

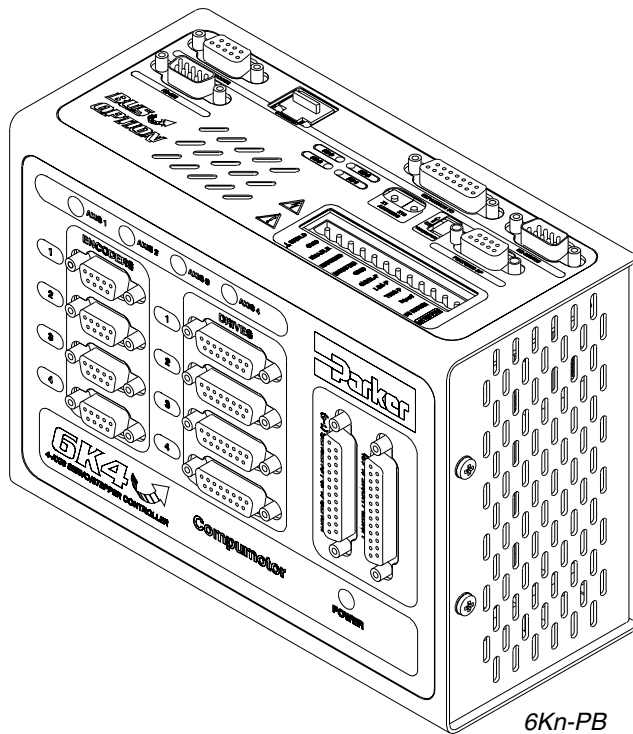


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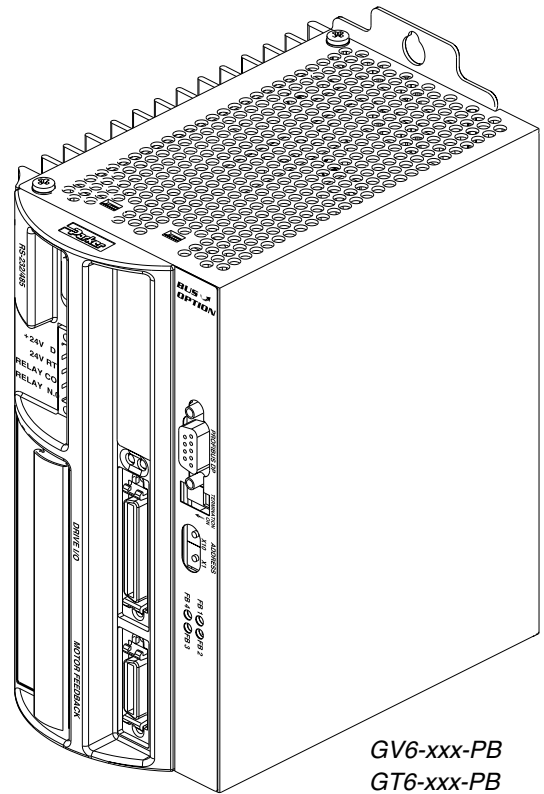
PROFIBUS Guide

for 6K and Gemini products

Effective: August 1, 2002



6Kn-PB



GV6-xxx-PB
GT6-xxx-PB

IMPORTANT

User Information



WARNING



Parker Automation products are used to control electrical and mechanical components of motion control systems. You should test your motion system for safety under all potential conditions. Failure to do so can result in damage to equipment and/or serious injury to personnel.

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Technical Assistance ⇨ Contact your local automation technology center (ATC) or distributor, or ...

North America and Asia:

Compumotor Division of Parker Hannifin
5500 Business Park Drive
Rohnert Park, CA 94928
Telephone: (800) 358-9070 or (707) 584-7558
Fax: (707) 584-3793
FaxBack: (800) 936-6939 or (707) 586-8586
e-mail: tech_help@cmotor.com
Internet: <http://www.compumotor.com>

Europe (non-German speaking):

Parker Digiplan
21 Balena Close
Poole, Dorset
England BH17 7DX
Telephone: +44 (0)1202 69 9000
Fax: +44 (0)1202 69 5750

Germany, Austria, Switzerland:

HAUSER Elektronik GmbH
Postfach: 77607-1720
Robert-Bosch-Str. 22
D-77656 Offenburg
Telephone: +49 (0)781 509-0
Fax: +49 (0)781 509-176

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Change Summary – Revision D

August 1, 2002

This document, 88-019048-01D, supersedes 88-019048-01C. Changes and corrections are noted below.

Topic	Description
Node Address Configuration	<ul style="list-style-type: none"> The software command FBADDR0 is now required to configure the node address via hardware (default from the factory). Refer to page 4 for 6K PROFIBUS; and to page 18 for Gemini PROFIBUS.
FBADDR Command	<ul style="list-style-type: none"> Range for the FBADDR command (Fieldbus Address) is now 0 – 125. The factory default value is now 0. Refer to page 8 for 6K PROFIBUS; and to page 28 for Gemini PROFIBUS.

Purpose of This Guide

This document is designed to help you implement the PROFIBUS features provided in your 6K and Gemini series products, as ordered with the PROFIBUS option. This publication addresses only the installation and programming tasks for the PROFIBUS features. For all other installation and programming instructions, refer to:

- *6K Series Hardware Installation Guide*, part number 88-017547-01
- *6K Series Command Reference*, part number 88-017136-01
- *6K Series Programmer's Guide*, part number 88-017137-01
- *Gemini GV6 Hardware Installation Guide*, part number 88-018364-01
- *Gemini GT6 Hardware Installation Guide*, part number 88-018374-01
- *Gemini Series Programmer's Reference*, part number 88-017778-01
- Refer also to the online help system in Motion Planner

What You Should Know

To install and troubleshoot your 6K and Gemini series products with the PROFIBUS option, you should have a fundamental understanding of:

- Electronics concepts, such as voltage, current and switches.
- Implementing and maintaining a given PROFIBUS network.
- Mechanical motion control concepts, such as inertia, torque, velocity, distance and force.
- Ethernet or serial (RS-232 or RS-485) communication, depending upon which communication protocol you are using.



WARNINGS



The 6K and Gemini products are used to control your system's electrical and mechanical components. Therefore, you should test your system for safety under all potential conditions. Failure to do so can result in damage to equipment and/or serious injury to personnel.

ALWAYS REMOVE POWER to the product before connecting any electrical devices (e.g., fieldbus connections, drives, encoders, I/O bricks, inputs, outputs, etc.).

Certification

6K and Gemini products with the PROFIBUS option have been PTO certified to comply with PROFIBUS-DP international standard EN 50170.

CHAPTER ONE

Implementing 6K PROFIBUS-DP

IN THIS CHAPTER

- [PROFIBUS Overview](#)..... 2
- [Hardware Interface](#) 3
- [Programming Notes](#) 5
- [Command Descriptions](#) 8
- [Programming Scenario](#) 13

6Kn-PB

The PROFIBUS option allows a 6K controller to be controlled via a PROFIBUS master, utilizing the PROFIBUS protocol for robust data exchange. The 6K is implemented as a generic PROFIBUS-DP device, allowing the user's application to fully define the data exchanged with a PROFIBUS master.

Cabling is not provided by Compumotor.

Technical Assistance

Technical questions regarding PROFIBUS should be addressed to your local PROFIBUS User Group. An address list is available on the PROFIBUS Internet site at www.profibus.com.

For support with 6K specific questions, contact Compumotor Applications Engineering at 800-358-9070, or e-mail us at tech_help@cmotor.com.

Implementation Process

PROFIBUS Master (user defined):

1. Use the provided CMTR090D.GSD file. Do not modify.
2. Configure communication baud rate.
3. Configure data packet size.

6K Controller:

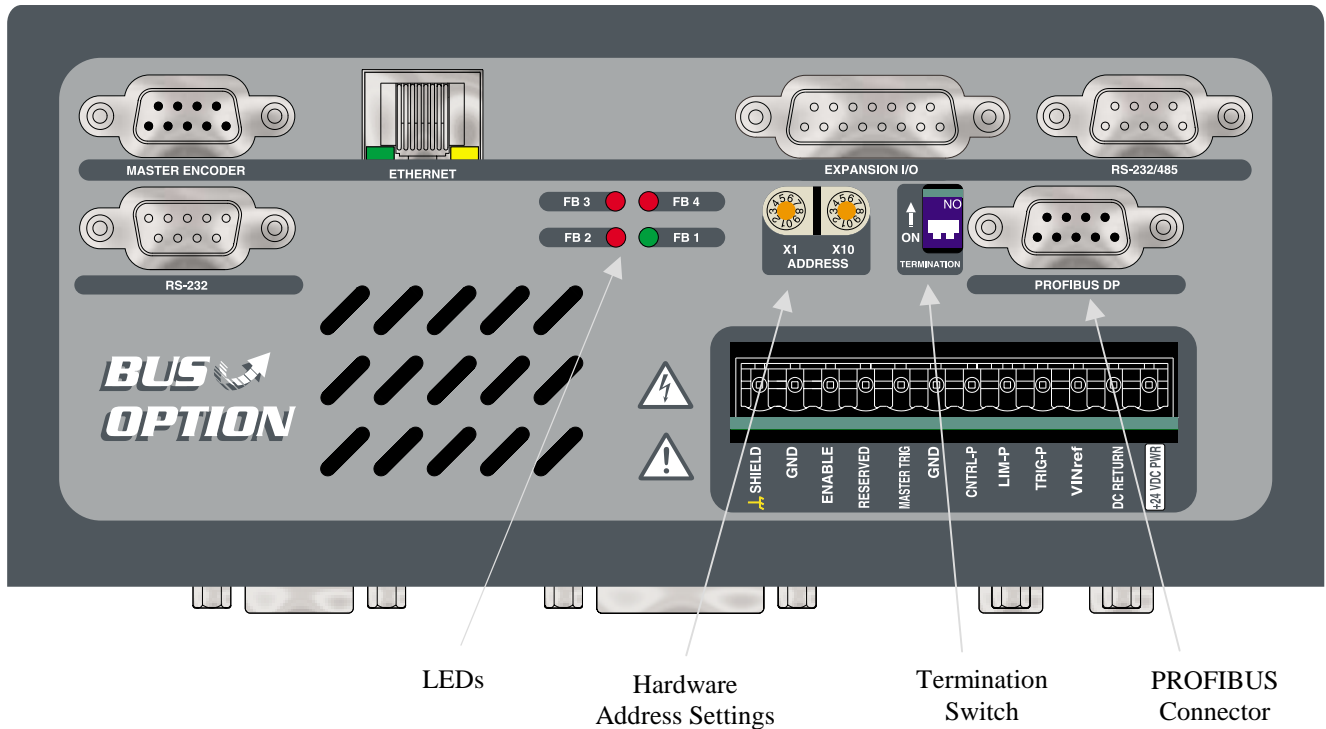
1. Enable/disable terminating resistors as needed (see page 4).
2. Launch Motion Planner (CD-ROM is provided in your ship kit).
3. Establish a direct communication link (serial) with the 6K. Refer to the *6K Series Hardware Installation Guide* for connection instructions.
4. Configure node address (see FBADDR on page 8, or use hardware method on page 4).
5. Configure data packet size (FBSIZE must match master configuration). Refer to step 3 in the PROFIBUS Master implementation process above.
6. Reset the 6K controller to initialize the PROFIBUS card.
7. Write user code using VARB1-VARB8 (depending on data packet size) for sending data from the 6K controller to the PROFIBUS master.
8. Write user code to read data from VARB9-VARB16 (depending on data packet size) for receiving data from PROFIBUS master to 6K controller.

For more information, refer to the Programming Scenario on page 13.

GSD File

Each device in a PROFIBUS network is associated with a GSD file, containing all necessary information about the device. The latest version of the 6K GSD file (CMTR090D.GSD) can be downloaded from www.compumotor.com.

Hardware Interface



LED Status Indicators

Bicolor LED indicators are provided on the PROFIBUS option card. Refer to the following table for troubleshooting information provided by these LEDs.

LED	Steady	Flash	Function	Status *
FB1	--	--	Not used	--
FB2	Off		Module is not online	FBS bit #4= 0
	Green		Module is online	FBS bit #4= 1
FB3	Off		Module is not offline	FBS bit #4= 1
	Red		Module is offline	FBS bit #4 =0
FB4	Off		No diagnostics present	--
		Red	1 flash/second - FBSIZE setting does not match network configuration	--
		Red	4 flashes/second - Hardware failure	--

* To check status, execute the `TFBS` command (bit status report) or the `TFBSF` command (full text status report) in the terminal emulator. You can also use the `FBS` operator to assign or compare one or more status bits (e.g., use in an `IF` expression, assign to `VARB` variable, etc.). Refer to the `TFBS` command description on page 12.

PROFIBUS Connector Pin Out

The following table gives the pin out for the PROFIBUS Connector. The industry standard PROFIBUS connectors are used.

Pin	Name	Function
Housing	Shield	Protective earth
1	Not connected	-----
2	Not connected	-----
3	B-Line	Positive Rx/TxD
4	RTS	Request to send *
5	GND BUS	Isolated GND *
6	+5V BUS	Isolated +5V *
7	Not connected	-----
8	A-Line	Negative Rx/TxD
9	Not connected	-----

* +5V BUS and GND BUS are used for termination. Some devices like optical transceivers (RS485 to fiber optics) might require external power from these pins (not to exceed 80 mA). RTS is used in some equipment to determine the direction of transmission. In normal applications only A-Line, B-Line, and Shield are used.

Termination

If the 6K controller is used as the last node in a network, the termination switch must be in the ON position. Otherwise the switch must be in the OFF position. Please note, if an external termination connector is used, the switch must be in the OFF position.



Node Address

To configure the node address via hardware, two rotary switches are provided to set a node address of 1-99. The software command `FBADDR0` is also required to configure the node address via hardware (default from factory). Setting the rotary switches to 0 enables software configuration of node address (see `FBADDR` on page 8).



Example:

Switch x1 = 3 and x10 = 2, node address is 23

Baud Rate

The 6K will auto detect the baud rate of the PROFIBUS network. For a complete list of supported baud rates, see the `CMTR090D.GSD` file.

Programming Notes

Data Format

When sending data over the fieldbus network, you can configure the data to be consistent over a word or the full data packet (see CMTR090D.GSD and `FBSIZE` on page 10). Most fieldbus masters will support full data packet consistency; however, some resource limited fieldbus masters may only be able to perform data consistency over a word.

The following table represents the internal binary variables and how they map to the data packet. Data is transmitted and received from left to right.

VARB1				VARB2				VARBn			
MSW ¹		LSW ²		MSW		LSW		MSW		LSW	
MSB ³	LSB ⁴	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB

¹ Most significant word, 16-bits, bits 31 to 16

² Least significant word, 16-bits, bits 15 to 0

³ Most significant byte, 8-bits

⁴ Least significant byte, 8-bits

Binary variables within the 6K programming language follow an unconventional format for bit assignment: bit 1 is the left-most bit and bit 32 is the right-most bit. When binary variables are exchanged with a PROFIBUS master, bit 1 may correspond to the right-most bit, and bit 32 may correspond to the left-most bit.

Example:

```
VARB1=h12345678      ; PROFIBUS Master receives, 0x87654321
VARI1=4PE            ; assume encoder position is +230
VARB1=VCVT(VARI1)    ; PROFIBUS Master receives, 0x000000E6
```

Implementing Data Exchange

It is up to the user's 6000 program to facilitate handshaking between the PROFIBUS master and the motion controller. There is no built-in handshaking or data synchronization performed by the motion controller (not to be confused with Sync mode).

To implement mailbox messaging (handshaking) between the 6K controller and the PROFIBUS master, you must set aside 2-bits/message within `VARB1-16`. One bit is used to acknowledge reading a message, a second bit is used notify the recipient a new message is available.

A message is user defined but could be used to control motion on a particular axis, update a task, update I/O, control a set of axes from a single message, or report motion status.

For example, if you would like to send a message from the PROFIBUS master to the 6K controller and then have the 6K controller generate a response message, the PROFIBUS master will use `VARB9` bits 1 and 2, and the 6K controller will use `VARB1` bits 1 and 2.

To send a mailbox message to the PROFIBUS master:

1. Make sure `VARB1 . 1` is equal to `VARB9 . 1`; no unprocessed messages.
2. Place the message in `VARB2` through `VARB8`.
3. Toggle `VARB1 . 1` to indicate new message is available. `VARB1 . 1` is now not equal to `VARB9 . 1`.

To receive a message from the PROFIBUS master:

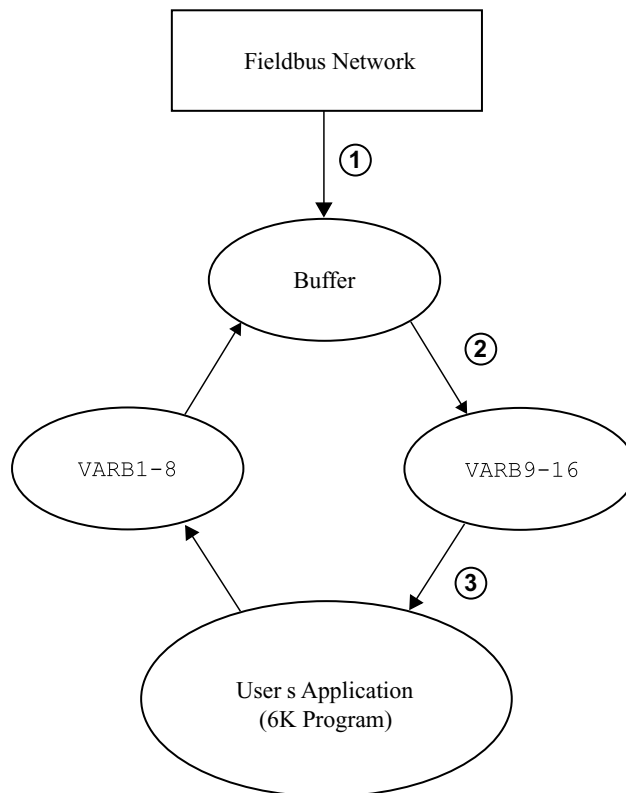
1. Make sure VARB1 . 2 is not equal to VARB9 . 2, new message available.
2. Read the message from VARB10-VARB16.
3. Toggle VARB1 . 2 to acknowledge reading the message. VARB1 . 2 is now equal to VARB9 . 2.

The same operation would be repeated on the master side, except bits 1 and 2 would be reversed. An application scenario using mailbox messaging is provided on page 13.

Network Behavior

For complete list of supported features, see the CMTR090D.GSD file.

The PROFIBUS master has the option to send a Sync Control command to the 6K, which will then exchange VARB9-16 only when a Sync command is received. The following diagram shows how data is exchanged in Sync mode.



1. 6K receives Sync Control command from PROFIBUS master.
2. 6K updates the contents of VARB9-16 from the network.
3. User's application reads the new VARB9-16 contents.

Note: VARB1-8 will still be sent to the master regardless of Sync mode.

Handling a PROFIBUS Fault

If a PROFIBUS fault (Option card fault) occurs, the event causing the fault can be determined by checking the Fieldbus Status bit values (see FBS on page 9).

- If error bit #19 is disabled (`ERROR.19-0`), the controller performs a kill all when a PROFIBUS fault occurs.
- If error-checking bit #19 is set (`ERROR.19-1`), the controller performs a kill all and Error Status bit #19 is set (reported with `ER`, `TER`, and `TERF`). If an error program is assigned with the `ERRORP` command, the 6K controller branches (`GOTO`) to the program.

On power-up or out of reset, the events that can generate a fieldbus fault are ignored. This allows the PROFIBUS master time to commission individual nodes without causing the 6K controller to fault. Error bit #19 is edge sensitive to fault conditions.

To recover from an `ER.19` fault, resolve the cause (see FBS on page 9) or reset the controller. To acknowledge the fault condition, issue the `ERROR.19-0` command and then the `ERROR.19-1` command. Refer also to page 13 for sample application scenarios.

Affected Commands and Features

When the PROFIBUS-DP option is installed, the following 6K commands and features are affected:

- Binary variables are affected by updates performed over the fieldbus network. See `FBSIZE` on page 10 for the exact binary variables affected by the fieldbus network.
- `VARCLR` will have no affect on binary variables assigned to the fieldbus network.
- A user's application will not be permitted to write to `VARB9-16`. If you attempt to change the state of `VARB9-16`, the controller will respond with an error message "`VARB USED BY OPTION CARD`" and the `VARB` command will not be executed; however, command processing will continue.
- A new bit definition for `ERROR` (bit #19) has been added for supporting the option card.
- A new function (option "I") has been added to the `OUTFNC` command to support detection of `ERROR` bit #19 being set.
- All commands preceded by "FB" or "TFB" (e.g., `FBSIZE`, `TFBS`, etc.) will be enabled when a fieldbus card is detected, and disabled when no fieldbus card is present or enabled.
- Ethernet will be disabled on the 6K when the PROFIBUS card is enabled (`OPTEN1`).

Command Descriptions

The following is a list of all the PROFIBUS specific commands. For a complete listing of 6K commands see the *6K Series Command Reference*.

ERROR (Error Checking Enable)See page 8
 FBADDR (Fieldbus Address)See page 8
 [FBS] (Fieldbus Status).....See page 9
 FBFSIZE (Fieldbus Data Size Packet)See page 10
 OPTEN (Option Card Enable/Disable)See page 10
 OUTFNC (Output Function).....See page 11
 TFBS (Transfer Fieldbus Status)See page 11
 TFBSF (Fieldbus Status Full Text)See page 12
 TOPSTS (Option Card Status Full Text).....See page 12

ERROR Error Checking Enable

Type:	Communication Setup	Product	Rev
Syntax:	<!><%>ERROR... (32bits)	6Kn-PB	5.2
Units:	n/a		
Range:	b=0 (disable), 1 (enable), or X (don't change)		
Default:	0		
Response:	ERROR: *ERROR0000_0000_0000_0000_0000_0000_0000_0000		
See Also:	OUTFNC, FBS, TER, TERF		

A new bit assignment is added for the ERROR command, bit #19.

See FBS on page 9 for the event causing the error condition. To clear the error event, first resolve the cause, and then issue the ERROR.19-0 command followed by the ERROR.19-1 command. Error bit 19 is edge sensitive to error events.

In the event an option card fault occurs, VARB1-16 are cleared on the controller side.

Bit #	Function	Branch Type
19	Option card fault	GOTO

FBADDR Fieldbus Address

Type:	Communication Setup	Product	Rev
Syntax:	<!>FBADDR<i>	6Kn-PB	5.2
Units:	i = fieldbus address		
Range:	i = 0-125		
Default:	0		
Response:	FBADDR: *FBADDR3		
See Also:	FBFSIZE, TOPSTS		

Use the FBADDR command to report the controller's current node address assignment and set the node address via software. The new value is saved into nonvolatile memory, and becomes effective after the controller is reset. Network configuration of node address is not supported. This command cannot report the hardware configuration setting. In order to set the node address via software, the hardware configuration method must be disabled (default from factory). Setting FBADDR0 is required to return to the hardware configuration method. See [Node Address](#) on page 4.

If the hardware configuration method is used to set the address, any attempt to set the address via software will be ignored and the message “CONFLICT WITH HARDWARE SETTING - DISABLE HARDWARE CONFIG FIRST” will be reported back.

Example:

Assume controller was assigned node address 1 out of reset:

```
>FBADDR
*FBADDR1
>FBADDR3      Set node address to 3
>FBADDR
*FBADDR3      New network setting will take effect after unit is reset!
```

[FBS]	Fieldbus Status	Product	Rev
Type:	Communication Setup	6Kn-PB	5.2
Syntax:	See below		
Units:	n/a		
Range:	n/a		
Default:	n/a		
Response:	n/a		
See Also:	ER.19, TFBS, TFBSF		

Use the FBS command to assign the fieldbus status to a binary variable or for use in a comparison command.

Example:

```
IF(FBS.4=b1) ;Branch based on the status of FBS bit 4
```

The Fieldbus Status register bits are defined as follows:

Bit #	Function (1=Yes, 0=No)	Description
1	TIMEOUT ^{1,2}	Watchdog timed out. Controller has lost communication with fieldbus card
2	CHECKSUM FAULT ^{1,2}	Fieldbus card failed hardware check on boot-up
3	HWD CFG MODE	0 - Configuration set via software, 1 - Configuration set via hardware
4	ONLINE ^{1,3}	Controller is connected and data exchange is possible
5-32	RESERVED	

¹ If any of these error conditions occur (bit #1 = 1, bit #2 = 1, or bit #4 = 0), the motion controller will perform a Kill (K command) on all axes. If error-checking bit #19 is enabled with the ERROR command (ERROR.19-1) the controller will also set error status bit #19 (ER, TER, and TERF) and branch to the ERRORP program.

² Error event is latched. Reset the controller to clear the error.

³ Error event is recoverable, if error checking (ERROR) bit #19 is enabled and ERRORP program exists. If error bit #19 is disabled or no ERRORP program exists, the event becomes latched, and you will need to reset the controller to clear the error.

FBSIZE Fieldbus Data Packet Size

Type:	Communication Setup	Product	Rev
Syntax:	<!>FBSIZE<i>	6Kn-PB	5.2
Units:	n/a		
Range:	i = 1-8		
Default:	8		
Response:	FBSIZE: *FBSIZE8		
See Also:	FBADDR, TOPSTS		

Use the FBSIZE command to set the number of binary variables exchanged with a PROFIBUS master. Data received or sent to the master is of the same size (cyclic), and each binary variable is 4 bytes. The new value is saved into nonvolatile memory, and becomes effective after the controller is reset.

Example:

```
FBSIZE8            ;Set fieldbus data packet size to 8 binary variables.
FBSIZE2            ;Set fieldbus data packet size to 2 binary variables.
```

Here are the variable assignments (from the controller's perspective) for each possibility of FBSIZE:

Command	Data Out	Data In
FBSIZE1	VARB1-VARB1	VARB9-VARB9
FBSIZE2	VARB1-VARB2	VARB9-VARB10
FBSIZE3	VARB1-VARB3	VARB9-VARB11
FBSIZE4	VARB1-VARB4	VARB9-VARB12
FBSIZE5	VARB1-VARB5	VARB9-VARB13
FBSIZE6	VARB1-VARB6	VARB9-VARB14
FBSIZE7	VARB1-VARB7	VARB9-VARB15
FBSIZE8	VARB1-VARB8	VARB9-VARB16

Regardless of FBSIZE setting, VARB1-16 are reserved for PROFIBUS activity and are not available for general use.

OPTEN Option Card Enable/Disable

Type:	Communication Setup	Product	Rev
Syntax:	<!>OPTEN<i>	6Kn-PB	5.2
Units:	n/a		
Range:	r = 0 (disable) or 1 (enable)		
Default:	1		
Response:	OPTEN: *OPTEN1		
See Also:	TOPSTS		

Use the OPTEN command to enable (OPTEN1) or disable (OPTEN0) the option card on power-up. This feature allows Ethernet to be enabled when an option card is installed but disabled (if applicable). It also restores VARB1-16 for use by the user's application. Caution: If you later re-enable OPTEN1, VARB1-16 are then reserved for fieldbus activity.

NOTE: The new value is saved into non-volatile memory, and becomes effective *after power is cycled*.

OUTFNC Output Function

Type: Output **Product** **Rev**
Syntax: <!>OUTFNC<i><-<a>c>
Units: i = output #, a = axis, c = function identifier
(letter) 6Kn-PB 5.2
Range: i = 1-32 (I/O brick dependent), a = 1-8 (depends on
product), c = A-I
Default: c = A (programmable output function - default)
Response: OUTFNC: (function and status of onboard outputs)
LOUTFNC: (function and status of outputs on I/O
brick 1)
LOUTFNC1: *LOUTFNC1-A PROGRAMMABLE OUTPUT - STATUS
OFF

See Also:

An additional function (I) is added to the OUTFNC functions:

Identifier	Function Description
I	Option Card Fault: Output activates when error bit #19 is set for the option card fault. See the ERROR command for description of events. This requires ERROR.19-1 to be set, or the output will not activate. The OUTFNC-I command can only be assigned to task 0. If it is assigned to other than task 0, the error message "ALTERNATE TASK NOT ALLOWED" will be generated. OUTFNC-I cannot be assigned to a specific axis.

Example:

```
0%LOUTFNC8-i ; Assign brick 1, output 8 to option card fault
0%LOUTFNC1-i ; Assign on-board output 1 to option card fault
2%LOUTFNC1-i ; Only task 0 allowed
2%ALTERNATE TASK NOT ALLOWED
```

TFBS Transfer Fieldbus Status

Type: Communication Setup **Product** **Rev**
Syntax: <!>TFBS<.i> 6Kn-PB 5.2
Units: i = status bit number
Range: 1-32
Default: n/a
Response: TFBS: TFBS.4: *1 (unit online or link ok, yes)
*TFBS0001_0000_0000_0000_0000_0000_0000_0000

See Also: ER.19, [FBS], TFBSF

The TFBS command provides information on the 32 fieldbus status bits. The TFBS command reports a binary bit report. If you would like to see a more descriptive text based report, use the TFBSF command.

Response for TFBS: *TFBS0001_0000_0000_0000_0000_0000_0000_0000

Bit#1...bit#32

For bit description, see FBS on page 9.

TFBSF Fieldbus Status Full Text

Type:	Communication Setup	Product	Rev
Syntax:	<!>TFBSF	6Kn-PB	5.2
Units:	n/a		
Range:	n/a		
Default:	n/a		
Response:	see example		
See Also:	ER.19, [FBS], TFBS, TOPSTS		

Use the TFBSF command to check the status of the fieldbus and display the status in full ASCII text to a terminal.

For status description, see FBS on page 9.

Example TFBSF response:

* TIMEOUT	NO	RESERVED	NO
* CHECKSUM FAULT	NO	RESERVED	NO
* HWD CFG MODE	NO	RESERVED	NO
* ONLINE	YES	RESERVED	NO
*			
* RESERVED	NO	RESERVED	NO
* RESERVED	NO	RESERVED	NO
* RESERVED	NO	RESERVED	NO
* RESERVED	NO	RESERVED	NO
*			
* RESERVED	NO	RESERVED	NO
* RESERVED	NO	RESERVED	NO
* RESERVED	NO	RESERVED	NO
* RESERVED	NO	RESERVED	NO
*			
* RESERVED	NO	RESERVED	NO
* RESERVED	NO	RESERVED	NO
* RESERVED	NO	RESERVED	NO
* RESERVED	NO	RESERVED	NO

TOPSTS Option Card Status Full Text

Type:	Communication Setup	Product	Rev
Syntax:	<!>TOPSTS	6Kn-PB	5.2
Units:	n/a		
Range:	n/a		
Default:	n/a		
Response:	see example		
See Also:	OPTEN, TFBSF		

Use the TOPSTS command to check the status of the option card, and display the status in full ASCII text to a terminal.

Example TOPSTS response:

*6K OPTION CARD STATUS
*
*Option Card Enabled: Yes
*Option Card Type: PROFIBUS-DP
*Option Card Firmware Rev: 92-018751-01-1.1
*Option Card Serial Number: 8-65535-65535
*
*6K PROFIBUS Product ID: 2317 (decimal)
*6K PROFIBUS Configured Via Software
*6K PROFIBUS Packet Size: FBSIZE8
*6K PROFIBUS Address: FBADDR1

Programming Scenario

NOTE: To understand the overall implementation process, refer to page 2.

```
*****
DEL ERHND
DEF ERHND

;-----
;Fieldbus error event
;If the error event can be resolved, an unconditional jump is made to
;re-initialize the controller.
;-----
IF (ER.19 = b1)
    ;Insert application specific events to execute when a fieldbus error occurs.

    ;Wait for controller to go back online
    WAIT(FBS = b00X1)

    ; Controller back online
    ERROR.19-0      ;Acknowledge error event has been resolved
    ERROR.19-1      ;

    JUMP MAIN      ;Call to MAIN or other suitable initializer.
NIF

;-----
;Post power-up error event
;If the error event can be resolved, an unconditional jump is made to
;re-initialize the controller.
;-----
IF (FBS <> b00X1)
    ;Wait for controller to go back online
    WAIT(FBS = b00X1)

    JUMP MAIN
NIF

END ;ERHND program

*****

;-----
;MAIN program
;
;In this program, the fieldbus error handler is assigned, enabled, and an output
;is activated when a fieldbus error occurs.
;
;Next a power-up check is made to determine if the 6k is active on the fieldbus.
;If not, the controller makes an unconditional jump to the error handler.
;
;After completing configuration and power-up checks, the controller begins
;exchanging data with the master. This section demonstrates mailbox messaging.
;
;-----
DEL MAIN
DEF MAIN

    ;Initialize controller
    ERRORP ERHND      ;Assign error handler program
    ERROR.19-1        ;Run ERRORP program (ERHND) when fieldbus error occurs
    OUTFNC8-I        ;Activate onboard output 8 if fieldbus fault occurs
```

```

;Post power-up check to verify no fieldbus errors exist.
IF(FBS <> b00X1) ;Check to see if it's online
    JUMP ERHND ;Fieldbus error, jump to error program
NIF

;Application's main loop
L
    IF(VARB9.1 <> VARB1.1)
        ;SEND NEW MESSAGE TO MASTER
        WRITE"SENT NEW MESSAGE"

        VARI1=4PE ;Assign axis 4 encoder position to VARI1
        VARB2=VCVT(VARI1) ;Send encoder position out

        VARB1=VARB1^H1 ;Notify master new message exists
        T2
    NIF

    IF(VARB9.2 <> VARB1.2)
        ;READ MESSAGE FROM MASTER
        WRITE"GOT NEW MESSAGE"

        VAR10=VCVT(VARB10)
        A,(VAR10) ;Assign new accel value

        VAR11=VCVT(VARB11)
        D,(VAR11) ;Assign new distance value

        VARB1=VARB1^H2 ;Acknowledge message received
        T2
    NIF
LN

END ; MAIN program

;*****
STARTP MAIN ;Assign MAIN as the program to be run automatically on power-up and reset.

```

CHAPTER TWO

Implementing Gemini PROFIBUS-DP

IN THIS CHAPTER

- PROFIBUS Overview 16
- Hardware Interface 17
- Configuration and Programming 19
- Acyclic Command Messages 20
- Command Descriptions 28
- Configuration Example 32

Gemini GT6-PB/GV6-PB

The Gemini GT6-PB and GV6-PB are high performance stepper and servo drives designed to support the PROFIBUS Trade Organization (PTO) specification for PROFIBUS-DP. These compact digital drives offer features such as digital tuning and notch filters for our servos, as well as sensorless stall detect and ABS damping for our steppers. These drive/controllers are configured over RS232/485 with either Motion Planner on a full size PC or laptop, or Pocket Motion Planner on a pocket PC.

Cabling is not provided by Compumotor.

Technical Assistance

Technical questions regarding PROFIBUS should be addressed to your local PROFIBUS User Group. An address list is available on the PROFIBUS Internet site at www.profibus.com.

For support with Gemini specific questions, contact Compumotor Applications Engineering at 800-358-9070, or e-mail us at tech_help@cmotor.com.

Implementation Process

PROFIBUS Master (user defined):

1. Use the provided CMTR090E.GSD file. Do not modify.
2. Select the module type “Gemini Drive (9 words IN/OUT)”.
3. Configure communication baudrate.

Gemini Drive:

1. Enable/disable terminating resistors as needed (see page 18).
2. Launch Motion Planner (CD-ROM is provided in your ship kit).
3. Establish a direct communication link (serial) with the Gemini. Refer to your hardware installation documentation for connection instructions.
4. Configure node address (see FBADDR on page 28, or use hardware method on page 18).
5. Configure cyclic data exchange (see FBPIC and FBPOC on page 29).
6. Configure programmable outputs (see FBMASK on page 29).
7. Reset the Gemini drive to initialize the PROFIBUS card.

GSD File

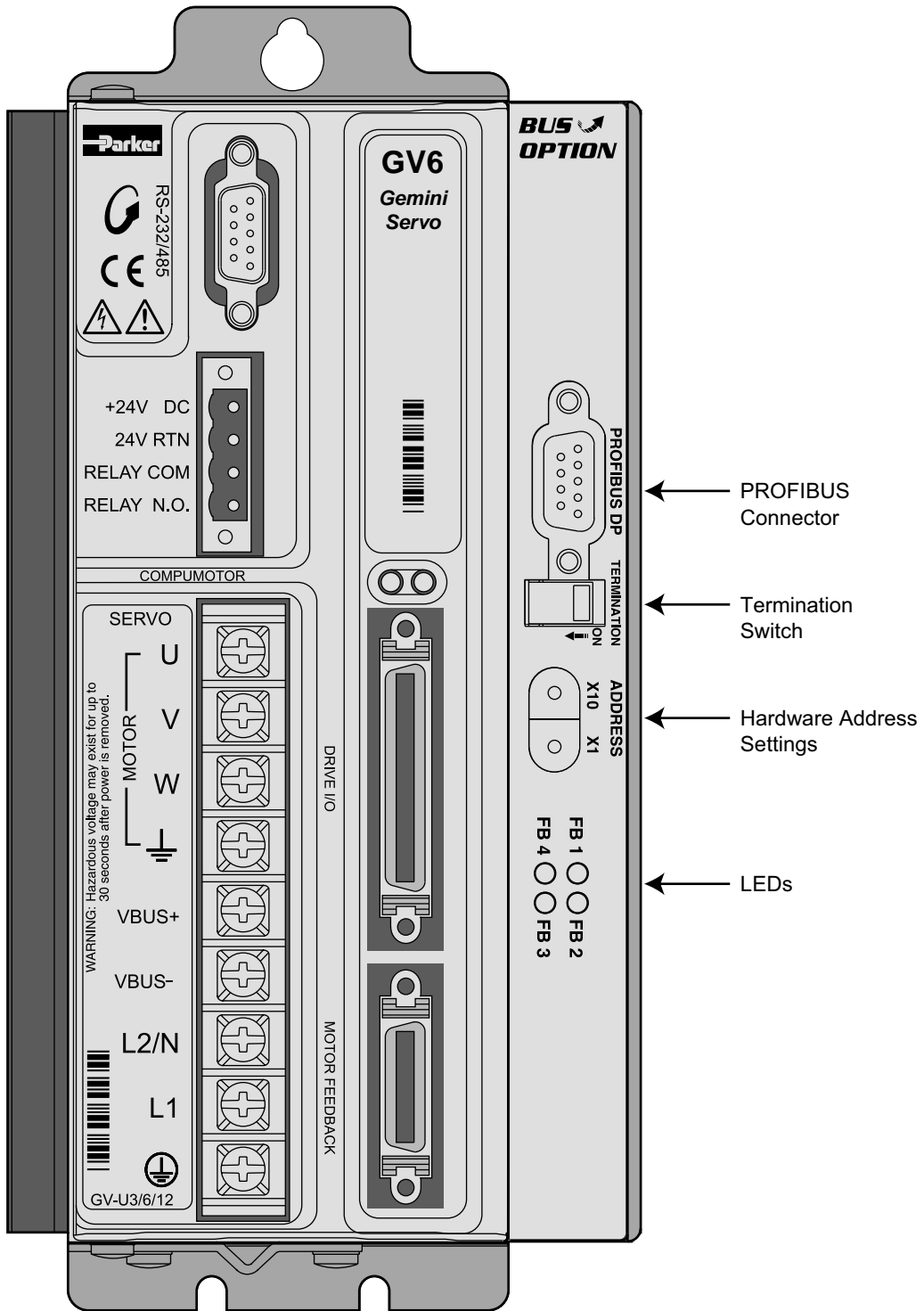
Each device in a PROFIBUS network is associated with a GSD file, containing all necessary information about the device. The latest version of the Gemini GSD file (CMTR090E.GSD) can be downloaded from www.compumotor.com.

Data Types

The table below describes the data type, number of bits, and min/max values.

Data Type	Number of Bits	Min Value	Max Value
BOOL (Boolean)	1	0 (False)	1 (True)
SINT (Short Integer)	8	-128	127
USINT (Unsigned Short Integer)	8	0	255
INT (Integer)	16	-32768	32767
UINT (Unsigned Integer)	16	0	65535
DINT (Double Integer)	32	-2 ³¹	2 ³¹ -1
UDINT (Unsigned Double Integer)	32	0	2 ³² -1

Hardware Interface



LED Status Indicators

Bicolor flashing LED indicators are provided on the PROFIBUS option card. Refer to the following table for troubleshooting information provided by these LEDs.

LED	Steady	Flash	Function	Status *
FB1	--	--	Not used	--
FB2	Off		Module is not online	FBS bit #4 = 0
	Green		Module is online	FBS bit #4 = 1
FB3	Off		Module is not offline	FBS bit #4 = 1
	Red		Module is offline	FBS bit #4 = 0
FB4	Off		No diagnostics present	--
		Red	4 flashes/second - Hardware failure	--

* To check status, execute the `TFBS` command (bit status report). You can also use the `FBS` operator to assign or compare one or more status bits (e.g., use in an `IF` expression, etc.). Refer to the `TFBS` command description on page 32.

PROFIBUS Connector Pin Out

The following table gives the pin out for the PROFIBUS Connector. The industry standard PROFIBUS connectors are used.

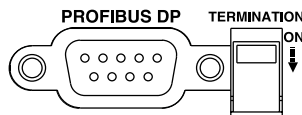
Pin	Name	Function
Housing	Shield	Protective earth
1	Not connected	-
2	Not connected	-
3	B-Line	Positive Rx/TxD
4	RTS	Request to send *
5	GND BUS	Isolated GND *
6	+5V BUS	Isolated +5V *
7	Not connected	-
8	A-Line	Negative Rx/TxD
9	Not connected	-

* +5V BUS and GND BUS are used for termination. Some devices like optical transceivers (RS485 to fiber optics) might require external power from these pins (not to exceed 80 mA). RTS is used in some equipment to determine the direction of transmission. In normal applications only A-Line, B-Line, and Shield are used.

Termination

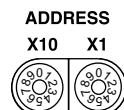


If the Gemini driver/controller is used as the last node in a network, the termination switch must be in the ON position. Otherwise the switch must be in the OFF position. Please note, if an external termination connector is used, the switch must be in the OFF position.



Node Address

To configure the node address via hardware, two rotary switches are provided to set a node address of 1-99. The software command `FBADDR0` is also required to configure the node address via hardware (default from factory). Setting the rotary switches to 0 enables software configuration of node address (see `FBADDR` on page 28).



Example:
Switch x1 = 3 and x10 = 2, node address is 23

Baud Rate

The Gemini drive/controller will auto-detect the baud rate of the PROFIBUS network. For a complete list of supported baud rates, see the CMTR090E.GSD file.

Configuration and Programming

There are no dip switches, pots, etc. for configuration and adjustment on any of the drives. All parameters on the drives are set over RS-232/485 except with regard to the PROFIBUS card. This card provides rotary switches for device number.

Basic Requirements

The Gemini PROFIBUS options (GV6-PB and GT6-PB) are based on the Gemini GV6 and GT6 platforms. All commands supported by GV6 and GT6 drives are also supported by GV6-PB and GT6-PB drives. See the *Gemini Series Programmer's Reference* for a complete listing of Gemini commands. Additional PROFIBUS-specific commands are listed on page 28 in this manual.

All commands that are sent over PROFIBUS are treated as immediate commands by the Gemini drive (i.e. the command will execute as soon as you send it to the drive).

Data Format Requirements

Devices are expected to operate in the following environment:

BKD (8 Bytes)				PZD				
				STW	PAD (8 BYTES)			
BKE	IND	BDA		ZSW	PED (8 BYTES)			
			0 1 2 3			0 1 2 3 4 5 6 7		

Data Coherency

Coherency is the amount of data that must be changed as a single block. It is important that multiple-byte data all change at the same time so that the correct values are received by the drive. The Gemini Drive module in the CMTR090E.GSD file breaks the data into three separate, coherent sections: BKD (3 words), STW/ZSW (1 word), PAD/PED (3 words).

Acyclic Command Messages

Acyclic messaging provides generic, multi-purpose communication paths between two devices. Acyclic messages are exchanged across the BKD section of the 18-byte data. Acyclic messages are used to command the performance of a particular task and to report the results of performing the task. The meaning/intended use of an acyclic message is stated within the BKE data word. Acyclic messaging provides the means by which typical request/response oriented functions are performed (e.g. module configuration).

PROFIBUS defines an acyclic messaging protocol that states the meaning of the message. An acyclic message consists of the command ID and the command data. All commands are not stored in non-volatile memory and are treated as immediate commands by the Gemini drive.

NOTE: The Gemini PROFIBUS interface only processes a new command if one of the incoming bytes has changed. Thus, if the interface is being used to poll a single status word (i.e. TAS) and the PZD data is not changing, the response will reflect the value at the time the initial BNU command was received by the drive; changes in the status word will not be updated in the BNU response. However, the values returned from the drive in the STW and PAD will be continually updated, regardless of the input packet.

Acyclic Message Command

The Command data sent from a master to the Gemini:

BKE

Octet 1								Octet 2							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
ACK								BNU							

ACK: Command sent to Gemini drive. See ACK table on page 22.

BNU: Acyclic command sent (Attribute number goes here)

IND

Octet 3								Octet 4							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Not currently used															

BDA (command data from the BNU command goes here)

Octet 5								Octet 6							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Octet 7								Octet 8							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

The Command response from a Master request:

BKE

Octet 1								Octet 2							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
ACK								BNU							

ACK: Command response to Master. See the ACK Table on page 22.

BNU: Acyclic command response (Attribute number response)

IND

Octet 3								Octet 4							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Not currently used															

BDA (response data from attribute number)

Octet 5								Octet 6							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Octet 7								Octet 8							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Examples of BDA data lengths:

For 1-bit data (BOOLEAN) or 8-bit data:

Octet 6							
7	6	5	4	3	2	1	0
(MSB) (LSBa)							

For 16-bit data (INTEGER):

Octet 5								Octet 6							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
(MSB)								(LSB)							

For 32-bit data (DOUBLE INTEGER):

Octet 5								Octet 6							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
(MSB)															
Octet 7								Octet 8							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
								(LSB)							

Acyclic Message Response

ACK (Acknowledge)



Command	Command: Master to Gemini	Reply	Reply: Gemini to Master
0	No Command	0	No Reply
1	Write Gemini Parameter	1	Parameter written
2	Read Gemini Parameter/status	2	Status read
3	Execute Gemini command	3	Executed
4	Read Command Status	4	Command Status Read
5	Unused	5	Invalid object
6	Unused	6	Command is read only
7	Unused	7	Command is write only
8	Unused	8	Cannot execute command
9	Unused	9	Unused
10	Unused	10	Unused
11	Unused	11	Unused
12	Unused	12	Unused
13	Unused	13	Unused
14	Unused	14	Unused
15	Unused	15	Unused

Acyclic BNU Commands Type 1 and 2 (Gemini Parameters)

This section describes the required behavior of the acyclic BNU commands sent in the BKE two-word object.

Instance Attributes

#	Attribute Name	Service Name	Description	Units	Range	Default	Scale Factor	Data Type
1	General Fault	Get_Attribute_Single	The logical OR of all fault condition attribute flags in the device. This bit is reset when the fault condition is removed. When active, this indicates a drive failure has occurred (bridge fault, overcurrent, etc). Logical OR of bits 14 and 23 of the TAS command and TAS . 13 if FLTDSB1 is set.	n/a	0 - No Fault 1 - Fault	0	1	BOO L
2	Fault Output	Get_Attribute_Single	Displays state of Hardware Fault Output	n/a	0 - Inactive 1 - Active	0	1	BOO L
3	Profile Units	Get_Attribute_Single	Returns the number of motor/feedback counts per second for velocity and acceleration/ deceleration. ERES command for servo and DRES for steppers	counts	200-1024000 (GV) 200-128000 (GT)	1	1	DINT
4	Home Active Level	Get_Attribute_Single Set_Attribute_Single	Sets the active level of the Hardware Home Input. INLVL for INFNCn-T. If no home input is defined, this is an invalid object.	n/a	0 - Active Low 1 - Active High	0	1	BOO L
5	Home Input Level	Get_Attribute_Single	Status of the home input. TIN command. Returns 0 if no home input is defined.	n/a	0 - Off 1 - On	0	1	BOO L
6	Forward Limit	Get_Attribute_Single Set_Attribute_Single	Motion is allowed in positive direction when active. Set when forward limit is active. Write = LH. Read = TAS . 15 .	n/a	0 - Pos. limit not active 1 - Pos. limit active	0	1	BOO L

#	Attribute Name	Service Name	Description	Units	Range	Default	Scale Factor	Data Type
7	Reverse Limit	Get_Attribute_Single Set_Attribute_Single	Motion is not allowed in the negative direction when active. Set when the negative limit is active. Write = LH. Read = TAS. 16.	n/a	0 - Neg. limit not active 1 - Neg. limit active	0	1	BOOL
8	Soft Limit Enable	Get_Attribute_Single Set_Attribute_Single	Enables Soft Limit checking (see LS). Returns 1 for LS1, LS2, or LS3; and 0 for LS0. Writing 1 sends !LS3 to drive.	n/a	0 - Disable Soft Limit Check 1 - Enable Soft Limit Check	0	1	BOOL
9	Positive Soft Limit Position	Get_Attribute_Single Set_Attribute_Single	Specifies the positive soft limit position in Position Units. See LSPOS.	n/a	-2^{31} to $(2^{31} - 1)$	n/a	1	DINT
10	Negative Soft Limit Position	Get_Attribute_Single Set_Attribute_Single	This specifies the negative soft limit position in Position Units. See LSNEG.	n/a	-2^{31} to $(2^{31} - 1)$	n/a	1	DINT
11	Enable Drive	Get_Attribute_Single Set_Attribute_Single	Enables/disables motor current. See DRIVE.	n/a	0 - Disable 1 - Enable	0	1	BOOL
12	Target Acceleration	Get_Attribute_Single Set_Attribute_Single	Sets/returns the target acceleration. See A.	rps ²	0.0001 - 9999.9999	10	10000	DINT
13	Target Deceleration	Get_Attribute_Single Set_Attribute_Single	Sets/returns the target deceleration. See AD.	rps ²	0.0001 - 9999.9999	10	10000	DINT
14	Target Velocity	Get_Attribute_Single Set_Attribute_Single	Sets/returns the target velocity. See V.	rps	0.0000 - 200.0000	1	10000	DINT
15	Target Position	Get_Attribute_Single Set_Attribute_Single	Sets/returns the target position. See D.	counts	-2^{31} to $(2^{31} - 1)$	0	1	DINT
16	Average Acceleration	Get_Attribute_Single Set_Attribute_Single	Sets/returns the average acceleration. See AA.	rps ²	0.0001 - 9999.9999	0	10000	DINT
17	Average Deceleration	Get_Attribute_Single Set_Attribute_Single	Sets/returns the average deceleration. See ADA.	rps ²	0.0001 - 9999.9999	0	10000	DINT
18	RESERVED	-----	-----	---	-----	---	---	----
19	Inputs Status	Get_Attribute_Single	Reports the input values. See TIN.	n/a	0000_0000 to 1111_1111 Input 1 	n/a	1	BOOL
20	Outputs Status	Get_Attribute_Single Set_Attribute_Single	Sets/reports the value of the outputs. See OUT and TOUT.	n/a	000_0000 to 111_1111 Output 1 	n/a	1	BOOL
21	Actual Position	Get_Attribute_Single Set_Attribute_Single	Sets a new position. Read = TPE on GV6, or TPC on GT6. Write = PSET.	counts	-2^{31} to $(2^{31} - 1)$	0	1	DINT
22	Drive Status	Get_Attribute_Single	Reports the drive status of the drive. See TAS.	n/a	0000_0000_ 0000_0000... 1111_1111_ 1111_1111...	n/a	1	DINT
23	Error Status	Get_Attribute_Single	Reports the error status of the drive. See TASX.	n/a	0000_0000_ 0000_0000... 1111_1111_ 1111_1111...	n/a	1	DINT
24	Actual Velocity	Get_Attribute_Single	Reports the actual velocity. See TVELA for GV6, TVEL for GT6.	rps	-200.0000000 to 200.0000000	n/a	10000	DINT
25	Positive Torque Limit	Get_Attribute_Single Set_Attribute_Single	Gemini GV6-PB only. Specifies maximum torque motor can achieve. See DMTIP.	Arms	0.00 - 128.00	n/a	256	INT
26	Maximum Dynamic Following Error	Get_Attribute_Single Set_Attribute_Single	Gemini GV6-PB only. Specifies maximum following error allowed before Following Error Fault. See SMPER.	counts	0 to $(2^{31} - 1)$	4000	1	DINT
27	Actual Following Error	Get_Attribute_Single	Gemini GV6-PB only. Reports the actual following error. See TPER.	counts	0 to $(2^{31} - 1)$	n/a	1	DINT

#	Attribute Name	Service Name	Description	Units	Range	Default	Scale Factor	Data Type
28	Position Bandwidth	Get_Attribute_Single Set_Attribute_Single	Gemini GV6-PB only. See DPBW.	Hz	1.00 - 100.00	5.0	327.68	INT
29	Position Damping Ratio	Get_Attribute_Single Set_Attribute_Single	Gemini GV6-PB only. See SGPRAT.	n/a	0.500 - 2.000	1	16384	INT
30	Load to Rotor Inertia Ratio	Get_Attribute_Single Set_Attribute_Single	See LJRAT command.	n/a	0.0 - 100.0	0.0	10	INT
31	Load Damping	Get_Attribute_Single Set_Attribute_Single	Gemini GV6-PB only. See LDAMP.	Nm/rad /sec	0.0000 - 1.0000	0.0000	32768	INT
32	Integrator Enable	Get_Attribute_Single Set_Attribute_Single	Gemini GV6-PB only. See SGINTE.	n/a	0 - Disable 1 - Enable 2 - Enable at end of move	1	1	INT
33	Velocity/ Position Bandwidth Ratio	Get_Attribute_Single Set_Attribute_Single	Gemini GV6-PB only. See SGPSIG.	n/a	0.100 - 2.000	1.000	16384	INT
34	Torque/Force Limit	Get_Attribute_Single Set_Attribute_Single	Gemini GV6-PB only. See DMTLIM.	Nm	0.0 - 500	500	65.536	INT
35	Enable a Gain Set	Get_Attribute_Single Set_Attribute_Single	Gemini GV6-PB only. See SGENB.	n/a	1 - 3	n/a	1	INT
40	Integer Variable	Get_Attribute_Single Set_Attribute_Single	Access to internal integer variables. See VARI.	n/a	-2^{31} to $(2^{31} - 1)$	0	1	DINT

EXAMPLES of Acyclic BNU Commands Type 1 and 2

(xx indicates "don't care")

- Set a velocity of 8.2 rps:
ACK = 1 (write parameter) = 1 hex
BNU = 14 (Target Velocity) = 00E hex
BDA = $8.2 * 10,000$ (desired velocity * scale factor) = 82000 = 14050 hex
This object is a 32-bit parameter so BKD = 10 0E xx xx 00 01 40 50
- Set the bandwidth of the position loop to 50 Hz:
ACK = 1 (write parameter) = 1 hex
BNU = 28 (Position Bandwidth) = 01C hex
BDA = $50 * 327.68$ (desired position loop bandwidth * scale factor) = 16384 = 4000 hex
This object is a 16-bit parameter so BKD = 10 1C xx xx 40 00 xx xx
- Enable soft limit checking:
ACK = 1 (write parameter) = 1 hex
BNU = 8 (Soft Limit Enable) = 008 hex
BDA = $1 * 1$ (desired value * scale factor) = 1 = 1 hex
This object is a Boolean parameter so BKD = 10 08 xx xx xx 01 xx xx
- Read acceleration value:
ACK = 2 (read parameter/status) = 2 hex
BNU = 12 (Target Acceleration) = 00C hex
Send to Gemini drive in BKD = 20 0C xx xx xx xx xx xx
So return value from Gemini drive BKD = 20 0C xx xx 00 07 A1 20
BDA = 00 07 A1 20 hex = 500000 = (accel value * scale factor), so the acceleration is 50 rps/sec.
- Read Position Damping Ratio:
ACK = 2 (read parameter/status) = 2 hex
BNU = 29 (Position Damping Ratio) = 01D hex
Send to Gemini drive in BKD = 20 1D xx xx xx xx xx xx
So return value from Gemini drive BKD = 20 1D xx xx 33 33 xx xx
BDA = 33 33 hex = 13107 = (damping ratio * scale factor) so the damping ratio is 0.8.

- Read Home Input Level:
 ACK = 2 (read parameter/status) = 2 hex
 BNU = 5 (Home Input Level) = 005 hex
 Send to Gemini drive in BKD = 20 05 xx xx xx xx xx xx
 So return value from Gemini drive BKD = 20 05 xx xx xx 01 xx xx
 BDA = 01 hex = 1 = (home input value * scale factor) so the home input state is active.
- Set Variable 5 to 305419896:
 ACK = 1 (write parameter) = 1 hex
 BNU = 40 (Integer Variable) = 028 hex
 IND = 5 (variable number) = 0005 hex
 BDA = 305419896 = 12345678 hex
 This object is a 32-bit parameter so BKD = 10 28 00 05 12 34 56 78
 NOTE: An invalid variable is indicated by an ACK of 9.

Acyclic BNU Commands Type 3 and 4 (Gemini Commands)

This section describes the required behavior of the acyclic BNU commands sent in the BKE 2-word object. See the ZSW for other motion commands.

#	Attribute Name	Service Name	Description	Range	Data Type
1	Start a Profile Move	Get_Attribute_Single Set_Attribute_Single	Used to load command data, start a profile move, and indicate that a profile move is in progress. This will remain set until the motion is complete, or a hard/soft stop is issued. Write = GO. Read = TAS . 1 (motion is commanded).	0 - No Action 1 - Start Move	BOOL
2	Uncompiled Program Selection	Get_Attribute_Single Set_Attribute_Single	Selects and runs a program in the drive. Write = RUN. Read = TSS . 3 (executing a program)	1 - 32	INT
3	Compiled Program Selection	Get_Attribute_Single Set_Attribute_Single	Selects and runs a compiled program in the drive. Write = PRUN. Read = internal value available over PROFIBUS only (not available over RS-232).	1 - 16	INT

EXAMPLES of Acyclic BNU Commands Type 3 and 4

(xx indicates "don't care")

- Execute Program 24
 ACK = 3 (execute Gemini command) = 3 hex
 BNU = 2 (Program) = 002 hex
 BDA = 24 = 1C hex
 This object is an integer parameter so BKD = 30 02 xx xx 00 1C xx xx
- Check Motion
 ACK = 4 (read command status) = 4 hex
 BNU = 1 (Start Move) = 001 hex
 Send to Gemini drive in BKD = 40 01 xx xx xx xx xx xx
 So return value from Gemini drive BKD = 40 01 xx xx xx 01 xx xx
 BDA = 01 hex = 1 = so the motor is currently moving.

PZD (10 Bytes) Cyclic Command Messages

PZD									
STW		PAD (8 BYTES)							
ZSW		PED (8 BYTES)							
		0	1	2	3	4	5	6	7

Gemini to Master (Input bytes – 10 bytes maximum)

STW (required by PROFIBUS - 2 bytes)

Status Word	2 Bytes
Bit 15	Positive direction end-of-travel limit hit
Bit 14	Negative direction end-of-travel limit hit
Bit 13	Moving
Bit 12	New position acknowledgment (bit toggles whenever a new position is received from the master in the PED)
Bit 11	Home successful
Bit 10	In Target Zone
Bit 9	Fieldbus operating
Bit 8	Position error
Bit 7	Alarm warning (indicates a bit is set in TASX)
Bit 6	E-stop (Enable pin)
Bit 5	At velocity
Bit 4	Continuous (1) / Preset (0)
Bit 3	Drive fault
Bit 2	Drive enabled
Bit 1	Absolute (1) / Incremental (0)
Bit 0	Drive ready

PAD (8 bytes, data is sent MSB first)

Available options (configured by FBPIC, see page 29)

#	Attribute	Description	Bytes
0	Zero word	Two-byte placeholder	2 bytes
1	Actual Position	Sends back the actual position of the motor as read by the TPE command for the GV6-PB and TPC for the GT6-PB.	4 bytes
2	Actual Speed	Sends back the actual speed of the motor as read by TVELA for GV6-PB and TVEL for GT6-PB.	4 bytes
3	Inputs	Sends back the current state of the inputs as read by the TIN command.	2 bytes
4	Outputs	Sends back the current state of the outputs as read by the TOUT command.	2 bytes
5	Position Error	Sends back the position error (only valid for GV6-PB).	2 bytes

Master to Gemini (Output bytes – 10 bytes maximum)

ZSW (required by PROFIBUS - 2 bytes)

Control	2 Bytes
Bit 15	Kill
Bit 14	Home in negative direction
Bit 13	Home in positive direction
Bit 12	Direction negative
Bit 11	Direction positive
Bit 10	Teach 0 Position
Bit 9	Absolute (1) / Incremental (0)
Bit 8 *	Enable drive (DRIVE1) and open brake
Bit 7 *	Enable drive (DRIVE1) and brake closed
Bit 6	Mode continuous
Bit 5	Pause (1) / Continue (0)
Bit 4	Stop
Bit 3	PED update toggle
Bit 2 **	Kill and disable drive
Bit 1 **	Drive disable (remove motor power)
Bit 0	Reset

* The brake output must be defined as a general-purpose output (OUTFNC7-A) for these commands to work correctly. If the brake is used as a fault output (OUTFNC7-F), the brake will open for both Bit 7 and Bit 8. Regardless, the DRIVE1 is still executed.

** Bit 1 will only remove motor power; the fault outputs will not be asserted. If a fault output is required as part of the disable process, Bit 2 should be used.

PED (8 bytes, data is sent MSB first)

Available options (configured by FBPOC, see page 30)

#	Attribute	Description	Bytes
0	Zero word	Two-byte placeholder	2 bytes
1	Position (D)	Go to new position	4 bytes
2	Speed (V)		4 bytes
3	Acceleration (A)		4 bytes
4	Outputs (OUT)	Set outputs, OUT . 1=LSB	2 bytes

Note: If D changes, a GO is also issued. If V or A changes and TAS . 1=1, a GO is issued.

Note: Bit 3 needs to toggle for data to be read.

Command Descriptions

The following is a list of all the PROFIBUS specific commands. For a complete listing of Gemini commands see the *Gemini Series Programmer's Reference*.

ERROR (Error Checking Enable)	See page 29
FBMASK (Fieldbus I/O Mask)	See page 29
FBPIC (Fieldbus Process Input Control).....	See page 29
FBPOC (Fieldbus Process Output Control)	See page 30
FBADDR (Fieldbus Address)	See page 28
[FBS] (Fieldbus Status).....	See page 30
OUTFNC (Output Function).....	See page 11
TASX (Transfer Extended Axis Status).....	See page 31
TCS (Transfer Configuration Status).....	See page 31
TFBS (Transfer Fieldbus Status)	See page 32

ERROR Error Checking Enable

Type:	Communication Setup	Product	Rev
Syntax:	<a_><!>ERROR... (32bits)	GV6-PB	1.70
Units:	n/a	GT6-PB	1.70
Range:	b=0 (disable), 1 (enable), or X (don't change)		
Default:	0		
Response:	ERROR: *ERROR0000_0000_0000_0000_0000_0000_0000_0000		
See Also:	[ASX], ERRORP, INFNC, LH, LS, S, TASX, TER, TRGFN		

A new bit assignment is added for the ERROR command, bit #19.

See FBS on page 30 for the event causing the error condition. To clear the error event, first resolve the cause, and then issue the ERROR.19-0 command followed by the ERROR.19-1 command. Error bit 19 is edge sensitive to error events.

Bit #	Function	Branch Type
19	Fieldbus Error	JUMP

FBADDR Fieldbus Address

Type:	Communication Setup	Product	Rev
Syntax:	<!>FBADDR<i>	GV6-PB	1.70
Units:	i = fieldbus address	GT6-PB	1.70
Range:	i = 0-125		
Default:	0		
Response:	FBADDR: *FBADDR3		
See Also:			

NOTE: This command does not take effect until after you cycle power to the drive or issue a RESET command.

Use the FBADDR command to report the controller's current node address assignment and set the node address via software. The new value is saved into nonvolatile memory, and becomes effective after the controller is reset. Network configuration of node address is not supported. This command cannot report the hardware configuration setting. In order to set the node address via software, the hardware configuration method must be disabled (default from factory). Setting FBADDR0 is required to return to the hardware configuration method. See [Node Address](#) on page 18.

Example:

Assume controller was assigned node address 1 out of reset:

```
>FBADDR
*FBADDR1
>FBADDR3      ; Set node address to 3
>FBADDR
*FBADDR3      ; New network setting will take effect after unit is
               ; reset!
```

FBMASK Fieldbus I/O Mask

Type:	I/O Setup	Product	Rev
Syntax:	<!>FBMASK , , , , , , , 	GV6-PB	1.70
Units:	n/a	GT6-PB	1.70
Range:	b=0 (Gemini control only), 1 (Gemini or Fieldbus control)		
Default:	1111_111		
Response:	FBMASK: *FBMASK0000_000		
See Also:	FBPOC		

Use FBMASK to prevent an output from being changed by fieldbus.

Note: Outputs must be configured as general-purpose type outputs to be changeable over the fieldbus (see the *Gemini Series Programmer's Reference* OUTFNC command).

Example:

```
FBMASK0010000      ; Only output #3 can be changed by fieldbus
```

Response for FBMASK: *FBMASK0010_000

FBPIC Fieldbus Process Input Control

Type:	Communications Setup	Product	Rev
Syntax:	<!>FBPIC<i>, <i>, <i>, <i>	GV6-PB	1.70
Units:	n/a	GT6-PB	1.70
Range:	i = 0 to 5		
Default:	0		
Response:	FBPIC: *FBPIC 0,0,0,0		
See Also:	FBPOC, TCS		

NOTE: This command does not take effect until after you cycle power to the drive or issue a RESET command.

The FBPIC command defines the data sent back to the master in the PAD. See the PAD for more details (page 26). If the data is too long (more than 8 bytes), a configuration error occurs (reported with TASX bit #7 and TCS), and the fieldbus interface is disabled.

Example:

```
FBPIC1,3,4      ; This places 1 Actual Position, 3 Input status, and 4
                ; output status. Actual Position uses 4 bytes, Input
                ; status uses 2 bytes, and output status uses 2 bytes.
                ; This totals the 8 bytes of data.
FBPIC0,0,3,4    ; This sends back Input data and output data in bytes 4-5
                ; and 6-7. Bytes 0-3 are left blank by the two 2-byte
                ; place holders.
```

FBPOC Fieldbus Process Output Control

Type:	Communications Setup	Product	Rev
Syntax:	<!>FBPOC<i>,<i>,<i>,<i>	GV6-PB	1.70
Units:	n/a	GT6-PB	1.70
Range:	i = 0 to 4		
Default:	0		
Response:	FBPOC: *FBPOC 0,0,0,0		
See Also:	FBPIC, FBMASK, TCS		

NOTE: This command does not take effect until after you cycle power to the drive or issue a RESET command.

The FBPOC command defines the data sent by the master. See the PED for more details (page 27). If the data is too long (more than 8 bytes), a configuration error occurs (reported with TASX bit #7 and TCS), and the data contained in the PED is ignored.

Example:

```
FBPOC1,2      ; This receives the Position command and the Velocity
               ; command. Position uses 4 bytes and Velocity uses 4 bytes.
FBPOC0,0,1    ; This receives the Position command and places it in
               ; bytes 4-7. Bytes 0-3 are left blank by the two 2-byte
               ; place holders.
```

[FBS] Fieldbus Status

Type:	Communication Setup	Product	Rev
Syntax:	See below	GV6-PB	1.70
Units:	n/a	GT6-PB	1.70
Range:	n/a		
Default:	n/a		
Response:	n/a		
See Also:	ER.19, TFBS		

Use the FBS command to assign the fieldbus status to a binary variable or for use in a comparison command.

Example:

```
IF(FBS.4=b1) ;Branch based on the status of FBS bit 4
```

The Fieldbus Status register bits are defined as follows:

Bit #	Function (1=Yes, 0=No)	Description
1	TIMEOUT ^{1,2}	Watchdog timed out. Controller has lost communication with fieldbus card
2	CHECKSUM FAULT ^{1,2}	Fieldbus card failed hardware check on boot-up
3	HWD CFG MODE	0 - Configuration set via software, 1 - Configuration set via hardware
4	ONLINE ^{1,3}	Controller is connected and data exchange is possible
5-32	RESERVED	

¹ If any of these error conditions occur (bit #1 = 1, bit #2 = 1, or bit #4 transitions from 1 to 0), the motion controller will perform a Kill (K command) on all axes and set error status bit #19 (ER, TER). Extended Axis Status bit #27 is also set. If error-checking bit #19 is enabled with the ERROR command (ERRORxxxxxxxxxxxxxxxxxxxx1) the controller will also branch to the ERRORP program. **NOTE:** Upon initialization, bit #4 is set to 0; this is not a fault. Once the drive is online (bit #4 = 1), a transition of bit #4 from 1 to 0 (bit#4 = 0) will cause a fault.

² Error event is latched. Reset the controller to clear the error.

³ Error event is recoverable.

OUTFNC Output Function

Type:	Output	Product	Rev
Syntax:	<!>OUTFNC<i>-<c>	GV6-PB	1.70
Units:	i = output #, c = function identifier (letter)	GT6-PB	1.70
Range:	i = 1-7, c = A-I		
Default:	(see programmer's reference)		
Response:	OUTFNC1: *OUTFNC1-A PROGRAMMABLE OUTPUT - STATUS OFF		
See Also:	INFNC, OUT, OUTLVL, POUTA, SMPER, TAS, TASX, TOUT		

A new identifier is added for the OUTFNC command:

Identifier	Function Description
I	FIELDBUS Error: Output activates when TASX bit #27 is set for FIELDBUS error.

Note: Outputs must be configured as general-purpose type outputs to be changeable over the fieldbus (see the *Gemini Series Programmer's Reference* OUTFNC command). Outputs must also be enabled for control with the FBMASK command.

Example:

```
OUTFNC1-i ;assign output 1 as a FIELDBUS Error output
```

TASX Transfer Extended Axis Status

Type:	Communication Setup	Product	Rev
Syntax:	<a_><!>TASX	GV6-PB	1.70
Units:	n/a	GT6-PB	1.70
Range:	n/a		
Default:	n/a		
Response:	TASX: *TASX 0001_0000_0000_0000_0000_0000_0000_0000		
See Also:	DCLRLR, DRIVE, RESET, TAS, TCS, TER		

A new bit assignment is added for the TASX command, bit #27.

See FBS on page 30 for the event causing the condition. To clear the status bit the drive must be reset or power must be cycled.

Bit #	Function	To Clear the status Bit
27	Fieldbus Error	RESET or cycle power

TCS Transfer Configuration Status

Type:	Communication Setup	Product	Rev
Syntax:	<a_><!>TCS	GV6-PB	1.70
Units:	Fault/Warning Code	GT6-PB	1.70
Range:	n/a		
Default:	n/a		
Response:	TCS: *TCS 46		
See Also:	DMTR, TASX		

Two new error assignments have been added for the TCS command.

See FBPIC and FBPOC on page 29-30 for the event causing the condition. To clear the error, the FBPIC or FBPOC must be redefined and a RESET must occur.

Code	Fault/Warning	Drive Type	Condition	Method to clear	TASX Bit Set
-32158	Fault	GV6-PB GT6-PB	Too many Bytes in FBPOC	Redefine FBPOC	Bit 27
-32168	Fault	GV6-PB GT6-PB	Too many Bytes in FBPIC	Redefine FBPIC	Bit 27

TFBS

Transfer Fieldbus Status

Type:	Communication Setup	Product	Rev
Syntax:	<!>TFBS<.i>	GV6-PB	1.70
Units:	i = system status bit number	GT6-PB	1.70
Range:	1-32		
Default:	n/a		
Response:	TFBS: TFBS.4: *1 (unit online or link ok, yes) *TFBS0001_0000_0000_0000_0000_0000_0000		
See Also:	ER.19, [FBS]		

The TFBS command provides information on the 32 fieldbus status bits. The TFBS command reports a binary bit report.

Response for TFBS: *TFBS0001_0000_0000_0000_0000_0000_0000

Bit#1...bit#32

For bit description, see FBS on page 30.

Configuration Example

NOTE: The commands below do not take effect until after you execute a RESET command, or cycle power to the drive. Enter these commands in a live communication session with the Gemini drive. (Use Motion Planner's Terminal window as your interface tool.)

```
FBADDR5      ; Set the node address to be 5
FBPOC1,0,4   ; Mast sends position command in PED bytes 0-3,
              ; and output control in bytes 6-7
FBPIC1,2     ; Drive returns actual position in PAD bytes 0-3,
              ; and actual velocity in bytes 4-7
RESET        ; Reset the drive, so the fieldbus settings will
              ; take effect
```

NOTE: The commands below take effect immediately. Therefore, you may execute them in a live communication session with the Gemini drive, or place them in a "power-up program" (i.e., a program that is to be identified with the STARTP command as the program to be executed on power-up or reset).

```
OUTFNC1-A    ; Define output #1 as a general-purpose (g-p) output
OUTFNC5-A    ; Define output #5 as a g-p output
OUTFNC7-A    ; Define output #7 (brake) as a g-p output
FBMASK1000101 ; Allow fieldbus to alter outputs #1, #5, and #7
ERROR.19=B1  ; Enable fieldbus error-checking (bit #19)
```

APPENDIX A

Gemini PROFIBUS CE Compliance

IN THIS CHAPTER

- [CE Compliance](#) 34
- [Installation Instructions](#) 34

The Gemini family of products is designed to meet the requirements of global regulatory agencies.

Gemini products, when installed in accordance with instructions in the appropriate *Hardware Installation Guide*, are compliant with CE directives. This appendix gives instructions for additional steps necessary for installing the Gemini PROFIBUS Option into a CE compliant system.

Installation Instructions

Gemini Drive – Installation Instructions

1. Follow the standard installation and configuration instructions in your Gemini drive's *Hardware Installation Guide*.
2. Follow additional installation instructions for CE compliance in *Appendix C – Regulatory Compliance* of your drive's *Hardware Installation Guide*.

Gemini PROFIBUS Option – Installation Instructions

1. Install PROFIBUS cabling and associated hardware in accordance with instructions in PROFIBUS Guideline No. 2.112, *Installation Guideline for PROFIBUS-DP/FMS*, available from the PROFIBUS Internet site at www.profibus.com
2. Consult your PROFIBUS Master's guide for additional requirements for the Master installation.

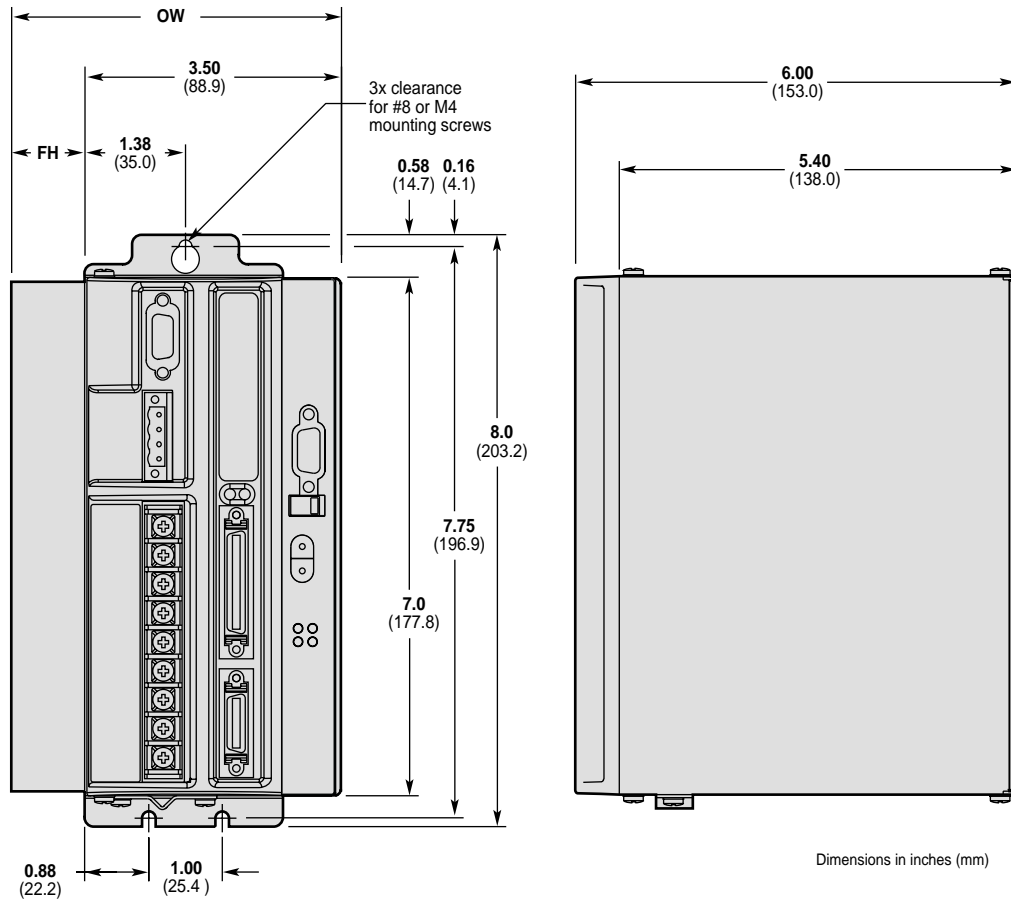
APPENDIX B

Gemini Dimensions

IN THIS CHAPTER

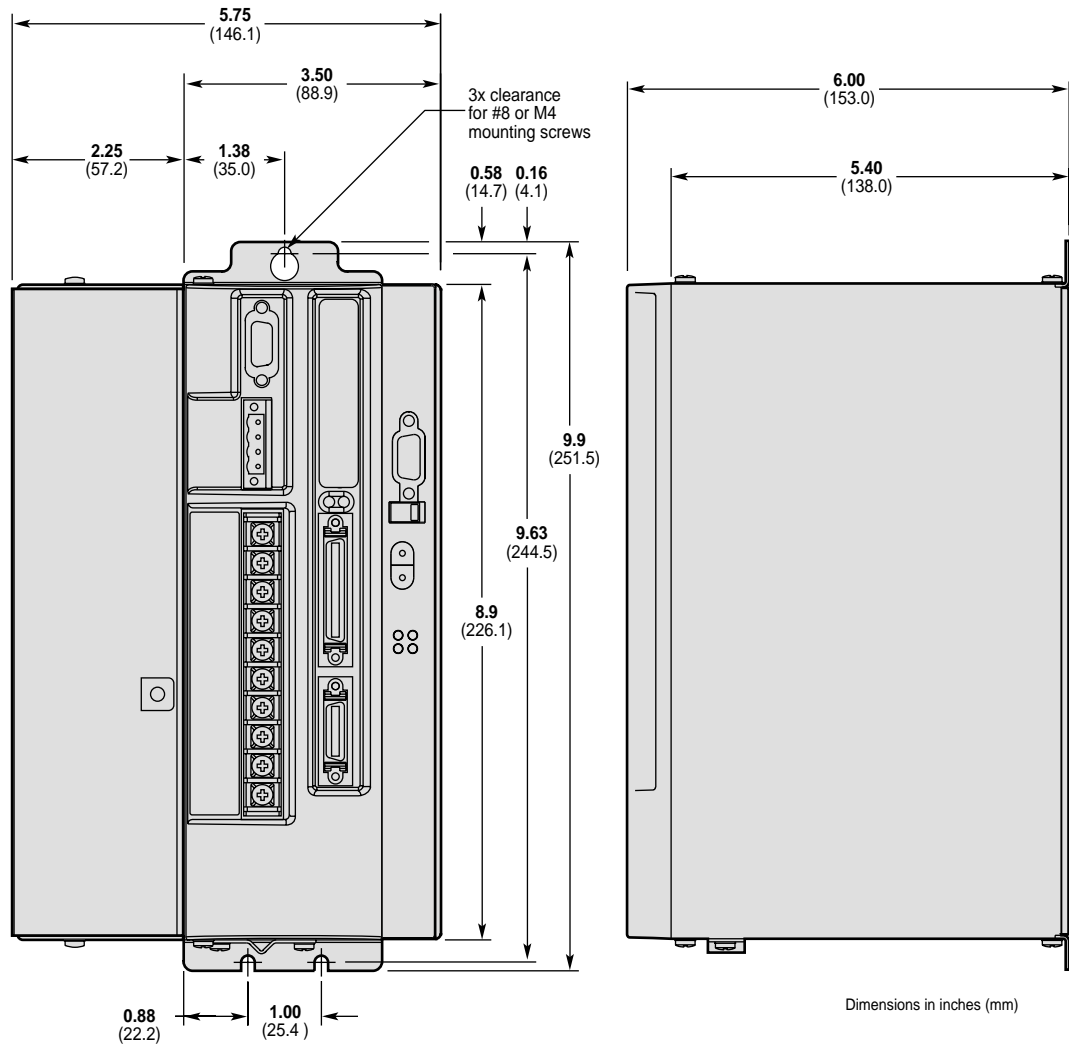
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Gemini Drive Dimensions

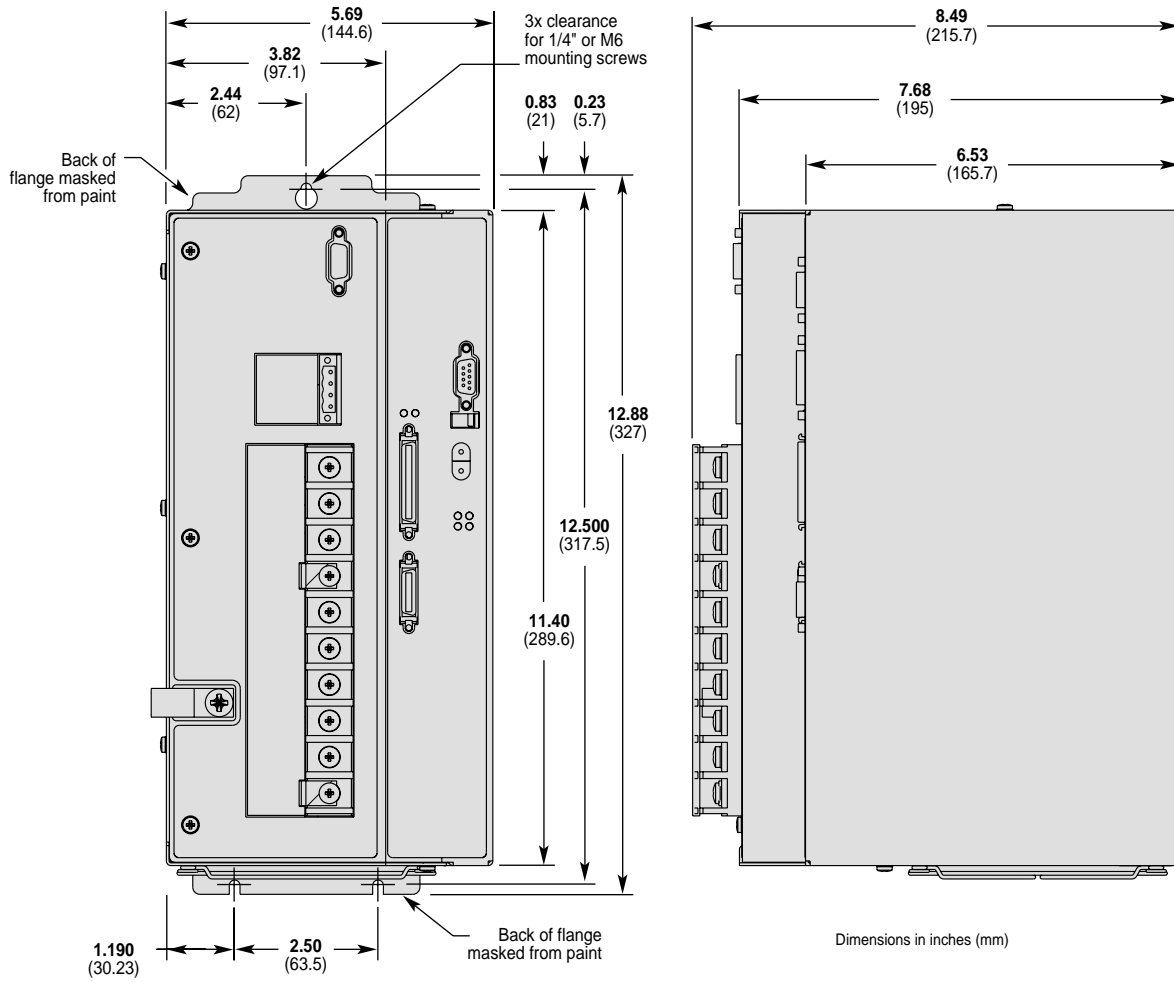


Product	OW Overall Width inches (mm)	FH Fin Height inches (mm)
GV6-L3n-PB	3.88 (98.6)	0.38 (9.5)
GV6-U3n-PB	3.88 (98.6)	0.38 (9.5)
GV6-U6n-PB	4.50 (114.3)	1.00 (25.4)
GV6-U12n-PB	4.50 (114.3)	1.00 (25.4)
GT6-L5-PB	3.88 (98.6)	0.38 (9.5)
GT6-L8-PB	4.50 (114.3)	1.00 (25.4)

Dimensions (Shorter Enclosure)

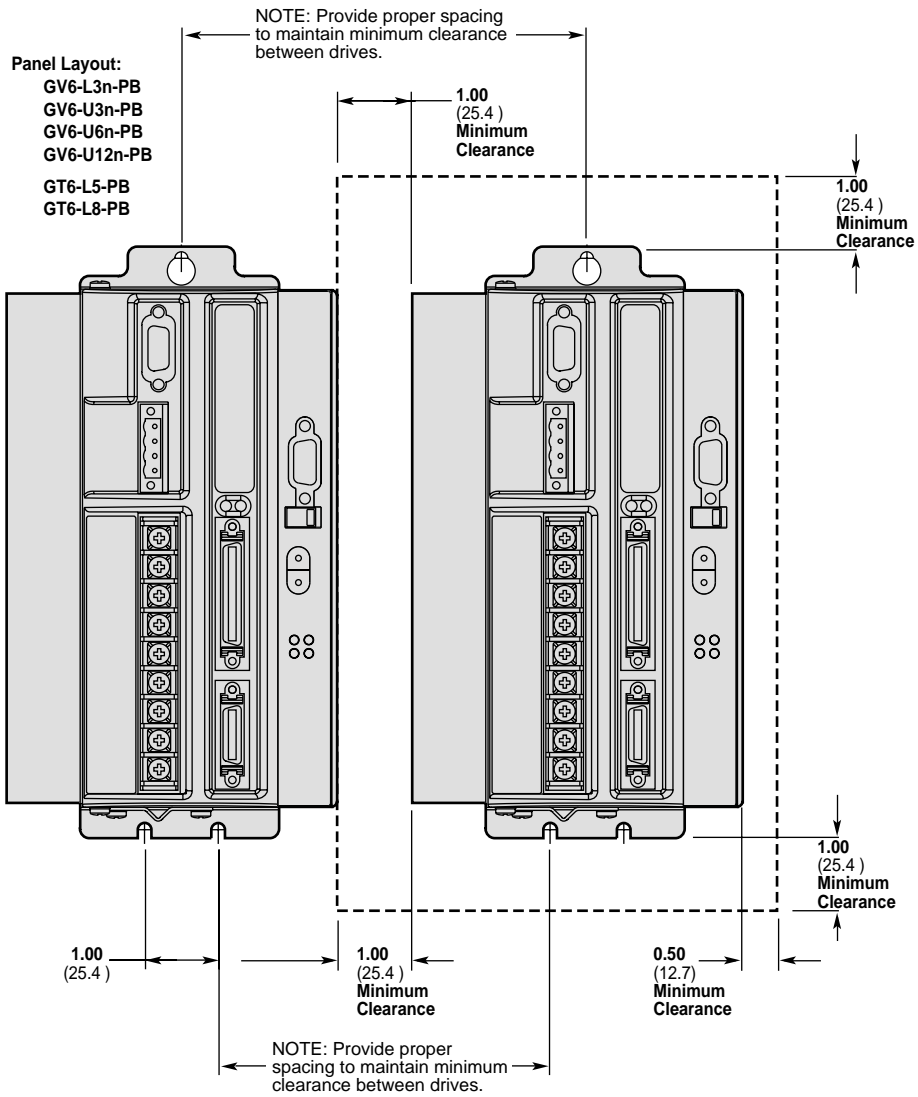


Dimensions – GV6-H20n-PB

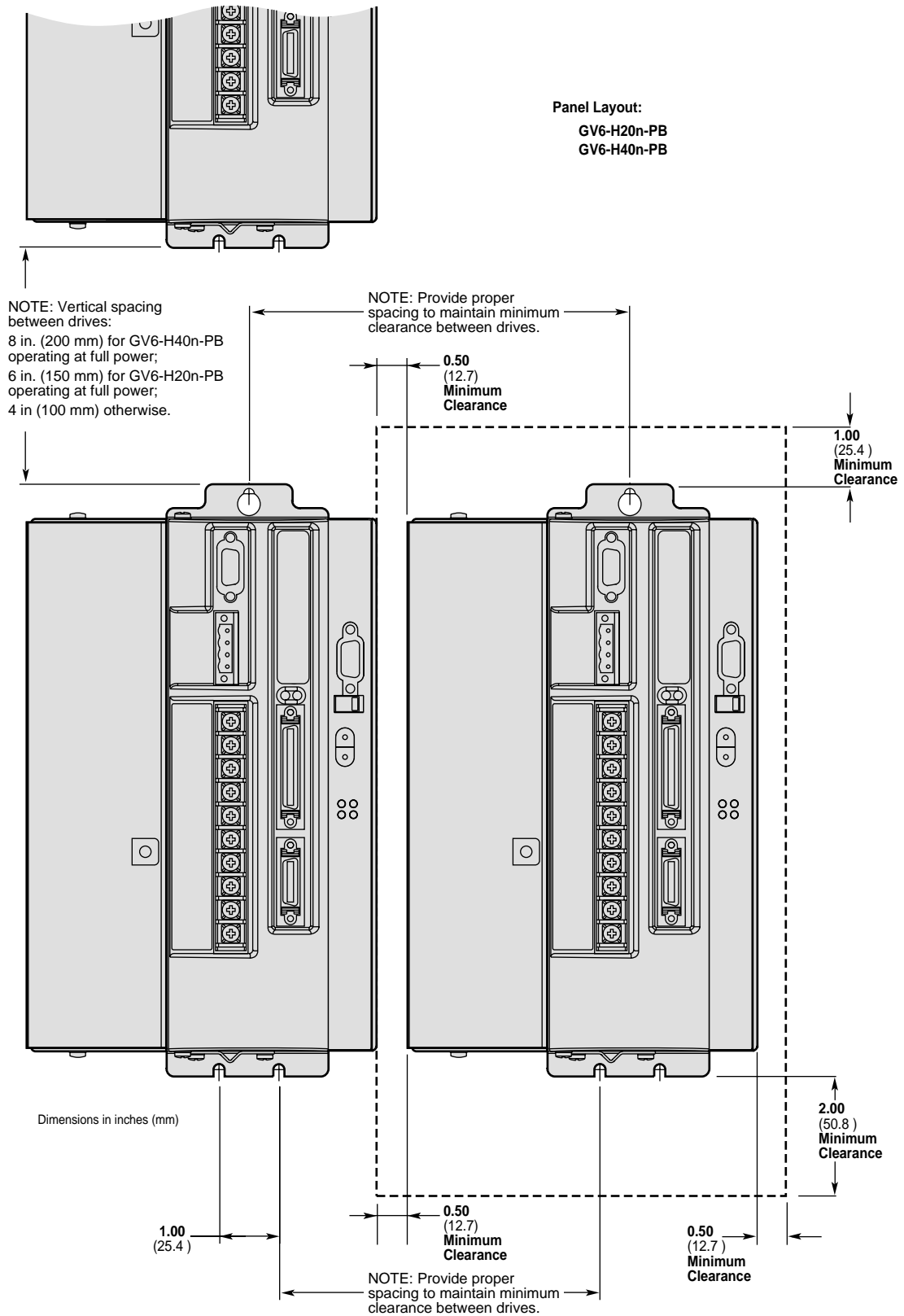


Dimensions – GV6-H40n-PB

Gemini Panel Layout Dimensions



Panel Layout Dimensions – Shorter Enclosure



Panel Layout Dimensions – Taller Enclosure