HORNER APG

User's Manual for the
HE300DNT100

DeviceNet™ Option Board

Fourth Edition
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PREFACE

This manual explains how to use the Horner APG Communications Option Cards for use with the GE Drives AF-300E$ and IMO JaguarVX Variable Frequency Drives.

The safety precautions shown in Chapter 2 have been based on the safety precautions shown in Section 1 of the GE AF-300E$™ Instruction Manual.

AF-300E$™ is a trademark of the General Electric Company.

JaguarVX is a trademark of IMO

DeviceNet™ is a trademark of the Open DeviceNet Vendor Association (OVDA), Inc.

LIMITED WARRANTY AND LIMITATION OF LIABILITY

Horner APG, LLC. ("HE-APG") warrants to the original purchaser that the Option Card manufactured by HE-APG is free from defects in material and workmanship under normal use and service. The obligation of HE-APG under this warranty shall be limited to the repair or exchange of any part or parts which may prove defective under normal use and service within two (2) years from the date of manufacture or eighteen (18) months from the date of installation by the original purchaser whichever occurs first, such defect to be disclosed to the satisfaction of HE-APG after examination by HE-APG of the allegedly defective part or parts. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE AND OF ALL OTHER OBLIGATIONS OR LIABILITIES AND HE-APG NEITHER ASSUMES, NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR HE-APG, ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF THIS OPTION CARD. THIS WARRANTY SHALL NOT APPLY TO THIS OPTION CARD OR ANY PART THEREOF WHICH HAS BEEN SUBJECT TO ACCIDENT, NEGLIGENCE, ALTERATION, ABUSE, OR MISUSE. HE-APG MAKES NO WARRANTY WHATSOEVER IN RESPECT TO ACCESSORIES OR PARTS NOT SUPPLIED BY HE-APG. THE TERM "ORIGINAL PURCHASER", AS USED IN THIS WARRANTY, SHALL BE DEEMED TO MEAN THAT PERSON FOR WHOM THE OPTION CARD IS ORIGINALLY INSTALLED. THIS WARRANTY SHALL APPLY ONLY WITHIN THE BOUNDARIES OF THE CONTINENTAL UNITED STATES.

In no event, whether as a result of breach of contract, warranty, tort (including negligence) or otherwise, shall HE-APG or its suppliers be liable of any special, consequential, incidental or penal damages including, but not limited to, loss of profit or revenues, loss of use of the products or any associated equipment, damage to associated equipment, cost of capital, cost of substitute products, facilities, services or replacement power, down time costs, or claims of original purchaser's customers for such damages.

To obtain warranty service, return the product to your distributor with a description of the problem, proof of purchase, post paid, insured and in a suitable package.

ABOUT PROGRAMMING EXAMPLES

Any example programs and program segments in this manual or provided on accompanying diskettes are included solely for illustrative purposes. Due to the many variables and requirements associated with any particular installation, Horner APG, LLC. cannot assume responsibility or liability for actual use based on the examples and diagrams. It is the sole responsibility of the system designer utilizing the Option Card to appropriately design the end system, to appropriately integrate the Option Card and to make safety provisions for the end equipment as is usual and customary in industrial applications as defined in any codes or standards which apply.

Note: **The programming examples shown in this manual are for illustrative purposes only. Proper machine operation is the sole responsibility of the system integrator.**

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CHAPTER 1: INTRODUCTION

1.1 Overview

1.1.1   The HE300DNT100 is a plug-in Option card to the GE AF300E$™ or IMO JaguarVX Inverter which allows remote control of a drive through the DeviceNet™ network. This Option card allows network access to the Inverter's configuration, control and status parameters. Configuration parameters may be accessed either remotely over the network or through the local keypad. Similarly, control and status parameters may be accessed through the high-speed DeviceNet™ "Polled" logical connection or through the local terminal and keypad. Manual override contacts are provided on the Option card, which allow real-time selection of either remote or local control.

1.1.2   The supported DeviceNet™ service is a Group-2-server-only with a single Poll Data I/O connection with fragmentation. This is a predefined master/slave protocol supported by almost all DeviceNet™ scanners. A DeviceNet™ Polled connection watchdog timer is provided such that a loss of communications will shut down the drive. Network configuration and connection error diagnostic information is available in an "option" function code, which is accessible through the Inverter's keypad.

2.1 Additional Information

2.1.1   Inverter wiring, configuration and operation are included with the manuals supplied with the Inverter.

3.1 Mechanical Description

3.1.1   The HE300DNT100 Option Board is a printed circuit assembly that mounts inside the housing of the Inverter. It connects to the Inverter through a multiple-pin connector, which is located under the front cover and next to the keypad connector. It also has a Phoenix-type 6-pin I/O vertical receptacle connector (Horner APG, LLC. provides the matching 6-pin screw terminal connector) which is used to connect a DeviceNet™ cable (dual twisted pairs with shield). In addition, a Phoenix-type 2-pin screw terminal, which is used to connect an optional remote override switch, is provided.

4.1 Electrical Description

4.1.1   The Option Board contains its own microprocessor and memory. It communicates with the Inverter through a provided serial communications channel. This serial communications channel provides access to the drive's control, status and configuration parameters. An internal watchdog timer and network diagnostics are provided. Connectors are provided for the DeviceNet™ and manual override connections.

5.1 DeviceNet Description

5.1.1   DeviceNet™ Communication Compliance:

- Conforms to DeviceNet™ standard Volume I Rel 1.3 and Volume II Rel. 1.2,
- Group 2 Server Only - Supporting Explicit and Polled I/O connections,Generic Profile,
- Node Isolation consuming bus power only for communications isolation,
- Pluggable bus connector
- Keypad configurable Mac Id (no default can be established),
- Keypad configurable Baud rate (no default can be established)

6.1 Network Power Consumption

6.1.1   Each option card requires a maximum of 95mA @ 11VDC of DeviceNet™ network power for the transceiver circuit. Input voltage range is from 11VDC to 24VDC

7.1 Response times (@500K baud):

Poll response   < 1mS   (consume 4 byte/produce 12 byte)
Explicit response
Typical   < 500uS
Maximum   < 400mS (Inverter parameter access)

8.1 Connections:

	Produced	**Consumed**
Explicit message:	20 bytes (maximum)	24 bytes (maximum)
Poll message:	12 bytes (expandable to 14)	4 bytes (expandable to 8)

9.1 Configuration:

9.1.1   The Card is configurable locally through the drive keypad or remotely through the network.The EDS file is provided for DeviceNet™ configuration programs such as DeviceNet™ Manager.

10.1 Introduction to DeviceNet™

10.1.1   DeviceNet™ is a high-speed twisted pair + power pair + Shield network primarily used to retrieve low level I/O data. In addition to accessing I/O, the network can be used to configure and modify operation of a remote node. By conforming to the DeviceNet™ specification, low-level devices from multiple venders can co-exist on the same network and be accessed from the same high- level device.

10.1.2   A DeviceNet™ network can support up to 64 nodes on a single network. Baud rates of 125, 250 and 500kbaud can be selected, based on the total span of the network. The network is typically configured in a Trunkline-dropline, which allows node removal without terminating the network.

10.1.3   Typical DeviceNet™ installations require a high-level device or master to access the data from low-level devices. Low-level devices, which simply control local hardware, are usually Group-2-Only Server devices. A Group-2-Only-Server device provides the protocol services of the Predefined Master/Slave Connection Set. While DeviceNet™ provides many connections and services, the Predefined Master/Slave Connection Set provides a limited and known subset of services which are sufficient and simple to access through most DeviceNet™ Scanners. The Master is high-level device, which is used to establish communication, initiate communication and transfer data with the low-level slave devices. A scanner is a type of master which is used to access data from a slave device in real-time. However, other masters may also exist such as a device which is used as a low-level device configuration tool (i.e. DeviceNet™ Manager).   A low-
level device which supports Group-2-Only-Server services can only be connected to one master at a time.

10.1.4   The typical connections provided by a Group-2-Server-Only devices are Explicit, Polled and Strobed. An Explicit connection is typically considered a low priority connection, which provides access to all the device's parameters accessible over the network. An Explicit connection is also required to start both the Polled and Bit-Strobed connections. A Polled connection is a higher priority and high-speed connection that moves small amounts of I/O data on a consistent basis. A Bit-Strobed connection is a higher priority connection that broadcasts control information in one packet for all low-level devices on the network. **The HE300DNT100 only supports the Explicit and Polled connections.**

CHAPTER 2: INSTALLATION

2.1 Installation Hardware

a) The option card.

b) One HE300KIT399 (consisting of one 0.5 inch plastic standoff, one M3 x 5 screw and one lock washer) for drives under 40 hp.

c) One HE300KIT401 (consisting of one 0.63 inch metal standoff, one metal bracket, two plastic fasteners, four M3 x 5 screws and four lock washers) for drives 40 hp and larger.

d) This document (User's Manual for the HE300DNT100).

2.2 Installation Procedure for Drives Under 40 H.P.

2.2.1   The Communications Option Cards have been designed to integrate seamlessly with the Inverter. The option card is installed within the inverter cover, so that the NEMA rating of the inverter is maintained after installation of the option card.

1.   Power down the inverter.

2.   Remove the cover the inverter as shown in the diagram below.
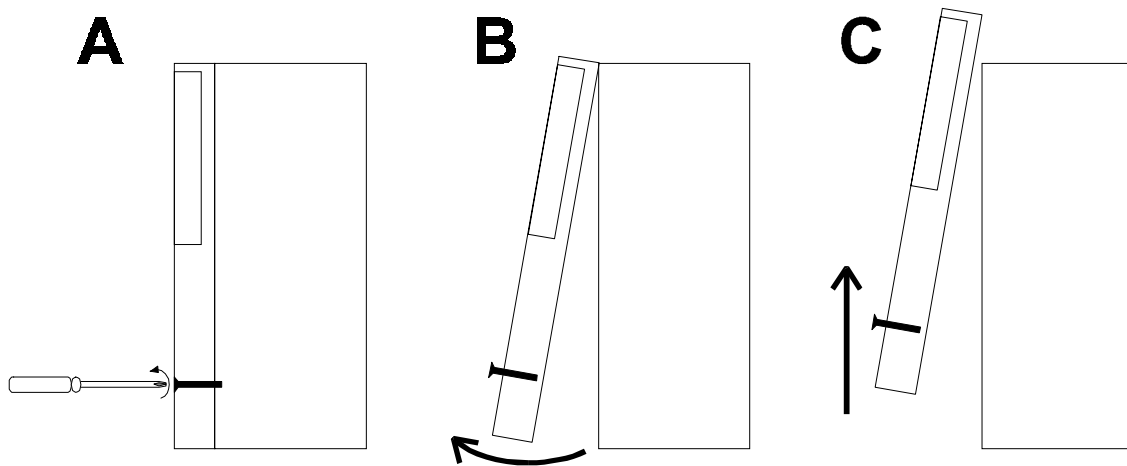
Figure 2-1. Drive Front Cover Removal Procedure

3.   Install the supplied plastic 1/2" standoff (A') in hole (A).
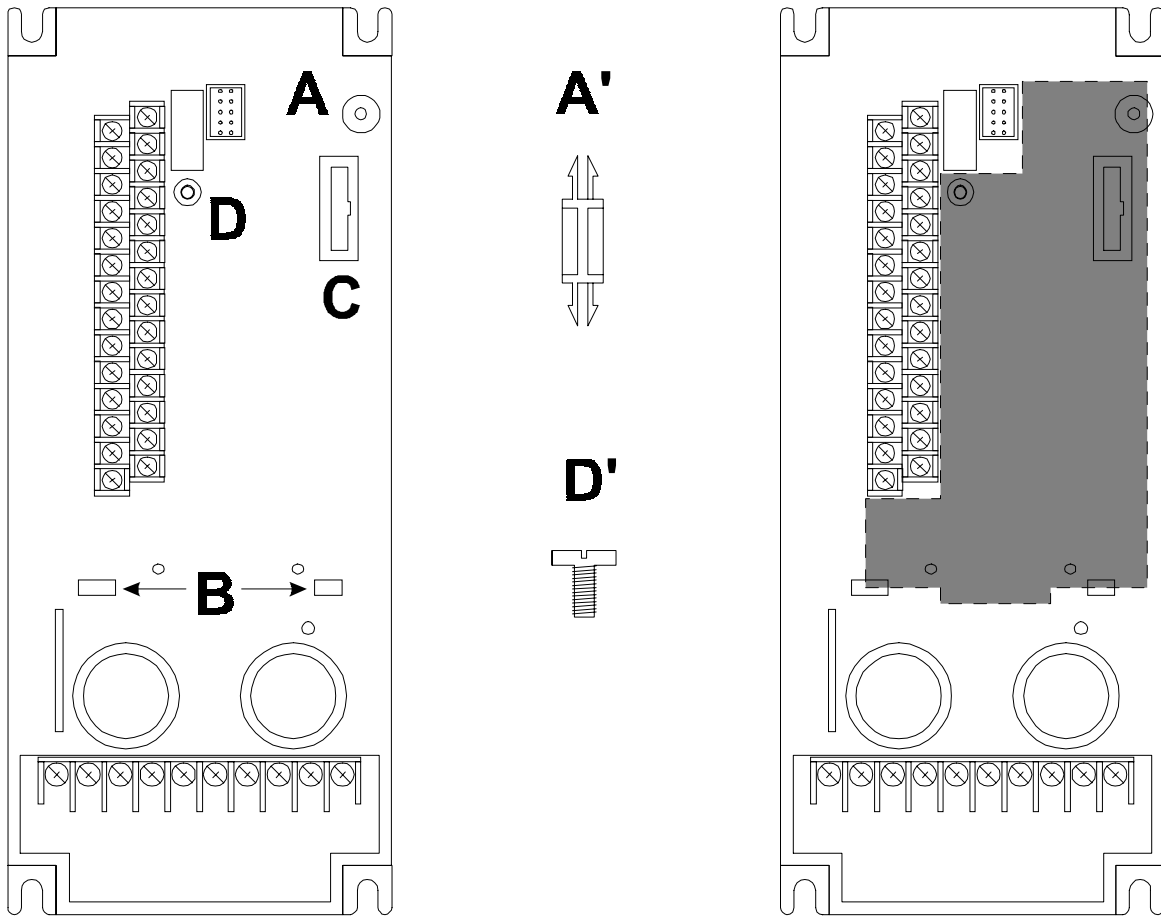
Figure 2-2. Drive Mounting Holes and Connectors (left), Mounting Hardware (center, not to scale), and Option Card Location (right).
Drive shown above is 1/2HP, viewed from the front.

4.   Install the HE300 option board. Use the plastic guides (B) to properly align the bottom of the option board. Snap the option board into the standoff (A') and option connector (C).

5.   Install the supplied M3 x 5 screw (D') with washer in hole D to secure the option board.

6.   Verify that jumper JP4 is in place.

7.   After inserting the Phoenix-type connector into the proper receptacle (P1), completing field wiring to the terminal strip(s) and installing the manual override connection wires and capacitor, replace the front cover.

8.   Power up the drive as needed.
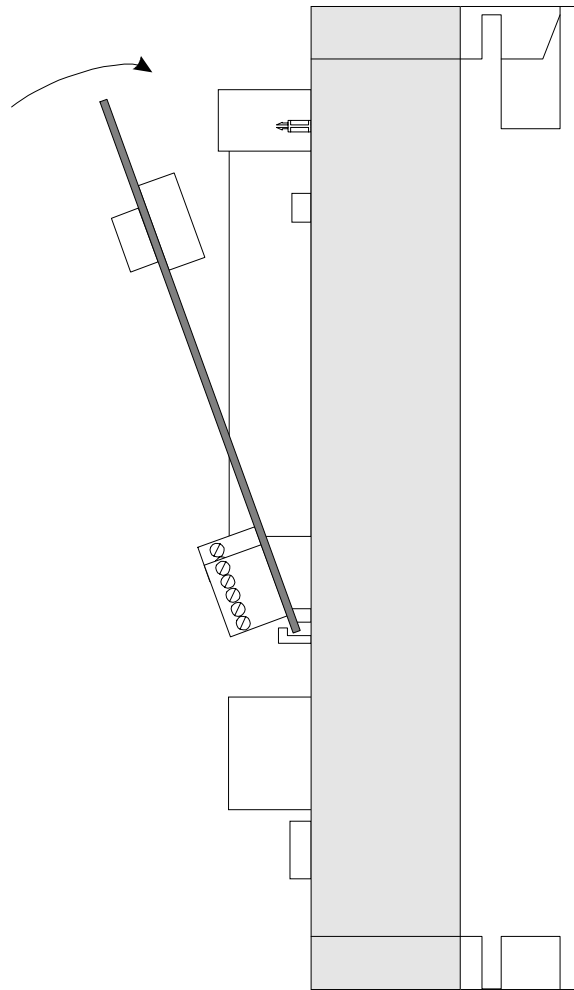
Figure 2-3. Installing the Option Board (Side View of 1/2HP drive shown.)

2.3 Installation Procedure for Drives 40 H.P. or More

2.3.1   The Communications Option Cards have been designed to integrate seamlessly with the inverter. The option card is installed within the drive cover, so that the NEMA rating of the drive is maintained after installation of the option card.

1.   Power down the drive.

2.   Remove the cover from the inverter using the 11 screws on the front panel.

3.   Remove the keypad and the keypad mounting plastic (4 screws) shown below.
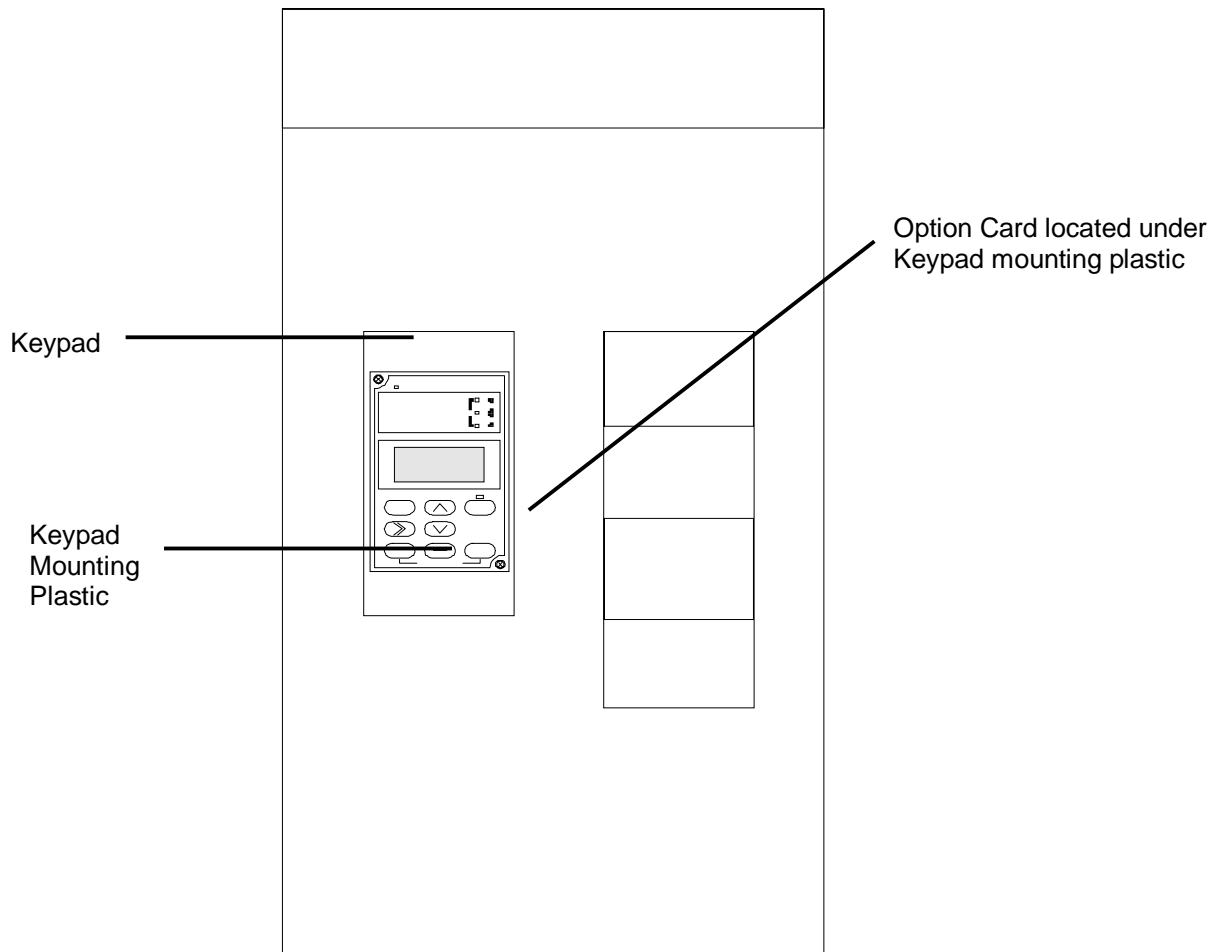
**Figure 2-4. Drive Keypad, Keypad Mounting Plastic and Option Card Location.
Drive shown above is 40HP, viewed from the front.**

4.   Install corner brackets (A') on bottom corners of interface board (A).

5.   Install corner brackets (A') on metal bracket (B') using the supplied M3 x 5 screws and
        lock washers in the corner bracket mounting holes (C).
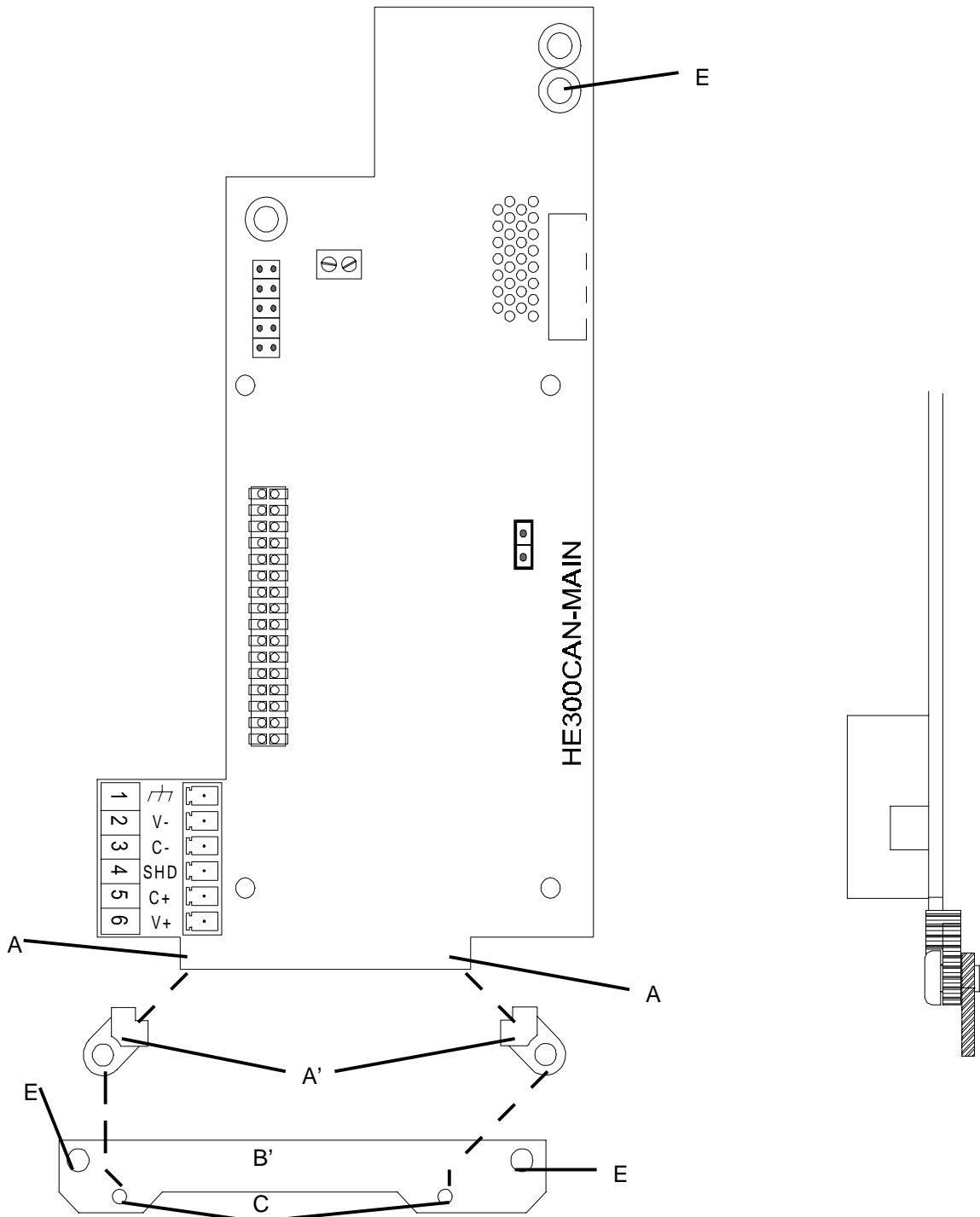
Figure 2-5. Option Card Assembly front (above) and side view (right).

7.   Install the assembled board into the drive using the M3 x 5 screws and lock washers in the mounting holes (E). If you used the plastic standoff in the upper right hand corner of the board you may need to use one of the M3 x 5 screws from the HE300KIT399.

8.   Verify that jumper JP4 is installed.

9.   Replace the keypad mounting plastic and the keypad.

10.   After inserting the Phoenix-type connector into the proper receptacle (P1), completing field wiring to the terminal strip(s) and installing the manual override connection wires and capacitor, replace the front cover.

11.   Power up the drive as needed.

Note: The metal standoff included with the HE300KIT401 can be used in place of the plastic standoff that comes with the drive. The plastic standoff is the preferred method of installation, but *if the metal standoff is to be used, the steps below should be followed*.

1.   Once the keypad and keypad mounting plastic is removed, remove the plastic standoff in the upper right corner of the drive board by holding the screw under the standoff with your finger, while unscrewing the plastic standoff.

2.   Once the standoff is removed, screw on the metal standoff that is supplied with the HE300KIT401.

3.   Do not remove the DC-to-DC converter as stated in step 6. Instead press the interface board down onto the metal standoff until it snaps into place.

4.   To remove the board you may need to use a pair of fine tipped pliers to squeeze the tip of the metal standoff together in order for the board to snap off of the standoff. To get to the tip of the standoff you may need to remove the DC-to-DC converter as stated in step 6.

2.4 Safety Precautions

2.4.1   WARNING – MECHANICAL MOTION HAZARD: Drive systems cause mechanical motion. It is the responsibility of the user to insure that any such motion does not result in an unsafe condition. Factory provided interlocks and operating limits should not be bypassed or modified.

2.4.2   WARNING – ELECTRICAL SHOCK AND BURN HAZARD: When using instruments such as oscilloscopes to work on live equipment, the oscilloscope's chassis should be grounded and the differential amplifier input should be used. Care should be used in the selection of probes and leads and in the adjustment of the oscilloscope so that accurate readings may be made. See instruments manufacturer's instruction book for proper operation and adjustments to the instrument.

2.4.3   WARNING – FIRE AND EXPLOSION HAZARD: Fires or explosions might result from mounting Drives in hazardous areas such as locations where flammable or combustible vapors or dusts are present. Drives should be installed away from hazardous areas, even if used with motors suitable for use in these locations.

2.4.4   WARNING – STRAIN HAZARD: Improper lifting practices can cause serious or fatal injury. Lift only with adequate equipment and trained personnel.

2.4.5   WARNING – ELECTRICAL SHOCK HAZARD: All motor bases and equipment enclosure housings should be grounded in accordance with the National Electric Code or equivalent.

2.4.6   WARNING – MOTOR OVERSPEED HAZARD: With 400 Hz Drive output possible, the Drive will allow the motor to run up to 6-7 times its base speed. Never operate the motor above its top mechanical speed or a catastrophic failure may occur.

2.4.7   WARNING – Before disassembling, disconnect and lock out power from the Drive. Failure to disconnect power may result in death or serious injury. A bus charge light provides visual indication that bus voltage is present; verify the bus voltage level by measuring the voltage between power terminals P(+) and N(-) using an analog meter. Do not attempt to service the Drive until the charge indicator has extinguished and the bus voltage has discharged to zero volts.

2.4.8   WARNING – Replace all covers before applying power to the Drive. Failure to do so may result in death or serious injury.

2.4.9   CAUTION: Do not connect power supply voltage that exceeds the standard specification voltage fluctuation permissible. If excessive voltage is applied to the Drive, damage to the internal components will result.

2.4.10 CAUTION: Do not connect power supply to the output terminals (U,V,W). Connect power supply only to the power terminals (L1, L2, L3).

2.4.11 CAUTION: Do not connect a power supply to the control circuit terminals (except 30A, B, C, maximum rating 250 volts, 0.3A ac/dc).

2.4.12 CAUTION: For RUN and STOP, use the FWD-CM (forward) and REV-CM (reverse) terminals. Do not use a contactor (ON/OFF) installed on the line side of the Drive for RUN and STOP.

2.4.13 CAUTION: Do not use a switch on the output side of the Drive for ON/OFF operation.

2.4.14 CAUTION: Do not connect filter capacitors on the output side of the Drive.

2.4.15 CAUTION: Do not operate the Drive without the ground wire connected. The motor chassis should be grounded to earth through a ground lead separate from all other equipment ground leads to prevent noise coupling. The grounding connector shall be sized in accordance with the NEC or Canadian Electrical Code. The connection shall be made by a UL listed or CSA certified closed-loop terminal connector sized for the wire gauge involved. The connector is to be fixed using the crimp tool specified by the connector manufacturer.

2.4.16 CAUTION: Do not perform a megger test between the Drive terminals or on the control circuit terminals.

2.4.17 CAUTION: **The drive develops an adjustable frequency via pulse width modulation, with the pulse rise time of 0.1 microseconds. While this does not present a problem on 200-230VaC applications, it may on 380-460Vac applications. When using the drives on 380-460, where the distance between the motor and the Drive exceeds 60 feet, get the motor manufacturer's approval that his insulation system can withstand the voltage spikes (up to twice the dc bus voltage 2 x 621Vdc for a 460Vac power source) of the Drive, in conjunction with the long motor cable lengths. If the insulation system does not meet this limit, utilize a filter to increase the Drive's pulse rise time to 1.0 microseconds.**

When using the drives on 575Vac, get the motor manufacturer's approval that their insulation system can withstand the voltage spikes (up to twice the dc bus voltage 2 x 813Vdc for a 575Vac power source) of the Drive, in conjunction with the motor cable lengths.

2.4.18 CAUTION: **Because the ambient temperature greatly affects Drive life and reliability, do not install the Drive in any location that exceeds the allowable temperatures. Leave the ventilation cover attached for temperatures of between 40 (104° F) and 50 (122° F) degrees C (30 HP and lower). If the cover needs to be removed, another type of enclosure may be required for safety purposes.**

2.4.19 CAUTION: **If the Drive's Fault Alarm is activated, consult the TROUBLESHOOTING section of the AF-300$™ GE Drive Instruction Book, and after correcting the problem, resume operation. Do not reset the alarm automatically by external sequence, etc.**

2.4.20 CAUTION: **Be sure to remove the desicant dryer packet(s) when unpacking the Drive. (If not removed these packets may become lodged in the fan or air passages and cause the Drive to overheat.)**

2.4.21 CAUTION: **AC induction motors require that they be sized based on the applications speed range and associated torque requirements for the motor-Drive system. This is to avoid excessive motor heating. Observe motor manufacturers recommendations when operating any ac induction motor with the Drive. Also observe motor manufacturer's recommended voltage/torque boost at lower operating frequencies.**

2.4.22 CAUTION: **The available power source connected to the Drive is not to exceed 500KVA. If the ac power source is greater than 500KVA and the Driver's rating (HP) is less than 10% of the power source's KVA; ac line reactors will have to be installed in L1, L2 & L3 power leads of the Drive.**

2.4.23 CAUTION: **The Drive must be mounted on a wall that is constructed of heat resistant material. While the Drive is operating, the temperature of the Drive's cooling fins can rise to a temperature of 90°C (194°F).**

2.5 DeviceNet™ Cable

The DeviceNet™ cable to be used in conjunction with the HE300DNT100 should be a dual twisted pair with shield. The printed circuit assembly contains a Phoenix-type 6-pin I/O vertical receptacle connector. Also included with the printed circuit assembly is a Phoenix-type 6-pin screw terminal connector. Shown below are diagrams of these connectors, which indicate the proper pin-outs.
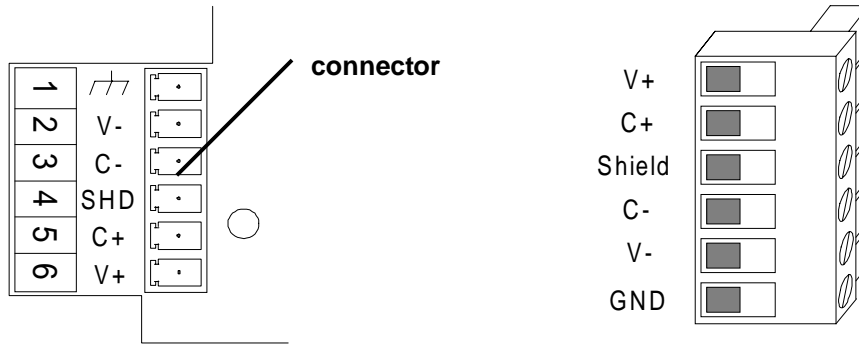
Figure 2-6.   Phoenix 6-pin I/O vertical Receptacle (located on printed circuit assembly) and 6-pin screw terminal connector.
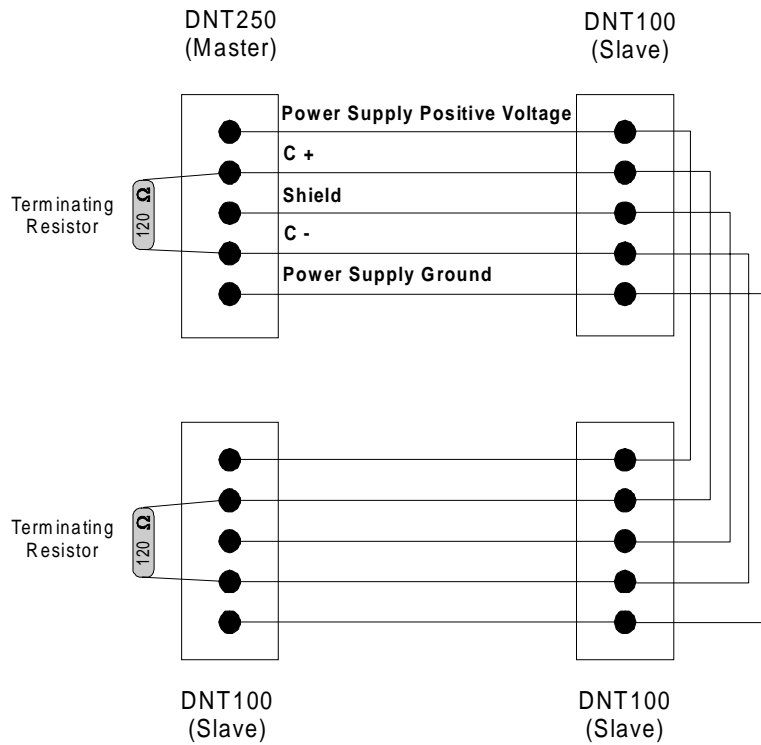
Figure 2-7. Example DeviceNet™ network connection with three slaves (DNT100's) and 1 master (DNT250). Note: Terminating resistors exist on each end of the network.

2.6   Manual Override Connections

2.6.1   Two modes of operation are provided (manual/automatic) which are controllable by a set of contacts on the Option card. Automatic mode allows control of the Inverter over the network. Manual mode provides local control of the Inverter through the terminal board and keypad. The contacts provided on the printed circuit assembly come in the form of a 2-screw terminal block (P2), which is shown below. When the contacts are open, the HE300DNT100 is in manual mode. When the contacts are closed, the HE300DNT100 is in automatic mode**. Horner APG, LLC. recommends using a twisted pair with shield for the contact wires.** The ground included with the twisted pair may be connected to earth ground. **As an added precaution against noise and faulty operation, Horner APG, LLC. recommends using a capacitor directly across the screw terminals to reduce noise.** A capacitor in the range of 0.1uF should be sufficient.
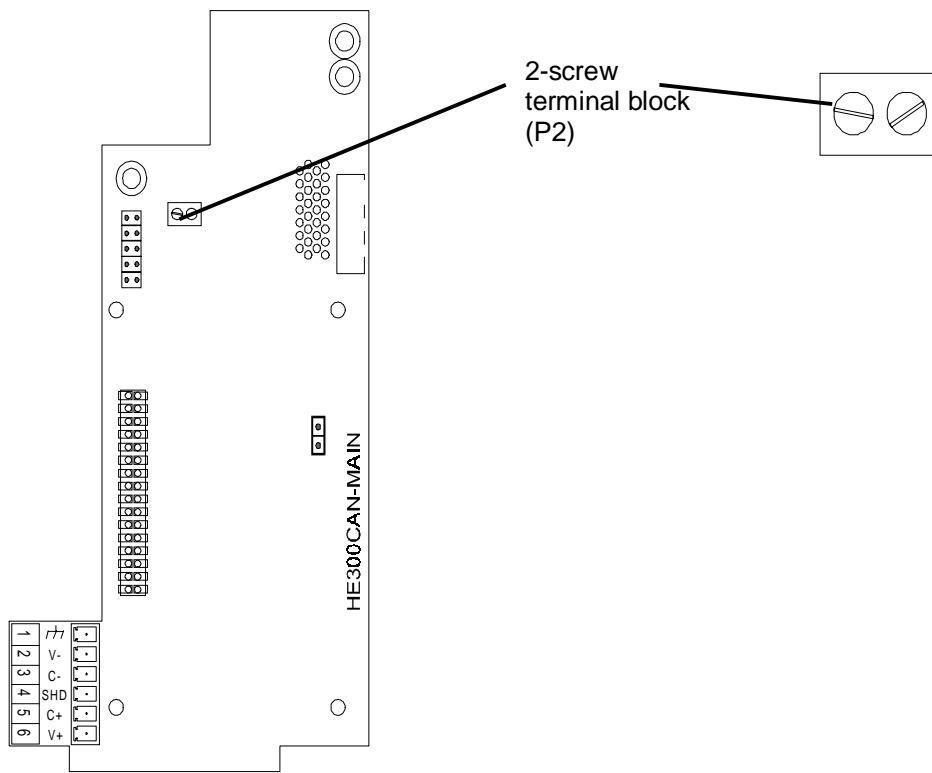
Figure 2-8. Location of Manual Override connection location.

CHAPTER 3: OPERATION

3.1 Power Up

3.1.1   At power-up, the HE300DNT100 Option card examines the keypad "option" function codes (P0x) associated with the DeviceNet™ configuration.   This is a basic check only to determine if the parameters are within range for valid network operation. The following checks are made:

P01:	Station Id < 64
P02:	Baud Rate < 3
P03:	1's position: I/O Assembly length selection < 3
	10's position: Loss-of-Network selection < 3
P04-P06:	Option parameters within acceptable range (if enabled)

3.1.2   Should any of these tests fail, the Option card will immediately Er5 with the appropriate error response placed in P00 (if enabled). Furthermore, the drive cannot be started regardless of the state of the manual override until these parameters are corrected. If there are DeviceNet™ parameters that are out of bounds, the user should re-configure using the configuration sequence described below.

3.1.3   Once the option function parameters are verified, the Option card will initialize the DeviceNet™ port with the associated "option" function codes, and then it will examine the state of the manual override contacts. If the contacts are open, the option card will toggle to manual mode and the Inverter will assume the state as defined by the keypad and the local terminal contacts, regardless of any network errors.

3.1.4   If the contacts are closed, the option card will toggle to automatic mode and will hold the Inverter at 'STOP' for a short delay until the network becomes active. Once active, the network provides the parameters that control the drive. Should the network not become active within the delay period, a predefined action specified by the Loss-of-Network parameter will take effect (fault drive, nothing or switch to terminal control).

3.2   Function Codes (Inverter and DeviceNet™ Configuration Parameters)

3.2.1   Before a drive can be started, the Inverter's function codes must be initialized. These function codes define the Inverter's operation and are defined in the Inverter's Instruction Manual. Inverter function codes are stored in EEPROM and may be configured either with the keypad or over DeviceNet™ with a configuration tool such as DeviceNet™ Manager. If configured over DeviceNet™, the function code being modified must be Application Object Attribute number. If using DeviceNet Manager, the supplied EDS file will perform this translation automatically. If using an alternate method, a translation will be required using the configuration information contained in Appendix A. Before using either configuration method, the DeviceNet™ "option" function codes must be first configured by keypad to enable the network.

3.2.2   When an option card such as the HE300DNT100 is installed in the Inverter, an extra set of function codes not defined in the Inverter's instruction manual will appear at the end of the function code list when examined with the keypad. These codes are referred to as "option" function codes and will be prefixed with a "P". These option function codes are used to store and display configuration parameters, which are dedicated to the installed option card. The HE300DNT100 uses only the first 8 of the option parameters. These parameters are also stored in the Inverter's EEPROM and will be "remembered" even if the option card is changed out.

3.2.3   The first option function code (P00) is used as a DeviceNet™ error indicator when an Er5 occurs. The user can then use the keypad to examine that code to determine the nature of the error.

> **WARNING: Since EEPROMs have a limited write life (in the order of 100,000 writes), continuous writing to the P00 Option function code can cause premature failure of the configuration memory.**

3.2.4   The Option card writes to the "option" function code P00 to indicate the specific error whenever a network fault occurs. If network faults occur frequently as part of normal operation, this feature should be disabled to save the Inverter's EEPROM memory. To disable this feature, temporarily set the Option card to manual mode and set the value in P00 to 255 with the keypad. Should a network error occur later with this code disabled, it can be re-enabled to display the error as long as the network error condition still exists. To re-enable, temporarily set the mode to manual and use the keypad to set P00 to zero. Next, set the mode back to automatic to re-generate the error code which will appear in the P00 function code value.

3.3 Manual/Automatic Mode

3.3.1   Two modes of operation are provided (manual/automatic) by the HE300DNT100,   which are controllable by a set of contacts on the Option card. Automatic mode allows control of the Inverter over the network and Manual mode provides local control of the Inverter through the terminal board and keypad.

3.3.2   The mode can be changed during normal operation; however, precautions should be observed to prevent adverse motor changes. **Both the Option board and the Inverter maintain a separate set of control parameters. The set that is selected is dependent on the current mode**. Additionally, if the selected mode is such that a set of control parameters may be not directly controlling the Inverter, they may still be changed and stored in memory. For example, DeviceNet™ Poll message bytes 0 and 1 are written to a pseudo-terminal block word, which in effect emulates contact closures on the Inverter's terminal when the unit is in automatic mode. In manual mode, the pseudo-terminal contact word can still be changed with a DeviceNet™ Poll message. It will be maintained and take effect once switched back to manual (assuming Poll connection is maintained).

3.3.3   While the Inverter's function parameters are always readable from either the keypad or the DeviceNet™ Poll message, the current mode affects which has write access. Table 3.1 summarizes access to the control and function parameter in the two modes:

Table 3-1. Mode selection parameter access.		
	Manual	**Automatic**
Terminal Board	Active	Inactive
Network Pseudo Terminal*	Inactive (memory)	Active
Local Freq. Control**	Active	Inactive (memory)
Network Freq. Control	Inactive(memory)	Active
Keypad Parameter Access	Read + Write	Read Only
Network Parameter Access	Read Only	Read + Write
* Keypad "Start" button can be assigned for final start control even under network control. The Keypad "Stop" button functions as an emergency stop even under network control. ** Local frequency control can be assigned to either the keypad or terminal analog input.		

3.3.4   Both the local frequency display and the Poll message response (Bytes 2,3) will contain the current drive frequency regardless of the mode.

3.3.5   While in automatic mode, the Option card monitors the state of the DeviceNet™ Poll connection. Should the connection fail (lost communications with the master), the Option card will take the action as specified by the Loss-of-Network parameter which is described later in this chapter. Should communications be lost with the Option card, the card can be placed in manual mode to gain local control of the drive.

3.4 DeviceNet™ Control

3.4.1   DeviceNet™ master (such as a scanner) can gain control of an Inverter by establishing a Predefined Master/Slave "Polled" connection with the Option card. The master must be capable of generating a Polled connection with fragmentation frames. During the connection, a master must also establish an Expected Packet Rate (EPR) at which Polled messages are expected to arrive at the Option card. Note: **This timer is critical because it establishes a time delay before the Option card assumes that communications has been lost and causes an action as defined by the Loss-of-Network parameter.**

3.4.2   Once a Poll connection has been established and the Option card is in automatic mode, Poll data will be used to control the drive operation.

3.4.3   DeviceNet™ refers to the data format passed in the Polled connection as an I/O Assembly. This is simply multiple control parameters grouped together in a defined pattern. Two I/O Assemblies are actually used. The first is the requesting data passed from the master to slave which contains control data. The second is the response data returned from the slave back to the master which contains the status. Both Assemblies are passed in a single request and response sequence. Since these formats are set at the slave, the master must be configured to pass and receive data in the data format defined in the Assemblies. **If the Poll request issued by the master does not contain the exact number of bytes defined by the request data assembly, a response will not be returned, and the data will not be processed by the option card.**

3.4.4   To start the drive, the master would send a Poll connection with I/O assembly values, which would have a direction bit and a frequency value set. Thereafter, the master must either maintain these values with re-occurring Poll messages or change them appropriately. The master can also retrieve status information in the returned I/O assembly. Since the Option card interface to the Inverter is somewhat slower than the network capabilities, the Option card maintains an intermediate table of values, which are immediately available to the network. Note: **Be aware that the status values returned in the I/O assembly may be up to 750mS old.**

3.4.5   When each Poll message is received, an Option card timer will be reset. The reset value of this timer is 4 times the established EPR (Expected Packet Rate). Should that timer expire, the Option card will take action as specified by the Loss-of-Network parameter. If the action specified is FAULT, and if P00 status is enabled, a value indicating an EPR_TIMEOUT will be loaded.

3.5 I/O Assembly Format

3.5.1   This defines the I/O Assemblies or formats of the data passed in the Poll messages. The Input (in terms of the master) assembly returns the status data and the Output assembly loads the Drive control parameters. The actual size of each Assembly is dependent on the assembly length value which must be configured in "option" function code P03 (one's position).

Table 3-2. Assembly word length based on Assembly length mode.			
Length mode(P03)	0	1	2
Output	6	7	7
Input	2	3	4

3.5.2   Setting the assembly length mode to a value greater than zero will slightly extend the number of data items passed in each I/O assembly. This will allow a user to pass additional configuration, status or control items. **Note: An increase in parameter numbers will add an additional fragment packet and increase network response time**.

Drive Status: Input Assembly Format

Poll Data Response Format

Byte	Bit7	Bit6	Bit5	Bit4	Bit 3	Bit2	Bit1	Bit0
0	Keycntl	Netctrl	Start	Fault	Brake	Run	Rev	Fwd
1	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve	Reserve	Lockout
2			Output Freq. (low)					
3			Output Freq. (high)					
4			Output Current (low)					
5			Output Current (high)					
6			Output Voltage (low)					
7			Output Voltage (high)					
8			Output Torque (low)					
9			Output Torque (high)					
10			Trip History (low-low byte)					
11			Trip History (low-high byte)					
12			(optional: low)					
13			(optional: high)					

Byte [0] - Drive Status Bits:

> Fwd - Motion is in forward direction
> Rev - Motion is in reverse direction
> Run - Motor is in motion.
> Brake   - DC Braking is being applied.
> Fault   - Fault has occurred, see status parameter 106/107/107
> Start- Motor command to start has been issued.
> Netctrl   - Option card has access to function codes and operation.
> Keypad   - Operation mode (00) set for keypad start/stop control.
> Lockout - Option card detected condition which should hold drive at
> "STOP" until reset by Poll request.

Byte [2-3] - Output Speed reference.

> Value in pulses (-6000 to 6000)

Byte [4-5] - Output Current
Byte [6-7] - Output Voltage
Byte [8-9] - Output Torque

> Value = [0-4095] (0-100% of nameplate value)

Byte [10-11] - Trip History

> Value = See Appendix A: Drive Parameters format #3 description

Bytes [12-13] Optional drive status word defined by PO4:

> 0-93:   Function Codes (see Appendix A attribute mapping)
> 101-121: Inverter Status   (see Appendix A attribute mapping)

Drive Control: Output Assembly Format

Poll Data Request Format

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	X2	X1	Reset	Reserve	Coast	Reserve	Rev	Fwd
1	Brake	AUT	PU	Down	Up	RT2	RT1	X3
2			Input Freq. (low)					
3			Input Freq. (high)					
4			(optional: low)					
5			(optional: high)					
6			(optional: low)					
7			(optional: high)					

Byte [0] – Pseudo-Terminal Input Commands (same as Inverter terminal):

Fwd	- Start motor in forward motion.
Rev	- Start motor in reverse motion.
Reserved	
Coast	- Coast stop command.
Reserved	
Reset	- Reset command.
X1,X2	- **See Application Note #2**.

Byte [1] – Pseudo-Terminal Input Commands - cont.:

X3	**See Application Note #2**
RT1, RT2	**See Application Note #2**
Up	**See Application Note #2**
Down	**See Application Note #2**
PU	**See Application Note #2**
AUT	**See Application Note #2**
Break	**See Application Note #2**

Byte [2-3] - Speed reference.

Desired speed entered as pulses (frequency * 15)

Byte [4-5] - Optional drive control value defined by P05:
Byte [6-7] - Optional drive control value defined by P06:

0 - 93	- Function Codes (some may not be alterable in run mode).
94	- Additional V1 Analog Voltage
97	- Terminal Input Commands high word.
98	- Output Frequency Compensation Input
99	- Drive Torque limit Setting.
100	- Braking Torque limit Setting.

3.5.1   The Assembly object instances are listed below and can also be accessed through the Explicit Message connection at the appropriate Assembly object attribute 3. However, this is not recommended since a Poll connection must be active.

Instance	Type	Name
1	Input	Drive Status
2	Input	Drive Status w/optional parameter
3	Output	Drive Control
4	Output	Drive Control w/1 optional parameter
5	Output	Drive Control w/2 optional parameters

3.6 Loss of Network

3.6.1   When the Option board is in automatic (network control) mode, and network communications has not yet been established or has been interrupted, the Option board will affect the drive operation based on the setting in the Loss-of-Network configuration parameter. At power-up, a ten second delay is provided to allow the network to become active before Loss-of-Network action takes effect. The Loss-of-Network configuration parameter may be preset to one of three values: 0-Fault, 1-Use_Last_Values and 3-Use_Term_Value. ***The following describes the actions on the drive for each of these values.***

0 - Fault

When communications are lost, the drive will immediately fault with an ER5 causing the motor to coast to a stop. When network communications are restored, the ER5 will be automatically reset. However, the drive will be maintained at 'stop' by lockout state. To regain control and release lockout state, a Poll message must first be sent with the control word FWD and REV bits set to zero. Once lockout mode is released, the drive will follow the commands of the last Poll message.

The user can take local (terminal) control of the drive when in ER5 by switching to manual and issuing a reset. (Note that terminal controls must be at stop before a reset can be issued.)

Switching back to automatic with the network inactive will cause an ER5 to occur. Switching back to automatic with network active will cause control to either follow the last Poll command word or 'STOP' depending on lockout state.

1 - Use_Last_Values

When communications are lost, the drive will continue to run using the last received Poll parameters. When network communications are restored, the drive will immediately follow the commands of the last Poll message (lockout state is not activated).

> **Warning: When in this mode, the only way to stop the drive is through local control. This requires either a switch to manual mode <or> use the STOP button on the local keypad. It is the user's responsibility to take the appropriate safety precautions.**

The user can take local (terminal) control of the drive while in this mode by switching to manual. However, if the mode is switched back to automatic while the network is inactive, the network control word will be reset before it is made active. That is, if the user switches back to automatic before the network is restored, the drive will be stopped regardless of the state of the last Poll message.

2 - Use_Term_Values

When communications are lost, the drive will receive the control commands from the terminal (as if option card was placed in manual mode). When network communications are restored, the drive will immediately follow the commands of the last Poll messages (lockout state is not activated).

> **WARNING: When in this mode, the drive will revert to the current state set at the terminal. It is the user's responsibility to preset this to a safe state.**

The user can take local (terminal) control of the drive while in this mode by switching to manual. However, if the mode is switched back to automatic while the network is inactive, the drive will continue to use the terminal controls until the network is made active.

> **NOTE: If FWD or REV contacts are closed at terminal at powerup an ER6 will be generated.**

3.7 Lockout State

3.7.1   The option card will enter lockout state on power up or when receiving a Poll command with zero data length or under certain losses of communications. Should the option card be in lockout state while in automatic mode with the network active, the option card will ignore further Poll commands requesting forward or reverse motion and hold the drive at 'STOP'. Lockout state is indicated by bit 0 in the second byte of the Drive status Poll response. Refer to 'Loss-of-Network actions' described above to determine when lockout state is activated during loss of communications.

3.7.2   Lockout state is reset by simply sending a Poll command where both the Fwd and Rev bits of byte 0 in the Drive Control Poll request are reset. Maintaining the drive at 'STOP' until the proper sequence of control bits is received prevents inadvertent startup when PLCs are switched from HALT to RUN after maintenance halts or network fault conditions.

CHAPTER 4: CONFIGURATION

4.1 Setting the Drive Option Parameters

1.   After powering up the drive, the drive's LCD display should display the following:

```
┌────────────────────────┐
│ STOP                   │
│ PRG > DATA SET          │
│ >>  > LED SEL           │
│                        │
│                        │
└────────────────────────┘
```

This display indicates that the drive is in STOP mode, and that the PRG key must be pressed in order to set the drive data.

2.   Press the PRG key. The display now shows the start of the list of the normal drive parameters as follows:

```
┌────────────────────────┐
│  00 FREQ COMND          │
│  01 OPR METHOD          │
│ 02 MAX Hz               │
│ 03 BASE Hz-1            │
│                        │
└────────────────────────┘
```

3.   The option parameters are at the bottom of the list, and cannot be seen until the cursor keys are pressed multiple times to display them. After pressing the UP or DOWN cursor keys repeatedly, the option card parameters are finally displayed as follows (note that holding the cursor keys down continuously causes the display to scroll quickly):

```
┌────────────────────────┐
│    P00 OPTION 0         │
│    P01 OPTION 1         │
│    P02 OPTION 2         │
│    P03 OPTION 3         │
│                        │
└────────────────────────┘
```

4.   In order to set P00, use the cursor keys (UP and/or DOWN) to highlight P00 (the highlight is represented below with the underlined text).

```
┌────────────────────────┐
│    P00 OPTION 0         │
│    P01 OPTION 1         │
│    P02 OPTION 2         │
│    P03 OPTION 3         │
│                        │
└────────────────────────┘
```

5.   Pressing the FUNC/DATA key will show the current value of P00, and allow the user to change it if necessary.

```
┌─────────────────────────┐
│   P00 OPTION 0          │
│          0              │
│         25              │
│  0~255                  │
│                         │
└─────────────────────────┘
```

6.   The bottom line of the display will flash between the allowable data range (in this case **0~255**) and the prompt **STORE > F/D KEY**. The current value of the parameter is shown on the third line (in this case 0). Pressing the cursor keys (UP, DOWN or >>) causes the new value to change. See the Drive User's Manual for detailed instructions on keypad data entry operation. In this case, pressing the UP key will cause the new value to increment, and move the current stored value from the third line to the second line, as shown below:

```
┌─────────────────────────┐
│   P01  OPTION  1        │
│   P02  OPTION  2        │
│   P03  OPTION  3        │
│   PO4  OPTION  4        │
│                         │
└─────────────────────────┘
```

Because option parameter P00 was just edited, option parameter P01 is now highlighted.

It is important to note that the keypad will allow a larger data value to be input than is legal for a given parameter. Option parameters with Illegal data values will be flagged by the option card when drive control is transferred from the keypad to the option card.

4.2   Option Function Codes (DeviceNet™ Communication)

4.2.1   Before the inverter can be used, the DeviceNet™ address, baud rate, format, and optional control and status parameter word index must be configured. A keypad is required for setting these configuration parameters.

> **Note: Any change made to an Option Function Code to affect DeviceNet™ operation will not take place until after a power-cycle.**

Set P00 - Network Fault indicator [0-Enable, 255-Disable]

Set P01 - Station Id [0-63]
        DeviceNet™ allows addressing of up to 64 different bus addresses. Address 0 is usually reserved for the scanner (Master) and address 62 is usually reserved for the on-line configuration program. **Setting of the address is only available through the keypad.**

        Note: Care must be taken not to assign the same address to different devices on the same network. The "Duplicate MAC ID Check" will cause duplicate addressed devices to stay in the "Critical Link Failure" state.

Set P02 - Baud Rate [0 - 125k, 1 - 250k, 2 - 500k]
> DeviceNet™ allows the specification of 3 transmission speeds (125, 250 and 500kBaud). Speed should be selected based on physical network cable length. All devices on a network must be configured at the same baud rate.

Set P03 - Loss-of-Network + I/O Assembly size mode
> Loss-of-network (see description above) is located in the ten's position of this parameter [0x - Fault, 1x - Use_Last_Value, 2x - Use_Term_Value].
> I/O Assembly size (see description above) is located in the one's position of this parameter [0 - 2]. If this position is set to value greater than zero, P04-P06 will also need configuration.

4.3   Inverter Function Codes (Drive Configuration)

4.3.1   The Inverter function codes may be configured through the keypad or through DeviceNet™. Both methods require that the Pxx parameters be first set to an acceptable value and the Option card be in the appropriate mode (Manual: keypad, Automatic: DeviceNet™). For more information on the Inverter function codes, refer to the inverter Instruction Manual.

4.3.2   When accessing function codes over the DeviceNet™ network, not all codes accessed over the network will have the same number as listed in the inverter Instruction Manual. See Appendix A for the network attribute number for each of the function codes. When using on-line configuration tools that use EDS files, translation is done automatically.

4.4   Electronic Data Sheet (EDS) File

4.4.1   The HE300DNT100 Option Card package contains a diskette consisting of an Electronic Data Sheet (EDS) for the HE300DNT100.   This EDS can be used with different DeviceNet™ on-line configuration programs such as DeviceNet™ Manager. This file contains information about each of the Inverter's Function Codes (such as prompts, location and value limitations). Please refer to the on-line configuration program instructions on installing the HE300DNT100 EDS file.

CHAPTER 5: FAULTS AND DIAGNOSTICS

5.1   Option Card Faults (ER5)

5.1.1   An Option card fault will cause the Inverter to **Er5**. Generally, an Option card fault is due to an invalid configuration parameter or a DeviceNet™ communications error.   Option Function Code P00 (if enabled) can be examined to determine the specific error.

> **101 - Invalid Id Fault**
> **102 - Invalid Baud Selection**
> **103 - Invalid Assembly or Loss-of-Network Selection**
> **104 - Invalid Optional Status Parameter**
> **105 - Invalid Optional Command 1 Parameter**
> **106 - Invalid Option Command 2 Parameter**
>
> **201 - Bus Power Fault**
> **202 - No Bus Activity**
> **203 - Duplicate Id Fault**
> **204 - Bus Off Fault**
> **205 - No Poll Connection Established**
> **206 - Poll Connection time-out**

5.2   DeviceNet™ Message Errors

5.2.1   The following errors may be returned in a response frame generated by a request from a DeviceNet™ master. Generally, these responses will be limited to request made by a DeviceNet™ configuration tool.

> **08h - Service Not Supported**
> > Attempt to access unsupported service.
>
> **09h - Invalid Attribute Value**
> > Attempt to write to a function code with an invalid data value.
>
> **10h - Device State Conflict**
> > Attempt to write to a function code when an option card is in manual mode or to a function code which is unable to be set while the Inverter is in Run mode.
>
> **0Eh - Attribute Unable to be Set**
> > Attempt to write to a read-only attribute.
>
> **0Fh - Access Denied**
> > Attempt to write to function code while function code access is set to "protected."
>
> **14h - Attribute not Supported**
> > Attempt to read or write to a non-existent object attribute

16h - Object does not Exist
 Attempt to write to an object instance that does not exist.

20h - Invalid Parameter
    Attempt to write an Attribute value greater than zero in order to Reset service in Identity
    class.

APPENDIX A: DRIVE PARAMETERS

PARAM NUMBER	PARAMETER DESCRIPTION	FC*	MINIMUM	MAXIMUM	UNIT	FORMAT	LENGTH	READ/ WRITE	CHANGE WHILE RUNNING
0	Frequency Command	00	0	2	-	0	1 WORD	R/W	N
1	Operation Method	01	0	1	-	0	1 WORD	R/W	N
2	Maximum Frequency	02	50	400	Hz	0	1 WORD	R/W	N
3	Base Frequency 1	03	50	400	Hz	0	1 WORD	R/W	N
4	Rated Voltage 1	04	0, 80	480	V	0	1 WORD	R/W	N
5	Acceleration Time 1	05	0.01	3600	s	5	1 WORD	R/W	Y
6	Deceleration Time 1	06	0.01	3600	s	5	1 WORD	R/W	Y
7	Torque Boost 1	07	0	20	-	1	1 WORD	R/W	Y
8	Elec. Thermal OL (Select)	08	0	2	-	0	1 WORD	R/W	Y
9	Elec. Thermal OL (Level)	09	Ratedx20	Ratedx135	A	6	1 WORD	R/W	Y
10	Restart after Power Failure	10	0	4	-	0	1 WORD	R/W	N
11	Frequency Limiter (High)	11	0	400	Hz	0	1 WORD	R/W	Y
12	Frequency Limiter (Low)	12	0	400	Hz	0	1 WORD	R/W	Y
13	Bias Frequency	13	0	400	Hz	0	1 WORD	R/W	Y
14	Gain (Freq. Setting Signal)	14	0	200	%	1	1 WORD	R/W	Y
15	Torque Limiter (Driving)	15	20	180,255	%	0	1 WORD	R/W	Y
16	Torque Limiter (Braking)	16	0,20	180,255	%	0	1 WORD	R/W	Y
17	DC Brake (Starting Freq.)	17	0	60	Hz	1	1 WORD	R/W	Y
18	DC Brake (Brake Level)	18	0	100	%	0	1 WORD	R/W	Y
19	DC Brake (Braking Time)	19	0	30	s	1	1 WORD	R/W	Y
20	Multistep Freq Setting 1	20	0	400	Hz	2	1 WORD	R/W	Y
21	Multistep Freq Setting 2	21	0	400	Hz	2	1 WORD	R/W	Y
22	Multistep Freq Setting 3	22	0	400	Hz	2	1 WORD	R/W	Y
23	Multistep Freq Setting 4	23	0	400	Hz	2	1 WORD	R/W	Y
24	Multistep Freq Setting 5	24	0	400	Hz	2	1 WORD	R/W	Y
25	Multistep Freq Setting 6	25	0	400	Hz	2	1 WORD	R/W	Y
26	Multistep Freq Setting 7	26	0	400	Hz	2	1 WORD	R/W	Y
27	Elec. Thermal OL (DB Res.)	27	0	2	-	0	1 WORD	R/W	Y
28	Slip Compensation Control	28	-9.9	5	Hz	1	1 WORD	R/W	Y
29	Torque Vector Control	29	0	1	-	0	1 WORD	R/W	N
30	Number of Motor Poles	30	2	14	-	0	1 WORD	R/W	N
31	Function Block (32-41)	31	0	1	-	0	1 WORD	R/W	Y
32	X1 - X5 Terminal Function	32	0	0x2222	-	11	1 WORD	R/W	N

* The performance of these parameters has not been fully evaluated at the time of publication of this manual.

PARAM NUMBER	PARAMETER DESCRIPTION	FC*	MINIMUM	MAXIMUM	UNIT	FORMAT	LENGTH	READ/ WRITE	CHANGE WHILE RUNNING
33	Acceleration Time 2	33	0.01	3600	s	5	1 WORD	R/W	Y
34	Deceleration Time 2	34	0.01	3600	s	5	1 WORD	R/W	Y
35	Acceleration Time 3	35	0.01	3600	s	5	1 WORD	R/W	Y
36	Deceleration Time 3	36	0.01	3600	s	5	1 WORD	R/W	Y
37	Acceleration Time 4	37	0.01	3600	s	5	1 WORD	R/W	Y
38	Deceleration Time 4	38	0.01	3600	s	5	1 WORD	R/W	Y
39	Base Frequency 2	39	50	400	Hz	0	1 WORD	R/W	N
40	Rated Voltage 2	40	0, 80	480	V	0	1 WORD	R/W	N
41	Torque Boost 2	41	0.1	20	-	1	1 WORD	R/W	Y
42	Function Block (43-51)	42	0	1	-	0	1 WORD	R/W	Y
43	FMP Terminal (Pulse Rate Mult.)	43	6	100	-	0	1 WORD	R/W	Y
44	FMP Terminal (Voltage Adjust)	44	50	120	-	0	1 WORD	R/W	Y
45	FMA Terminal (Voltage Adjust)	45	65	103	-	0	1 WORD	R/W	Y
46	FMA Terminal (Function)	46	0	3	-	0	1 WORD	R/W	Y
47	Y2 - Y5 Terminal Function(low word)	47	0	0xFFFF	-	12	2 WORD	R/W	N
48	Y1 Terminal Function(high word)		0	0xF	-	13		R/W	N
49	FAR Function Signal (Hysteresis)	48	0	10	Hz	1	1 WORD	R/W	Y
50	FDT Function (Level)	49	0	400	Hz	0	1 WORD	R/W	Y
51	FDT Function (Hysteresis)	50	0	30	Hz	1	1 WORD	R/W	Y
52	OL Function Signal (Level)	51	Ratedx20	Ratedx135	A	6	1 WORD	R/W	Y
53	Function Block (53-59)	52	0	1	-	0	1 WORD	R/W	Y
54	Jump Frequency (Jump Freq. 1)	53	0	400	Hz	0	1 WORD	R/W	N
55	Jump Frequency (Jump Freq. 2)	54	0	400	Hz	0	1 WORD	R/W	N
56	Jump Frequency (Jump Freq. 3)	55	0	400	Hz	0	1 WORD	R/W	N
57	Jump Frequency (Hysteresis)	56	0	30	Hz	0	1 WORD	R/W	N
58	Starting Frequency (Freq.)	57	0.2	60	Hz	1	1 WORD	R/W	N
59	Starting Frequency (Holding Time)	58	0	10	s	1	1 WORD	R/W	N
60	Freq. Setting Signal Filter	59	0.01	5	s	2	1 WORD	R/W	Y
61	Function Block (61-79)	60	0	1	-	0	1 WORD	R/W	Y
62	LED Monitor (Function)	61	0	8	-	0	1 WORD	R/W	Y
63	LED Monitor (Display at Stop Mode)	62	0	1	-	0	1 WORD	R/W	Y
64	Coeff. for Machine & Line Speed	63	0.01	200	-	2	1 WORD	R/W	Y
65	LCD Monitor	64	0	4	-	0	1 WORD	R/W	Y

*The performance of these parameters has not been fully evaluated at the time of publication of this manual.

PARAM NUMBER	PARAMETER DESCRIPTION	FC*	MINIMUM	MAXIMUM	UNIT	FORMAT	LENGTH	READ/ WRITE	CHANGE WHILE RUNNING
66	Pattern Operation (Mode Select)	65	0	3	-	0	1 WORD	R/W	N
67	Pattern Operation (Stage 1)	66	0	6000	s/-	7	1 WORD	R/W	Y
68	Pattern Operation (Stage 2)	67	0	6000	s/-	7	1 WORD	R/W	Y
69	Pattern Operation (Stage 3)	68	0	6000	s/-	7	1 WORD	R/W	Y
70	Pattern Operation (Stage 4)	69	0	6000	s/-	7	1 WORD	R/W	Y
71	Pattern Operation (Stage 5)	70	0	6000	s/-	7	1 WORD	R/W	Y
72	Pattern Operation (Stage 6)	71	0	6000	s/-	7	1 WORD	R/W	Y
73	Pattern Operation (Stage 7)	72	0	6000	s/-	7	1 WORD	R/W	Y
74	Acc./Dec. Pattern (Mode Select)	73	0	2	-	0	1 WORD	R/W	N
75	Energy Saving Operation	75	0	1	-	0	1 WORD	R/W	N
76	Rev. Phase Sequence Lock	76	0	1	-	0	1 WORD	R/W	N
77	Data Initializing (Data Reset)	77	0	1	-	0	1 WORD	R/W	N
78	Language (Japanes/English)	78	0	3	-	0	1 WORD	R/W	Y
79	LCD Display Brightness	79	0	10	-	0	1 WORD	R/W	Y
80	Function Block (81-94)	80	0	1	-	0	1 WORD	R/W	Y
81	Motor Sound (Carrier Frequency)	81	0	10	-	0	1 WORD	R/W	Y
82	Auto Restart (Restart Time)	82	0	5	s	1	1 WORD	R/W	N
83	Auto Restart (Freq. Fall Rate)	83	0	100	Hz/s	2	1 WORD	R/W	N
84	Auto Reset (Times)	84	0	7	-	0	1 WORD	R/W	Y
85	Auto Reset (Reset Interval)	85	2	20	s	0	1 WORD	R/W	Y
86	Motor 1 (Capacity)	86	0	3	-	0	1 WORD	R/W	N
87	Motor 1 (Rated Current)	87	0	2000	A	6	1 WORD	R/W	N
88	Motor 1 (No-Load Current)	88	0	2000	A	6	1 WORD	R/W	N
89	Motor 2 (Rated Current)	89	0	2000	A	6	1 WORD	R/W	N
90	Motor 1 Impedance (Tuning)	90	0	1	-	0	1 WORD	R/W	N
91	Motor 1 Impedance (%R1 Setting)	91	0	50	%	2	1 WORD	R/W	Y
92	Motor 1 Impedance (%X1 Setting)	92	0	50	%	2	1 WORD	R/W	Y
93	Data Protection	95	0	1	-	0	1 WORD	R/W	N
94*	Additional V1 Analog Voltage		-10	10	V	0	1 WORD	R/W	Y
95	High Res. Frequency Setting (Pulses)		-6000	6000	Pulses	14	1 WORD	R/W	Y
96	Terminal Input/Output (low word)		BIT MAP	BIT MAP	-	4	16 bits	R/W	Y
97	Terminal Input/Output (high word)		BIT MAP	BIT MAP	-	4	16 bits	R/W	Y
98*	Output Frequency Compensation Input		-6000	6000	Pulses	14	1 WORD	R/W	Y

*The performance of these parameters has not been fully evaluated at the time of publication of this manual.

PARAM NUMBER	PARAMETER DESCRIPTION	FC*	MINIMUM	MAXIMUM	UNIT	FORMAT	LENGTH	READ/ WRITE	CHANGE WHILE RUNNING
99	Drive Torque Limit Setting		20	180,255	%	0	1 WORD	R/W	Y
100	Braking Torque Limit Setting		0,20	180,255	%	0	1 WORD	R/W	Y
101	Output Frequency		-6000	6000	Pulses	14	1 WORD	R	Y
102	Output Current				%	10	1 WORD	R	Y
103	Output Voltage				%	10	1 WORD	R	Y
104	Output Torque				%	10	1 WORD	R	Y
105	Operation Status		BIT MAP	BIT MAP	-	8	16 bits	R	Y
106	Trip History (low word)				-	3	1 WORD	R	Y
107	Trip History (high word)				-	3	1 WORD	R	Y
108	Inverter Capacity				-	15	1 WORD	R	Y
109	Total Operation Time				h	0	1 WORD	R	Y
110	Inverter Rated Current				A	16	1 WORD	R	Y
111	Fin Temperature				C	0	1 WORD	R	Y
112	Internal Temperature				C	0	1 WORD	R	Y
113	Output Terminal Condition		BIT MAP	BIT MAP	-	9	16 bits	R	Y
114	V2 Terminal Voltage				V	1	1 WORD	R	Y
115	V1 terminal Voltage				V	1	1 WORD	R	Y
116	C1 Terminal Current				mA	1	1 WORD	R	Y
117**	FMP Frequency				Pulses	0	1 WORD	R	Y
118	FMP Output Voltage				V	1	1 WORD	R	Y
119	FMA Output Voltage				V	1	1 WORD	R	Y
120	Inverter Terminal Input (low word)		BIT MAP	BIT MAP	-	4	16 bits	R	Y
121	Inverter Terminal Input (high word)		BIT MAP	BIT MAP	-	4	16 bits	R	Y
122	Option Status		BIT MAP	BIT MAP	-	17	16 bits	R/W	Y

** Not operational at this time.

Data Formats

The Drive Parameters listed in the previous pages describe the "format" in which the data is presented. There are 17 different formats, all listed in this manual section. For further details beyond this manual, consult the user documentation provided with the drive.

FORMAT 0
Direct Translation

FORMAT 1	
READ	WRITE
/10	X10

FORMAT 2	
READ	WRITE
/100	X100

Format 3

LOW WORD															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	PRIOR FAULT #1					0	0	0	PRESENT FAULT				

HIGH WORD															
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
0	0	0	PRIOR FAULT #3					0	0	0	PRIOR FAULT #2				

Fault Codes						
Code	Type	Description	Code	Type	Description	
0	-	No Trip History	12	OH3	Overheat (Internal Temp.)	
1	OC1	Overcurrent During Acc.	13	OH2	External Fault	
2	OC2	Overcurrent During Dec.	14	dbH	DB Resistor Overload	
3	OC3	Overcurrent Steady State Running	15	FUS	DC Fuse Burnout	
4	EF	Ground Fault	16	Er1	Memory Error	
5	OV1	Overvoltage During Acc.	17	Er3	Inverter CPU Error	
6	OV2	Overvoltage During Dec.	18	Er4	Option COmmunications Error	
7	OV3	Overvoltage Steady State Running	19	Er5	Option Malfunction	
8	LV	Low Voltage	20	Er6	Keypad Panel Operation Error	
9	OL	Electric Thermal Overload Relay	21	Er7	Auto Tuning Error	
10	OLU	Inverter Overload	22	Er2	Keypad Panel Communication Error	
11	OH1	Heatsink Overheat				

FORMAT 4															
LOW WORD															
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
DCB	AUT	PU	DOWN	UP	RT2	RT1	X3	X2	X1	RST	THR	BX	HLD	REV	FWD
HIGH WORD															
31	**30**	**29**	**28**	**27**	**26**	**25**	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	**16**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	PRT	VF2

ABBREVIATION DEFINITIONS

FWD	RUN DRIVE FORWARD
REV	RUN DRIVE REVERSE
HLD	N/A
BX	COAST STOP COMMAND
THR	N/A
RST	FAULT RESET
X1,X2,X3,RT1,RT2	SEE GEI-100211
UP	INCREMENT SET FREQUENCY
DOWN	DECREMENT SET FREQUENCY
PU	LINE TO INVERTER TRANSITION
AUT	SELECT 4-20mA FOR FREQ SETTING
DCB	DC BRAKE COMMAND
VF2	2ND MOTOR V/F SELECTION
PRT	DATA PROTECTION

FORMAT 5															
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	0	0	0	BASE		ACCELERATION / DECELERATION TIME									

BASE		ACCEL / DECEL TIME	
0	10ms	**1-999**	0.01-9.99s
1	0.1s	**100-199**	10.0-99.9s
2	1s	**100-199**	100-999s
3	10s	**100-360**	1000-3600s

FORMAT 6															
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	0	0	0	BASE		CURRENT DATA									

BASE		CURRENT DATA	
0	0.01A	**1-999**	0.01-9.99A
1	0.1A	**100-999**	10.0-99.9A
2	1.0A	**100-999**	100-999A
3	10A	**100-200**	1000-2000A

FORMAT 7

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DIR	TIME SELECT			BASE		ACCELERATION / DECELERATION TIME									

DIRECTION		TIME SELECT		BASE		ACCEL / DECEL TIME	
0	FWD	**0**	TIME 1	**0**	0.01S	**1-999**	0.01-9.99A
1	REV	**1**	TIME 2	**1**	0.1S	**100-999**	10.0-99.9A
		2	TIME 3	**2**	1.0S	**100-999**	100-999A
		3	TIME 4	**3**	10S	**100-600**	1000-6000A

FORMAT 8

3	2	1	0
DC Brake Applying	RUN	REVERSE	FORWARD
7	**6**	**5**	**4**
Keypad Operation Status (LED)	Data Change Priority Option Side: 1, Keypad Side: 0	RUN Command by Keypad	Trip Condition

FORMAT 9

7	6	5	4	3	2	1	0
0	0	0	Y5	Y4	Y3	Y2	Y1

FORMAT 10

(DRIVE VALUE / 4096) X NAMEPLATE VALUE = DESIRED VALUE

DRIVE VALUE / 40.96 = PERCENT VALUE

FORMAT 11

WRITE															
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
X1/X2 TERMINAL (0-FH)				X3 TERMINAL (0-FH)				X4 TERMINAL (0-FH)				X5 TERMINAL (0-FH)			

READ							
7	6	5	4	3	2	1	0
X5		X4		X3		X1/X2	

FORMAT 12

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Y2 TERMINAL (0-FH)				Y3 TERMINAL (0-FH)				Y4 TERMINAL (0-FH)				Y5 TERMINAL (0-FH)			

FORMAT 13

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0	Y1 TERMINAL (0-FH)			

FORMAT 14

PULSES TO FREQUENCY = PULSES / 15
FREQUENCY TO PULSES = absolute value of (FREQUENCY X 15)

FORMAT 15

200V Series		400V Series	
Capacity (HP)	Data	Capacity (HP)	Data
1/4	2	1/2	131
1/2	3	1	132
1	4	2	133
2	5	3	134
3	6	5	135
5	7	7.5	136
7.5	8	10	137
10	9	15	138
15	10	20	139
20	11	25	140
25	12	30	141
30	13	40	142
40	14	50	143
50	15	75	144
75	16	55	145
55	17	100	146
100	18	125	147
125	19	150	148
		175	149
		200	150
		250	151
		300	152

FORMAT 16	
Capacity (HP)	**FORMULA**
30HP and below	CURRENT = DATA / 100
40HP and above	CURRENT = DATA / 10

FORMAT 17			
3	**2**	**1**	**0**
Terminal Input (Run Command Input) thru option card (See olso P1)	High Resolution Frequency Setting thru option card (See also P0)	0	0
7	**6**	**5**	**4**
0	1 = Local (Keypad) Control, 0 = Remote (Option Card) Control	Function Input thru Option card	Output Frequency Compensation thru Option card
11	**10**	**9**	**8**
0	0	0	0
15	**14**	**13**	**12**
0	0	0	0

December 16, 1997

Revision pages for

Horner APG's DeviceNet™ Option Board User Manual

HE300DNT100, Fourth Edition

Attached to this cover page is a revision for the **Horner APG's DeviceNet™ Option Board User Manual dated December 5, 1997, MAN0016-04.**

THESE REVISED REQUIREMENTS ARE NOW IN EFFECT.

New and revised pages may be issued periodically. For user manual updates, please contact Horner APG, Technical Support Division, at (317) 916-4274 or visit our website at www.heapg.com.

Revision Key

Changes to text, tables or graphics contained in the attached revision are indicated as follows:

1. **Added text is** underlined.
2. **Deleted text is lined through.**
3. **New, revised, or deleted items are specified as such in ( ).**

List of Effective Pages

The most current user manual consists of the following list of effective pages including *the attached revision pages: * Denotes new or revised pages.*

Page   **Date**

3.   Install the supplied plastic 1/2" standoff (A) in hole (A).
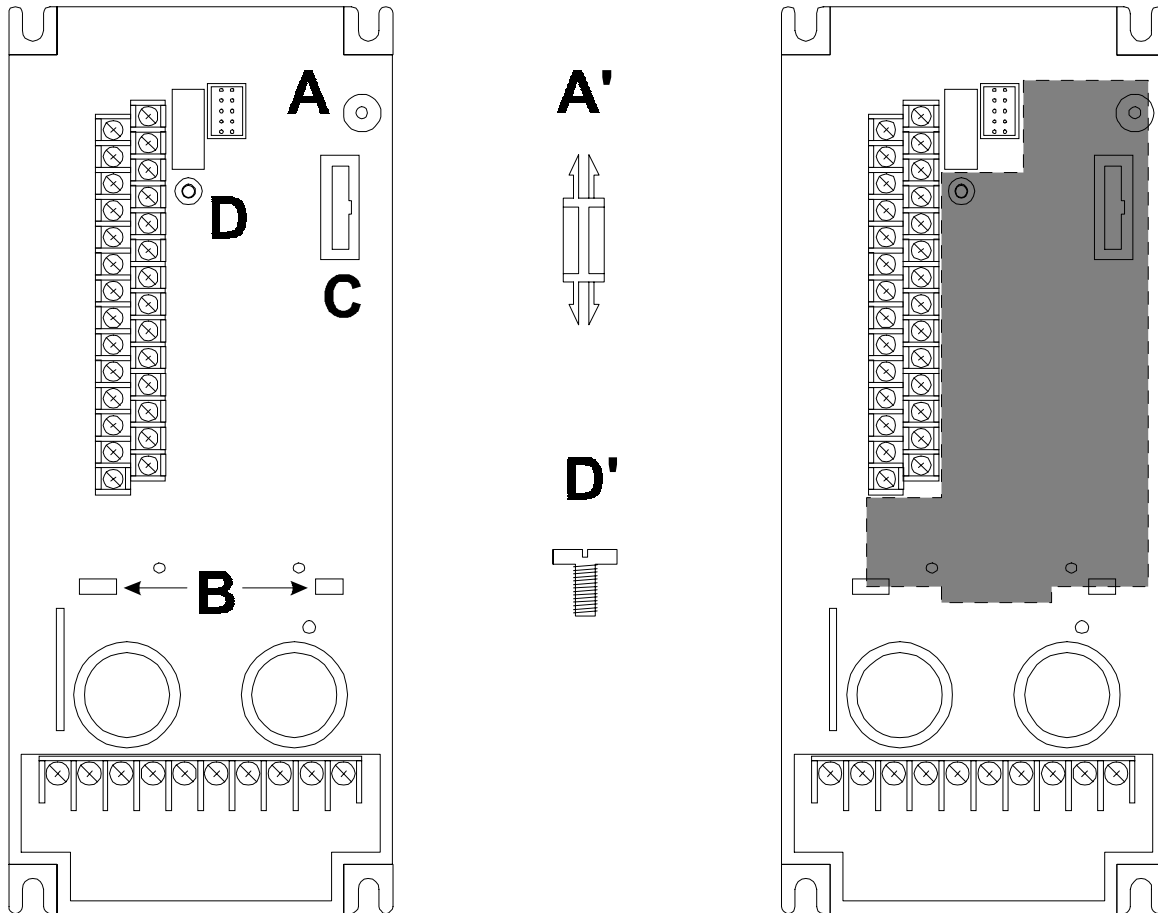
Figure 2-2. Drive Mounting Holes and Connectors (left), Mounting Hardware (center, not to scale), and Option Card Location (right).
Drive shown above is 1/2HP, viewed from the front.

(REVISED)

4.   Install the HE300 option board. Use the plastic guides (B) to properly align the bottom of the option board. Snap the option board into the standoff (A') and option connector (C).

5.   Install the supplied M3 x 5 screw (D') with washer in hole D to secure the option board.

~~6.   Verify that jumper JP4 is in place.~~
(Item revised 12-16-97)

7.   After inserting the Phoenix-type connector into the proper receptacle (P1), completing field wiring to the terminal strip(s) and installing the manual override connection wires and capacitor, replace the front cover.

8.   Power up the drive as needed.

7. Install the assembled board into the drive using the M3 x 5 screws and lock washers in the mounting holes (E). If you used the plastic standoff in the upper right hand corner of the board you may need to use one of the M3 x 5 screws from the HE300KIT399.

(REVISED)

8. ~~Verify that jumper JP4 is installed.~~
(Item revised 12-16-97)

9. Replace the keypad mounting plastic and the keypad.

10. After inserting the Phoenix-type connector into the proper receptacle (P1), completing field wiring to the terminal strip(s) and installing the manual override connection wires and capacitor, replace the front cover.

11. Power up the drive as needed.

Note: The metal standoff included with the HE300KIT401 can be used in place of the plastic standoff that comes with the drive. The plastic standoff is the preferred method of installation, but ***if the metal standoff is to be used, the steps below should be followed***.

1. Once the keypad and keypad mounting plastic is removed, remove the plastic standoff in the upper right corner of the drive board by holding the screw under the standoff with your finger, while unscrewing the plastic standoff.

2. Once the standoff is removed, screw on the metal standoff that is supplied with the HE300KIT401.

3. Do not remove the DC-to-DC converter as stated in step 6. Instead press the interface board down onto the metal standoff until it snaps into place.

4. To remove the board you may need to use a pair of fine tipped pliers to squeeze the tip of the metal standoff together in order for the board to snap off of the standoff. To get to the tip of the standoff you may need to remove the DC-to-DC converter as stated in step 6.

2.4 Safety Precautions

2.4.1 WARNING – MECHANICAL MOTION HAZARD: Drive systems cause mechanical motion. It is the responsibility of the user to insure that any such motion does not result in an unsafe condition. Factory provided interlocks and operating limits should not be bypassed or modified.

2.4.2 WARNING – ELECTRICAL SHOCK AND BURN HAZARD: When using instruments such as oscilloscopes to work on live equipment, the oscilloscope's chassis should be grounded and the differential amplifier input should be used. Care should be used in the selection of probes and leads and in the adjustment of the oscilloscope so that accurate readings may be made. See instruments manufacturer's instruction book for proper operation and adjustments to the instrument.

2.4.3 WARNING – FIRE AND EXPLOSION HAZARD: Fires or explosions might result from mounting Drives in hazardous areas such as locations where flammable or combustible vapors or dusts are present. Drives should be installed away from hazardous areas, even if used with motors suitable for use in these locations.