



User Manual for the
HE300RSL100
HE300GEN100

Option Cards for
GE Drives AF-300E\$
Adjustable Frequency Drives

Fourth Edition
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MAN0017-04

PREFACE

This manual explains how to use the Horner APG Communications Option Cards for use with the GE Drives Adjustable Frequency Drives.

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

Revisions to This Manual

This version (MAN0017-04) of the **Drive Communications Card User Manual** contains the following revisions, additions and deletions:

1. Converted manual into Word format.
2. Changed company name from Horner Electric, Inc. to Horner APG, LLC.

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NOTES

CHAPTER 1: INSTALLING THE OPTION CARD

1.1 Installation Hardware

Included in the packaging with the AF-300E\$ option card should be the following:

- A) The option card (RTU or Genius),
- 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, and
- D) This document.

1.2 The Installation Procedure for Drives Under 40 Horsepower

The AF-300E\$ Communications Option Cards have been designed to integrate seamlessly with the AF-300E\$ drive. 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 the AF-300E\$ drive as shown in the diagram below.

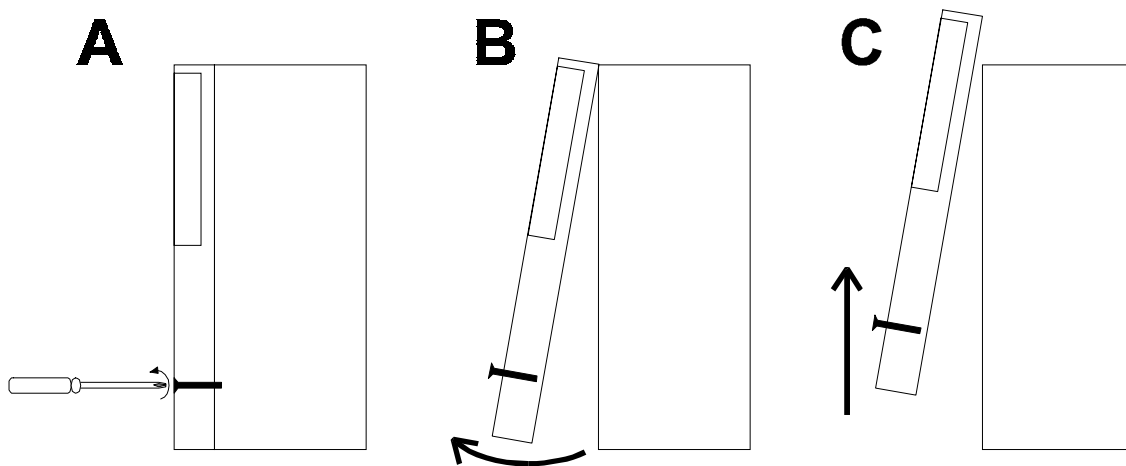


Figure 1.1 – Drive Front Cover Removal Procedure

3. Install the supplied plastic 1/2" standoff (A') in hole (A).

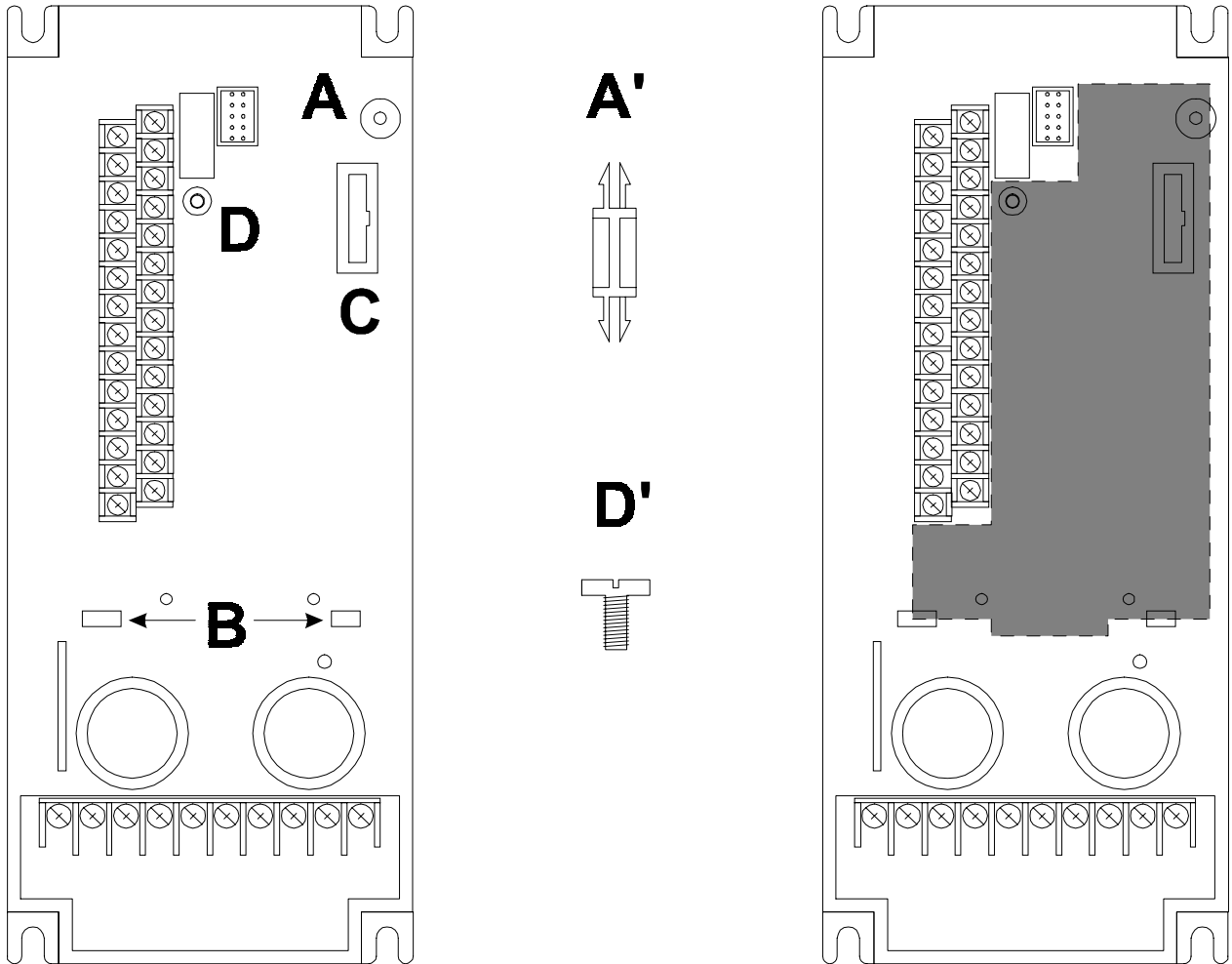


Figure 1.2 – Drive Mounting Holes and Connectors (left), Mounting Hardware (center, not to scale), and Option Card Location (right). Drive shown is 1/2HP Af-300E\$ viewed from the front.

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 removed and JP3 is on the two pins closest to the "E".
7. After completing field wiring to the removable terminal strip(s), replace the front cover.
8. Power up the drive as needed.

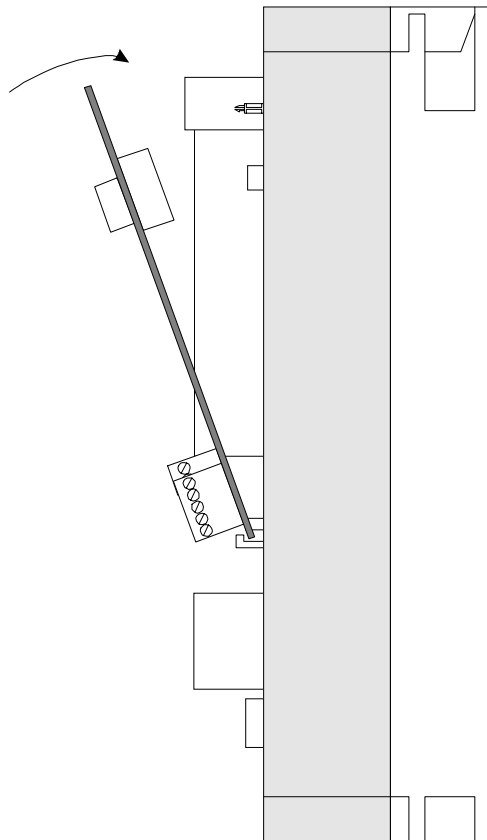
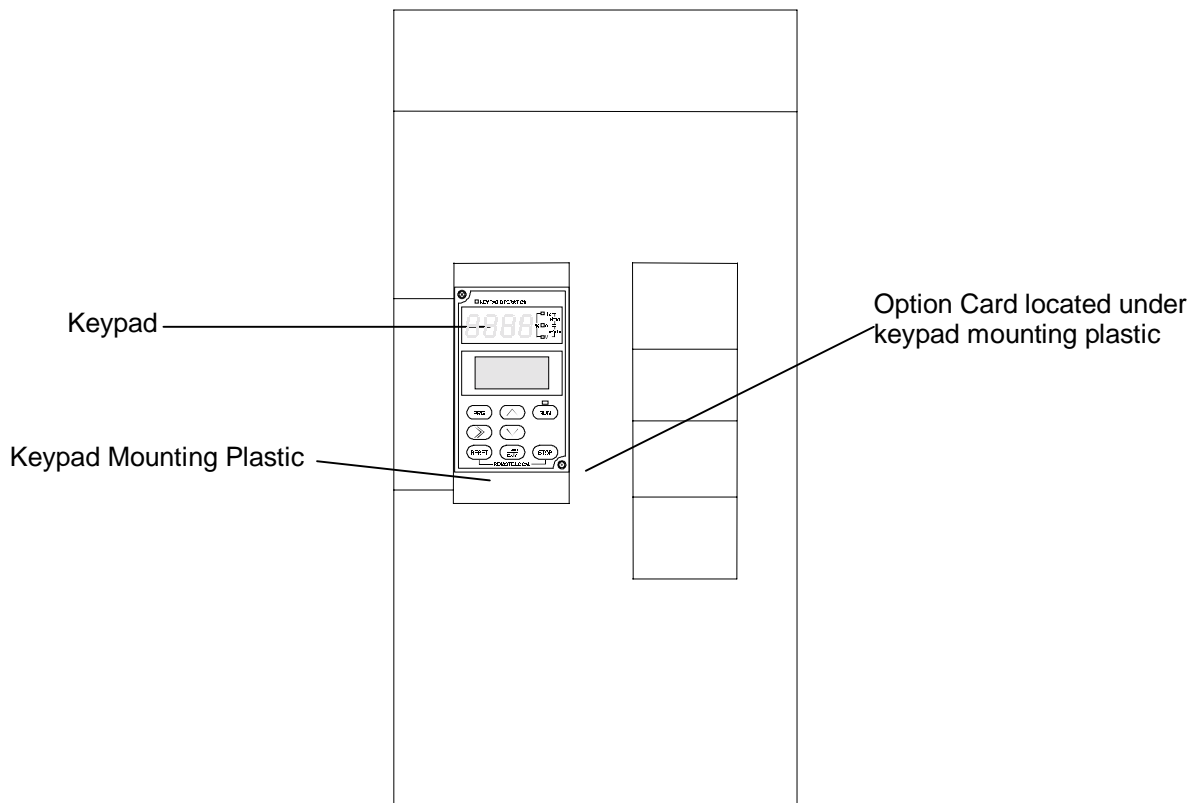


Figure 1.3 – Installing the Option Board (Side View of AF-300E\$ 1/2HP shown)

1.3 The Installation Procedure for Drives 40 Horsepower and Larger

The AF-300E\$ Communications Option Cards have been designed to integrate seamlessly with the AF-300E\$ drive. 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 AF-300E\$ using the 11 screws on the front panel.
3. Remove the keypad and the keypad mounting plastic (4 screws) shown below.



**Figure 1.4 – Drive Keypad, Keypad Mounting Plastic and Option Card Location.
Drive shown is a 40HP AF-300E\$ 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).
6. For the HE300GEN100 gently remove DC-to-DC converter (D), being careful not to bend the pins. The HE300RSL100 does not have this part installed.

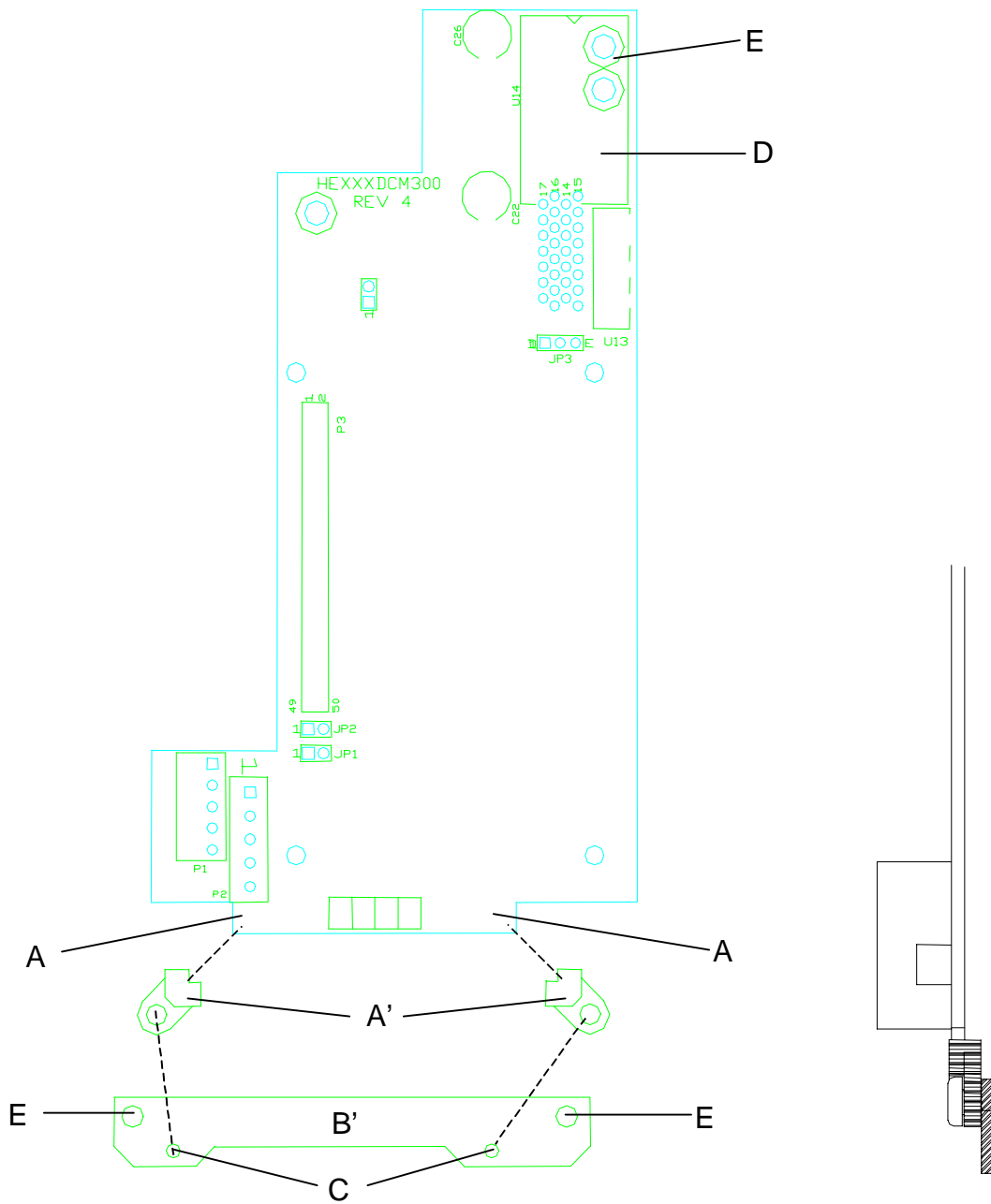


Figure 1.5 – Option Card Assembly front and side view (right)

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 and JP3 is on the two pins closest to the "E".
9. Replace the keypad mounting plastic and the keypad.
10. After completing field wiring to the terminal strip(s), 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.

CHAPTER 2: GENIUS COMMUNICATIONS

2.1 Introduction to Genius

Genius is a high-speed token passing network which has been used in industrial applications for many years. The network supports up to 32 devices, with baud rates of up to 153.6kbaud. A wide variety of Genius devices exist which can reside on the network, ranging from intelligent I/O blocks to more sophisticated communications devices such as personal computers. In recent years a number of third party devices have emerged, including Operator Interface Units, valve manifolds, RF tag readers, etc.

In a typical industrial application, Genius devices are distributed throughout a fairly wide area, wired in a daisy chained fashion with a single shielded, twisted pair. The AF-300E\$ Genius option card allows the AF-300E\$ Drives to be distributed on the factory floor on the same twisted pair as the I/O blocks and other Genius devices. This provides a new level of PLC integration for the drives. The physical nature of the network can allow for great savings in wiring, as many discrete wires can be replaced with a single communications cable. This allows tasks such as starting, stopping, reversing, and changing speeds to be accomplished over the LAN. In addition, drive parameters and diagnostic data previously not available to the PLC are easily accessible.

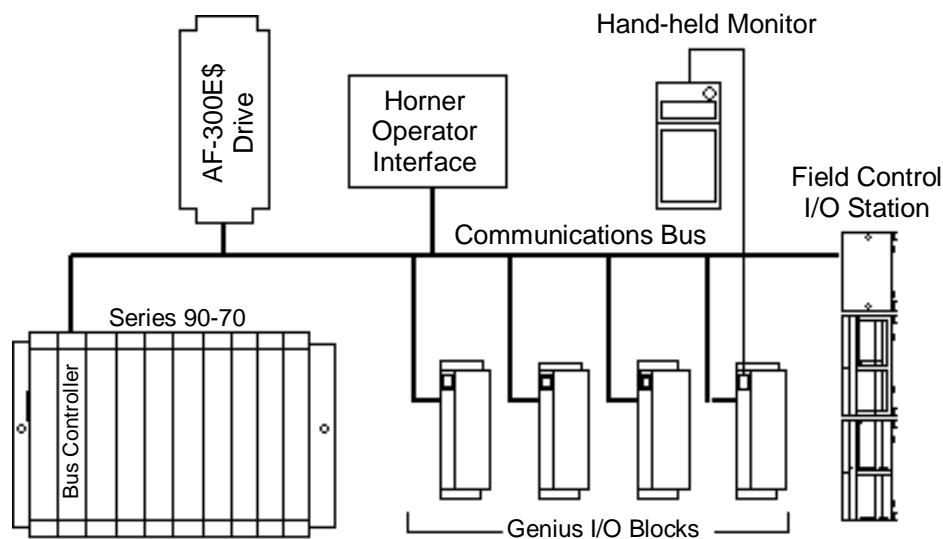


Figure 2.1 – Typical Genius Devices and Architecture

2.2 Network Architecture

Normally, a GE Fanuc programmable controller runs the network, through a PLC module called a Genius Bus Controller (GBC). Devices (up to 32 in number) are wired in a daisy-chained fashion. Network devices support four communications terminals, Serial 1, Serial 2, Shield In and Shield Out. The network is terminated at each end with an appropriate terminating resistor. The value of the resistor should be chosen to match the characteristic impedance of the cable. Refer to GE Fanuc Automation publication GFK-90486 for help in selecting an appropriate cable type for your application. Note: If the characteristic impedance of the cable is unknown, 120 ohm terminating resistors should be used.

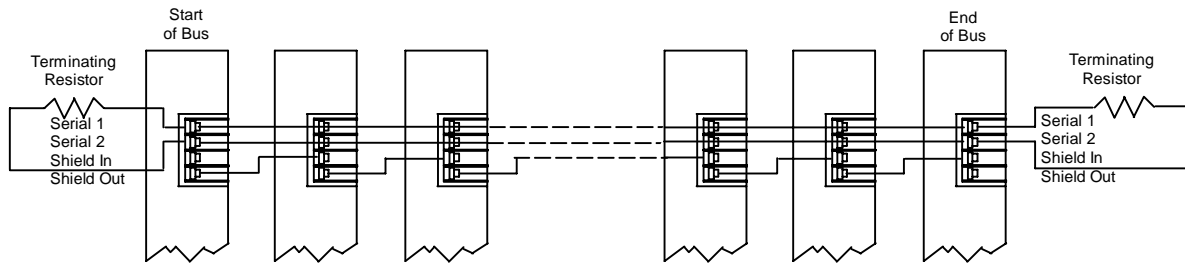


Figure 2.2 – Typical Genius wiring technique

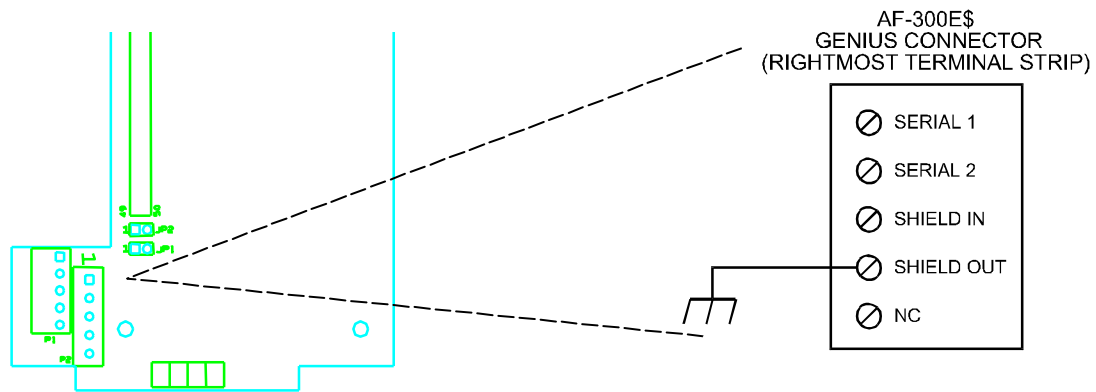


Figure 2.3 – AF-300E\$ Genius Connector Pinout

The AF-300E\$ Genius connections are made on the rightmost of its two terminal strips (P2). In addition to the normal Genius connections shown in **Figure 2.2**, Earth Ground must be connected to the “Shield Out” terminal, Terminal 4.

Each of the (up to) 32 devices on the network is assigned a Genius Bus Address ranging from 0 to 31. Bus Controllers are most typically assigned a Genius Bus Address of 31. In applications with redundant bus controllers, the “backup” bus controller is address 30. Bus address 0 is normally reserved for the Genius Hand Held Monitor.

Among other tasks, the bus controller allows Genius I/O (including the drives) on the network to be mapped into PLC memory, monitoring inputs and controlling outputs. Intelligent, data intensive Genius devices also share their data with the PLC through communications with the bus controller.

2.3 Genius Communications Services

As stated previously, the AF-300E\$ Genius option card allows the drive to reside directly on the Genius LAN, providing drive control and data access capabilities to the PLC. There are three types of communications that can occur on the Genius LAN. These are I/O Services, Global Data and Datagrams. The AF-300E\$ supports all three of these communications types.

2.3.1 I/O Service

I/O Service is the manner in which data is transferred to and from Genius I/O Blocks. Outputs are selectively written to each I/O block from the CPU bus controller each scan. The outputs written by the

CPU bus controller to the AF-300E\$ drives include start/stop, fwd/rev, frequency (speed), fault reset, etc. Many I/O blocks also broadcast inputs to the bus every bus scan. The AF-300E\$ does not support this means of communications, as it broadcasts its inputs (feedback) as global data.

2.3.2 *Global Data*

Global data is data broadcast over the network at large, with no particular "destination". Each Genius device has the capacity to broadcast up to 128 bytes of global data. Intelligent devices which reside on the LAN (bus controllers, OIUs, etc.) can read this data off the network. These devices are intelligent enough to interpret this data, as the data content differs from Genius device to Genius device. The AF-300E\$ Genius interface utilizes global data to broadcast drive feedback data over Genius. Drive feedback data consists of parameters such as speed reference, torque, current, faults, function settings, etc. The AF-300E\$ Genius interface allows the system designer to select which data is broadcast by the drive as global data. This is important for two reasons. First of all, the data which is desired to be monitored on a regular basis varies from application to application. Second, the amount of global data broadcast by the drive is directly proportional to response time. The ability to control the amount and content of global data output is a vital feature of the AF-300 Genius interface.

In general, the procedure for configuring the drive's Global output data is a process of mapping the global output data words to drive parameters. There are three different means in which this "mapping" of global data output words to drive parameters can be accomplished. These are; from the keypad, from the Genius Hand Held Monitor, and from the optional personal computer configuration utility. Chapters are dedicated to each of these configuration means.

2.3.3 *Datagrams*

Datagrams are messages sent over the Genius LAN from one device to another. Datagrams are typically performed in PLC applications through a communications request, or COMREQ. Typically, COMREQs are used for occasional data access. For instance, COMREQs would typically not be used to monitor speed reference on a continuous basis, but might be used to change a drive parameter once a shift or once a week. Datagrams (through COMREQs) could also be used to upload or download all drive parameters over the network. In PLC applications, a bus controller is required to perform datagrams or COMREQs.

NOTES

CHAPTER 3: RTU COMMUNICATIONS

3.1 Introduction to RTU Communications

The RTU protocol has become a de facto industry standard over the past several years. Originally developed by Modicon as the MODBUS™ protocol, it has gained wide acceptance due to its simplicity and versatility. It is a protocol which has translated well to various media, as it is used with RS-232, RS-485, radio modems, fiber optics etc. It is the most common protocol of SCADA (Supervisory Control And Data Acquisition) and DCS (Distributed Control Systems) Systems.

The AF-300E\$ Remote Serial Link option card allows the AF-300E\$ drive to act as an RTU slave. Therefore it is able to communicate to the multitude of RTU masters (hosts) in use in industrial applications. Through the option card, the AF-300E\$ drive offers both RS-232 and RS-485 interfaces for RTU communications.

3.2 Network Architecture

Through the RS-232 connection, the AF-300E\$ can only be used in point-to-point mode, connected directly to an RTU host less than 50 feet away. Five conductors should be used, Transmit Data, Receive Data, Signal Ground, Request To Send, and Clear to Send. Other network topologies can be used through the RS-232 port, but external hardware (converters/modems, etc.) is required.

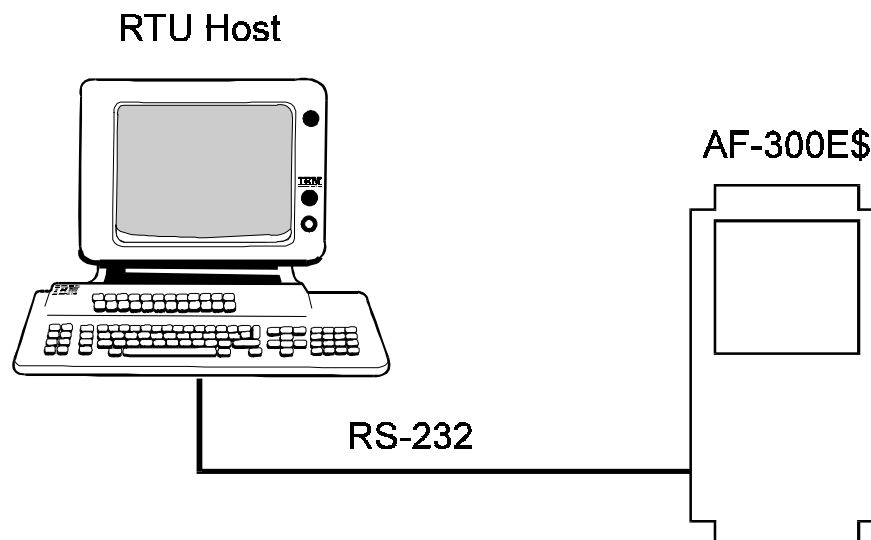


Figure 3.1 – RS-232 Layout

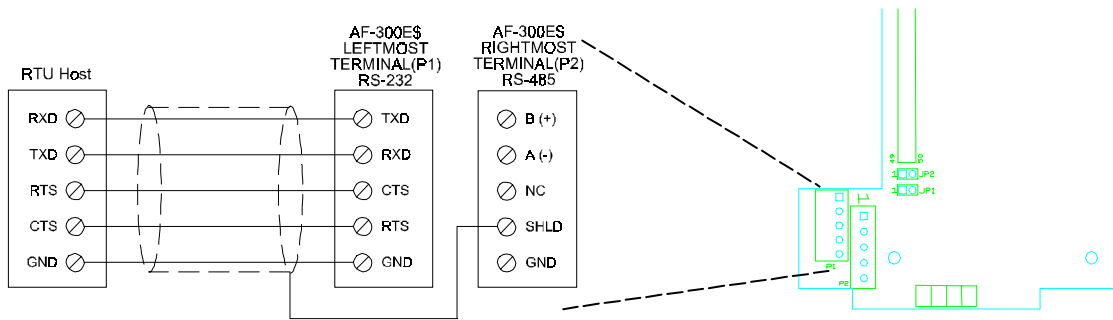


Figure 3.2 – RS-232 Wiring

Note: The shield wire should be connected to earth ground on one end.

If the RS-485 port is utilized, multidrop installations are possible. Standard RS-485 wiring techniques should be used. Without external hardware (repeaters, etc.), up to 32 nodes can be connected, with a total network distance of up to 4000 feet. Using RS-485 repeaters, multiple segments can be used, increasing the overall network distance and number of nodes.

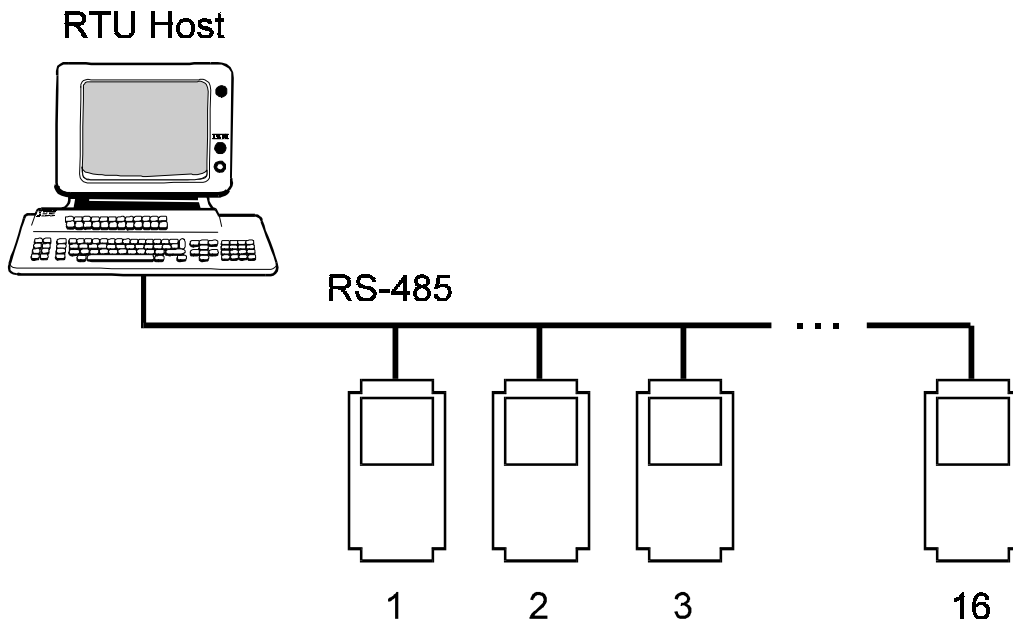


Figure 3.3 – RS-485 Network Layout (without repeaters)

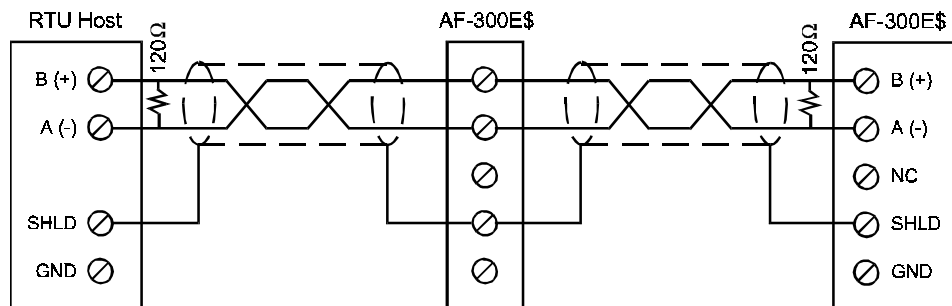


Figure 3.4 – RS-485 Wiring

Note: The shield wire should be connected to earth ground on one end.

The network is terminated at each end with an appropriate terminating resistor. The value of the resistor should be chosen to match the characteristic impedance of the cable. Note: If the characteristic impedance of the cable is unknown, 120 ohm terminating resistors should be used.

Note: Signal Ground must be run on the network if 7V or greater of ground potential exists between any two devices

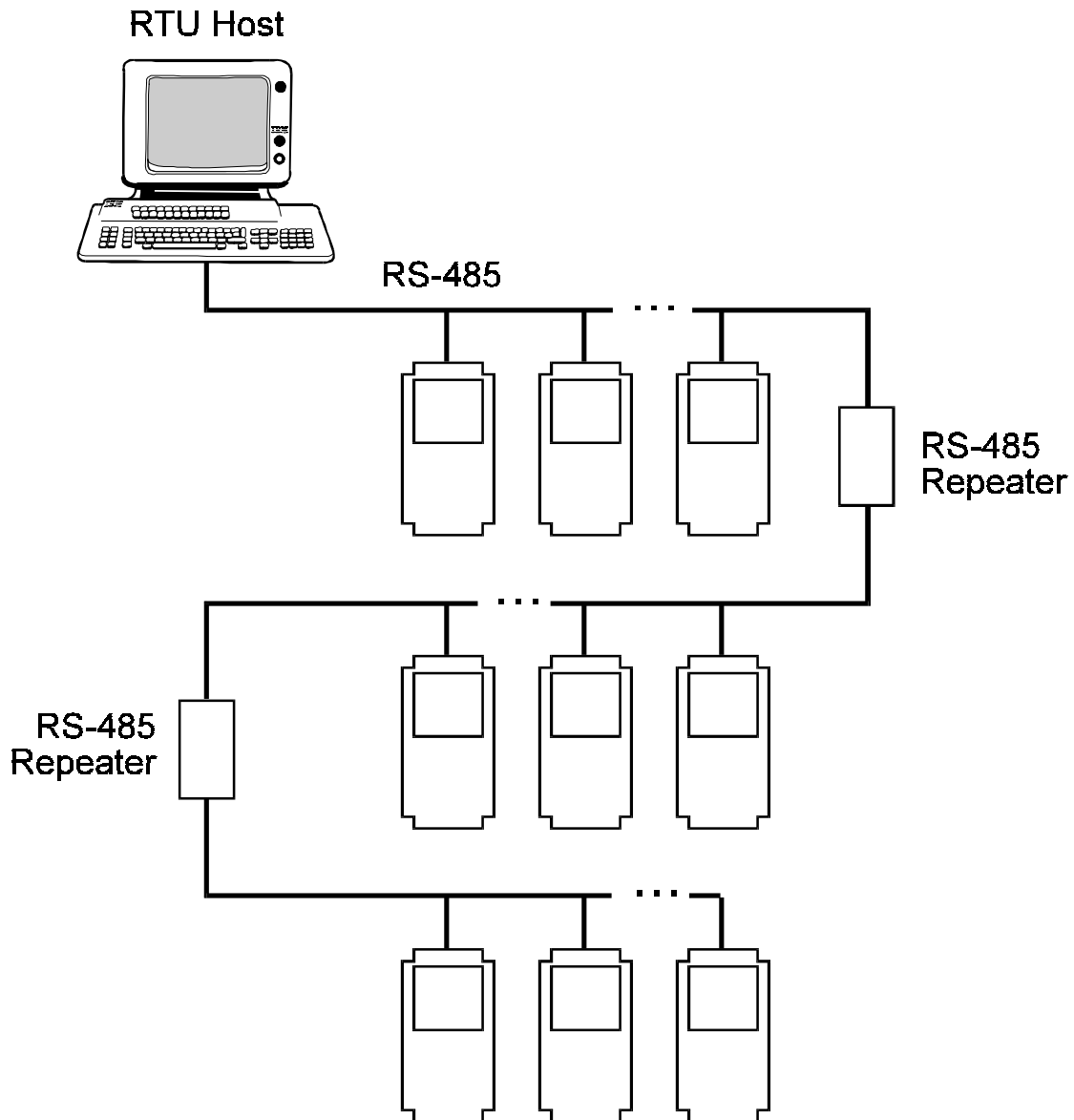


Figure 3.5 – RS-485 Layout (with repeaters)

3.3 RTU Data

The RSL100 allows RTU hosts to read/write drive data by mapping all drive control data and parameters into RTU Address Space. There are a variety of RTU Address types, including Output Coils, Input Contacts, Holding Registers, and Input Registers. The RSL100 supports only *Holding Registers*, which are each 1 word (16 bits), in length. All 122 Drive Parameters (101 Read/Write Parameters + 21 Read Only Parameters) are mapped into Holding Registers. There is a one-to-one correspondence -- in other words, Drive Parameter 1 is mapped to Holding Register 1, Drive Parameter 2 is mapped to Holding Register 2, and so on. Note that Modbus addresses usually have an offset of 4001, 40001, or 400001. Therefore (depending on the Modbus driver) Drive Parameter 1 may correspond to holding register 40,002 (40,001 + 1), Drive Parameter 2 may correspond to holding register 40,003, and so on.

3.4 RTU Commands and Responses

RTU communications is made between an *RTU Host* and one or more *RTU Slaves*. *Commands* are communications from the Host to a Slave, and *Responses* are communications from the Slave to Host. Commands and Responses consist of "message frames" in either ASCII or RTU (binary) format, which contains the following information:

1. Slave Address
2. Function Code
3. Data
4. Error Check Code

If an RTU command's slave address matches a slave's address, that slave executes the indicated Function Code and then returns an RTU Response back to the Host. If an RTU command's slave address is zero, all RTU slaves execute the indicated Function Code and do not return an RTU response. Note that only Function Codes 6 and 16 may be "broadcast" in this way. If the RTU slave detects an error, it does not execute the indicated Function Code, but may return an Exception Response instead. **Table 3.1** lists the exception codes supported by the RSL100.

Code	Name	Meaning
01	Illegal Function	Invalid command function was sent
02	Illegal Data Address	Invalid reference, or size exceeded table bounds
03	Illegal Data Value	Not valid data for a particular reference
04	Failure in Device	See loopback diagnostic test command for details

To access the holding register (drive parameter) data, the RSL100 supports 3 RTU function codes (Function Codes 3, 6, and 16). The RSL100 also supports Function Code 8, the Loopback Diagnostic Test. All four supported Function Codes are listed in **Table 3.2**. The Sub-function Codes for Function Code 8 are listed in **Table 3.3**.

Code	Meaning	I/O	Type	Min	Max
03	Read Holding Registers	I	Word	1	125
06	Preset Single Register	0	Word	1	1
08	Loopback Diagnostic Test	(See Table 3.3)			
16	Preset Multiple Registers	0	Word	1	125

Code	Meaning	I/O
00	Return 2-Byte query data	I
01	Re-start communications hardware (no response)	0
02	Return 16-bit diagnostics register	I
03	Change ASCII mode delimiter (LF is default)	0
04	Force Slave into listen only mode (no response)	0
10	Clear counters and diagnostic register	0
11	Return 16-bit bus message count	I
12	Return 16-bit bus CRC error count	I
13	Return 16-bit bus exception error count	I
14	Return 16-bit Slave message count	I
15	Return 16-bit Slave no response count	I

3.5 RTU Setup Parameters

A number of RTU Setup parameters must be set in the drive before the RSL100 can successfully communicate with a RTU Host. **Table 3.4** lists these parameters. These parameters may be set with the AF-300E\$ keypad, or the Horner Electric Drive Configuration Software (optional). Each of these devices has a chapter dedicated to its operation.

Parameter	Options
RTU Slave Address	0 to 128
Protocol	RTU (binary) or ASCII
Baud Rate	300 to 19,200 baud
Parity	None, Odd, or Even
Stop Bits	1 or 2
Port Type	RS-232 or RS-485
Handshaking	None, Software, Hardware, or Multidrop
DCS Timeout	0 (disabled) to 12 Seconds

CHAPTER 4: KEYPAD OPERATION

4.1 Initializing Drive and Option Card Function Codes (Parameters) through Keypad

With the option card installed, two sets of drive parameters (Function Codes) must be configured for proper operation of the drive <and> communications with the drive over the Option card's communications channel. The first set are the drive specific parameters which define drive operation and are described in the GE Drives (AF-300E\$) Instructions. The second set are the option card specific parameters which define the operation of the communications channel and are described below.

While other methods are available for modifying both Drive and Option Card parameters, it is typical that the drive's keypad will be used initially for setting both sets of drive parameters. Keypad operation pertaining to modification of drive parameters is described in the GE Drives (AF-300E\$) Instructions. However, additional information is provided below pertaining to the additional option card parameters (not covered by the GE Drives manual) and slight variations in keypad operation caused by the presence of the Option Card. Note that option card parameters will only be visible through the keypad if the option card is installed. Additionally, the option card parameters will start at the end of the Drive's parameter list and will be prefixed with 'P'.

When the option card is installed, the keypad does not always have write access to both sets of drive parameters. Write permission by the drive's keypad is removed when control of the drive has been granted to the communications channel. This feature prevents undesirable concurrent write access to a parameter both by the communications channel and the drive's keypad.

At power-up, default operation verifies the current Option Card parameters and valid, initializes and grants drive control to the communications channel. Any attempt to change drive parameters with the keypad from that point will be blocked with the display message of 'Option Active'. To gain write access to the drive's keypad, the following steps must be followed:

1. Remove power from the drive. (See RS-232 Wiring on page 20.)
2. Jumper the RTS/CTS of the RS232 port (P1). (See RS-232 Wiring on page 20.)
3. Verify NO jumper at RX/TX of the RS232 port (P1).
4. Return power to the drive.

At this point, all drive control is local and initialization of the communications channel is stalled. Additionally, write access is now granted to the drive's keypad and the Drive and Option Card parameters can be changed. Section 4.3 describes the method to enter option card parameters and their associated description. Section 4.4 describes option card parameter verification and immediately releasing control to the communication channel (completing initialization). However, before the next power-cycle, the RTS/CTS jumper must be removed to allow normal operation.

4.2 Keypad Layout

The keypad consists of eight buttons, three LEDs, a 4-digit display, and a LCD display. **Figure 4.1** (below) shows the keypad:

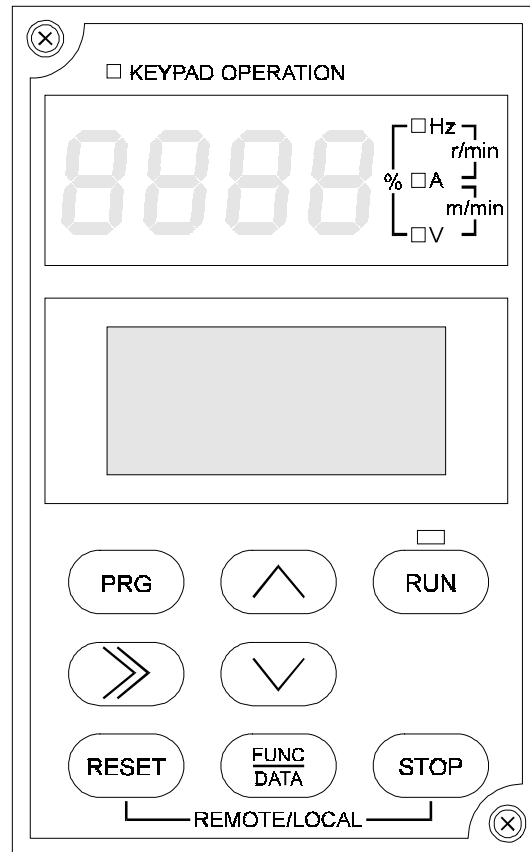


Figure 4.1 – Keypad Layout

4.3 Setting the Drive Option Parameters

4.3.1 Non-volatile memory modification through keypad (HE300GEN100 ONLY)

The HE300GEN100 option card contains non-volatile memory, which is used to store 'mapping' information on which drive parameters to pass over the current Genius connection. More specifically, this information defines the number and a listing of the drive parameters both for those received in the Genius 'Directed' data frame and those sent in the Genius 'Global' data frame. This information can be loaded to non-volatile memory through one of four different sources: Factory defaults, Drive Keypad, Genius Hand-held Programmer and DrvCfg (personal computer configuration software).

To use the drive's keypad to modify non-volatile memory requires first gaining keypad write access (as described in section 4.1) and then modifying option card 'mapping' parameters P04-P29. Then, parameter P03 must be set to 'Keypad' (1) and control returned to the option card (as described in section 4.4). Once the parameters are loaded, P03 will then be reset to 'Option card' (0), which indicates

that no change will be made to non-volatile memory on the next power-cycle. Note that P03 can also be set to 'Factory Presets' (2) prior to releasing control to the option card, which will cause non-volatile memory to be loaded with factory default values (see figure 7.4). Changes made to non-volatile memory 'mapping' information with the Genius Hand-held or the personal computer configuration software can be made during run-time without dependency on P03.

When setting the 'mapping' parameters, P04 and P05 respectively select the amount of data output (global) and data input (directed) from the drive to the Genius network. These sizes are configurable to give the user flexibility in setting the ratio between number of parameters needing immediate access and network loading. Since global and directed data are passed on the network on a continuous manner, only those drive parameters that need immediate visibility should be entered into these 'Pxx' parameters. Drive parameters that only need occasional access should be acquired through the datagram service. Parameters P06 through P17 are used to specify the drive parameters that are output (global) to the Genius network. Each 'Pxx' parameter specifies a corresponding drive parameter number (listed in chapter 8) that will produce a word (16bit) value in the drive's global data space. Parameters P18 through P29 are used to specify the drive parameters that are input (directed) from the Genius network. Again, each received drive parameter will consume a word (16bit) value in the drive's directed data space. Note that drive parameter numbers that are specified as READ ONLY should not be used in parameters P18 through P29.

The drive's keypad can be used to display the current contents of non-volatile memory (actual configuration) with P04 through P29 regardless of the method used to load non-volatile memory with the following exceptions. First, changes made through the Genius Hand-held Programmer and the personal computer configuration software are NOT correctly reflected until the next power cycle if the drive is in Local control when change is made. Secondly, both the Genius Hand-held Programmer and personal computer configuration software have the capability to configure larger Genius global and directed data frames for the Genius network than the drive's keypad. Those configured drive parameters beyond the ability of the keypad display will NOT be viewable.

4.4 Transferring Drive Control from the Keypad to the Option Card

After setting the option parameters to the desired values, control of the drive can be transferred from the keypad to the option card. This is accomplished from the keypad by setting the "Control" parameter (P02 on the GEN100 and P08 on the RSL100) to a value of "1". This "Control" parameter is set in the same fashion as any other option parameter.

After the Control Option Parameter has been set to a value of 1, the option card will "check" the parameters to make sure that the values are legal. If the values are legal, the option card will assume control of the drive and Step 8 of the drive setup process can be made (see **Section 4.5. on the following page.**)

Before attempting to set the drive option parameters from the keypad, make sure that Steps 1-5 of the drive setup process have been followed. These are listed in Section 4.5 (Page 4-5), which follows later in this chapter.

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.

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
```

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
```

Table 4.1 and **Table 4.2** on Pages 29-30 list the option parameters for the RSL100 and GEN100, respectively (Similar data is shown in earlier chapters). Each option parameter is set in the exact same fashion. For illustrative purposes, we will set option parameter P00 to a value of 25. P00 represents the RTU Slave Address for the RSL100, and represents the Genius Bus Address for the GEN100.

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
```

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
0~255
```

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:

P00 OPTION 0
0
<u>25</u>
0~255

When the option parameter is at the desired value (in this case 25), pressing the FUNC/DATA key will cause the parameter to be stored. As the data is being stored, the bottom line of the display will show a **DATA STORING** message. After the data has been stored, the option parameter list will return to the display and the next option parameter will be highlighted, as shown below:

<u>P01</u> OPTION 1
P02 OPTION 2
P03 OPTION 3
P04 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. In the case of P00, the legal data values are 0-31 for the GEN100, or 1-128 for the RSL100. The keypad will allow any data value to be entered which is 0-255. 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.

NOTE: When defining P06-P29, bit mapped values should be placed first in the parameter map. See Pages 43 through 46 to determine which values are bit mapped.

Table 4.1 – Option Parameters for RTU Option Card (RSL 100)		
	Parameter	Legal Values
P00	RTU Address	0 to 128
P01	Protocol	0 = RTU (binary) or 1 = ASCII
P02	Baud Rate	0 = 300, 1 = 600, 2 = 1200, 3 = 2400, 4 = 4800, 5 = 9600, 6 = 19200
P03	Parity	0 = No, 1 = Odd, 2 = Even
P04	Stop Bits	0 = 1 Stop Bit, 1 = 2 Stop Bits
P05	Port Type	0 = RS-232, 1 = RS-485
P06	Handshaking	0 = None, 1 = Software, 2 = Hardware, 3 = Multidrop
P07	DCS Timeout	0 (disabled) to 12 Seconds
P08	Control	1 = Option Card Control

Table 4.2 – Option Parameters for Genius Option Card (GEN100)		
	Parameter	Legal Values
P00	Bus Address	0 to 31
P01	Baud Rate	0 = 153.6k EXT, 1 = 153.6k STD, 2 = 76.8k, 3 = 38.4k
P02	Control	1 = Option Card
P03	Cfg. Values	0 = Option Card, 1 = Keypad, 2 = Factory Presets
P04	Global Data Length	1 to 12
P05	Directed Data Length	1 to 12
P06 - P17	Broadcast Data 1 – 12	101 to 121 or 255
P18 - P29	Control Data 1 - 12	0 to 100, 122 or 255

4.4 Transferring Drive Control from the Keypad to the Option Card

After setting the option parameters to the desired values, control of the drive can be transferred from the keypad to the option card. This is accomplished from the keypad by setting the "Control" parameter (P02 on the GEN100 and P08 on the RSL100) to a value of "1". This "Control" parameter is set in the same fashion as any other option parameter.

After the Control Option Parameter has been set to a value of 1, the option card will "check" the parameters to make sure that the values are legal. If the values are legal, the option card will assume control of the drive and Step 8 of the drive setup process can be made (see **Section 4.5** on the following page).

If one or more of the drive option parameters are illegal, an "Error 5" message will be displayed (see below)

<p>OPTION ERROR F/D > FACTOR >> > ITEM SEL RESET</p>

The option parameter with the illegal value can be determined by examining the value of the Control Parameter (P02 for the GEN100 and P08 for the RSL100). The value of the Control Parameter will be 100 + the option parameter in error. If P00 is illegal, for instance, the Control Parameter will have a value of 100. If P05 is illegal, the Control Parameter will have a value of 105.

After correcting the illegal parameter, the Control Parameter must be once again set to a value of 1. The option card will then recheck the option parameter values. If all the parameters are now legal, control will be transferred and the Error 5 can now be reset. This is accomplished by going to the main display (by pressing the PRG key), and then pressing the RESET key. After the drive has successfully cleared the error, Step 8 of the drive setup process can be made (see **Section 4.5** on the following page).

4.5 Drive Setup from the Keypad

The following steps need to be taken in order to place the drive (with option card) into service:

1. Install the communications option card as described in Chapter 1.
2. Make sure that the jumper has been removed which connects the FWD and CM terminals on the Drive terminal strip. This jumper is factory installed and must be removed prior to operation of the drive with the option card.
3. Wire the communications option card to the appropriate Genius (GEN100) or RTU (RSL100) network. Wiring diagrams and pinouts are provided in Chapter 2 (GEN100) and Chapter 3 (RSL100) respectively.
4. Terminals 3 and 4 on P1 of the option card must be jumpered together. This can be accomplished with a short piece of copper wire, alligator clip jumper wire, a permanently mounted switch, etc. (See Figure 4-2 on the following page). If a permanently mounted switch performs this function, place the switch in the CLOSED position.
5. Power up the drive. **Prior to powering up the drive, make sure that all instructions and provisions described in the AF-300E\$ User's Manual have been followed.**
6. Set the drive option parameters (P00>P08 for the RSL100, P00>P29 for the GEN100) to the desired values (see **Section 4.3**). **IMPORTANT: IN ORDER FOR CHANGES IN P04-P29 MADE FROM THE KEYPAD TO TAKE EFFECT, P03 MUST BE SET TO A 1 (GEN100 ONLY).**
7. Turn over control of the drive from the keypad to the option card. (See **Section 4.4**).
8. Remove the jumper from option card terminals 3 and 4 on P1. If a permanently mounted switch performs this function, place the switch in the OPEN position (See Figure 4-2 on the following page).
9. This completes the option card setup process using the AF-300E\$ drive keypad.

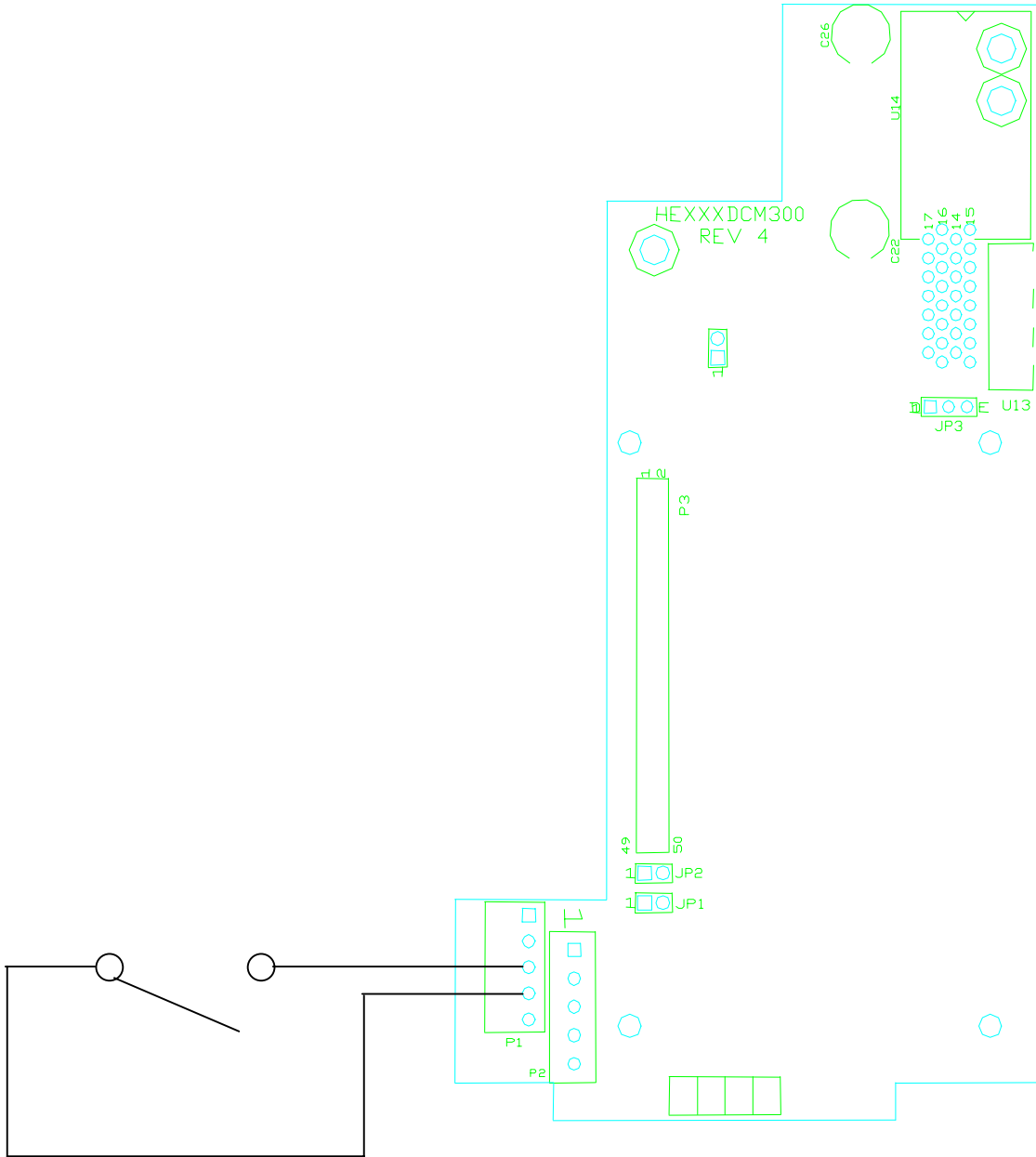


Figure 4.2 – Switch for Terminals 3 and 4

CHAPTER 5: GENIUS HAND HELD MONITOR OPERATION

This chapter describes the operation of the Genius Hand Held Monitor in the setup of the AF-300E\$ Genius Communications Card. For further instructions on the operation of the Genius Hand Held Monitor, the following GE Fanuc document should also be referenced: **GFK-0121E** - *Genius Hand-held Monitor User's Guide*

5.1 Hand Held Monitor Functionality

The Genius Hand Held Monitor performs many functions for the Genius network, but this manual discusses only its functions in setting up the HE300GEN100 communications interface. The Genius Hand Held Monitor (HHM) can only be used as follows with the GEN100 card:

1. Set the number of directed data words (from 1 to 30),
2. Map the directed data to drive parameters,
3. Set the number of global data words broadcast by the AF-300E\$ (from 1 to 30), and
4. Map drive parameters to global data.

The Hand Held Monitor (HHM) cannot be used to set the Genius baud rate, Genius bus address, or transfer control from the keypad to the GEN100 option card. These functions must still be performed from the AF-300E\$ keypad, or with the optional personal computer configuration software.

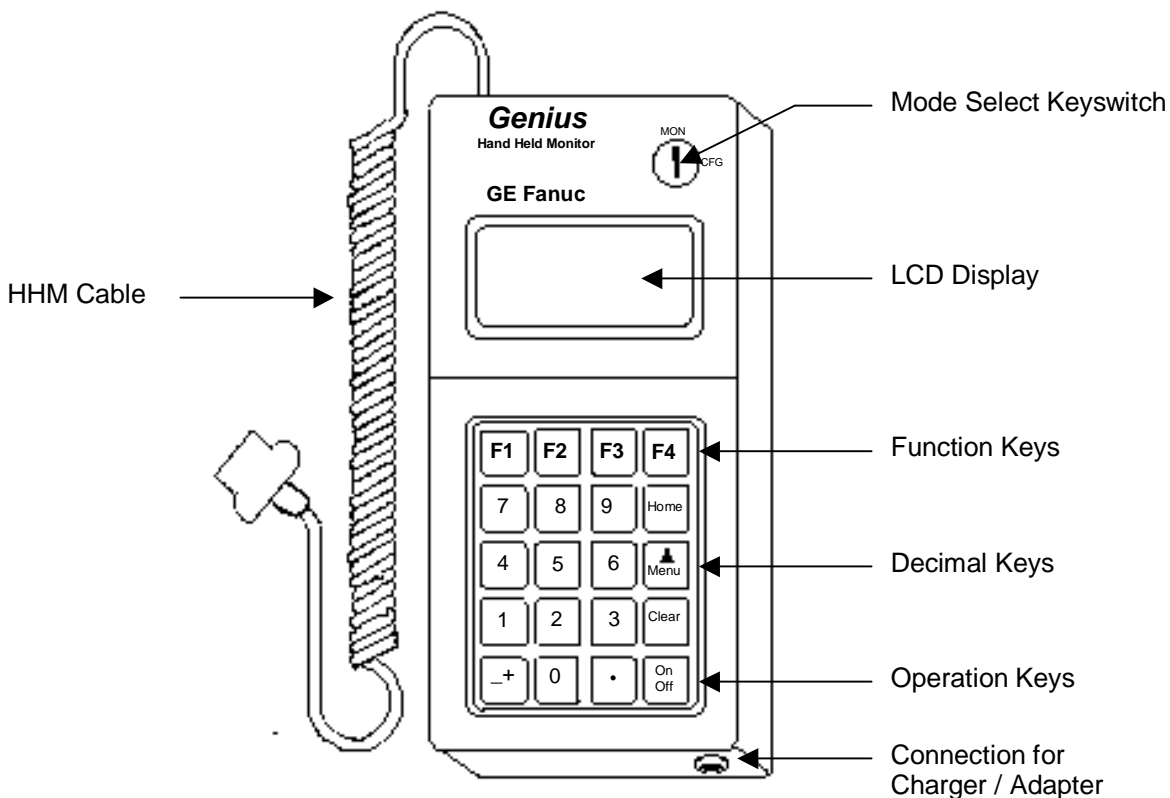


Figure 5.1 – Genius Hand Held Monitor

5.2 Changing GEN100 Setup Parameters

After powering up the Hand Held Monitor and setting its bus baud rate to match the bus, the main menu (below) is displayed:

```
F1: HHM UTILITIES
F2: ANALYZE
F3: CONFIGURATION
F4: DEVICE MEMORY
```

Select F2 (Analyze), and the following menu is displayed:

```
F1: MONITOR BLOCK
F2: MNTR/CNTL REF
F3: BLOCK/BUS STS
F4: PULSE TEST
```

Selecting F3 (Block/Bus Status) causes a screen similar to the following to appear:

```
GENI
BUS ADR: 31    V1.7
REG 32766
nxt  prv  r/g  bus
```

Pressing F1 (nxt) or F2 (prv) toggles through the Genius devices on the bus. Continue toggling through the devices until the AF-300E\$ drive to be configured is selected. A screen similar to the following will appear:

```
GENIO
BLOCK 1  V2.0
NO FORCE
nxt  prv  actv  bus
```

Select F3 (actv) to make this block active. The word "ACTIVE" will appear on the display to indicate the active status of this block. Now that the block is active, return to the main menu by pressing the HOME key.

```
F1: HHM UTILITIES
F2: ANALYZE
F3: CONFIGURATION
F4: DEVICE MEMORY
```

This time, select F3 (configuration) from the main menu, and the following menu appears:

```
F1: PROG BLOCK ID
F2: CONFIG BLOCK
F3: COPY CONFIG
F4:
```

Select F2 (config block), and the GEN100's first configuration screen appears:

```
MAXIMUM GLOBAL
INPUT WORDS
                                     7
rng  chng  nxt
```

"MAXIMUM GLOBAL INPUT WORDS" is the parameter to be set, and "7" is the current value of this parameter. All GEN100 configuration screens are formatted in this fashion, with a description of the parameter in the top two lines, the current value displayed on the third line, and the available function keys displayed on the fourth line. Pressing F1 (rng) causes the HHM to display the legal range of data entry for the parameter. After pressing F1 (rng), the above display changes to the following:

```
MAXIMUM GLOBAL
INPUT WORDS
MIN:          0
MAX:         16384
```

Keep in mind that the minimums and maximums displayed refer to the range of data which the HHM will allow to be entered. This range may or may not match the legal range for the parameter. Above, the data entry range for the maximum global input words is 0-16384, while the legal range for that parameter is 0-30.

Pressing the F1 key again causes the display to return to its previous state, displaying the current parameter value and the function key selections.

```
MAXIMUM GLOBAL
INPUT WORDS
                                     7
rng  chng  nxt
```

F2 (chng) is pressed if the current value of the parameter is to be changed. In the screen shown above, the current value of the "Maximum global input words" parameter is shown as 7. To change that value, F2 is pressed:

```
MAXIMUM GLOBAL
INPUT WORDS
                _
    chng  entr
```

The new value for the parameter can now be numerically keyed in, and it is accepted when F3 (entr) is pressed. To revert back to the current value (abort changing it), the F2 (chng) key can be pressed instead of F3 (entr). If we enter a value of 3 for this parameter, the display changes to the following:

```
MAXIMUM GLOBAL
INPUT WORDS
                3
    rng   chng   nxt
```

The F4 key can be pressed to advance to the next parameter.

```
GLOBAL INPUT
PARAMETER #00
                105
    rng   chng   nxt
```

The next 30 screens allow the user to map parameter numbers to be broadcast as global input words. Each of the 30 parameters will be set to either a legal drive parameter number (0-122), or to a value of 255. A value of 255 indicates that no drive parameter is to be mapped to this global input parameter.

After cursoring through the Global Input Parameters #00-#29, the Maximum Directed Data parameter screen is shown as follows:

```
MAXIMUM DIRECTED
DATA WORDS
                2
    rng   chng   nxt
```

Following this screen are the 30 screens for setting the Directed Data Parameters #00-#29, an example of which is shown below:

```
DIRECTED DATA
PARAMETER #00
                95
    rng   chng   nxt
```

After configuring an AF-300E\$ drive in the fashion described above, the configuration data for one drive can be copied to another. This is useful for applications with multiple drives with identical GEN100 configuration. To select this option, display the Block Configuration Menu (shown below):

```
F1: PROG BLOCK ID
F2: CONFIG BLOCK
F3: COPY CONFIG
F4:
```

Selecting F3 (Copy Config) displays the following configuration screen:

```
COPY CONFIG
FROM:  1 TO:  _
      chng entr
```

This screen allows the current configuration to be copied to another block. In the screen shown above, the current block is "1". To copy this configuration to block number 4 simply enter a numeric 4 and press F3 (entr).

NOTE: When defining Global Input Parameter #00-#29 and Directed Data Parameter #00-#29, bit mapped values should be placed first in the parameter map. See Pages 43 through 46 to determine which values are bit mapped.

NOTES

CHAPTER 7: PLC CONFIGURATION

7.1 PLC Configuration

This chapter discusses the configuration of the PLC in Genius applications using the AF-300E\$ drive with GEN100 Genius option board. As mentioned in a previous chapter, Genius LANs performing control require a Genius Bus Controller. Most GE Fanuc PLCs offer a module which acts as the bus controller. This document discusses configuration of the Series 90 PLCs -- Series 90-30 and Series 90-70.

7.2 Series 90-70 Configuration

For successful integration of the Series 90-70 GBC, the document GFK-0398, *Series 90-70 Genius Bus Controller User's Manual* is required.

Configuration of Series 90-70 PLC system requires the use of Logicmaster 90-70, the personal computer software package used for ladder logic programming and system setup. Configuration of the Genius devices residing on the LAN with Logicmaster 90-70 cannot be accomplished until the Genius Bus Controller (GBC) is configured. For instructions on that process, consult GFK-0398 from GE Fanuc.

After configuration of the GBC has been completed, the Genius devices residing on the LAN may be configured by zooming into the slot containing the GBC. A Logicmaster screen similar to that below will appear:

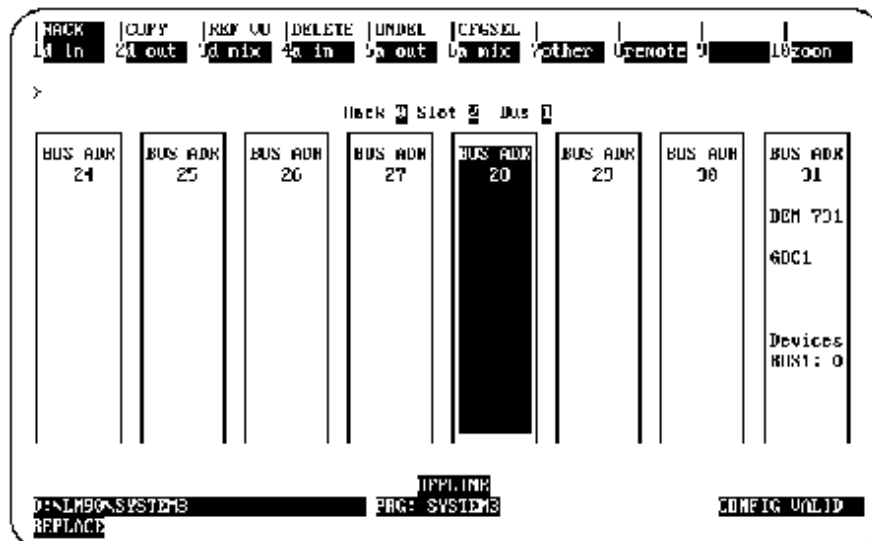


Figure 7.1 – Logicmaster 90-70 Configuration Screen

This is a representation of the Genius LAN, with each device shown as a "block". Because only eight devices can be shown on the screen at once, the screen "wraps around" from left to right. The left and right cursor keys are used to select the device to be configured. When the desired block is highlighted, the type of Genius device can be selected using the function keys. The AF-300E\$ is configured as a "Generic Genius I/O Device". This device is selected by pressing the "Other" (F7) function key, and selecting the "Generic I/O" device from the devices listed.

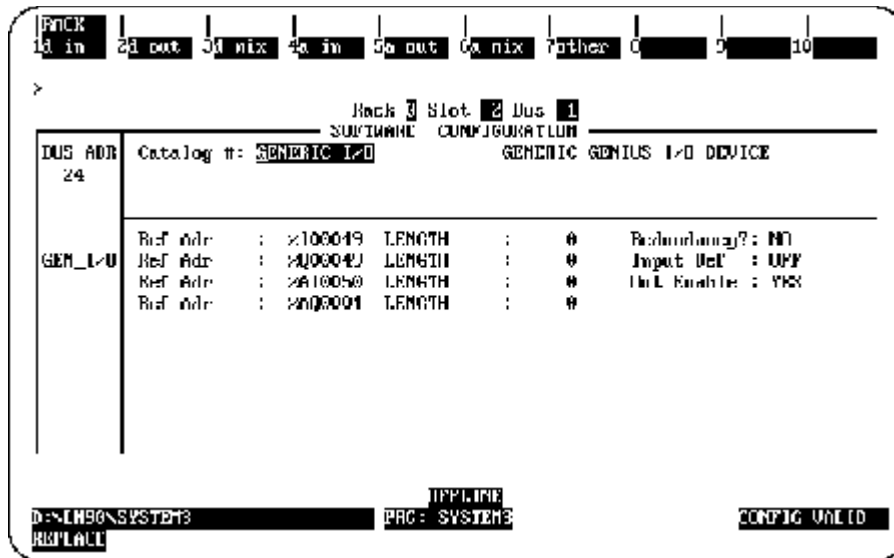


Figure 7.2 – Generic I/O Device Configuration Screen

Below, each configuration parameter is described. The proper setting for a drive with a default data configuration is also listed. **Figure 7-4** on the next page lists the default drive data configuration.

%I Length (Default = 16)

The number of %Is assigned to the AF-300E\$ drive should be equal to 16 times the number of bit-mapped global data words broadcast by the drive. Bit mapped parameters should be mapped first in the drive and defined using %Is in the PLC configuration.

%Q Length (Default = 16)

The number of %Qs assigned to the AF-300E\$ drive should be 16 times the number of bit-mapped directed control words (directed data). Bit mapped parameters should be mapped first in the drive and defined using %Qs in the PLC configuration.

%AI Length (Default = 6)

The number of %AIs assigned to the AF-300E\$ drive should be equal to the number of non-bitmapped global data words broadcast by the drive.

%AQ Length (Default = 1)

The number of %AQs assigned to the AF-300E\$ drive should be equal to the number of non-bitmapped directed control words.

Reference Addresses

In addition to the length of each of the four I/O references (%I, %Q, %AI, %AQ), the starting reference address for each I/O type must be set for each of the I/O references with a non-zero length. This reference address should not conflict with any other I/O module or Genius device.

Redundancy

If the AF-300E\$ is used in a redundant application, this parameter should be set to YES.

Input Default

The input defaults can be set to OFF or HOLD, as desired.

Outputs Enabled

If outputs from the PLC are to be enabled (most cases), this parameter should be set to YES.

Table 7.1 – Default Drive Configuration Parameters						
Keypad Param.	Description	Param. / Value	Description	Bit Map?	90-70 Data	90-30 Data
P06	Global Data Word 1	105	Operation Status	Yes	%I	%I, %AI, %G, %R
P07	Global Data Word 2	101	Output Frequency	No	%AI	%I, %AI, %G, %R
P08	Global Data Word 3	102	Output Current	No	%AI	%I, %AI, %G, %R
P09	Global Data Word 4	103	Output Voltage	No	%AI	%I, %AI, %G, %R
P10	Global Data Word 5	104	Output Torque	No	%AI	%I, %AI, %G, %R
P11	Global Data Word 6	106	Trip History (low word)	No	%AI	%I, %AI, %G, %R
P12	Global Data Word 7	107	Trip History (high word)	No	%AI	%I, %AI, %G, %R
P13-17	Global Data Words 8-12	255	Not Used	N/A	---	---
P18	Directed Control Word 1	96	Terminal I/O (low word)	Yes	%Q	%Q, %AQ, %G, %R
P19	Directed Control Word 2	95	High Res. Freq. Setting	No	%AQ	%Q, %AQ, %G, %R
P20-29	Directed Control Words 3 - 12	255	Not Used	N/A	---	---

Note: The reference types available for mapping into Series 90-30 memory are more numerous than those available for the Series 90-70. This is due to the fact that the Series 90-70 performs more data type checking than the Series 90-30. This extra checking requires that the number and type of memory references match exactly in the Series 90-70. The Series 90-30 requires only that the amount of data match exactly.

7.3 Series 90-30 Configuration

For full information on the configuration of Genius LANs with the Series 90-30 PLC, consult the GE Fanuc document GFK-1034, *Series 90-30 Genius Bus Controller User's Manual*.

The Series 90-30 PLC is configured using Logicmaster 90-30. In the configuration package, the Genius Bus Controller (GBC) configuration screen appears as follows:

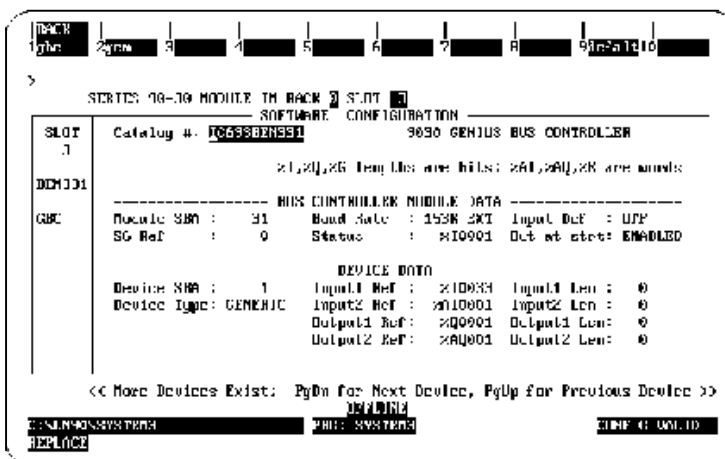


Figure 7.3 – Series 90-30 GBC Configuration Screen

The devices residing on the Genius LAN are configured in the lower "Device Data" section of the screen. The cursor keys are used to navigate around the screen. When the cursor is on the "Device Data" section of the screen, the PageUp and PageDown keys are used to select the Device number. Once the proper device number is displayed for the AF-300E\$, the following parameters can be set.

Device Type

The AF-300E\$ is configured as a GENERIC device type, which is the default.

Input References (Input 1 Ref, Input 2 Ref)

These parameters specify where the AF-300E\$'s global data is mapped in Series 90-30 memory. Legal reference types for these parameters are %I, %G, %AI, and %R. As you can see, the global data broadcast by the AF-300E\$ can be divided into two different areas of PLC memory. For instance, part of the global data could be mapped into %I, and the remainder into %AI. Two non-consecutive areas of the same reference type could also be mapped. For instance, part of the global data could be mapped to %R1, and the remainder to %R500.

Input Length (Input 1 Len, Input 2 Len)

These parameters specify how much global data is broadcast by the AF-300E\$. If the Input Reference specified is bit-type (%I, %G), the length parameter is in bits. If the Input Reference specified is word type (%AI, %R), the length parameter is in words. The total amount of data mapped into the Series 90-30 must exactly match the total amount of global data broadcast by the AF-300E\$.

If bit-type parameters are used then they must be defined in the first global words of the drive. They must also be configured as bit-type data in the bus controller. For example: If the drive is configured to have parameters 101 through 105 as global broadcast data then 105 must be placed first and then 101 through 104 can be in any order after them. The Genius Bus Controller would then be configured with 16 %Is and 4 %AIs, in that order.

Output References (Output 1 Ref, Output 2 Ref)

These parameters specify where the AF-300E\$'s directed control data is mapped in Series 90-30 memory. Legal reference types for these parameters are %Q, %G, %AQ, and %R. As you can see, the directed data input by the AF-300E\$ can be divided into two different areas of PLC memory. For instance, part of the global data could be mapped into %Q, and the remainder into %AQ. Two non-consecutive areas of the same reference type could also be mapped. For instance, part of the directed data could be mapped to %R1, and the remainder to %R500.

Output Length (Output 1 Len, Output 2 Len)

These parameters specify how much directed data is received by the AF-300E\$. If the Output Reference specified is bit-type (%Q, %G), the length parameter is in bits. If the Output Reference specified is word type (%AQ, %R), the length parameter is in words. The total amount of data mapped from the Series 90-30 must exactly match the total amount of global data received by the AF-300E\$.

If bit-type parameters are used then they must be defined in the first global words of the drive. They must also be configured as bit-type data in the bus controller. For example: If the drive is configured to have parameters 95 through 97 as directed control data then 96 and 97 must be placed first and then 95 can be after them. The Genius Bus Controller would then be configured with 32 %Qs and 1 %AQs, in that order.

CHAPTER 8: AF300E\$ DRIVE PARAMETERS

8.1 Drive Parameter Descriptions

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	FMP Terminal (Voltage Adjust)	45	65	103	-	0	1 Word	R/W	Y
46	FMP 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	Coef. 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 (Japanese/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.

8.2 Data Formats

The Drive Parameters listed in the previous pages list, among other things, 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 AF-300E\$ drive.

Table 8.2 – Format 0
Direct Translation

Table 8.3 – Format 1	
Read	Write
/10	X10

Table 8.4 – Format 2	
Read	Write
/100	X100

Table 8.5 – 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					

Table 8.6 – 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			

Table 8.7 – 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	UP	INCREMENT SET FREQUENCY
REV	RUN DRIVE REVERSE	DOWN	DECREMENT SET FREQUENCY
HLD	N/A	PU	LINE TO INVERTER TRANSITION
BX	COAST STOP COMMAND	AUT	SELECT 4-20mA FOR FREQ SETTING
THR	N/A	DCB	DC BRAKE COMMAND
RST	FAULT RESET	VF2	2ND MOTOR V/F SELECTION
X1,X2,X3,RT1,RT2	SEE GEI-100211	PRT	DATA PROTECTION

Table 8.8 – 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												

Table 8.9 – 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		Accel. / Decel. Time													
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												

Table 8.10 – 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						

Table 8.11 – 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

Table 8.12 – Format 9							
7	6	5	4	3	2	1	0
0	0	0	Y5	Y4	Y3	Y2	Y1

Table 8.13 – Format 10
(DRIVE VALUE / 4096) X NAMEPLATE VALUE = DESIRED VALUE
DRIVE VALUE / 40.96 = PERCENT VALUE

Table 8.14 – 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			

Table 8.15 – 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)			

Table 8.16 – 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)			

Table 8.17 – Format 14														
PULSES TO FREQUENCY = PULSES / 15														
FREQUENCY TO PULSES = absolute value of (FREQUENCY X 15)														

Table 8.18 – Format 15			
200V Series		400V Series	
Capacity (HP)	Data	Capacity (HP)	Data
¼	2	½	131
½	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

Table 8.19 – Format 16	
Capacity (HP)	FORMULA
30HP and below	CURRENT = DATA / 100
40HP and above	CURRENT = DATA /10

Table 8.20 – Format 17			
3	2	1	0
Terminal Input (Run Command Input) thru option card (See also P1)	High Resolution Frequency Setting thru option card (See also P0)	0	0
7			
0	6 1 = Local (Keypad) Control, 0 = Remote (Option Card) Control	5 Function Input thru Option card	4 Output Frequency Compensation thru Option card
11			
0	10	9	8
15			
0	14	13	12

Note: See chapter 9 for a more thorough explanation of format 17.

NOTES

CHAPTER 9: TERMINAL STRIP CONTROL

This chapter describes how to allow the VF Drive terminal strip to assume partial or total control of the VF Drive. This VF Terminal Strip control can be temporary or on a more permanent basis. VF Terminal Strip control is desired for several different applications, including

- 1) Switching the VF Drive from "Remote" to "Local" mode and vice-versa. This transfers control of the drive from the PLC/Option Card (Remote mode) to the VF Drive terminal strip (Local mode). This typically allows an operator to manually override the machine "automatic" mode.
- 2) Acquiring data *only* from the Option Card. Control functions are handled through the VF terminal strip by some other controller, such as a closed loop controller like the GE Fanuc Axis Positioning Module (APM). This is advantageous for applications which require very tight speed control.

The VF Drives are very flexible in their operation, and allow the drive control functions to be divided between the PLC (through the option card) and the VF Drive terminal strip. One of the VF Drive parameters controls how the various drive control functions are distributed. VF Drive Parameter 122 is the parameter which assigns control functions between the option card and the terminal strip.

9.1 Remote / Local Operation

9.1.1 Local switch point (Remove/Local) operation (HE300GEN100 ONLY)

Beginning with version [H] of the HE300GEN100 Option card, functionality was added to allow optional switching of Remote/Local operation locally at the Option card without involving PLC (master bus controller) logic or I/O. When enabled, Remote/Local operation can be controlled by a hardware switch directly connected to P1 (RS-232) terminals.

This switch point function provides:

1. The operator the ability to take local control of the drive should the network connection fail.
2. The ability to provide Remove/Local switching without consuming PLC or Master resources.

However, this switch point function is limited to:

1. Control of ALL drive parameters is switched together as one group including the Speed Reference, Terminal Strip and write access to Function Codes. (Does not allow the selective control as that provided through network communications to Parameter 122).
2. Must be the exclusive switch point. Master must NOT write access Parameter 122.

WARNING: Unpredictable program behavior which can result in personal injury or death can occur when attempting to use concurrent control of the Remote/Local switch point through BOTH local (P1 contacts) and network communications (Parameter 122).

To enable this local switch point function, the RX and TX contacts on the P1 connector (refer to drawing RS-232 Wiring Drawing on page 3-2) must be shorted at power-up. Thereafter, the RTS and CTS contacts on the same connector may be switched open or closed at any time to provide Local or Remote control of the drive respectively. Note that should the switching circuit fail (open) the drive will revert to

Local control operation. For hardware switch ratings, the switching voltage provided by RTS is at communication levels ($\pm 15\text{vdc}$).

When using the procedure defined in section 4.5 to use keypad parameters to set the non-volatile 'mapping' information, the RX and TX contacts must be OPEN at power-up to disable this local switch point function. While, keypad access is available when using this local switch point function (switch to Local mode), procedure 4.5 should be followed when changing 'Pxx' parameters to provide parameter verification.

A definition of "Remote" and "Local" Operation is as follows. "Remote" mode refers to the machine condition when the Controller, typically a PLC, is in control of the VF Drive. Generally, the PLC makes all the machine logic decisions and performs Start/Stop, Speed Control, and other control functions. "Local" mode refers to the machine condition when a machine operator, typically through a manual override located near the VF Drive, assumes control of the VF Drive. Logic decisions are performed by the machine operator through the use of manual pushbuttons and other switches wired to the VF Drive terminal strip. **Figure 9.1** shows an example hardwired pushbutton station which might be used in "Local" mode.

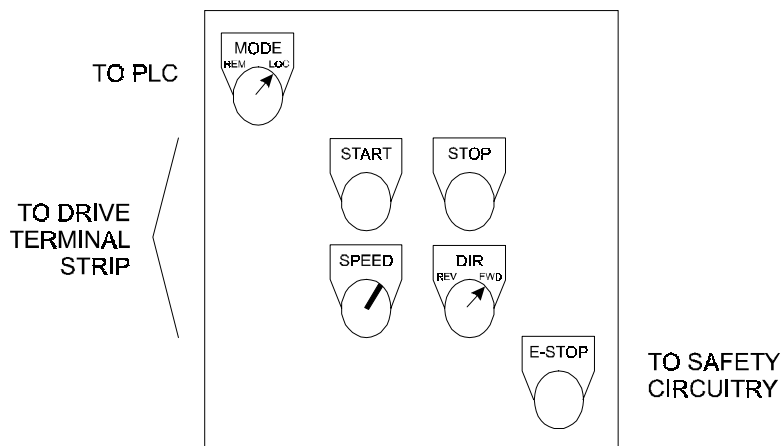


Figure 9.1 – Example Remote Panel

Note: Some applications may require additional operators. Be sure to consult the VF Drive User's Documentation for proper wiring instructions.

For effective Remote/Local Operation of the VF Drive, several hardwired pushbuttons are required at the local station. Generally, they should include buttons to Start and Stop the drive, along with others to control speed and direction. These hard-wired pushbuttons are wired directly to the Terminal Strip of the VF Drive, per instructions provided in the VF Drive instruction manual. **In addition to the above mentioned operators, a selector switch wired to a PLC input is required.** This operator is required because the VF Drive is switched from Local to Remote mode (and vice-versa) by communications initiated by the PLC. In a Genius application, the Remote/Local pushbutton/selector switch can be wired into a Genius I/O Block located near the VF Drive.

Upon detecting a Remote-to-Local switch transition, the PLC initiates communications with the VF Drive in order to set VF Drive Parameter 122. **Table 9.1**, below shows the four most common settings for Parameter 122:

Parameter 122 Value (in HEX)	Parameter 122 Value (in Decimal)	Definition
003CH	60	PLC (option board) has full control of Start/Stop & Frequency
0030H	48	VF Drive terminal Strip has full control of Start/Stop & Frequency
0034H	52	PLC (option board) has Frequency Control, VF Terminal Strip has Start/Stop Control
0038H	56	PLC (option board) has Start/Stop Control, VF Terminal Strip has Frequency Control

Note: For 48 (30H) and 56 (38H) on drives less than 40hp, Function 2 needs to be set to a 2 for an external source.

In most applications, the PLC assumes control of both Start/Stop and Frequency control during Remote mode, and the VF Terminal Strip assumes these functions during Local mode. Table 9-1 shows that for these applications, a Remote-to-Local mode transition involves setting Parameter 122 from a value of 60 (003CH) to a value of 48 (0030H). A Local-to-Remote mode transition requires that Parameter 122 be changed from 48 (0030H) back to 60 (003CH).

In Genius applications, setting Parameter 122 requires the use of a Communications Request (COMM_REQ) block in the PLC logic. In RTU applications, setting Parameter 122 involves simply writing the correct value from Table 9-1 to the appropriate RTU address.

9.2 Sending a Datagram Using a Communications Request

The Communications Request or COMM_REQ requires a group of registers for setting up the data for the command. In the case of changing parameter 122, we will need 16 registers. We will also need 2 registers for the status word. Below is the definition of each of the 16 registers.

Register	Definition	Default Value	Register	Definition	Default Value
R1	Command Length	10	R9	Function	32
R2	No Wait	0	R10	Sub Function Code	32
R3	Status Block Memory Type	8	R11	Priority	0
R4	Status Block Offset	see below	R12	Datagram Length (bytes)	8
R5	Idle Timeout Value	0	R13	Datagram Content (1)	see below
R6	Max Communication Time	0	R14	Datagram Content (2)	0
R7	Command Number	14	R15	Datagram Content (3)	512
R8	Device Number	see below	R16	Datagram Content (4)	see below

R4 - Status Block Offset

The number placed in this register determines where the COMM_REQ will report its status information. If a value of 50 is placed in this register then the status information is stored in %R0050 and %R0051.

R8 - Device Number

The number placed in this register determines which Genius block will be sent the datagram.

R13 - Datagram Content (1)

The high byte of this register is the parameter that is to be changed. For the parameter number 122 this register should be set to a 7A00H or 31232. The low byte of this register is unused.

R16 - Datagram Content (4)

The number placed in this register is the value which will be downloaded to the chosen parameter. For parameter 122 the values could be 3CH (60), 30H (48), 34H (52) or 38H (56).

The COMM_REQ block in the PLC ladder code will need 4 inputs; Power, IN, SYSID and TASK. The Power input should be assigned to a contact that will be turned on for only one scan. Leaving this contact on will cause the datagram to be sent multiple times, and will slow down the response time on the Genius LAN. The IN input should be set to a %R reference that contains all of the registers determined above. The SYSID input specifies which rack and slot has the Genius Bus Controller that will receive this command. The upper byte is the rack, and the lower byte is the slot. For a Genius Bus Controller in slot 6 of rack 2 the value should be 0206H or 518. The TASK input should always be set to a 1.

The following page shows an example for sending a datagram to a HE300GEN100 addressed at Genius Block 1. This example will use %R0050 as a status register and %R0100 as the starting point for the defining registers. The Genius Bus Controller is located in rack 0, slot 2. The datagram will be changing parameter 122 to a 30h or 48. The execution of the Datagram is caused by an external pushbutton wired to %I0001.

NOTES

CHAPTER 10: WIRING DIAGRAMS

10.1 Genius Wiring

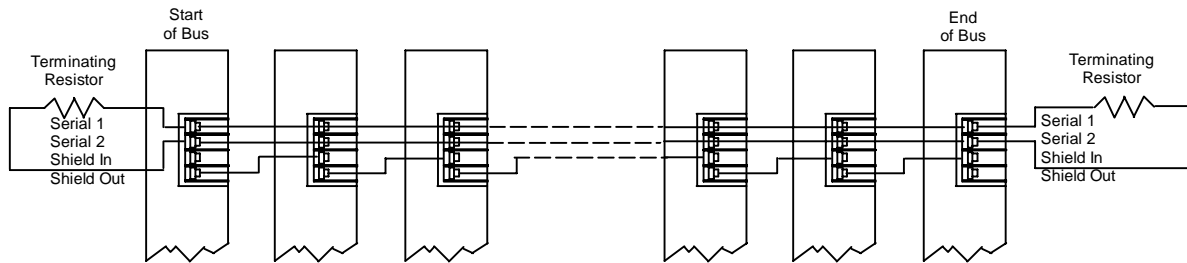


Figure 10.1 – Typical Genius Wiring Technique

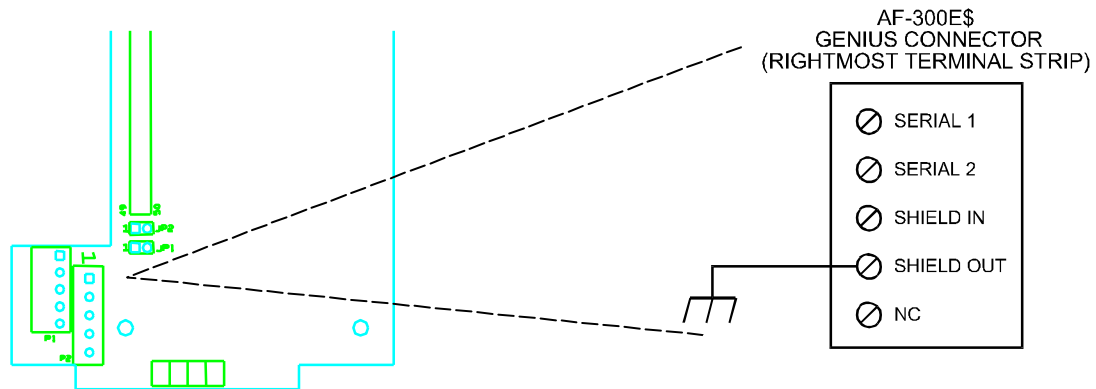


Figure 10.2 – AF-300E\$ Genius Connector Pinout

The AF-300E\$ Genius connections are made on the rightmost of its two terminal strips (P2). In addition to the normal Genius connections shown in **Figure 10.1**, Earth Ground must be connected to the “Shield Out” terminal, Terminal 4.

10.2 RTU Wiring

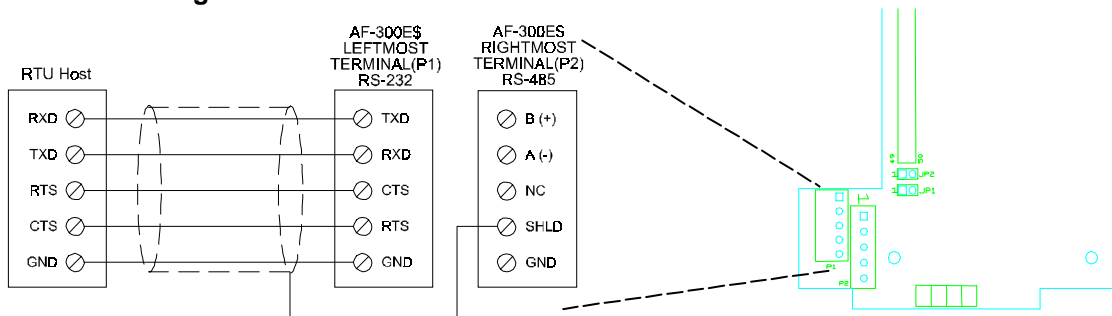


Figure 10.3 – RS-232 Wiring

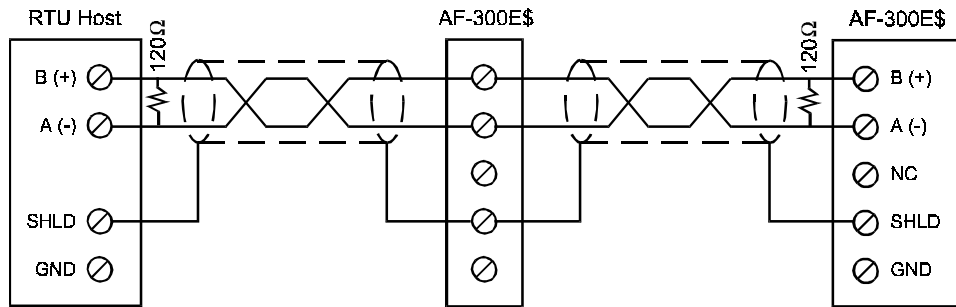


Figure 10.4 – RS-485 Wiring

The network is terminated at each end with an appropriate terminating resistor. The value of the resistor should be chosen to match the characteristic impedance of the cable. Note: If the characteristic impedance of the cable is unknown, 120 ohm terminating resistors should be used.

Note: Signal Ground must be run on the network if 7V or greater of ground potential exists between any two devices.

10.3 Serial Programming

The cable supplied with the HE300SFW100 is designed to allow a straight through 9-pin serial cable to be connected between a 9-pin comm port on the PC and this cable. The pinouts for these cables are shown below.

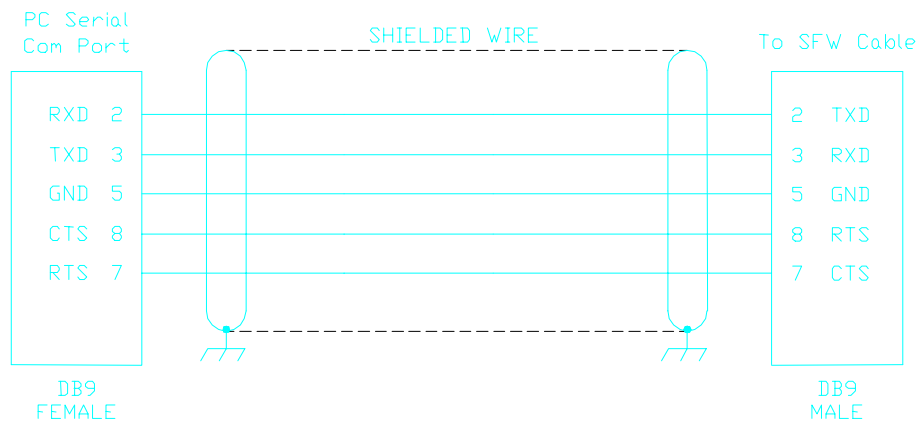


Figure 10.5 – HE300SFW100 Programming Cable

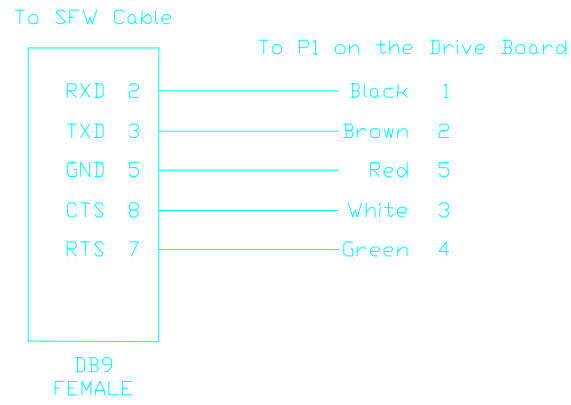


Figure 10.6 – Serial Cable

NOTES