



User Manual for the  
*HE300GEN200*

**Genius™ Serial Bus Interface  
Option Card for GE Drives  
AV-300/DV-300™  
Adjustable Speed Drives**

Third Edition  
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MAN0018-03

## PREFACE

This manual explains how to use the Horner APG Genius Serial Interface card for use with the GE AV-300 and DV-300 drives.

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**Note: This manual is to be used in conjunction with the AV-300/DV300 instructions manuals, the GECFG300 software configuration help file, and the GE Fanuc Genius™ I/O System and Communications (GEK-90486F-1) User's Manual.**

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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 (MAN0018-03) of the **HE300GEN200 User Manual** contains the following revisions, additions and deletions:

1. Revised Section 8.3, Item F, 1 to set Jumper JP1.
2. Converted manual into standard format.
3. Changed company name from Horner Electric, Inc. to Horner APG, LLC.



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## CHAPTER 1: INTRODUCTION

The HE300GEN200 is a Genius Serial Bus Interface (SBI) that resides in the AV300 and/or DV300 adjustable speed drive.

The SBI card is GENA based. Since the GENA interface board is a "slave" only Genius communications device, it cannot control other devices on the Genius bus or look at other device data. Communication can only be coordinated via a "master" device such as a Genius Bus Controller (GBC). This is accomplished in the standard Genius format by sending Broadcast (Global) Data to the GBC, and listening to Directed Control Data from the GBC. The SBI allows up to 32 words of Broadcast Data and up to 16 words of Directed Data to be configured per drive.

To maintain flexibility with future parameter numbers, the SBI does not have parameter information hard coded into its memory. All of the required parameter information must be configured and loaded into the SBI. This is accomplished using the GECFG300 software configuration tool or through Genius datagrams.

Note: The GECFG300 software configuration tool can be purchased through Horner APG, LLC.



NOTES

## CHAPTER 2: DRIVE OVERVIEW

It is important to understand the inner workings of the drive before understanding the Genius Serial Bus Interface (SBI) operation.

The Genius SBI accesses values in the drive by means of predefined parameter numbers. These parameter numbers are contained in the drive, and are described in the AV-300/DV-300 instruction manual. The SBI can communicate with the drive and the DGFC.

The DGFC-386 option card (DGFC) is another option for the AV-300/DV-300 drive. This card is mounted directly to the left of the SBI card. The DGFC also contains parameter numbers, independent of the drive's parameter numbers. The difference is that the DGFC does not have predefined parameter numbers. The user has to program these parameter numbers.

The parameters in both the drive and the DGFC can be a length of either 1 or 2 words. The predefined drive parameters also have predetermined data types (Integer, Unsigned Integer, Float, etc.). The data type determines the data length. An Integer is 1 word and a Float is 2 words. The DGFC has variable data types for each user-defined parameter. The data type is not fixed like the drive parameter data types.

The SBI has four different access methods used to communicate with the drive. These are low priority word, high priority word, high priority discrete bits (Virtual I/O) and low priority discrete bits. The parameter table in the AV300/DV300 manual is used to determine the access method available for a given parameter number. Low priority word access can be used to communicate with all of the drive parameter numbers defined as type R (read), W (write), Z (write only when drive disabled), and/or C (command parameter-the writing of any value causes the execution of a command) in the RS485 column (located in the parameter tables of the AV-300/DV-300 Instructions Manual).

Table 2.1 – SBI Access Methods	
SBI Access Method	Description
<b>Low Priority Word</b>	All Fixed Parameters (R, W, C, Z) 16 or 32 Bit.
High Priority Word	R, W, Z Fixed parameters, 16 bit.
Low Priority Word	Variable DGFC Parameters.
High Priority Discrete Bits (Virtual I/O)	R, W, Z Maximum of 16 Bits.
Low Priority Discrete Bits	R, W, Z Maximum of 16 bits.

When accessing the drive, the length will be either one or two words depending on the FORMAT column (located in the parameter tables of the AV-300/DV-300 Instructions Manual). The high priority word access can be used with all of the drive parameters defined as type R, W and/or Z in the PDC column and have a minimum value of 0 and a maximum value greater than one. *The length of high priority word access is fixed at one word.*

The only way to communicate directly with the DGFC is with low priority word access. When accessing the DGFC, the length depends on the data type value defined in the DGFC manual. Due to the differences between the drive and the DGFC, the SBI requires the source/destination, parameter number, and parameter information. The source/destination is the drive or the DGFC (The SBI needs to know where to retrieve (source) or send (destination) the data). The parameter number is either a predefined

drive parameter number or a user programmed DGFC parameter number. This information tells the SBI where to access the value (the drive or DGFC). The parameter information contains two pieces of information. One piece is the data type, and the other piece is the access method. In the case of the drive, the data type determines the number of words required for the parameter number. In the case of the DGFC, the data type is a number representing an Integer, Unsigned Integer, Float, etc.

**Note: The software configuration tool GECFG300 sets up this information for Global and Discrete Control Data. The user must provide this information when using Genius datagrams to access the data.**

*See the datagrams section for more information.*

High priority communication with the DGFC is accomplished by high priority communication from the SBI to the scratch pad and Synchronous communication from the scratch pad to the DGFC.

The high priority discrete bits (Virtual I/O) are identified by R, W and/or Z in the PDC column and a minimum value of zero and a maximum value of one. The SBI allows up to 16 high priority and 16 low priority discrete bits to be configured. The low priority discrete bits are identified as a low priority word with a minimum of zero and a maximum of one. Both the high and low priority discrete bits are accessed as a bit packed word. In the case of the high priority bits, there is a pre-configuration done between the SBI and the drive. This allows the SBI and the drive to access the bit packed word directly. *The low priority bit access is equivalent to doing up to 16 low priority word accesses.* This is important to remember when configuring the SBI due to the fact that the low priority bit access will take a greater amount of time to process than will a normal low priority data word.

## CHAPTER 3: GENIUS – SBI COMMUNICATION

### 3.1 Genius SBI Operation

There are two types of Genius communication that can be used between the Genius Bus Controller (GBC) and the SBI, automatic data transfer and datagrams.

The automatic data transfer type is the most common. This type of communication uses broadcast (global) data to transfer information from the SBI to the GBC, and directed control data to transfer information from the GBC to the SBI. With this data type, the GBC is always communicating with the SBI.

The datagram type requires the GBC to use read device and write device datagrams to communicate with the SBI. Datagrams are used for slow changing data or infrequent read/write operations.

The two types of communication are described in detail in the following sections.

### 3.2 Automatic Data Transfer

To communicate with Genius using Automatic Data Transfer, all of the required parameter information previously discussed in the Drive Overview section (the global data to transfer information from the SBI, and Directed Control Data to transfer data from the GBC to the SBI) must be configured and loaded into the SBI.

The SBI configuration is accomplished using the GECFG300 software configuration tool. The configuration consists of 2 memory maps, the global data memory map and the directed control data memory map. The memory maps associate parameter numbers and parameter information with corresponding data words. The GECFG300 configuration tool uses “pick lists” for choosing parameter numbers. The pick lists change depending on which access method is chosen. This eliminates the need to manually determine all of the information described in the Drive Overview section.

The global data memory map contains a parameter number and parameter information for each global data word from the drive to the GBC. The directed control data memory map contains a parameter number and parameter information for each directed control word from the GBC to the drive. Once the memory maps are created using GECFG300, they are downloaded into the SBI non-volatile memory.

Figures 3.1 and 3.2 are examples of a global data configuration and a directed control data configuration.

The software configuration tool is setup in such a manner so that when the user chooses a parameter from the “picklist”, that parameter is set at that global data word. When the SBI scans a configuration, it separates the high priority words and the low priority words and stores them in two different arrays. The data is then scanned sequentially from each array, depending on where it is at in the scan cycle. The high priority words are scanned first and more frequently than the low priority. For more information on the scanning sequence, see chapter 2. The following is a brief example of a Global data configuration.

The global data configuration is configured to have the SBI send parameter 503 (pad 0) in global data word 0, parameter 504 (pad 1) in global data word 1, and parameter 1 (speed minimum amount) in global data words 2 and 3. **See Figure 3.1.**

The directed control data configuration looks the same as the global data configuration. It is designed to allow the SBI to receive the value for parameter 503 in directed data word 0, the value for parameter 504 in directed data word 1 and the value for parameter 1 in directed data words 2 and 3. **See Figure 3.2.**

**NOTE: The following sections will reference these figures.**

### 3.3 SBI to/from GBC Communication using Global Data

After the global data configuration is downloaded from the configuration tool to the SBI, the SBI will start retrieving values from the drive for the configured parameter numbers. Referring to Figure 3-1 and 3-2, the SBI will first scan all the high priority data and store it in the corresponding global data locations. During a high priority scan, the SBI: reads the high priority word, reads the high priority bits, writes the high priority word, and writes the high priority bits in that order.

The SBI will then retrieve the value in the drive at parameter 503 (Low Priority From Drive) using the low priority method and store it in global data word zero. Then the high priority parameters will be scanned again in the same manner as before. The SBI will then retrieve the data from Directed Control data word zero, and write it to parameter 503 (Low Priority to Drive). The data is continuously read in this manner (scanning the high priority data, reading low priority data, scanning high priority data again, and writing low priority data).

While the low priority read or write is waiting for command response from the drive, the high priority data is scanned until the drive responds, or a "timeout" occurs.

The SBI will continually update all of the global data words with the values of the corresponding parameter numbers. The parameter number source, access method and data type/length is determined by the associated parameter information that was also configured along with the parameter number.

The directed control data communication works on a change detect basis (once the SBI recognizes that a directed control data word has changed, it writes the value to the corresponding parameter).

Refer to Figure 3-2. If directed control data word zero changes, then the SBI detects the change and writes the value stored in directed control data word zero to parameter 503 in the drive using the low priority method. If either directed control data words two or three change then the SBI will write directed control data words two and three to parameter one in the drive using the low priority method.

The parameter destination, access method and data type/length is determined by the associated parameter information that was also configured along with the parameter number.

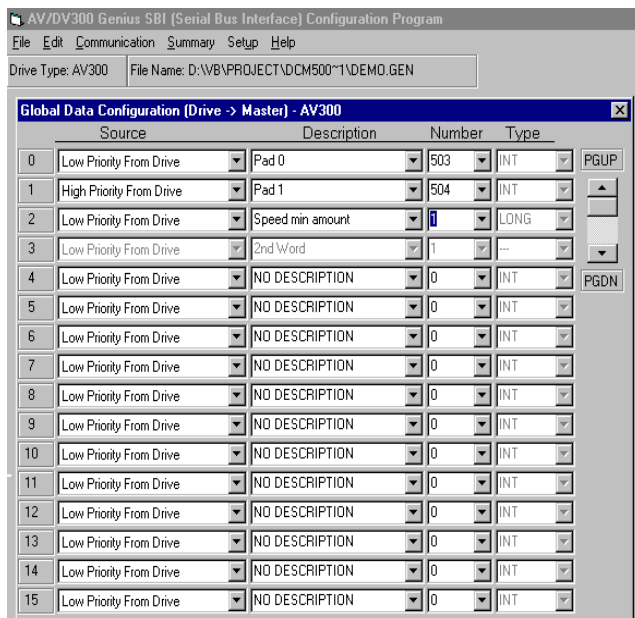


Figure 3.1 - Global Data Transfers

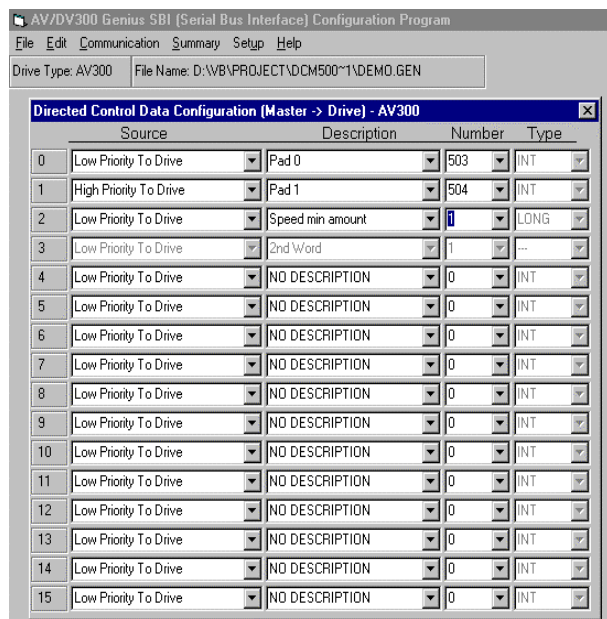


Figure 3-2: Directed Control Data

### 3.4 Datagrams

There is no configuration in the SBI to handle parameter access using datagrams. Unlike the automatic data transfer method, the GECFG300 software configuration tool is not used. Therefore, the vital parameter information must be contained in the datagram.

The access method is always low priority word to either the drive or the DGFC. There are two datagram message types used by the master controller to access drive and/or DGFC parameters, Read Device (1EH) and Write Device (20H). Read Device is used to retrieve data from the drive. The SBI responds to the Read Device datagram with a Read Device Reply (1FH).

The Read Device Reply will contain drive and/or DGFC parameter values that the master requested in the Read Device datagram. Write Device is used to write values to the drive and/or DGFC.

***The SBI does not respond to a Write Device datagram.***

The following are descriptions of the COMMREQ header formats that the 90-30 bus controller uses to send datagrams. Refer to GFK-1034B *Series 90-30 Genius Bus Controller* manual for more details. The header information is independent of the data bytes that are necessary to access drive and/or DGFC parameters. The data bytes are described in detail in the Specific Operations Section.

3.4.1 Read Device (1EH) Datagram Header Format

This format is used by COMMREQ #15: Request Datagram Reply

Table 3.1 – Read Device (1EH) Datagram Header Format			
Address #	Description	Value	Notes
Address	Command Length	# of words (Address+ 6 to Data Byte n)	
Address+1	No wait	Always 0	
Address+2	Status Block mem type	(See the AV300/DV300 Manual)	
Address+3	Status Block Offset	Beginning address for status	Offset+1 is actual register used
Address+4	Idle timeout value	0	
Address+5	Max com time	0	
Address+6	Command Number	15	
Address+7	Device Number	0-31	
Address+8	Function Code	32 (20H)	
Address+9	Subfunction Code	30 (1EH)	
Address+10	Priority	0 (Normal) 1 (High Priority)	
Address+11	Datagram length	# of Bytes (Add.+16 to Data Byte n)	Value=6+Value of Data byte 5
Address+12	Reply Subfunction	31 (1FH)	
Address+13	Reply memory type	(See the AV300/DV300 Manual)	
Address+14	Reply memory offset	Starting Address	
Address+15	Max memory length	Max # of reply words (64 max)	Maximum number of words
Data Bytes	See Specific oper.	Sections	
Data Byte+n			

3.4.2 Write Device (20H) Datagram Header Format

This format is used by COMMREQ #14: Send Datagram Command.

Table 3.2 – Write Device (20H) Datagram Header Format			
Address #	Description	Value	Notes
Address	Command Length	# of words (Address+ 6 to Data Byte n)	
Address+1	No wait	Always 0	
Address+2	Status Block mem type	(See the AV300/DV300 Manual)	
Address+3	Status Block Offset	Beginning address for status	Offset+1 is actual register used
Address+4	Idle timeout value	0	
Address+5	Max com time	0	
Address+6	Command Number	15	
Address+7	Device Number	0-31	
Address+8	Function Code	32 (20H)	
Address+9	Subfunction Code	30 (1EH)	
Address+10	Priority	0 (Normal) 1 (High Priority)	
Address+11	Datagram length	# of bytes (Address+12-data Byte n)	Value=6+Value of Data byte 5
Data Bytes	See Specific operations	Sections	
Data Byte+n			

### 3.4.3 *Specific Operations*

The Read Device and Write Device datagrams transfer data bytes that contain the necessary information to access the drive and/or the DGFC. There is a command byte, and a Data Byte 1 associated with both types of datagrams.

The command byte allows for two methods of drive/DGFC access. They are sequential and random access. A command byte value of zero equals sequential access and a command byte value of one equals random access. The sequential command is used when accessing parameters that are contiguous. The byte value for random command is used when accessing parameters that are not contiguous. The two command methods mixed with the two datagram message types gives the option of 4 different methods of accessing the drive/DGFC, Sequential Write Device, Random Write Device, Sequential Read Device and Random Read Device. The SBI will respond to both methods of Read Device datagram with a Read Device Reply.

The following are descriptions of all 4 methods of accessing the drive/DGFC. The descriptions are shown in byte format. The Series 90-30™ PLC uses word format to load registers, and stores words/integers as least significant bytes first then as the most significant byte. When a MOVE INT data move is used to move the constant 0102H (258), it is stored as Byte zero = 02 and Byte one = 01. This is important to keep in mind when loading the data bytes of the datagram.

The lines separating the data bytes represent the breaks between information for a multiple parameter access. Data Byte 0 to the first line represents the necessary information to access one parameter. From the data byte following the first line to the next line represents the information needed to access the second parameter. Subsequent parameters use the same data byte format as the second parameter.



3.4.4 Sequential Write Device

From GBC to SBI sequential write operation

Table 3.3 – Sequential Write Device			
Data Byte 0	Reserved	0	First Parameter
Data Byte 1	Command	0-Sequential	
Data Byte 2	Parameter number (LSB)		
Data Byte 3	Parameter number (MSB)		
Data Byte 4	0		
Data Byte 5	# of bytes from Data Byte 6 to n (max = 128 Bytes)		
Data Byte 6	Parameter type		
Data Byte 7	Parameter Destination		
Data Byte 8	Parameter Value (LSB)	Low Word	
Data Byte 9	Parameter Value (MSB)		
Data Byte 10	Parameter Value (LSB)	High Word	
Data Byte 11	Parameter Value (MSB)		
Data Byte 12	Parameter type		Second Parameter
Data Byte 13	Parameter Destination		
Data Byte 14	Parameter Value (LSB)	Low Word	
Data Byte 15	Parameter Value (MSB)		
Data Byte 16	Parameter Value (LSB)	High Word	
Data Byte 17	Parameter Value (MSB)		
....			Subsequent parameters
Data Byte+n			Max. n = 133

3.4.5 *Random Write Device*

From GBC to SBI random write operation

Data Byte 0	Reserved	0	First Parameter
Data Byte 1	Command	1-Random	
Data Byte 2	Parameter number (LSB)		
Data Byte 3	Parameter number (MSB)		
Data Byte 4	0		
Data Byte 5	# of bytes from Data Byte 6 to n (max = 128 Bytes)		
Data Byte 6	Parameter type		
Data Byte 7	Parameter Destination		
Data Byte 8	Parameter Value (LSB)	Low Word	
Data Byte 9	Parameter Value (MSB)		
Data Byte 10	Parameter Value (LSB)	High Word	
Data Byte 11	Parameter Value (MSB)		
Data Byte 12	Parameter Number (LSB)		Second Parameter
Data Byte 13	Parameter Number (MSB)		
Data Byte 14	Parameter Type		
Data Byte 15	Parameter Destination		
Data Byte 16	Parameter Value (LSB)	Low Word	
Data Byte 17	Parameter Value (MSB)		
Data Byte 18	Parameter Value (LSB)	High Word	
Data Byte 19	Parameter Value (MSB)		
.....			Subsequent Parameters
Data Byte+n			Max. n = 133

3.4.6 *Sequential Read Device*

From GBC to SBI sequential read device operation

Data Byte 0	Reserved	0	First Parameter
Data Byte 1	Command	0-Sequential	
Data Byte 2	Parameter number (LSB)		
Data Byte 3	Parameter number (MSB)		
Data Byte 4	0		
Data Byte 5	# of bytes from Data Byte 6 to n (max = 128 Bytes)		
Data Byte 6	Parameter type		
Data Byte 7	Parameter Destination		
Data Byte 8	Parameter type		Second Parameter
Data Byte 9	Parameter Destination		
.....			Subsequent Parameters
Data Byte+n			Max. n = 133

3.4.7 *Random Read Device*

From GBC to SBI random read device operation

<b>Table 3.6 – Random Read Device</b>			
<b>Data Byte 0</b>	Reserved	0	First Parameter
<b>Data Byte 1</b>	Command	1-Random	
Data Byte 2	Parameter number (LSB)		
Data Byte 3	Parameter number (MSB)		
Data Byte 4	0		
Data Byte 5	# of bytes from Data Byte 6 to n (max = 128 Bytes)		
Data Byte 6	Parameter type		
Data Byte 7	Parameter Destination		
Data Byte 8	Parameter Value (LSB)	Low Word	
Data Byte 9	Parameter Value (MSB)		
Data Byte 10	Parameter Value (LSB)	High Word	
Data Byte 11	Parameter Value (MSB)		
Data Byte 12	Parameter Number (LSB)		Second Parameter
Data Byte 13	Parameter Number (MSB)		
Data Byte 14	Parameter Type		
Data Byte 15	Parameter Destination		
....			Subsequent Parameters
Data Byte+n	Parameter Value (MSB)		Max. n = 133

3.4.8 *Read Device Reply*

From SBI read device reply (1FH)

<b>Table 3.7 – Read Device Replay</b>			
<b>Data Byte 0</b>	Reserved	0	First Parameter
<b>Data Byte 1</b>	Command	1-Random	
Data Byte 2	Parameter number (LSB)		
Data Byte 3	Parameter number (MSB)		
Data Byte 4	0		
Data Byte 5	# of bytes from Data Byte 6 to n (max = 128 Bytes)		
Data Byte 6	Parameter Value (LSB)	Low Word	
Data Byte 7	Parameter Value (MSB)		
Data Byte 8	Parameter Value (LSB)	High Word	
Data Byte 9	Parameter Value (MSB)		
Data Byte 10	Parameter Value (LSB)	Low Word	Second Parameter
Data Byte 11	Parameter Value (MSB)		
Data Byte 12	Parameter Value (LSB)	High Word	
Data Byte 13	Parameter Value (MSB)		
.....	.....	....	Subsequent parameters
Data Byte+n			Max. n = 133

### 3.4.9 *Miscellaneous Information About Datagrams*

The Gena on the SBI does not clear unused bytes in the receive datagram buffer. Meaning that data can remain in the buffer from a previous message. This is a problem when the Datagram Length is set smaller than 6 + value of Data Byte 5.

The GBC will not send a datagram if the Command Length is not set large enough to accommodate the necessary number of words needed to send the whole datagram.

NOTES

## CHAPTER 4: GENIUS COMMUNICATIONS

This chapter is just a brief overview and introduction to the Genius network. It does not cover detailed information on the Serial Bus Option card or the AV-300/DV-300 drives.

### 4.1 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 Serial Bus Interface Genius option card allows the AV300/DV300 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.

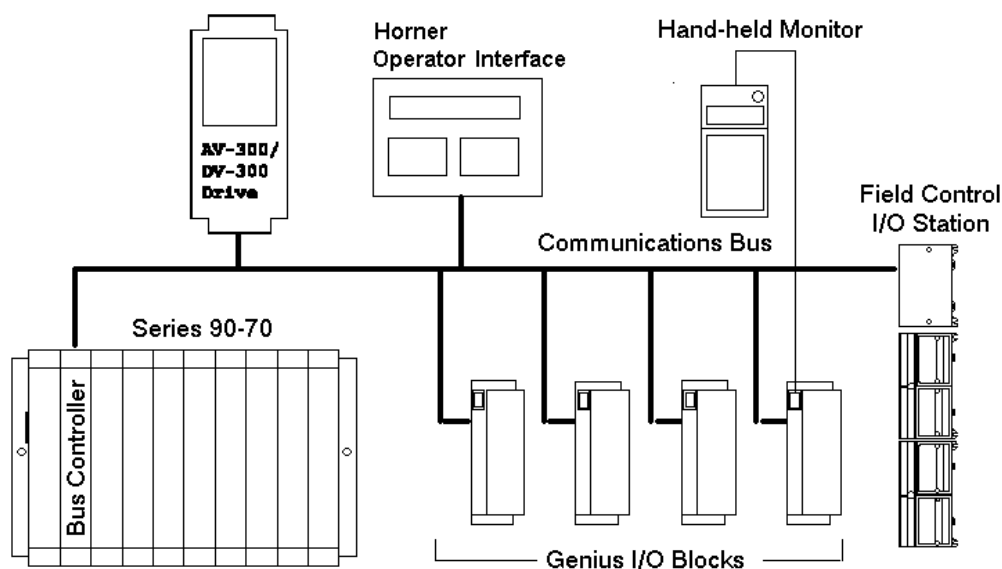


Figure 4.1 - Typical Genius Devices and Architecture

### 4.2 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.

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.

### **4.3 Genius Communications Services**

As stated previously, the Serial Bus Interface 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 Serial Bus Interface option card supports all three of these communications types.

#### **4.4 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. Many I/O blocks also broadcast inputs to the bus every bus scan.

#### **4.5 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. Drive feedback data consists of parameters such as speed reference, torque, current, faults, function settings, etc. The Serial Bus 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.

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.

#### **4.6 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.

## CHAPTER 5: PLC CONFIGURATION

### 5.1 PLC Configuration

This chapter discusses the configuration of the PLC in Genius applications using the AV-300/DV-300 drives with the Serial Bus Interface 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.

### 5.2 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:

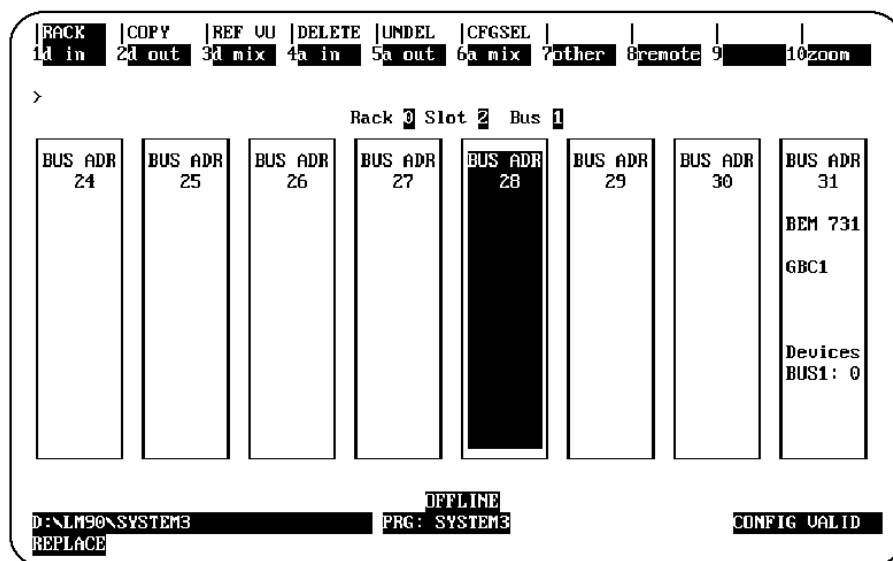


Figure 5.1 - Logicmaster 90-70 Configuration Screen

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 SBI 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.



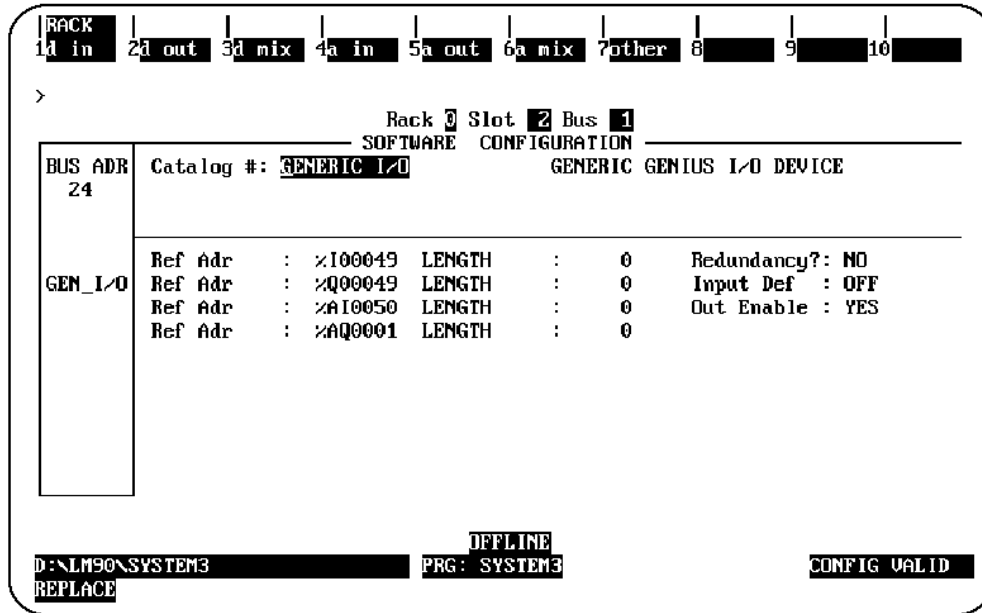


Figure 5.2 - Generic I/O device Configuration Screen

Below, each configuration parameter is described. The proper setting for a drive with a default data configuration is also listed. Figure 5.3 on the next page lists the default drive data configuration.

5.2.1 %I Length (Default = 16)

The number of %I's assigned to the 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 SBI and defined using %Is in the PLC configuration.

5.2.2 %Q Length (Default = 16)

The number of %Qs assigned to the 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.

5.2.3 %AI Length (Default = 6)

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

5.2.4 %AQ Length (Default = 1)

The number of %AQs assigned to the drive should be equal to the number of non-bitmapped directed control words.

5.2.5 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.

### 5.2.6 Redundancy

If the AV-300/DV-300 is used in a redundant application, this parameter should be set to YES.

### 5.2.7 Input Default

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

### 5.2.8 Outputs Enabled

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

**Note that 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.**

## 5.3 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:

```

RACK 1 2 3 4 5 6 7 8 9 default 10
|gbc | | | | | | | | |
>
SERIES 90-30 MODULE IN RACK 0 SLOT 3
SOFTWARE CONFIGURATION
SLOT 3 Catalog #: IC693BEM331 9030 GENIUS BUS CONTROLLER
BEM331 %I,%Q,%G lengths are bits: %AI,%AQ,%R are words
GBC ----- BUS CONTROLLER MODULE DATA -----
Module SBA : 31 Baud Rate : 153K EXT Input Def : OFF
S6 Ref : 0 Status : %I0001 Out at strt: ENABLED
----- DEVICE DATA -----
Device SBA : 1 Input1 Ref : %I0033 Input1 Len : 0
Device Type: GENERIC Input2 Ref : %AI0001 Input2 Len : 0
Output1 Ref : %Q0001 Output1 Len: 0
Output2 Ref : %AQ001 Output2 Len: 0
<< More Devices Exist; PgDn for Next Device, PgUp for Previous Device >>
OFFLINE
C:\LM90\SYSTEM3 PRG: SYSTEM3 CONFIG VALID
REPLACE

```

Figure 5.3 - 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 AV-300/DV-300, the following parameters can be set.

### 5.3.1 *Device Type*

The AV-300/DV-300 is configured as a GENERIC device type, which is the default.

### 5.3.2 *Input References (Input 1 Ref, Input 2 Ref)*

These parameters specify where the SBI'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 SBI 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.

### 5.3.3 *Input Length (Input 1 Len, Input 2 Len)*

These parameters specify how much global data is broadcast by the SBI. 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 SBI.

### 5.3.4 *Output References (Output 1 Ref, Output 2 Ref)*

These parameters specify where the AV-300/DV-300 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 SBI 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.

### 5.3.5 *Output Length (Output 1 Len, Output 2 Len)*

These parameters specify how much directed data is received by the SBI. 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 SBI.

## CHAPTER 6: AV-300 / DV-300 DRIVE PARAMETERS

### 6.1 Drive Parameter Descriptions

The parameters and parameter numbers associated with the AV-300 and DV-300 adjustable speed drives are listed as "Pick Lists" in the software configuration tool, and can be accessed with the hand held monitor attached to the drive. For further information on these parameters, consult the AV-300/DV-300 instruction manuals.

**Due to constant revisions to the parameters, the parameter information will not be contained in this manual. The information can be obtained from the AV-300/DV-300 Instructions Manual.**

**The following sections explain how the AV-300 and DV-300 Manual Parameter Table relates to the Software Configuration Tool Pick Lists.**

### 6.2 DIRECTION:

The parameter table contains "R", "W", "Z" and "C" symbols to designate read and write parameters. A "R" represents a read from the drive to the master. This relates to the Edit Global Data configuration option in the software configuration tool. A "W", "Z" or "C" represents a write from the master to the drive. This relates to the Edit Directed Control Data configuration option in the software configuration tool.

### 6.3 ACCESS METHOD:

The access method is selected under SOURCE while configuring Global Data or Directed Control Data. The options discussed below are Low Priority To/From Drive, High Priority To/From Drive, Low Priority Discrete Bit Word To/From Drive and High Priority Discrete Bit Word To/From Drive.

The following shows the columns needed to determine the available SOURCE options available for a given parameter and a description on how the columns are used.

### 6.4 LOW PRIORITY TO/FROM DRIVE:

RS485/BUS/Opt2-M - A read or write in this column designates that the parameter can be accessed using the Low Priority To/From Drive option.

### 6.5 HIGH PRIORITY TO/FROM DRIVE: \*

MINIMUM, MAXIMUM, Opt2-A/PDC - A read or write in Opt2-A/PDC and a minimum value not equal to 0 or a maximum value greater than 1 designates that the parameter can be accessed using the High Priority To/From Drive option.

### 6.6 LOW PRIORITY DISCRETE BIT WORD TO/FROM DRIVE:

MINIMUM, MAXIMUM, Opt2-A/PDC - A minimum value of 0 and a maximum value of 1. All High Priority Discrete Bit Words qualify for Low Priority Discrete Bit Words.

### 6.7 HIGH PRIORITY DISCRETE BIT WORD TO/FROM DRIVE: \*

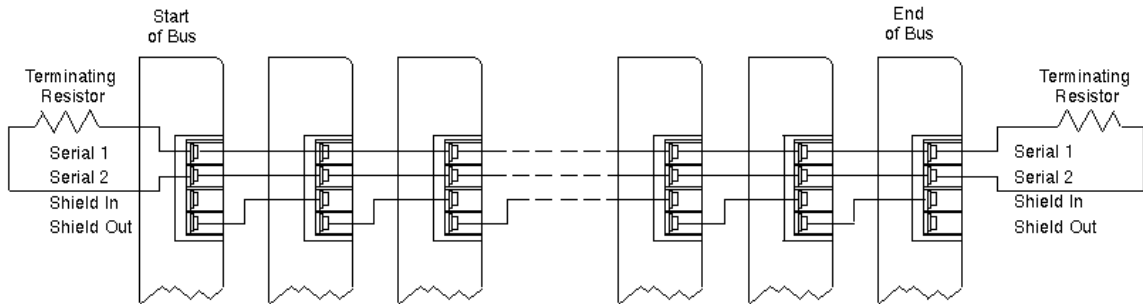
MINIMUM, MAXIMUM, Opt2-A/PDC - A minimum value of 0 and a maximum value of 1 and a read or write in Opt2-A/PDC column.

**\*NOTE: The High Priority To/From Drive and the High Priority Discrete Bit Word To/From Drive are mutually exclusive. A parameter is either eligible for High Priority access or High Priority Discrete Bit Word access, not both.**

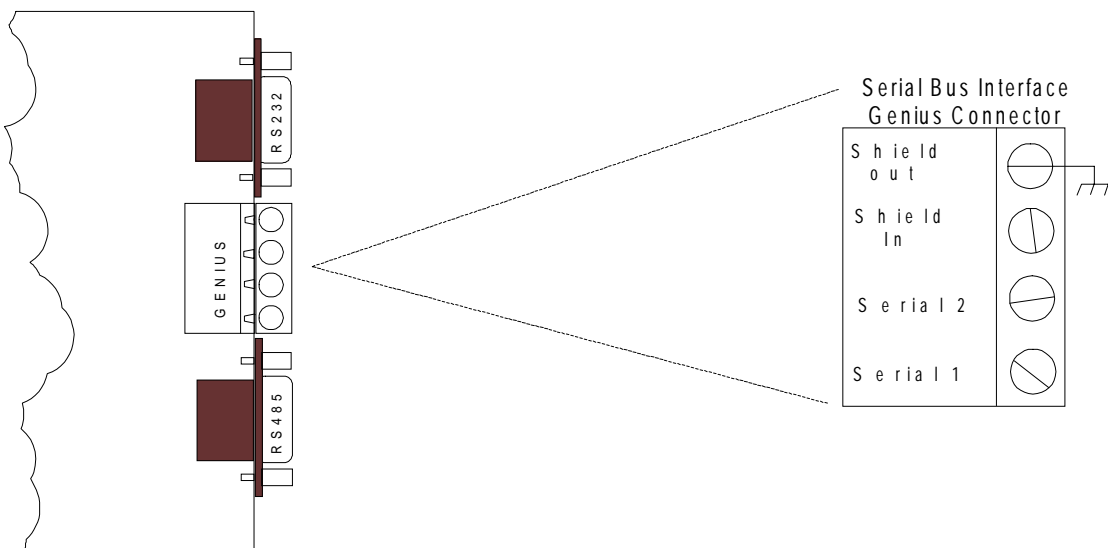
NOTES

**CHAPTER 7: WIRING DIAGRAMS**

**7.1 Genius Wiring:**



**Figure 7.1 - Typical Genius Wiring Diagram**



**Figure 7.2. Serial Bus Interface Genius Connector**

**Note: Shield Out is connected to the metal shell and jack screws of J1 and J2. Earth ground can be connected at any of these locations. Earth Ground must be connected!**

For further instruction on wiring, consult the GE Fanuc User's Manual GEK-90486f-1 (Genius I/O Systems and Communications).

7.2 RS232/RS485 Pinout:

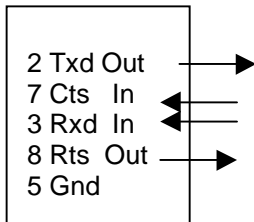


Figure 7.3 - RS232 - J1

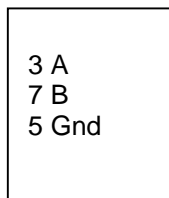


Figure 7.3 - Two-Wire RS485 - J2  
(Operates in Half-Duplex Mode)

The following jumpers are associated with RS485 (J2).

- a) JP2 - Jumper on places a 120 Ohm terminating resistor on the circuit. (See 8.3.8.)
- b) JP10 - Places 5volts at J2 Pin9. (See 8.3.9.)

For more information on the hardware setup, see the GE CFG Help file.

## CHAPTER 8: INSTALLING THE SBI CARD

### 8.1 Installation Hardware

Included in the packaging with the SBI option card are the following:

- a. The option card.
- b. One installation kit. (consisting of four metal standoffs, four Phillips head screws, four lock-washers, and one 3" 40 pin ribbon cable)
- c. This Document.

### 8.2 Required Tools

The following tools are required to install the SBI option card.

- a. Philips Screwdriver.
- b. Flat tip Screwdriver.
- c. 5/32's Nut-driver.

### 8.3 The installation procedures.

The SBI option card is installed inside the drive cover, so that the NEMA rating of the drive is maintained after installation of the option card.

- a. Power down the drive.
- b. Remove the cover from the drive.

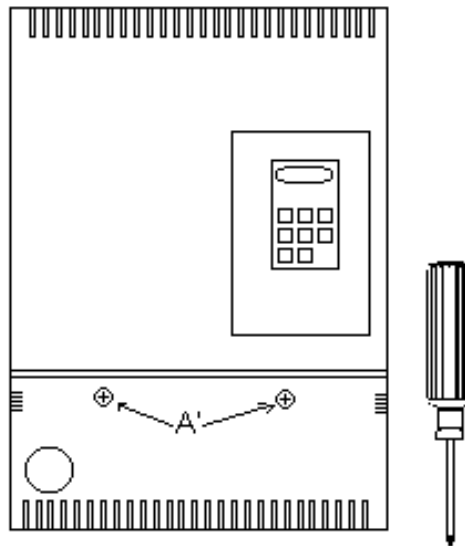


Figure 8.1 - Removing the Front panel



The front cover is divided into two parts. First remove the lower section by unscrewing the two Phillips screws (Marked A' on Figure 8.1) just enough for the section to separate from the upper section. Lift lower section up while pulling down at the same time. Remove the top section by lifting up on the back until the pins slide over the holes (on the top of the drive), then disconnect the ribbon cable attached to the keypad.

- c. Install the four metal standoffs.

Using a 5/32's nut driver, screw the standoffs into holes marked "A" (see Figure 8.2).

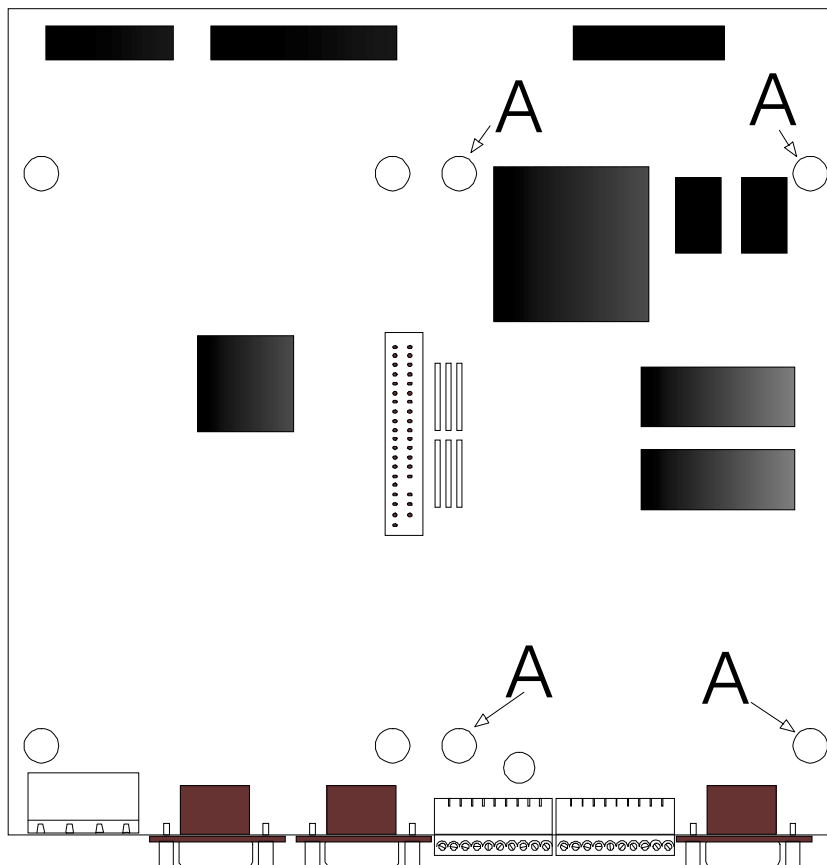


Figure 8.2 – Installing Metal Standoffs

- d. Place the SBI board on the standoffs

Align the holes marked "B" with the top of the standoffs (see Figure 8.3). Attach using the four screws with lock washers. Make sure the connectors on the SBI card are pointing at the same end as the connectors on the drive board.

e. Insert one end of the 40-pin ribbon cable into the connector on the SBI card (P3), and the other end into the connector on the drive (marked XO). The red ribbon (symbolizing pin 1) should be facing the back of the board.

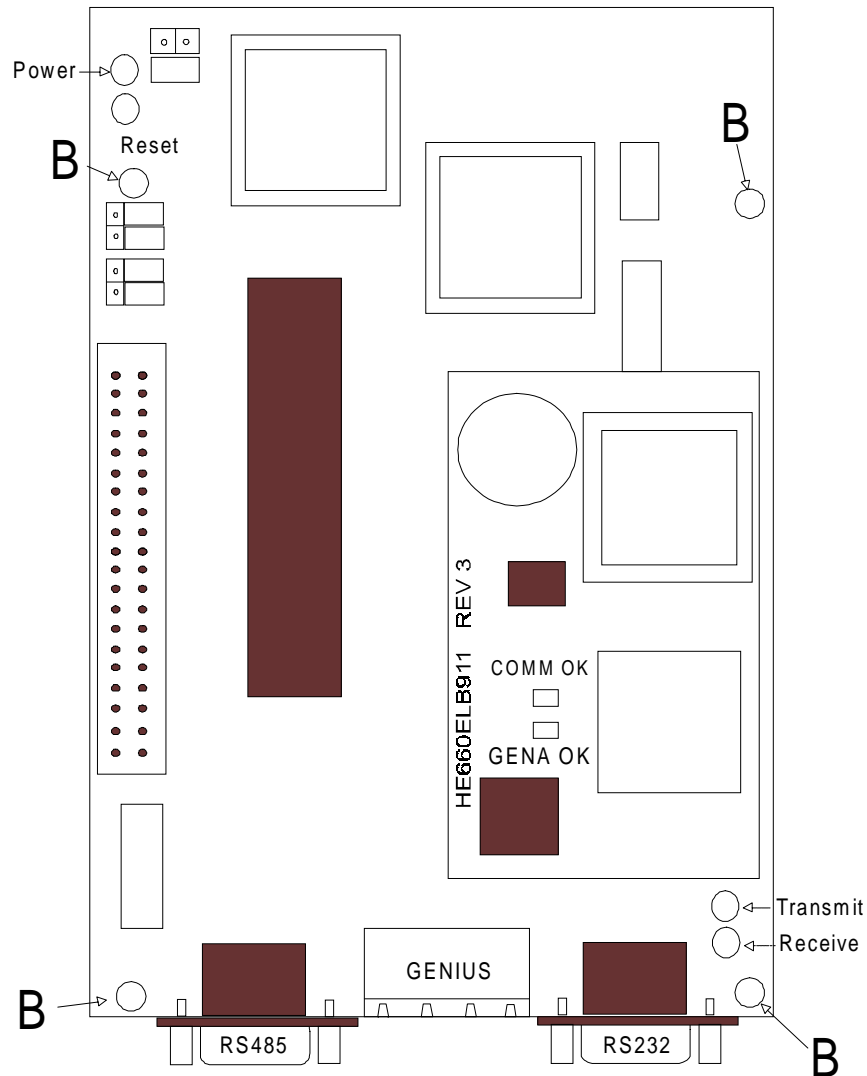
- f. Set the jumpers (JP1, JP2, and JP10) on the SBI option card.

### 1. JP1: RS-232/485 port select

Jumper on, RS-232 port selected, jumper off, RS-485 port selected. This jumper determines which port is used for sending/receiving configuration information, The state of the jumper is only checked at power up.

### 2. JP2: Termination Resistor

Jumper on, 120 ohm resistor, jumper off, no termination. This jumper allows a 120 ohm terminating resistor to be connected between data +(A) and -(B).



**Figure 8.3 – Placing the SBI Board on Metal Standoffs**

### 3. JP10

RS-485 power: Jumper on, +5volts out, Jumper off, no +5volts out. This jumper allows power to be supplied to the RS-485 connector to power RS-485 converters. **Set jumper for no power.**

## 8.4 Grounding the AV/DV 300 GE Drive Genius SBI Option Card

### 8.4.1 Installation

For installations where noise is a problem, it is necessary to connect a grounding wire to the Genius Serial Bus Interface card. Since no part of the Interface board physically makes contact to the drive, an external ground between the jacketing screw on the RS-485 port and the panel ground is necessary. The following instructions on the next page give a detailed representation of how to do this. A ground wire is included with the SBI card.

- a. If Possible, Disconnect power to the AV/DV drive.
- b. Remove the cover panel from the AV/DV drive (for instructions on how to do so consult Chapter 8 in the manual).
- c. Using a 5/16 nut driver loosen the jack screw labeled "A" in Figure 8.4 enough to be able to slide the terminal connector onto the stud between the nut and the jacket of the RS485 connector.
- d. Place the terminal lug between the jacket and the jack screw head. Secure the lug firmly by tightening the jack screw head.

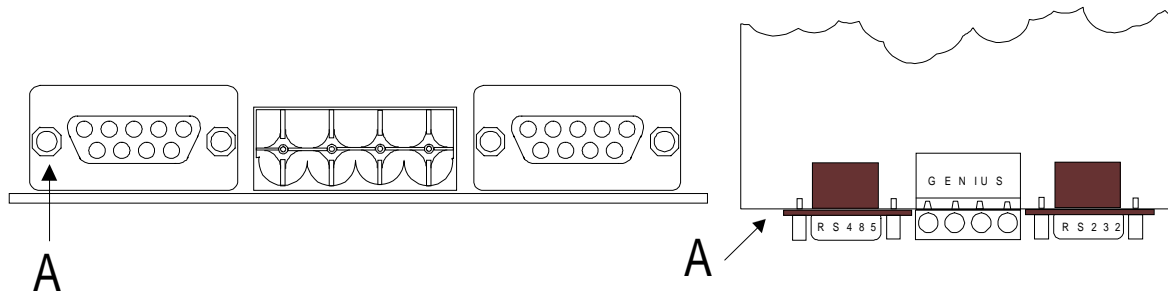


Figure 8.4 – Jack Screw

- e. Route the grounding wire along the front of the drive and connect the stripped end to the panel mounting screw marked "B" on Figure 8.5.

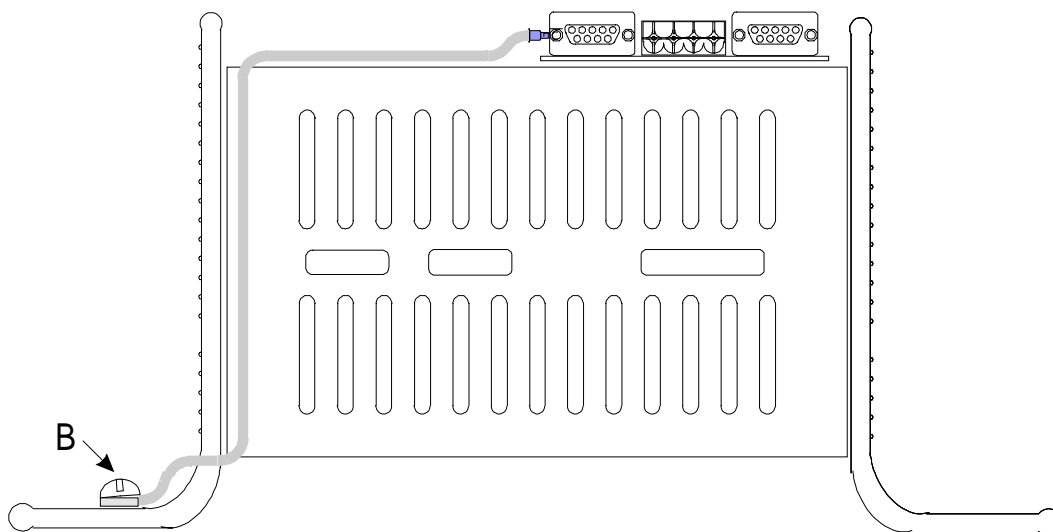


Figure 8.5 – Panel Mounting Screw

f. After configuring the SBI option card with the software configuration tool, and connecting the Genius cable to P1, replace the front cover.

The drive is now ready to be operated with the SBI option card.

NOTES

## CHAPTER 9: SBI CARD LED INDICATORS

The SBI card has six LED indicators for general troubleshooting. See figure 9.1 for the location of the LED's (next page).

### 9.1 "Power" Indicator

The "Power" indicator informs the user that the SBI card is getting power. If the Drive is powered up, and this light is not illuminated, insure the ribbon cable is properly connected.

### 9.2 "Reset" Indicator

The "reset" indicator will be illuminated as long as the power light is illuminated. If the SBI card appears to be having problems, and the reset LED is not illuminated, contact Horner APG's Technical Support.

### 9.3 "Transmit" Indicator

The "Transmit" indicator will flash when data is transmitted to a PC while reading the configuration from the SBI card with the software configuration tool.

### 9.4 "Receive" Indicator

The "Receive" indicator will flash when data is received while writing a configuration to the SBI using the software configuration tool.

### 9.5 "GENA OK" Indicator

The "GENA OK" indicator will be illuminated unless there is a fault with the GENA board.

### 9.6 "COMM OK" Indicator

The "COMM OK" indicator illuminates when the GENA board is communicating with the GBC properly. If the "COMM OK" LED is not illuminated after configuration, check the following:

Make sure the SBI configuration Global Data and Directed data length matches the Summary Global Data words, and the Directed Control Data words (In the software configuration tool).

Make sure the Cable is wired correctly between the GBC and the SBI card.

Check the GBC configuration (LM90 Configuration package). The Global data length, and the Directed control data length must match the input length and the output length respectively.

LED "A": Power indicator.  
LED "B": Reset Indicator.  
LED "C": Transmit Indicator.  
LED "D": Receive Indicator.  
LED "E": GENA OK Indicator.  
LED "F": Communication OK.

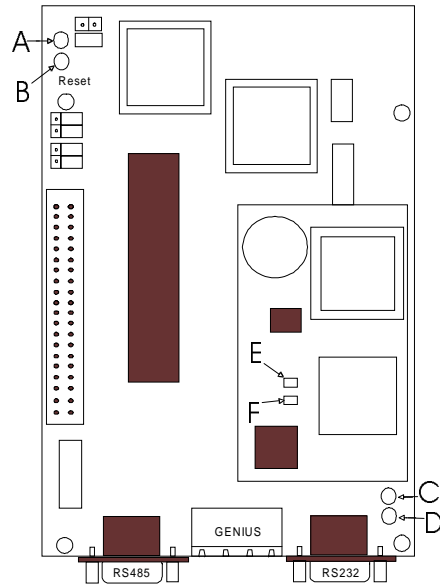


Figure 9.1 - Serial Bus Interface LED description, and nomenclature

**APPENDIX A: HE300GEN200 ECHO TEST TIMING RESULTS****A.1 Test Setup:**

Equipment:

- 1 Dual PCIM in a Pentium 200
- 1 AV-300/Dv-300 Drive
- 1 Genius SBI w/ V1.10 Firmware

**A.2 Setup**

PCIM is installed in computer and configured.

PCIM connected to Genius SBI via Genius cable.

Computer serial port connected to SBI serial port for configuration changes using the Software configuration tool.

**A.3 General Procedure**

The SBI is configured as described in the different sections. The Gena configuration is also described in the different sections. GENIUS.EXE program is run. F1 is pressed to start the test. The test program writes a value to the drive over Genius then times how long it takes to receive the same value back. There are 999 different values sent and timed. The average time, maximum time and minimum time are displayed as the test is running. The timing results are displayed in milliseconds. A time of 0 is a time of less than 1ms.

**A.4 HIGH PRIORITY I/O TEST**

Software Configuration Tool Settings: 1 High Priority DCD to Pad 0, 1 High Priority Global from Pad 0

Genius Configuration: 1 IN/1 OUT

<u>Attempt</u>	<u>Average Time</u>	<u>Max Time</u>	<u>Min Time</u>
1	35.40	55	0 (< 1ms)
2	35.07	55	1

Software Configuration Tool Settings: 1 High Priority DCD to Pad 0, 1 High Priority Global from Pad 0

Genius Configuration: 5 IN/5 OUT

<u>Attempt</u>	<u>Average Time</u>	<u>Max Time</u>	<u>Min Time</u>
1	35.95	54	0
2	35.42	55	0

Software Configuration Tool Settings: 5 High Priority DCD to Pad 0 through Pad 4, 5 High Priority Global from Pad 0 through Pad 4. Genius Configuration: 5 IN/5 OUT

<u>Attempt</u>	<u>Average Time</u>	<u>Max Time</u>	<u>Min Time</u>
1	34.51	55	0
2	33.60	55	0



**A.5 LOW PRIORITY I/O TEST:**

Software Configuration Tool Settings: 1 Low Priority DCD to Pad 0, 1 Low Priority Global from Pad 0  
Genius Configuration: 1 IN/1 OUT

<u>Attempt</u>	<u>Average Time</u>	<u>Max Time</u>	<u>Min Time</u>
1	98.30	165	79
2	98.12	165	76

Software Configuration Tool Settings: 1 Low Priority DCD to Pad 0, 1 Low Priority Global from Pad 0  
Genius Configuration: 5 IN/5 OUT

<u>Attempt</u>	<u>Average Time</u>	<u>Max Time</u>	<u>Min Time</u>
1	98.03	165	78
2	98.84	165	79

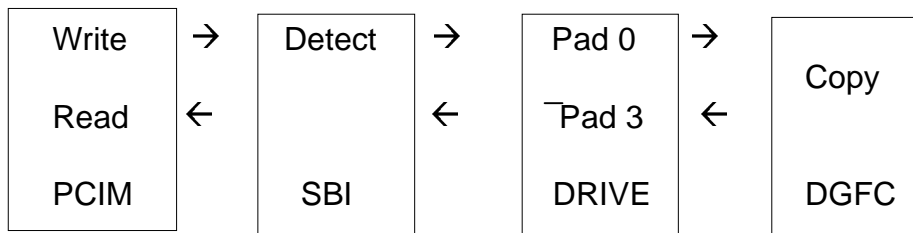
Software Configuration Tool Settings: 5 Low Priority DCD to Pad 0 through Pad 4, 5 Low Priority Global from Pad 0 through Pad 4. Genius Configuration: 5 IN/5 OUT

<u>Attempt</u>	<u>Average Time</u>	<u>Max Time</u>	<u>Min Time</u>
1	204.85	275	165
2	204.39	275	131

**A.6 DGFC I/O TEST:**

This test used a program already in the DGFC that copies Pad 0 to Pad 3. The value was sent out of the PCIM over Genius to the SBI. The SBI detected a data change and wrote the value to Pad 0 in the drive. The DGFC then copied the value from Pad 0 to Pad 3. The SBI was configured to read Pad 3, so it was reading Pad 3 every time through its internal scan and storing the result in the Gena memory.

The following diagram shows the data path:



**A.7 High Priority Test**

Software Configuration tool Settings: 1 High Priority DCD to Pad 0, 1 High Priority Global from Pad 3  
Genius Configuration: 2 IN/2 OUT

<u>Attempt</u>	<u>Average Time</u>	<u>Max Time</u>	<u>Min Time</u>
1	26.34	55	0
2	26.61	55	0

**A.8 Low Priority Test**

Software Configuration Tool Settings: 1 Low Priority DCD to Pad 0, 1 Low Priority Global from Pad 3  
Genius Configuration: 2 IN/2 OUT

<u>Attempt</u>	<u>Average Time</u>	<u>Max Time</u>	<u>Min Time</u>
1	99.06	165	78
2	98.57	165	79

**A.9 OLD VS NEW (Version 1.09 VS Version 1.10)**

The same configuration was used for all of the testing in this section. The configuration is as follows:

Software Configuration Tool Settings: 1 High Priority DCD to Pad 0

1 Low Priority DCD to Pad 1

1 High Priority Global from Pad 0

1 Low Priority Global from Pad 1

Genius Configuration: 2 IN/2 OUT

OLD VERSION (1.09) HIGH PRIORITY:

<u>Attempt</u>	<u>Average Time</u>	<u>Max Time</u>	<u>Min Time</u>
1	60.72	118	78
2	59.18	110	45

OLD VERSION (1.09) LOW PRIORITY:

<u>Attempt</u>	<u>Average Time</u>	<u>Max Time</u>	<u>Min Time</u>
1	115.53	218	-----
2	114.85	217	55

NEW VERSION (1.10) HIGH PRIORITY:

<u>Attempt</u>	<u>Average Time</u>	<u>Max Time</u>	<u>Min Time</u>
1	32.82	55	0
2	32.89	54	0

NEW VERSION (1.10) LOW PRIORITY:

<u>Attempt</u>	<u>Average Time</u>	<u>Max Time</u>	<u>Min Time</u>
1	105.37	165	64
2	106.68	165	71

**A.10 Genius SBI Internal Timing Result:**

Test code was inserted into the Genius SBI firmware. There were 2 parts to the test code. The first part of the test code detected when a new value was in Gena memory and cleared a port pin. The value was then written to the drive as usual. The second part detected when the same value was read back from the drive and set the port pin. This allowed for a scope to be used to determine how long it took the SBI to detect a data change, write the value to the drive, receive the value back from the drive and write it to the Gena memory. The same GENIUS.EXE program and test was used as above. The scope was used to determine maximum and minimum SBI internal timing.

**A.11 High Priority Timing**

Software Configuration Tool Settings: 1 High Priority DCD to Pad 0, 1 High Priority Global from Pad 0

Genius Configuration: 1 IN/1 OUT

Result: 2.5 to 25ms

**A.12 Low Priority Timing:**

Configuration Tool Settings: 1 Low Priority DCD to Pad 0, 1 Low Priority Global from Pad 0

Genius Configuration: 1 IN/1 OUT

Result: 80 to 90 ms (This can vary depending on which parameter is being accessed and time it takes the drive to access that parameter.)

## APPENDIX B: TECHNICAL SUPPORT

For any questions or problems not addressed by this manual, contact Horner APG's Technical Support at 317-916-4274, or drop an e-mail to [techspt@heapg.com](mailto:techspt@heapg.com).

For further information on Horner APG products, go to our web site located at [HTTP://www.heapg.com](http://www.heapg.com).

The web site has a technical support area, as well as a product catalog. If a manual is needed for a certain product, the manual can be downloaded in PDF format using Acrobat from the web site.

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