



**User Manual for the
*HE693PBM100***

PROFIBUS MASTER

22 June 2000

MAN0001-02

PREFACE

This manual explains how to use the Horner APG's Profibus Master Module (HE693PBM100).

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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.

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CHAPTER 1: INTRODUCTION

1.1 Product Description

1.1.1 General

Horner APG's Profibus Master Module (HE693PBM100) functions as a Profibus DP network master capable of controlling up to 64 slave devices. The Profibus DP application allows for the connection of I/O devices and simple field devices to an automation system via a Profibus network. Emphasis is on fast transmission of small data volumes. The HE693PBM100 operates as Profibus DP module only and does not support other types of Profibus (FMS, PA).

Profibus uses a Master-Slave type of communication with the HE693PBM100 functioning as the master device. The HE693PBM100 communicates with slave devices such as input/output devices, drives, valves, and measuring transmitters via a Profibus network. The HE693PBM100 (when used with HE Profibus Slave Modules) also allows communication between modules located in different PLC racks via the Profibus network. (For information covering HE-APG Slave Modules, see the User Manuals for the HE693PBS105 and the HE693PBM106.)

1.1.2 "Pseudo Slave" Feature of the HE693PBM100

The "Pseudo Slave" feature of the HE693PBM100 enables users to access three additional functions that are not available using the normal configuration procedure in Chapter 3. **If the functions are desired, users must perform additional configuration procedures as indicated in Appendix A.**

The "Pseudo Slave" is neither a physical device nor is it true slave device. The "Pseudo Slave" is simply a part of the software which allows the HE693PBM100 to access specific information from a PLC, and thus, provides the additional functions. Appendix B covers the following functions in more detail.

- a. SYNC/FREEZE Control – Allows the Logic to control the data flow to and from the inputs and outputs of the slaves.
- b. Additional slave "system diagnosis" status information
- c. Firmware Release information

1.2 Profibus Overview

Profibus, a token-passing network, supports one master controlling the network and writing to the slave devices. Multiple masters, however, can read information simultaneously off the Profibus network. Master devices (HE693PBM100) are used to determine the data communication on the bus.

Slave devices are peripherals such as input/output devices, valves, drives, and measuring transmitters, etc. Slaves devices also include HE-APG Profibus Slave Modules located in PLCs that the HE693PBM100 reads or writes to over the Profibus network. Slaves do not have bus access rights and can only acknowledge received messages or send messages to the master when requested to do so. Data from the slave devices can be read by any master. All connected Slaves have the same priority.

Up to 32 devices (masters or slaves) can be connected in one segment without using repeaters or up to 64 devices can be connected using repeaters.

For further information, refer to the following web site: <http://www.profibus.com>.

1.3 System Requirements:

Important requirement information:

- a. The HE693PBM100 requires a CPU351 (or higher) with Firmware Version 8.0 (or better).
- b. CIMPLICITY® Control Version 2.0 or higher is required to configure the modules.
- c. *Logicmaster® software and earlier versions of CPU Firmware can NOT support these modules.*

1.4 Physical Layout of HE693PBM100:

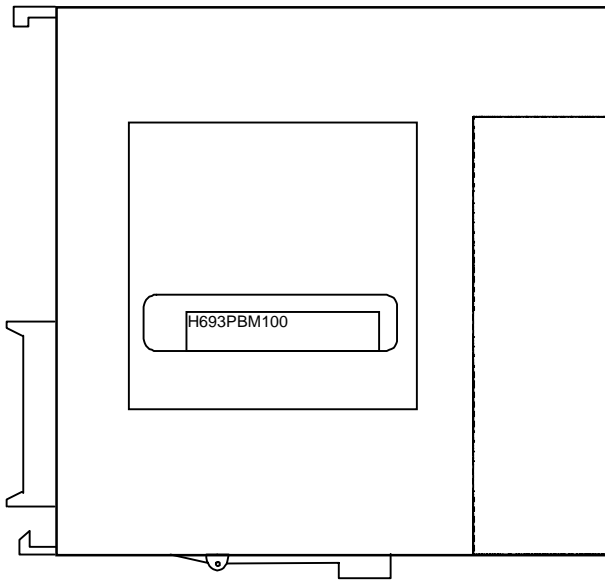


Figure 1.1 - Front Cover

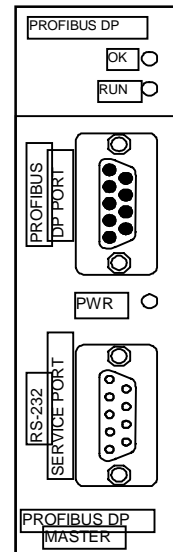


Figure 1.2 – Side View

CHAPTER 2: INSTALLATION

2.1 Mounting Requirements

The HE693PBM100 Module is designed to plug into any Series 90™-30 local slot. The HE693PBM100 requires at least a CPU351 model or higher with Firmware Revision 8. The HE693PBM100 will not operate correctly with a lower version Firmware. Please refer to the 90-30 Installation manual (GFK-0356E) for information on installing the module.

2.2 Profibus DP Connector

The 9-pin Profibus DP connector is for physical connection between the slaves and the master. For further information on the cable and connectors, see **Chapter 4** in this manual.

2.3 RS-232 Connector

The RS-232 Service Port is used to upgrade the firmware specific to the slave. This port uses a standard RS-232 9-pin connector.

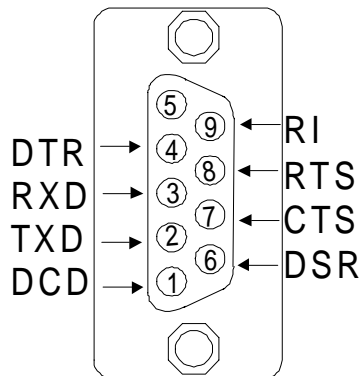


Figure 2.1- Pin-out for the RS-232

2.4 LED Operation of HE693PBM100:

There are three visible LED's on the HE693PBM100, the OK LED, RUN LED, and the POWER LED. Various combinations of these LED's will indicate different states of the master. See **Table 2.1** for the states indicated by the LED's. **Table 2.2** indicates fault conditions.

| Table 2.1 – LED Operation | | | |
|----------------------------------|-----------------------------------|-----------|--|
| OK LED | RUN LED | POWER LED | Meaning |
| Off | Off | Off | Module not receiving any power. |
| Yellow | Red | Green | Module has good power, but has not received valid configuration from CPU and is not communicating on the Profibus-DP network. |
| Green | Red | Green | Module has good power, has received valid configuration from CPU but is not communicating on the Profibus-DP network. This may be due to the CPU being in STOP mode. |
| Green | Yellow | Green | Module has good power, has received valid configuration from CPU and is communicating on the Profibus-DP network ,but one or more configured slaves is not responding. |
| Green | Green | Green | Module has good power, has received valid configuration from CPU and is communicating on the Profibus-DP network. |
| Red | Blinking between yellow and green | Yellow | A fault has occurred. Refer to the following description to determine fault. |

| Table 2.2 – Fault Conditions * | |
|---------------------------------------|--|
| Pulse Count | Meaning |
| 2 | An error was encountered receiving configuration from the PLC CPU. |
| 3 | An error was encountered creating the Profibus-DP network configuration. |
| 4 | An internal error was encountered while communicating with the Profibus hardware |
| 10-23 | Internal Error Codes. If witnessed, record value and report to GE Fanuc. |

* The blinking RUN light indicates a fault. To determine the fault, simply count the number of green pulses (the LED will pause for 2 seconds, pulse green a number of times, then repeat the cycle) Table 1-2 will describe the fault as represented by the number of green pulses.

2.5 PBM101 Status Error/Reporting

2.5.1 PLC Status Bit Definition

The PBM101 has 64 bits of status information reported to the PLC CPU. The bits are defined as follows:

| Table 2.3 – PLC Status Bit Definition * | | | |
|---|-------------|------------|--|
| Name | Byte Offset | Bit Offset | Values |
| Area 1 Slave Active Indication (This corresponds to the Slave 1 definition in the “Slave Information” tab of the PBM100 configuration). | 0 | 0 | 1= Slave actively communicating on network with no errors. 0= Problem with Slave. Either the slave is not in data exchange or the slave has a fault (ERROR). |
| Area 2 Slave Active Indication (This corresponds to the Slave 2 definition in the “Slave Information” tab of the PBM100 configuration) | 0 | 1 | 1= Slave actively communicating on network with no errors. 0= Problem with Slave. Either the slave is not in data exchange or the slave has a fault (ERROR). |
| | : | : | |
| | : | : | |
| Area 64 Slave Active Indication (This corresponds to the Slave 64 definition in the “Slave Information” tab of the PBM100 configuration) | 7 | 7 | 1= Slave actively communicating on network with no errors. 0= Slave not active on network, (possibly due to ‘no config’, bad config’ or ‘bad network connection’. |
| <p>Bits do <u>not</u> represent slave addresses. Bits 0-63 are the slave status bits ordered by the slave areas of the master configuration in Cimplicity™ Control</p> <p>In order to determine which slave is <u>not</u> properly functioning, the user must:</p> <ol style="list-style-type: none"> 1. First, identify the affected bit using <i>this table</i>; 2. Second, determine the area (See Figure 3.5 – Data Area of Master Parameters screen) The area is indicated in the first column of the screen. 3. Third, the slave address is located next to the appropriate Data Area column. <p>Example: bit 0 = area 1 (as seen in Figure 3.5) bit 1 = area 2 “ thru bit 63 = area 64 “</p> | | | |

NOTES

CHAPTER 3: CONFIGURATION

WARNING: Do *not* use the load function of Cimplicity™ Control for Profibus. Cimplicity™ is unable to disassemble binary data to information that it can use itself. Using the Load function will result in a corrupt Cimplicity™ data file.

NOTE: The “Pseudo Slave” Feature of the HE693PBM100

The “Pseudo Slave” feature of the HE693PBM100 enables users to access three additional functions that are not available using the normal configuration procedure in Chapter 3. **If the functions are desired, users must perform additional configuration procedures as indicated in Appendix A.**

NOTE: The “Pseudo Slave” is neither a physical device nor is it true slave device.

The “Pseudo Slave” is simply a part of the software which allows the HE693PBM100 to access specific information from a PLC, and thus, provides the additional functions. Appendix B covers the following functions in more detail.

3.1 Configuring the HE693PBM100

CIMPLICITY® Control Version 2.0 or higher is required in order to configure the HE693PBM100. The following is a step by step methodology on configuring the HE693PBM100 using CIMPLICITY® Control.

Step 1: Get into CIMPLICITY® Control and select “Create New Equipment Folder” at the opening window. Give the new folder a name.

Step 2: Select Hardware Configuration. A screen similar to **Figure 3.1** should appear.

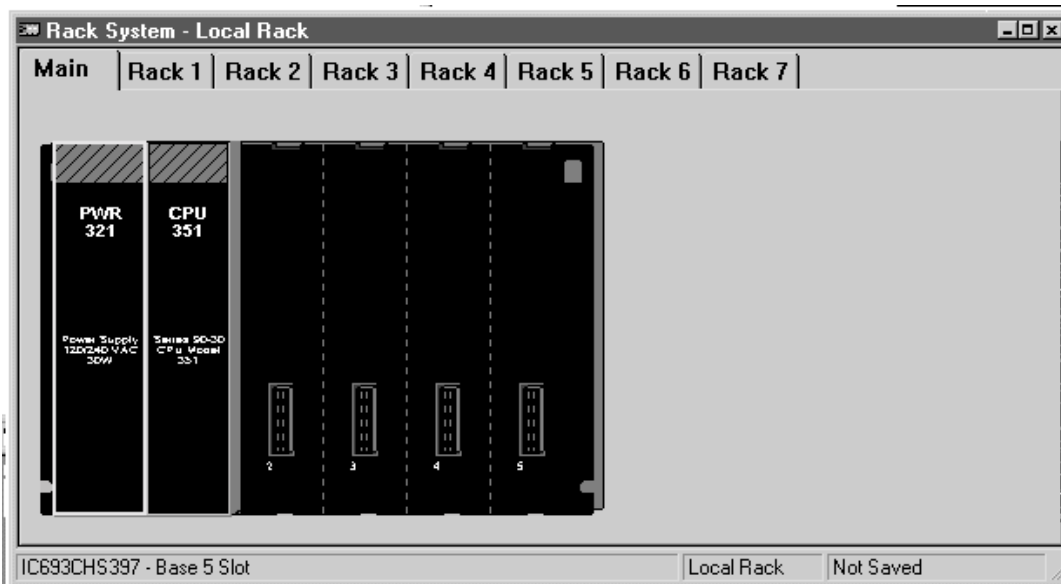


Figure 3.1

Step 3: If the rack type is not correct, place the mouse cursor (arrow) on the rack, press the right mouse button (right clicking) and select Change Rack Type.

Step 4: Highlight the slot where the HE693PBM100 is to be placed by left clicking (pressing the left mouse button) on that spot.

Step 5: Right click on the highlighted slot and select "Add Module". The following screen appears (Figure 3.2).

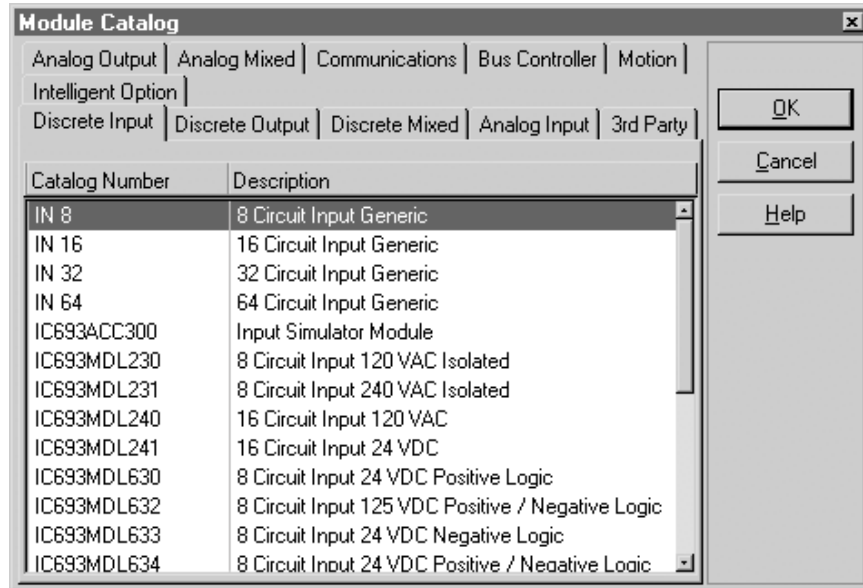


FIGURE 3.2

Step 6: Click on the "Bus Controller" tab and select HE693PBM100. The empty slot on the virtual PLC is replaced with the PBM module. The following screen appears (Fig. 3.3).

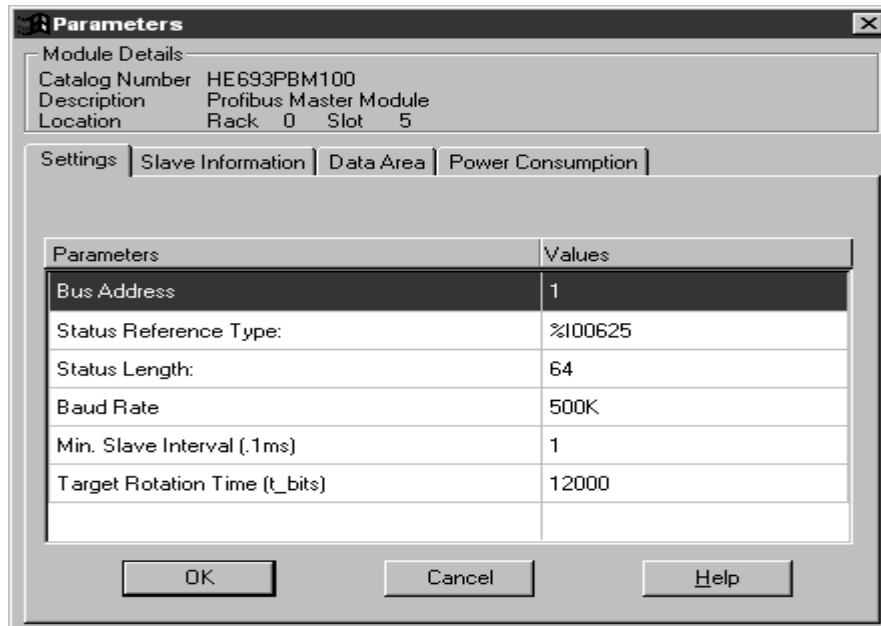


Figure 3.3

The following table briefly describes the fields on the Settings Tab.

| Table 3.1 – Fields on the Settings Tab | |
|--|---|
| Bus Address | This refers to the Profibus-DP bus address. |
| Status Reference Type | Location of Status Bits (see Table 1.3 of this document) in PLC memory. (8 bytes) |
| Status Length | Number of Status Bits (Fixed at 64) |
| Baud Rate | Baud Rate of data transmissions on the Profibus network. (range between 9.6K - 12M) |
| Min. Slave Interval (.1ms) | Smallest allowed period of time between two successive poll cycles of a particular slave. It is in .1ms units and has a range of 1-65535. |
| Target Rotation Time (t_bits) | Allowable cycle time in which all slaves will be polled by this master. It is in t_bits and has a range of 1-65535. |

Step 7: Set the Bus Address, Status Reference Type, Baud rate, Min. Slave Interval and Target Rotation Time.

Step 8: After the above parameters are set, click on the “Slave Information” tab. The following Screen should appear (**Figure 3.4**). (**See Appendix A if “Pseudo Slave” functions are desired.**)

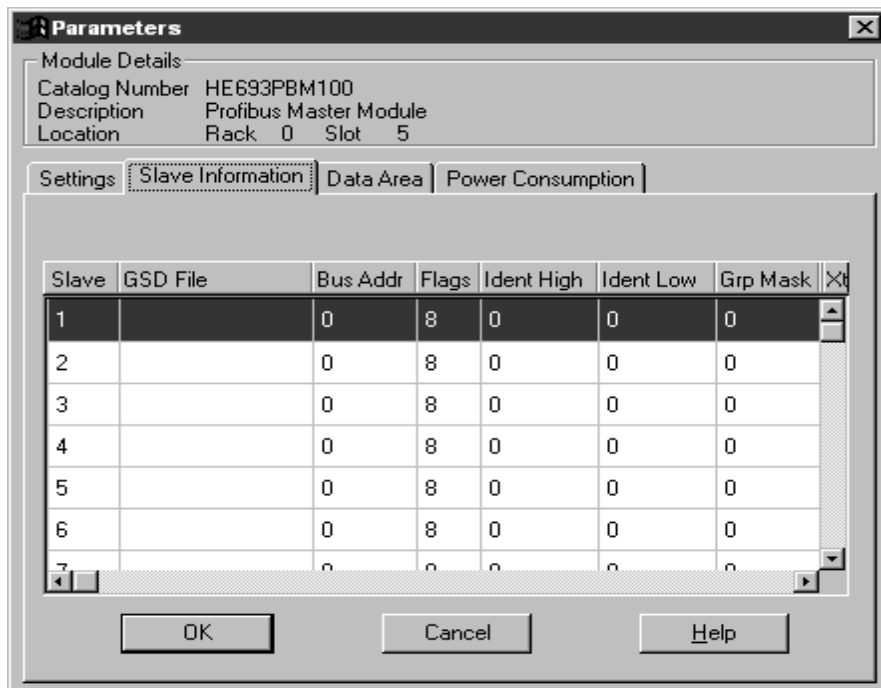


FIGURE 3.4

a. The GSD File contains mapping information from the Master to the Slave. This file is imported from the GSD directory.

Note: The GSD Files can be found on the Horner APG’s Web site at www.heapg.com.

b. The BUS Addr field refers to the bus address of the slaves that are being mapped to this Master.

- c. The Flags field sets a bit mask denoting operating characteristics of the particular slave.

| | |
|---------|--|
| Bit 0-2 | Reserved |
| Bit 3 | 1 = Watchdog Control Activated; 0 = Not Activated |
| Bit 4 | 1 = Operate in Freeze mode, 0 = No Freeze Control |
| Bit 5 | 1 = Operate in Sync Mode, 0 = No Sync Mode |
| Bit 6-7 | Lock Control – 00 = TsdR can change only, 10=slave will be unlocked for other masters, 01=slave is locked for other masters, all parameters accepted except TsdR; 11=slave is unlocked for other masters |

- d. The Ident High field sets the High byte Ident Number of the DP-Slave device as assigned by the Profibus Trade Organization.
- e. The Ident Low field sets the Low byte Ident number of the DP-Slave device as assigned by the Profibus Trade Organization.
- f. The Grp Mask field sets the Bit Mask denoting group control for Freeze and Sync Functions. Each bit identifies a particular group. Group Control is only possible if bit 7 in the above Operating Flags is set to 1.

Step 9: Next Click on the Data Area tab, the following screen should appear (**Figure 3.5**).

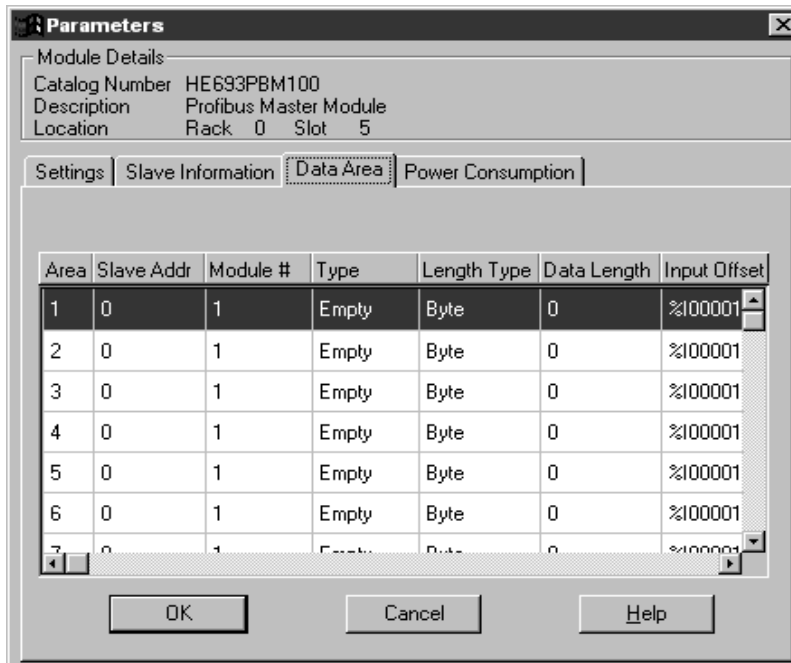


Figure 3.5

- a. This tab is where the configuration for the mapping of the Profibus-DP network data to PLC memory locations is completed. The order that the data is configured must be identical to that of the DP-Slave. If configuration mismatches exist, no data is exchanged with that particular slave. For the HE693PBS105 Slave Module, output data must be configured first on the list for each slave. For example, if there is a slave at bus address 3 with an input configuration and an output configuration, the output must be configured before the input.
- b. To configure the slave at bus address 3, start on the next available unused line (in Figure 2-5 this is the very first line, represented by Area 1), Enter in the bus address (for this example it will be 3). Enter a "1" for the module number. The module type will be "Output" so left click on the field with the mouse and select output from the pull down menu. The Length Type is either a byte or a word, and the data length is the desired length. The remainder of the lines are used to map the input and outputs to the slave.
- c. To configure the input, tab down to the next line (area 2 in **Figure 3.5**). Enter a 3 for the Slave Address. The module type is a 2. Since the slave is configured for both inputs and outputs, it is looked at by the master as two modules with the same bus address. Configure the type, length, and mapping as before. The master is now configured for a slave at bus address 3 and as both in input device and an output device.

NOTE: It is important to remember that an input to the Slave is an Output to the Master and vice-versa.

| Table 3.3 – Fields on the Data Area Tab | |
|---|---|
| Area | Memory area being defined within the PLC. It is not configurable. The master currently supports configuring 64 unique areas. |
| Slave Address | Bus address of the particular slave for which you are adding a data area mapping. It must be equal to a corresponding value set in the Slave n Settings tab. |
| Module # | Particular module ID which is being configured for the given slave address. The number of modules used must be identical to the slave configuration for proper data exchange to occur. For example, if the slave to which communication is desired is a GE Fanuc Field Control Profibus BIU which has an input module followed by an output module, the number of modules would be three. The Module # of the area mapped to the BIU would be 1; the Module # of the input module would be 2; and the Module # of the output module would be 3. |
| Type | Data Type of module being defined. Possible types are: Input, Output, I/O (both input and output), Special input, Special output, Special I/O, and Empty. |
| Length Type | Specifies whether data is of type Byte or Word. |
| Data Length | Length of data. This value is expressed in units according to the Length Type field. If the Type field is set to I/O, this value is both the length of the input and the length of the output. Range is 0-16. A value of 0 implies that this area is not defined. |
| Input Offset | Memory location in PLC where input data will be mapped. This field must be set if the Type value is Input or I/O. |
| Output Offset | Memory location in PLC where output data will be mapped. This field must be set if the Type value is Output or I/O. |
| Consistency | Consistency Option Flag. Possible choices are: "Byte/Word" and "Entire Length". (Not used for "Special" Types) |
| Special In Byte | Data Byte used for Types Special Input and Special I/O. This byte (range 0-ff) represents a special input identifier as defined by a particular slave. |
| Special Out Byte | Data Byte used for Types Special Output and Special I/O. This byte (range 0-ff) represents a special output identifier as defined by a particular slave. |

- d. The "Power Consumption Tab" is used to display power consumption characteristics of the module. No fields are editable on this tab.
- e. After the configuration is complete download the configuration to the PLC. Complete details on how to do so can be found in GE Fanuc manual GFK-1295A, using CIMPLICITY CONTROL.

NOTES

CHAPTER 4: WIRING DIAGRAMS

4.1 Profibus Wiring:

Assembling the cable for use with the DP port on the HE693PBM100 and PBS105.

- a. The HE693PBM100 uses a 9-pin D-sub plug connector for its DP port. The pin assignment of the plug connector and the wiring are shown below (Figure 4.1).

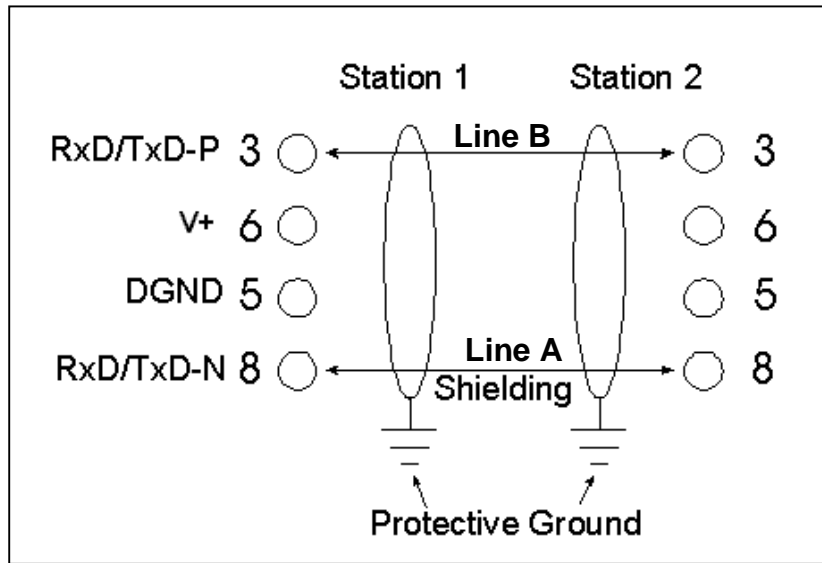


Figure 4.1

- b. It is necessary to terminate both ends of the network. Both terminations must have power to them to insure proper operation of the network. The following diagram (Figure 4.2) illustrates the correct connection for the termination resistors.

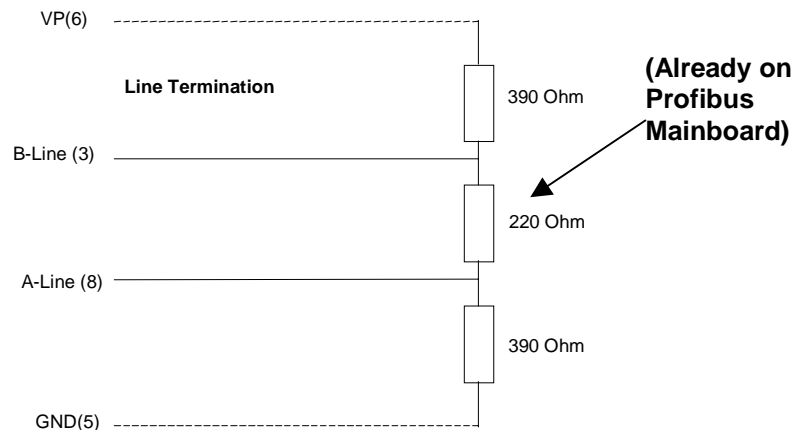


Figure 4.2

NOTE: The above wiring diagram (Fig. 4.2) is for illustrative purposes only. Cabling and connectors must be PTO approved to achieve the desired performance results. See Section 4.3 for recommended part numbers.

- c. The shield braiding and, if present, the shield foil should be connected to protective ground on both sides and with good conductivity via shield clamps covering as large an area as possible. In addition, it is recommended that the data lines be kept separate from all high-voltage cables.

4.2 Other considerations when wiring the Profibus network:

- a. In the Profibus network, up to 32 stations (master or slaves) can be connected per segment without the addition of repeaters. If more than 32 stations are desired repeaters must be used. The repeaters are used to connect individual bus segments together.
- b. The maximum cable length depends on the transmission speed. The specified cable length can be increased by the use of repeaters. However, the use of more than three repeaters in series is not recommended.
- c. The following cable length specifications are based on type-A cable with a 135 to 165 Ohm impedance, less than 30 pf/m capacity, a loop resistance of 110 Ohms/Km, a wire gauge of .64mm, and a conductor area of 0.34mm².

| | | | | | | | |
|--------------------|-------|-------|--------|--------|------|------|------|
| Baud Rate(bit/sec) | 9.6K | 19.2K | 93.75K | 187.5K | 500K | 1.5M | 12M |
| Distance/Segment | 1200m | 1200m | 1200m | 600m | 200m | 200m | 100m |

- d. For data transmission speeds of greater than 500 kbit/sec, Stub lines (free hanging ends of the cable) should be avoided. There are plug connectors available on the market that permit data line A and data line B to be connected directly to the plug connector.

4.3 Recommended Part numbers:

It is highly recommended that the following cable and connectors be used for high speed data transmissions. Both Cable and Connector part numbers are Siemens part numbers.

a. **Connectors:**

Extra 9-pin DSUB for easy cable stacking.



Figure 4.3 - Connectors

b. **Cable: Part Number 6XV1-830-OAH10**

NOTES

APPENDIX A: IMPLEMENTATION OF THE HE693PBM100 “PSEUDO SLAVE”

1.1 General

The “Pseudo Slave” feature of the HE693PBM100 enables users to access the following three functions that are not available using the normal configuration procedure in Chapter 3.

- a. SYNC/FREEZE Control - The Sync/Freeze controls allow the Logic to control the data flow to and from the inputs and outputs of the slaves.
- b. Additional slave “System Diagnosis” status information.
- c. Firmware release information

If the above functions are desired, the user must perform additional configuration procedures as indicated herein Appendix B.

2.1 “Pseudo Slave” Description

The “Pseudo Slave” is neither a physical device nor is it true slave device. The “Pseudo Slave” is simply a part of the software which allows the HE693PBM100 to obtain specific information from a PLC, and thus, provides three additional functions. The “Pseudo Slave” is designed strictly for use by the HE693PBM100.

3.1 Adding the “Pseudo Slave” to the Cimplicity Control Configuration

Although the “Pseudo Slave” is added to the Cimplicity Control Configuration in the same manner as a true slave device, the slave information is not passed to the Profibus network and does not affect network traffic. The “Pseudo Slave” is simply an extension of the HE693PBM100’s I/O.

1. While configuring the Master Module, select the Slave information tab. This will allow the addition of slaves to the Master configuration.
2. In the desired line (Slave 1 - 64) click on the “GSD File” field, type a space character followed by the “ENTER”, this will bring up a file selection dialog. (See Chapter 3, Figure 3.4.)
3. Select the “HEMASTIO.GSD” from the directory that contains it. Cimplicity Control will then import the GSD data and insert the I/O modules into the next available fields in the “Data Area”. The needed “Slave Information” fields will also be filled.
4. After the import is finished, the Slave address must be assigned. Enter any valid unused address into the “Slave Information” “Bus Address” field. This address must be used to update the “Data Area” “Slave Address” fields of the modules added by the Import. The “Data Area” “Modules #” fields will also need to be updated so that they are numbered sequentially from 1 to 8. (See Chapter 3, Figure 3.5.)
5. The “HEMASTIO.GSD” contains data to setup the slave as follows:

| | | |
|------------------------|----------|---------------------------------|
| Slave Ident | = 0x0008 | “Special Reserved Ident Number” |
| 1 st module | = 0x23 | - 4 bytes of Output |
| 2 nd module | = 0x11 | - 2 bytes of Input |
| 3 rd module | = 0x17 | - 8 bytes of Input |

Module 1 is used to pass Sync/Freeze control data, module 2 is used to pass firmware version information, and module 3 is used to pass the additional slave status data.

6. Although Cimplicity Control assigns Data Offset values to each module, these can be changed by the user to optimize their use in logic. These offsets can be referenced as %I, %Q, %AI, %AQ and %R types.

4.1 Accessing Additional Functions of the HE693PBM100

4.1.1 SYNC/FREEZE Control

The following explanation describes the SYNC/FREEZE function and indicates the information needed to setup the SYNC/FREEZE parameters in the program language being used (such as Ladder Logic, C-Programming, etc.).

- a. The SYNC/FREEZE controls allow the Logic to control the data flow to and from the inputs and outputs of the slaves. The FREEZE control can be used to synchronize the slave inputs and the SYNC command is used to synchronize the slaves' outputs.
- b. The FREEZE control freezes the physical input data existing on one or more slaves simultaneously, like taking a snap shot. The selected slave(s) will stay in the frozen state until an UNFREEZE control is issued.
- c. The SYNC control works in much the same way, it will lock the physical output data existing on one or more slaves simultaneously. This data will remain static until an UNSYNC control or new SYNC control is issued. Additional SYNC controls will update the output data.
- d. The slaves can be selected individually or in groups. To use the group functions, the Slaves must have been configured for a group. The "Slave Information" dialog screen contains the "Grp Mask" fields for each slave. This field can contain a group number of 0 - 8. The zero group is a global group.
- e. The format of the SYNC/FREEZE control data is as follows:

Byte 0 = Group data

Bit 0 = Group 1

Bit 1 = Group 2

Bit 2 = Group 3

Bit 3 = Group 4

Bit 4 = Group 5

Bit 5 = Group 6

Bit 6 = Group 7

Bit 7 = Group 8

data FFH = Group 0, Global group

Byte 1 = Slave Address (7FH = broadcast, all addresses)

Byte 2 = Control type

01H = UNFREEZE

02H = FREEZE

04H = UNSYNC

08H = SYNC

Byte 3 = Transmit Control command

This can be any data, as any change in this byte will trigger a Control update.

4.1.2 *Slave Status*

The following explanation describes the Slave Status and indicates the information needed to setup the Slave Status parameters in the program language being used (such as Ladder Logic, C-Programming, etc.).

- a. The Slave Status inputs contain additional information about the slaves which is useful for system diagnosis. This data is contained in 8 bytes with each bit containing the "system diagnosis" state for each slave.
- b. A true bit indicates that the Slave has a fault or has diagnostic information available. These bits correspond to the slaves in the same format as the Master Status Reference. Bit 0 of Byte 0 is the indicator for Slave number 1 of the "Slave Information" dialog, Bit 1 of Byte 0 is the indicator for Slave number 2 and so on. The 64 bits represent the 64 available slaves.

4.1.3 *Master Firmware Version*

The Master Firmware Version function allows a user to determine which firmware version is being used by the HE693PBM100. The following indicates the information needed to setup the parameters for determining firmware version:

The two input bytes of the master Firmware version have to following format:

Byte 0 = High nibble = Major revision number
 Low nibble = Minor revision number

Byte 1 = future use

NOTES