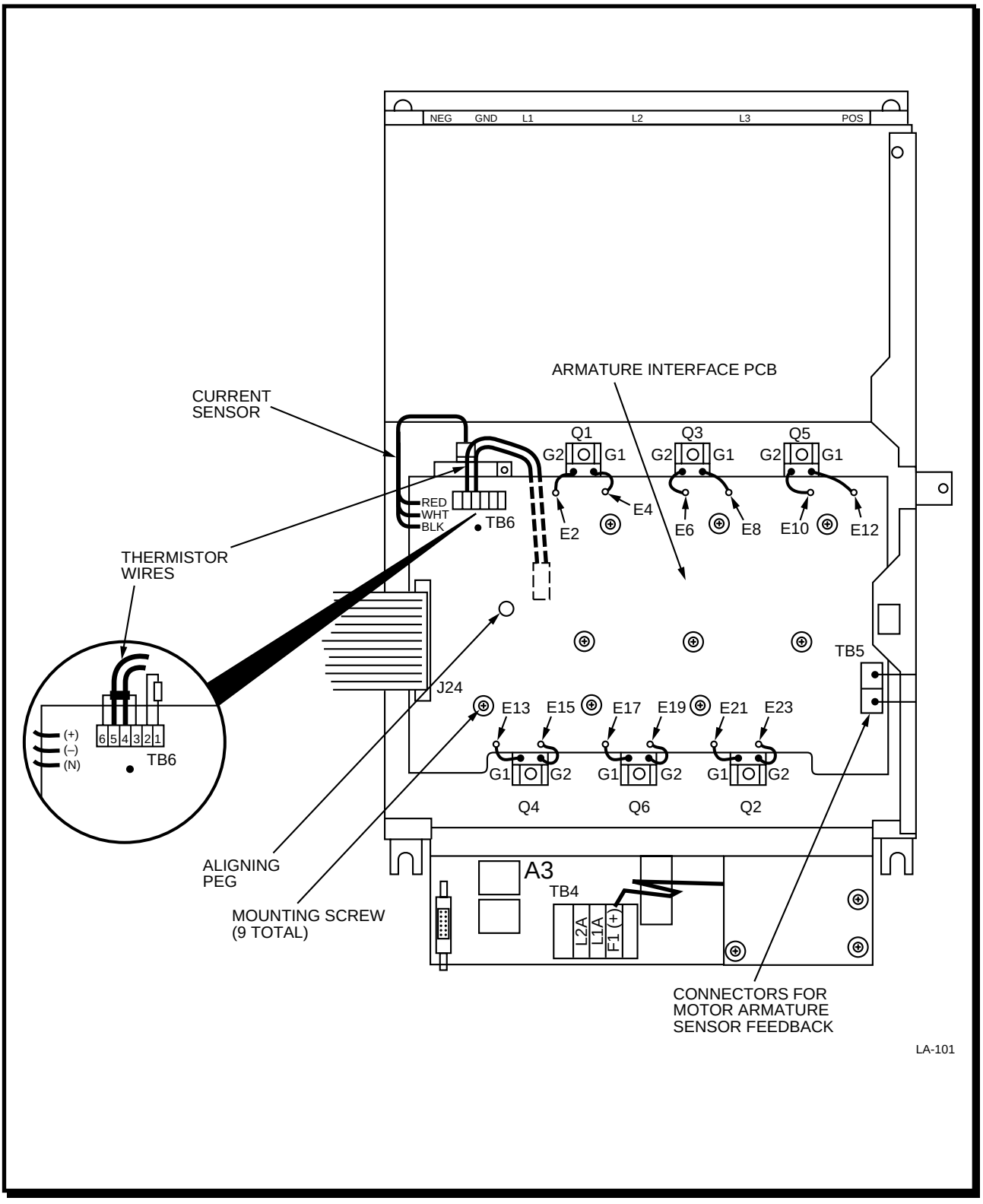


Figure 14. ***DSD Armature Interface PCB Replacement***

Replacing the DSD Armature Interface PCB

CAUTION

The DSD Armature Control PCB contains electrostatic sensitive components. You must follow Electrostatic Discharge (ESD) procedures to protect the components.

To replace the DSD Drive Armature Interface PCB, follow this procedure:

WARNING

Before performing any maintenance, disconnect all input and output power from the DSD drive.

- ❑ Remove all input and output power to the DSD drive.
- ❑ Locate the Armature Interface PCB. This board is located behind the door assembly.
- ❑ Allow the DSD drive to sit for a few seconds to allow the SCRs to discharge.
- ❑ Remove the J24 connector (see Figure 14).
- ❑ Remove (unscrew) the wire connectors to the motor armature sensor feedback wires at TB5 (see Figure 14).
- ❑ Disconnect the SCRs (Q1 through Q6) gate leads (12 leads) using a needle nose pliers. Six leads are located on the top and six on the bottom section of the armature PCB.
- ❑ Disconnect (unscrew) the thermistor wires at terminals 4 and 5 at TB6 (see Figure 14).
- ❑ Disconnect the current sensor (see Figure 14).
- ❑ Remove the mounting screws (9 screws).
- ❑ Hold board from top left corner and center bottom and pull out.
- ❑ Install new board. Line up new board with peg (see Figure 14), and push new board in making sure not to pinch any wires under the board.
- ❑ Install the mounting screws (Torque specification of 5-1/2 inch-pounds).
- ❑ Reconnect the current sensor.
- ❑ Reconnect the thermistor wires at terminals 4 and 5 at TB6.

- ❑ Reconnect the SCR gate leads making sure they are not crossed, and are pushed all the way in (gate leads will first “click” and can then be pushed in for an additional 1/8” to 1/64”).
- ❑ Reconnect the Armature sensor feedback wires making sure to observe the polarity. If these leads are connected in reverse, a Fault 917 (Reverse Armature Voltage Connection Fault) will occur.
- ❑ Reconnect the J24 connector.
- ❑ Apply power to the drive.

DSD 406 and 412 Spare Parts List

The parts in Table 5 are replacements for DSD 406 / 412 230 Volt drives.
The parts in Table 6 are replacements for DSD 406 / 412 460 Volt drives.

Table 5. **230 Volt Drives Spare Parts**

Description	Ref. Design.	Qty/Drive	Part Number
Drive Control PCBA	A1	1	46S02975-0202
Armature Interface PCBA	A2	1	
DSD 406: 1 - 15 HP			46S03049-0010
20 - 30 HP			-0020
40 - 60 HP			46S02976-0040
DSD 412: 1 - 15 HP			46S02976-0010
20 - 30 HP			-0020
40 - 60 HP			-0030
75 - 100 HP			46S03088-0010
Field Interface PCBA	A3		
0.2 - 1.9 A			46S03046-0010
0.8 - 4.0 A		1	-0020
1.4 - 6.9 A			-0030
2.0 - 9.6 A			-0040
2.0 - 16 A			-0050
5.0 - 24 A			-0060
Power Supply PCBA	A4		05P00090-0293
Snubber PCBA	A5	1	
1 - 7.5 HP			46S03020-0010
10 - 15 HP		1	-0020
20 - 30 HP			-0030
40 - 60 HP			46S03017-0010
75 - 100 HP (DSD 412 only)			46S03089-0010
SCR	DSD 406: Q1-3 DSD 412: Q1-6	DSD 406: 3 DSD 412: 6	
1 - 15 HP			05P00050-0409
20 - 30 HP			-0410
40 - 60 HP (DSD 412 only)			-0412
SCR			
40 - 60 HP (DSD 406 only)	Q1, 3, 5	3	05P00050-0446
	Q2, 4, 6	3	-0447
SCR	Q1-12	12	
75 - 100 HP (DSD 412 only)			46S03214-0010

Table 5. **230 Volt Drives Spare Parts - Continued**

Description	Ref. Design.	Qty/Drive	Part Number
Fan / Guard	B1	1	
1 - 10 HP			None
15 - 30 HP			05P00016-0048
40 - 60 HP			-0012
75-100 HP (DSD 412 only)			-0008
Current Transducer	U1	1	
1 - 7.5 HP			05P00217-0015
10 - 15 HP			-0014
20 - 30 HP			-0013
40 - 60 HP			-0012
75 - 100 HP (DSD 412 only)			-0020
Field Power Module	Q7	1	05P00050-0442
AC Line Fuse	F1-3	3	
1 HP (10 A)			05P00017-0387
1.5 - 2 HP (12 A)			-0349
3 - 5 HP (35 A)			-0226
7.5 - 10 HP (50 A)			-0227
15 HP (70 A)			-0155
20 - 25 HP (125 A)			-0228
30 HP (150 A)			-0166
40 - 50 HP (200 A)			-0179
60 HP (200 A)			-0220
75 - 100 HP (400 A) (DSD 412 only)			-0234
DC Bus Fuse (DSD 412 Only)	F4	1	
1 HP (10 A)			05P00017-0387
1.5 HP (12 A)			-0349
2 HP (15 A)			-0243
3 - 5 HP (50 A)			-0227
7.5 - 10 HP (70 A)			-0155
15 HP (100 A)			-0178
20 - 25 HP (150 A)			-0166
30 HP (200 A)			-0179
40 - 50 HP (250 A)			-0220
60 HP (300 A)			-0366
75 HP (400 A)			-0234
100 HP (500 A)			-0235
Burden Resistor	R4	1	See Table 7
Power Range Resistor	R5	1	See Table 8

Table 6. **460 Volt Drives Spare Parts**

Description	Ref. Design.	Qty/Drive	Part Number
Drive Control PCBA	A1	1	46S02975-0202
Armature Interface PCBA	A2	1	
DSD 406: 2 - 30 HP			46S03049-0010
40 - 60 HP			-0020
75 - 125 HP			46S02976-0040
DSD 412: 2 - 30 HP			46S02976-0010
40 - 60 HP			-0020
75 - 125 HP			-0030
150 - 200 HP			46S03088-0010
Field Interface PCBA	A3	1	
0.2 - 1.9 A			46S03046-0010
0.8 - 4.0 A			-0020
1.4 - 6.9 A			-0030
2.0 - 9.6 A			-0040
2.0 - 16 A			-0050
5.0 - 24 A			-0060
Power Supply PCBA	A4	1	05P00090-0293
Snubber PCBA	A5	1	
2 - 15 HP			46S03020-0010
20 - 30 HP			-0020
40 - 60 HP			-0030
75 - 125 HP			46S03017-0010
150 - 200 HP (DSD 412 only)			46S03089-0010
SCR	DSD 406: Q1-3 DSD 412: Q1-6	DSD 406: 3 DSD 412: 6	
2 - 30 HP			05P00050-0409
40 - 60 HP			-0410
75 - 125 HP (DSD 412 only)			-0412
SCR			
75 - 125 HP (DSD 406 only)	Q1, 3, 5	3	05P00050-0446
	Q2, 4, 6	3	-0447
SCR	Q1-12	12	46S03214-0010
150 - 200 (DSD 412 only)			
Fan	B1	1	
2 - 25 HP			None
30 - 60 HP			05P00016-0048
75 - 125 HP			-0012
150 - 200 HP (DSD 412 only)			-0008

Table 6. **460 Volt Drives Spare Parts - Continued**

Description	Ref. Design.	Qty/Drive	Part Number
Current Transducer	U1	1	
2 - 15 HP			05P00217-0015
20 - 30 HP			-0014
40 - 60 HP			-0013
75 - 125 HP			-0012
150 - 200 HP (DSD 412 only)			-0020
Field Power Module	Q7	1	05P00050-0442
AC Line Fuse	F1-3	3	
2 HP (10 A)			05P00017-0387
3 - 5 HP (12 A)			-0349
7.5 - 10 HP (35 A)			-0226
15 - 20 HP (50 A)			-0227
25 - 30 HP (70 A)			-0155
40 - 50 HP (125 A)			-0228
60 HP (150 A)			-0166
75 - 100 HP (200 A)			-0179
125 HP (200 A)			-0220
150 - 200 HP (400 A) (DSD 412 only)			-0234
DC Bus Fuse (DSD 412 Only)	F4	1	
2 HP (10 A)			05P00017-0387
3 HP (12 A)			-0349
5 HP (15 A)			-0243
7.5 - 10 HP (50 A)			-0227
15 - 20 HP (70 A)			-0155
25 - 30 HP (100 A)			-0178
40 - 50 HP (150 A)			-0166
60 HP (200 A)			-0179
75 - 100 HP (250 A)			-0220
125 HP (300 A)			-0366
150 HP (400 A)			-0234
200 HP (500 A)			-0235
Burden Resistor	R4	1	See Table7
Power Range Resistor	R5	1	See Table 8

Table 7. **Burden Resistor**

HP Rating		Part No.	Description	Qty.	Ref. Design.
230V	460V				
1	2	05P00225-2250	64.9 ohms, 1% metal film, 1/4 Watt.	1	R4
1.5	3	05P00225-2250			
2	5	05P00225-2260	76.8 ohms, 1% metal film, 1/4 Watt.	1	R4
3	7.5	05P00225-2260			
5	10	05P00225-2260			
7.5	15	05P00225-2260			
10	20	05P00225-1610	38.3 ohms, 1% metal film, 1/4 Watt.	1	R4
—	25	05P00225-1610			
15	30	05P00225-1610			
20	40	05P00225-3600	9.53 ohms, 1% metal film, 1/4 Watt.	1	R4
25	50	05P00225-3600			
30	60	05P00225-3600			
40	75	05P00041-0703	4.32 ohms, 1% metal film, 3 Watt.	1	R4
50	100	05P00041-0703			
60	125	05P00041-0703			
75	150	05P00225-1992	20.0 ohms, 1% metal film, 1 Watt.	1	R4
100	200	05P00225-0022	15 ohms, 1% metal film, 1 Watt.	1	R4

Table 8. **Power Range Resistor**

HP Rating		Part No.	Description	Qty.	Ref. Design.
230V	460V				
1	2	05P00225-2060	26.7 ohms, 1% metal film, 1/4 Watt.	1	R5
1.5	3	05P00225-2060			
2	5	05P00225-2300	86.6 ohms, 1% metal film, 1/4 Watt.	1	R5
3	7.5	05P00225-2300			
5	10	05P00225-2770	196 ohms, 1% metal film, 1/4 Watt.		
7.5	15	05P00225-2770			
10	20	05P00225-0200	332 ohms, 1% metal film, 1/4 Watt.	1	R5
—	25	05P00225-0200			
15	30	05P00225-0200			
20	40	05P00225-0230	499 ohms, 1% metal film, 1/4 Watt.	1	R5
25	50	05P00225-0230			
30	60	05P00225-0230			
40	75	05P00225-3590	715 ohms, 1% metal film, 1/4 Watt.	1	R5
50	100	05P00225-3590			
60	125	05P00225-3590			
75	150	05P00225-3780	953 ohms, 1% metal film, 1/4 Watt.	1	R5
100	200	05P00225-3790	1.27 K ohms, 1% metal film, 1/4 Watt.	1	R5

Glossary

A/D – Analog to Digital converter.

Active Hub – A central component in LAN star networks that ensures data integrity over distances of up to 2000 feet by regenerating the network signal.

Active menu item – The menu item for an RDU that will be used to get the source of the information to be displayed. When a menu item number is selected, the Control/Display Unit (CDU) menu item data will be used; if there is no data in the CDU menu item for the selected menu item number, then the default menu item data is used.

Active Link – A device that interconnects two LAN bus networks.

ANIO – Remote Analog I/O [Input/Output] PCB.

Broadcast message – A type of LAN message which is capable of being received by all nodes on the LAN. The message contains the source of the message, but the destination is all nodes that have been enabled to receive broadcast messages.

CDU – Control/Display Unit. There are two CDUs supported for the MicroTrac DSD drive: the Standard CDU (see *SCDU* definition) and the Portable CDU (see *PCDU* definition).

CDU menu item – A menu item of an RDU that was built by using the PCDU.

Channel – The second level address used to further define the location of information external to the the PAC environment (the first level of addressing being the Node number - see *NODE* definition). To access information external to the PAC environment requires reference to that information by an address which includes all levels of addressing defined for that particular information. That is, to use a Channel number also requires the associated Node number such as Node 50, Channel 21. The system will support a maximum of 256 (0 through 255) Channel numbers.

Complex PAC task – Any of the more complicated PAC functions (as opposed to the simpler elemental functions), which consists of two (or more) interrelated PAC tasks. These interrelated tasks are referred to as segments. Each segment is a self-contained module which executes sequentially, although each segment executes separately. The interrelated segments exchange information between each other which has predefined significance. The various segments need not be programmed in a common scan (see *SCAN* definition).

An example of a complex task would be SPDR, the speed regulator task, which consists of two related segments. One segment executes in the fast scan, and consists of the actual function of regulating the speed by comparing the speed

reference to the feedback and generating a torque command based on the difference and the required gains of the regulator. The other segment consists of the code used to calculate the gains required for the speed regulation function in the format required by that segment. In other words, it translates from the engineering terms used to describe regulator performance (such as load inertia and desired crossover frequency) to the integral and proportional gains required by the regulator segment. Since these defining parameters are rarely changed, this segment needs to execute only rarely, thus saving processor time for other functions which do require frequent execution.

Conditional scan – Conditional scan tasks define sub-programs (i.e. sub-programs consisting of unique interconnections of PAC tasks) which execute only when certain logic conditions related to the conditional scan task are satisfied. When the conditional scan executes, the program defined for the conditional scan executes at the scan level at which the conditional scan task is programmed (see *SCAN* definition). The use of conditional scans allows greater utilization of the limited processor time.

Custom fault – A fault (or error) defined via the PAC task "FLTD". These faults have significance only to a particular PAC design. (See *Fault* or *Error* definition).

D/A – Digital to Analog converter.

DCU – Drive Control Unit. The drive control unit refers to the hardware and software used to control the drive as opposed to the hardware and software used to control the power conversion process. Specifically, it refers to the hardware and software associated with the DCU microprocessor. The DCU software includes the variable software generated as a result of the PAC program and the fixed software (see *Kernel* definition) used to control execution of the PAC program.

Default menu – A menu for an RDU that contains the default menu items as received through the LAN from the drives. Each drive connected to the LAN can have default menu items that are to be displayed on specific RDUs. The default menu items and the order of the menu items are determined by the PAC programmer.

Directed message – A type of LAN message which can be received only by one LAN Node. This type of message contains both the source and destination Node numbers.

Elemental PAC task – The simpler PAC language functions where everything associated with that function is contained in one sequentially executed module.

EPROM – Erasable Programmable Read Only Memory. An integrated circuit that is usually used to hold the instructions for a microprocessor's program.

Error – An abnormal condition considered less serious than a fault (see *FAULT* definition). The difference between the two is that an error is recorded in the NVRAM, but not announced on the CDUs. The declaration of a fault will cause immediate display of the fault code number on the SCDU and the lighting of the **FAULT** LED. Any abnormal condition, standard or custom (also see *STANDARD FAULT* and *CUSTOM FAULT* definitions) may be declared as an error, a fault or both. Each abnormal condition is given an initial default classification as either an error, a fault, or both an error AND a fault. A special CDU function is provided to override that initial default classification.

The declaration of an error places the error number assigned to that error at the end of the Last Error List. This error list is of fixed length (16) and allows display via the CDU of the latest errors (note this differs from the First Fault List, which displays the oldest faults). In addition to the display of the error code number, this error list also allows the display of the task number of the PAC task generating the error (if the error was not generated by a PAC task, then task number zero [0] is displayed) and a time stamp of when the error occurred.

Fault – An abnormal condition generally requiring corrective action. A fault is considered to be a condition more serious than an error (see ERROR definition). The difference between the two is that an error is recorded in the NVRAM, but not announced on the CDUs. The declaration of a fault will cause immediate display of the fault code number on the SCDU and the lighting of the Fault LED. If multiple faults occur, the last declared fault is the fault displayed on the CDU.

A fixed number of faults (16) are recorded in order of declaration. This Fault List may be reviewed by order of fault declaration via a special CDU function. Once the Fault List is full, declaration of additional faults will not appear on the Fault List until space on the list is made available. The same CDU function used to display the Fault List may be used to clear from the list either all the faults or individual faults. The **FAULT** LED will remain lit until all the faults have been cleared from the Fault List.

Faults can be classified into two categories: "Standard" (see *STANDARD FAULT* definition) and "Custom" (see *CUSTOM FAULT* definition).

In most cases, no action is taken when a fault is declared. In these cases, the corrective action is the responsibility of the PAC program. In some cases, however, the abnormal condition is so severe that corrective action must be taken without regard to the PAC program (see *SEVERE FAULT* definition).

All defined abnormal conditions may be categorized as a fault or not a fault via a special CDU function. Each of these conditions is given an initial default (i.e. it

is either categorized as a fault or not). The special CDU function allows overriding of that initial definition.

Fixed point number – A number system used internally in the computer which is encoded in a specific manner. Fixed point numbers have a limited range of values which they can represent. In the case of the fixed point numbering system used for the PAC language, the maximum value which can be represented is +/- 32,767.99998 and the smallest non-zero value is +/- 0.000015.

The advantage of fixed point numbers is that some of the arithmetic operations such as addition, subtraction, and comparison execute much faster than a value represented in floating point.

Floating point number – A number system used internally in the computer which is encoded in a specific manner. In this case the encoding method (i.e. format) is a widely used format developed by the IEEE organization. The encoding scheme is similar to scientific notation of numbers which make use of number field and exponent. For example, 1.2 x E-2 is a scientific notation of the number 0.012 (1.2 times ten to the minus 2 power). The advantage of floating point numbers is that they can represent a very large range of values from the very small to the very large.

HIT – High Impedance Transceiver. A type of transceiver circuitry on a LAN Node that electrically connects to the coaxial cable. HIT Nodes may be interconnected in star or bus networks. MicroTrac DSD uses this type of transceiver.

Kernel – This is the fixed (i.e. non-changeable) code for the DCU microprocessor which forms the operating system of the microprocessor. As such, it controls the generation of the various scans, the order of execution of the PAC tasks, the information passed to and from the PAC tasks and the execution of other standard code not directly associated with the PAC tasks such as the control of the CDU or LAN handler.

LAN – Local Area Network. A high speed serial communication network which allows two-way communications between multiple devices (referred to as Nodes) all connected to the same communications cable. The specific LAN used is “ARCNET”.

LAND – LAN Driver transceiver. A type of transceiver circuitry on a LAN Node that electrically connects to the coaxial cable. LAND Nodes may be interconnected in a star network only.

LAN Node – A point in a network where service is provided, service is used, or communications channels are interconnected.

LCD – Liquid crystal display.

LED – Light emitting diode.

Local I/O – The class of Input and Output hardware located on the MicroTrac DSD chassis. All connections between the Main CPU Control PCB and these I/O boards are made via ribbon cables. All connections between the actual I/O devices (i.e. push buttons, thumbwheel switches, lights etc.) are made with individual wires between the I/O device and the drive.

Local RDU – When referring to a keyboard, the local RDU is the RDU that the keyboard is connected to.

Locked RDU – An RDU whose display may not be modified by a keyboard or push button connected to another RDU.

LOGIO – Remote Logic I/O [Input/Output] PCB.

Menu – A list of items for an RDU, any one of which may be selected to be displayed on that RDU.

Menu item – A source definition of where the information to be displayed on an RDU, when selected, is to come from. The source definition includes the Drive Node number, the Channel number, and the Subchannel number. The decimal point location is also defined.

Node – Originally a term used to identify the base address of devices connected to the LAN. For MicroTrac DSD this term has been expanded to refer to the base address of anything outside the PAC program environment. Thus, the PCU and Local I/O PCBs are each assigned a Node number, even though the DCU does not communicate with those devices over the LAN. The system will support Node numbers 1 thru 258.

Node numbers assigned to devices on the LAN are unique, and refer to only one device on the LAN. Node numbers other than those on the LAN are predefined and not changeable. (Also see *LAN Node* definition.)

NVRAM – Non-Volatile Random Access Memory. Memory that can be written to as well as read from. In addition, this memory is protected from losing data when the power is lost. Usually this is accomplished with a battery that is good for at least 10 years.

PAC – Programmable Application Control. The graphically oriented task-based language used to customize the DCU (i.e. customize the drive for a specific application).

PAC Diagram – A drawing, resembling a schematic diagram, which shows the various PAC tasks and the unique interconnection of those PAC tasks.

PAC task – The smallest unit which can be programmed in the PAC language. Numerous types of PAC tasks are provided, each performing a specific, well defined function. Each type of PAC task may be used numerous times in a PAC design. Each PAC task is represented by a block on the PAC Diagram.

PAC task number – A unique number assigned by the PAC programmer to each PAC task on the PAC Diagram. These numbers may be assigned in any order and serve only as a means of identifying unique sources of information in the PAC program. The system will support up to 32,767 PAC tasks with the allowable task numbers being 1 to 32767.

Parameter upload – The process of a computer sending all settable parameters (i.e. the .PAR file) to a DSD 406/412 drive. This process can be used to set up the drive with a set of tuned constants.

Parameter download – The process of the DSD 406/412 drive sending all of its settable parameter values (i.e. the .PAR file) to a computer. This process can be used for memory backup. A parameter download is the only data transfer process that can occur while the drive is running a motor.

Passive Hub – A central component in LAN star networks that splits the network signal. Data integrity is ensured over a distance of 100 feet for a 4-port Passive Hub.

PCB – Printed Circuit Board.

PCDU – Portable Control/Display Unit. A device which can plug into a drive or an RDC, via a cable with a modular connector (similar to a telephone cord), that has two lines of 16 character alphanumeric display and a 30 key keyboard. It allows the viewing and setting of variables.

PCU – Power Conversion Unit. The power conversion unit refers to the hardware and software associated with the power conversion from the AC lines to the motor. Specifically, it refers to the hardware and software associated with the PCU microprocessor as well as the power related components. The PCU is responsible only for the power conversion process, not determination of how much power should be converted (which is a function of the DCU).

Per-unit value – A per-unit value is a method of representing a quantity where the value 1.0 represents the “Rated” value for that quantity. Whereas the “Rated” value is generally a dimensioned value, the Per-Unit value is a dimensionless quantity.

Power cube – The MicroTrac DSD chassis and all components mounted on or inside it. A power cube alone cannot operate a motor; auxiliary items such as isolation transformer, input circuit breaker, control power transformer and motor loop contactor are needed to make up a complete MicroTrac DSD drive.

Program upload – The process of a computer sending a new PAC program (i.e. the .PRG file) To a DSD 406/412 through the drive's serial port. This process may be required when, upon application of power, the drive finds the PAC program loaded into memory is invalid. This process may also be used when it is desired to change the PAC program from what was previously loaded. Some of the steps shown below are skipped when the PAC program in memory is found to be invalid.

Program download – The process of the DSD 406/412 drive sending the PAC program (i.e. the .PRG file) through the drive's serial port to a computer. This process can be used for memory backup.

Queue – A list consisting of values where each new value is entered at the end of the list and values read from the list are taken from the beginning of the list. In other words, a first-in first-out [FIFO] buffer.

"RAM" – Random Access Memory. Memory that can be written to as well as read from. The data in this memory is lost when the power is lost.

RDC – Remote Display Controller LAN Node PCB. A board that includes the LAN Node circuitry and the software to control what is displayed on each of up to 31 RDUs. This device also communicates with the drives over the LAN.

RDU – Remote Display Unit. A device that has a 16 character alphanumeric display and a 5-1/2 digit plus sign numeric display. This device is controlled by an RDC.

RDU message – The data that is displayed on both displays of the RDU. The source of the message is defined in the RDC by a Menu Item number, Drive number, Channel number, Subchannel number, decimal position, a flag stating what type of message it is (whether the message is modifiable or not), and - if it is modifiable - the minimum and maximum allowable limits of an entered value.

RIO – Remote I/O [Input/Output] Controller LAN Node PCB. A board that includes the LAN Node circuitry and the software to control outputs to and monitor inputs from Remote (Logic or Analog) I/O boards. This device also communicates with the drives over the LAN.

Scan – This term refers to the frequency at which a particular PAC task will execute. All PAC tasks programmed in a particular scan will execute in the

same time frame. MicroTrac DSD is provided with four timed scans and one background scan. Each PAC task programmed in a timed scan will execute once in that time frame. The background scan executes each PAC task once in whatever time is left over from the timed scans and then starts over executing each task again.

SCDU – Standard Control/Display Unit. The 4-1/2 digit numeric display, 4 push buttons (keypad) and multi-color LED on the drive. It allows viewing and setting of variables.

Selected menu item – The menu item number in the RDU's menu that is being displayed.

Severe fault – An abnormal condition whose severity requires immediate action by the microprocessor sensing the error. An example of a severe error is an IST condition sensed by the PCU. In this case, the PCU disconnects the load; it does not wait for the PAC program to command load disconnect. (Also see *FAULT* definition.)

Speed Command – The desired speed setpoint prior to local PAC task modification such as linear accel/decel control, draw modification, trim modification, etc. (Also see *SPEED REFERENCE* definition.)

Speed Reference – The speed reference signal after all PAC task modification such as linear accel/decel control, draw modification, trim modification, etc. That is, the instantaneous value of the reference which is applied to the speed regulator. (Also see *SPEED COMMAND* definition.)

Standard fault – A fault (or error) which is independent of a particular PAC design. These conditions are associated with the operation of the DCU microprocessor or the PCU or the LAN handler. (See *FAULT* or *ERROR* definition.)

Subchannel – The PAC language defines a particular input or output by use of a Node, a Channel, and a Subchannel. The Subchannel refers to a specific input or output of a given Node and Channel.

The third level of addressing which further defines the location of information external to the PAC program environment; the first level is the Node number (see *NODE* definition) and the second level is the Channel number (see *CHANNEL* definition). To access information requires specifying all levels of addressing defined for that piece of information. For example, Node 251, Channel 4, Subchannel 0 refers to the Local Digital I/O PCB connected to connector J1 (assigned Node 251), Thumbwheel switch inputs (assigned as

Channel 4 of the Digital I/O PCB), and specifically the set of thumbwheel switches designated as Bank 0 (i.e. Subchannel 0).

Token – A term used with the LAN to describe a special LAN message. This message is passed from one LAN Node to another. When a LAN Node receives this message (i.e. the token), it is allowed to transmit a message it has generated while waiting to receive permission to transmit. Once it has completed its transmission, it must pass the token to the next node (in numerical sequence). Nodes which do not have the token may receive messages but may not transmit a message until the token is received. If the node receiving the token does not have any messages to transmit, it simply passes the token to the next node.

TWIO – Remote Thumbwheel I/O [Input/Output] PCB.

Unlocked RDU – An RDU whose display may be modified by a keyboard or push button connected to another RDU. This is the default RDU lock state.

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MICROTRAC DSD DIGITAL SYSTEM DRIVES

Effective 02/06/95

Electrical Hook-up Addendum

The following additional information must be followed when performing Electrical Hook-Up of a DSD 406 or DSD 412 drive, according to the procedures listed on pages 12-15 of technical manual TM 6107, dated 4/15/94.

– Although the three phase input power line is fuse protected internal to the drive, it is recommended to provide branch circuit protection by means of a circuit breaker in accordance with the National Electrical Code, local codes and with a rating of not less than 5,000 rms Symmetrical Amperes and 600 Volts for 2 to 25 Hp rated drives or 10,000 rms Symmetrical Amperes and 600 Volts for 30 to 60 Hp rated drives.

– Electronic overload protection is provided as part of the standard DSD product. It is electronically timed and will shut down the drive along a time/output current curve which provides shutdown at 60 seconds at 150% or 10 seconds at 200% of rated output current. An overload relay may be added external to the drive in accordance with the National Electrical Code and local codes for additional protection.

– Main Circuit Input/Output Wire Sizing:

L1-3: Using 600V vinyl-sheathed wire per the following table.

Drive Hp	Recommended Wire Gauge (Copper Only)		Torque (in-lbs)
	60°C	75°C	
2	14	14	35
3	14	14	35
5	14	14	35
7	8	10	40 - 35 *
10	8	10	40 - 35 *
15	6	8	45 - 40 *
20	6	8	45 - 40 *
25	4	4	45
30	4	4	45
40		1	150
50		1	150
60		1/0	180
75		3/0	250
100		3/0	250
125		250 MCM	325
150		600 MCM	375
200		600 MCM	375

* Torque per wire gauge.

Electrical Hook-up Addendum

ARM(–): Using 600V vinyl-sheathed wire per the following table.

Drive Hp	Recommended Wire Gauge (Copper Only)			Torque (in-lbs)
	60°C	75°C	90°C	
2	14	14		35
3	14	14		35
5	14	14		35
7	6	8		45 - 40 *
10	6	8		45 - 40 *
15	4	4		45
20	4	4		45
25		3		50
30		3		50
40		1/0		50
50		1/0		50
60		3/0		50
75		250 MCM		325
100		250 MCM		325
125		350 MCM		325
150		500 MCM		375
200			700 MCM	375

* Torque per wire gauge.

ARM(+): Using 600V vinyl-sheathed wire per the following table.

Drive Hp	Recommended Wire Gauge (Copper Only)			Torque (in-lbs)
	60°C	75°C	90°C	
2	14	14		35
3	14	14		35
5	14	14		35
7	6	8		45 - 40 *
10	6	8		45 - 40 *
15	4	4		45
20	4	4		45
25		3		50
30		3		50
40		1/0		180
50		1/0		180
60		3/0		250
75		250 MCM		325
100		250 MCM		325
125		350 MCM		325
150		500 MCM		375
200			700 MCM	375

* Torque per wire gauge.

Electrical Hook-up Addendum

– Field Current Wire Sizing: The recommended conductor for field current ratings between 10.0 Ampere and 16.0 Ampere is 12 AWG. The recommended conductor for field current ratings below 10.0 Ampere is 14 AWG. Use 600 V vinyl-sheathed 105°C wire or equivalent. The recommended torques on the field lugs for 14-10 AWG is 25 in-lbs.

– GND: Recommended conductor size, 2 AWG 600 V vinyl-sheathed for COPPER wire, 1/0 AWG 600 V vinyl-sheathed for ALUMINUM OR COPPER CLAD ALUMINUM wire. Recommended torque on the GND lug is 50 in-lbs.

– Control Circuit Wire Sizing:

TB1: Recommended conductor size, 22-18 AWG 300 V 105°C vinyl-sheathed wire. Recommended torque is 3.4 in-lbs.

TB3: Recommended conductor size, < 12 AWG 300 V 105°C vinyl-sheathed wire. Recommended torque is 5 in-lbs.

TB5: Recommended conductor size, 14 AWG 600 V 105°C vinyl-sheathed wire. Recommended torque is 3.4 in-lbs.

Please send information concerning scheduled dates of Training Seminar(s) for the DSD 406 / 412

Send information to:

MagneTek
Attn: Training Department
16555 West Ryerson Road
New Berlin, WI 53151
(800) 541-0939, Ext 449
(414) 782-0200 Ext. 449

Applicant Name _____

Position/Title _____

Company _____

Address _____

City _____ State _____ ZIP _____

Telephone ( ) _____

Number of Attendees _____

Fax (414) 782-3418

DSD 406 / DSD 412

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