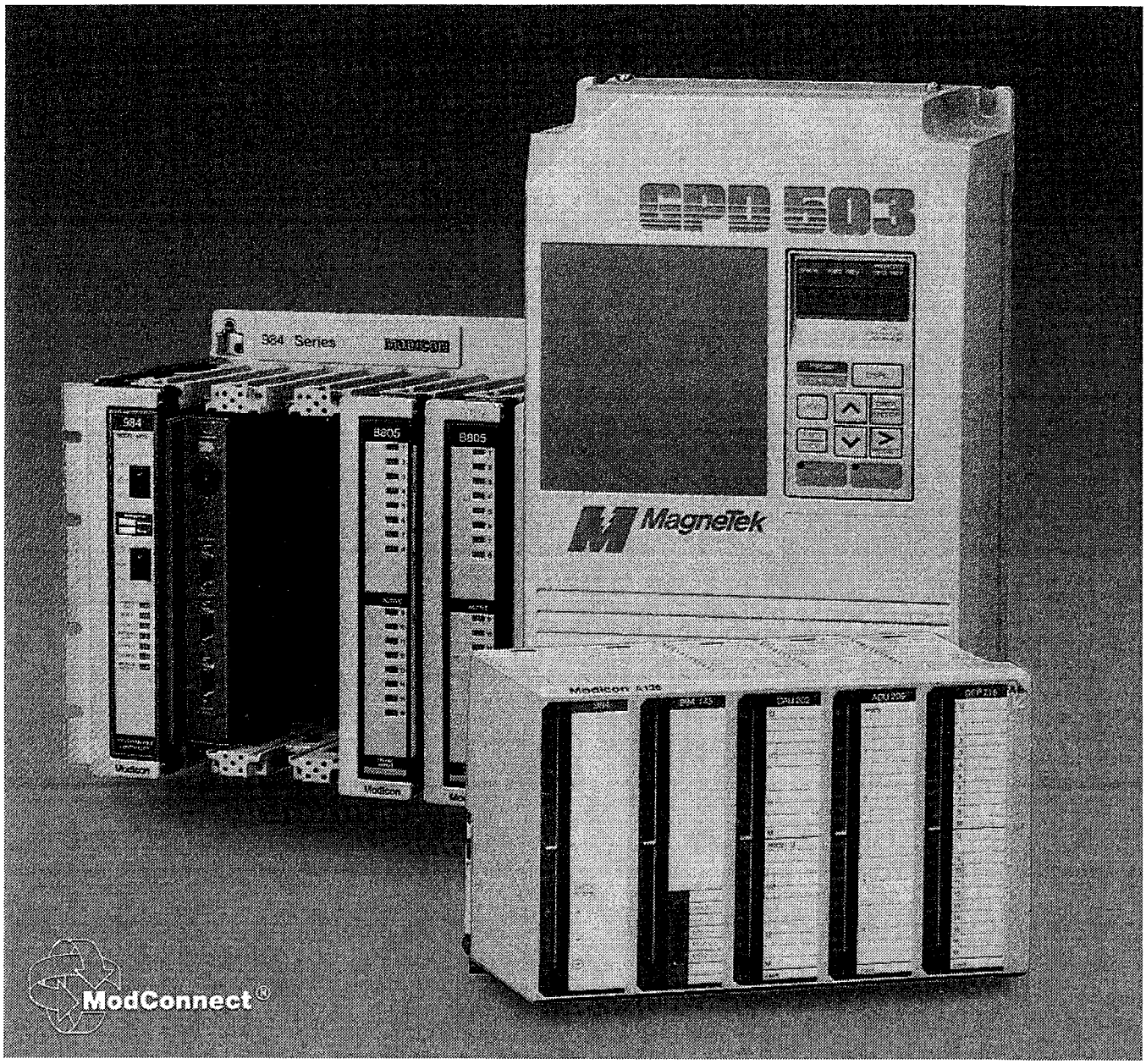
MagneTek

GPD 503 AC Drive
Modbus Plus Communication



Additional Technical References

Refer to the following MagneTek publications for technical information about the GPD503:

- ***MagneTek GPD503 Technical Manual***
  Publication TM4231

Refer to the following Modicon publications for technical information about Modicon, Modbus Plus communications and Programmable Controllers:

- ***Modicon Modbus Plus Network Planning and Installation Guide***
  Publication GM-MBPL-001

- ***Modicon Ladder Logic Block Library User Guide***
  Publication 840 USE 101 00

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Additional Technical References

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Chapter 1
Introducing the MB+ Network

- Overview
- MB+ Network Introduction
- How the Network Operates

Overview

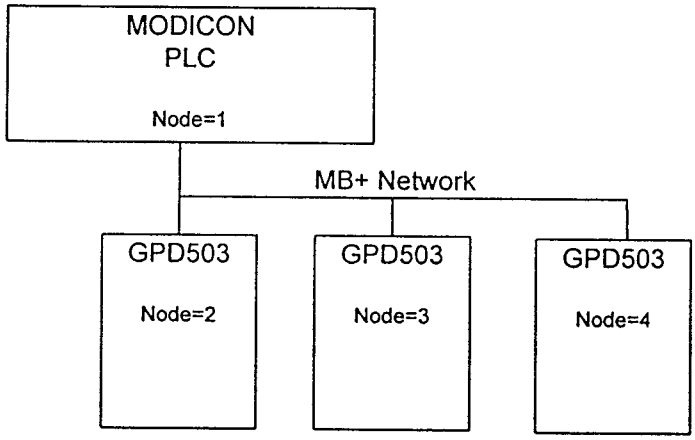
This manual describes the installation of a MagneTek Modbus Plus Communication Kit, configuration of the MB+ board and programming of the master (MSTR) function blocks, necessary for network nodes (GPD503 drives) to process message transactions

This manual should be used for personnel involved in developing, installing, or troubleshooting MagneTek drives communicating via the Modbus Plus network

Modbus Plus Communications Introduction

Modbus Plus is a communications system designed for industrial control applications Modbus Plus is a LAN (Local Area Network) communication scheme which allows a host PLC to communicate with slave devices (nodes) on a network. Each network supports up to 64 addressable node devices, at a data transfer rate of 1 MegaBaud

With a MB+ board installed, a GPD503 can be configured as one of the 64 nodes. The connection between nodes on the LAN is achieved using a shielded, twisted-pair cable between each node



Example MB+ Network

How the Network Operates

Network nodes are identified by addresses assigned by the system designer. Each device is independent and its node address is unique. Duplicate node addresses are not allowed. Addresses are within a range of 1 to 64, and are not required to be sequential

How Nodes Access the Network

Network nodes function as peer members of a logical ring, gaining access to the network upon receipt of a token.

Initialization. When a network is initialized, each node becomes aware of the other active nodes. Each node builds a table identifying the other nodes, and initial ownership of the token is established

Token Hold. While holding the token, a node initiates message transactions with other nodes Each message contains routing fields defining its source and destination on the network

Token Pass: While passing the token, a node can write into a global database, for broadcast to all nodes on the network. Other nodes monitor the token pass and can extract the global data if programmed to do so

Token Rotation Sequence

The token rotation sequence is established by node address Token rotation begins at the network's lowest-addressed active node, proceeding consecutively through each higher-addressed node, until the highest-addressed active node receives the token That node then passes the token to the lowest one to begin a new rotation. This rotation occurs without respect to the physical proximity of one node to another.

If a node leaves the network, a new token passing sequence is established, typically within 100 milliseconds. New nodes joining the network are included in the correct address sequence for passing the token, typically within 5 seconds.

When multiple networks are joined by bridges, tokens are not passed through a bridge device from one network to another Each network performs its token passing process independently of other networks

Point to Point Message Transactions

While a node holds the token, it may send application messages. If the node does not have any messages to transmit, it will pass the token Each message can contain up to 100 controller registers consisting of 16-bit words of data. The other node(s) monitor the network for incoming messages

When a node receives a message, it sends an immediate acknowledgment to the originating node. If the message is a request for data, the receiving node will begin assembling the requested data into a reply message When the message is ready, it will be transmitted to the requester when the node receives a subsequent token granting it access to transmit After a node sends all of its messages, the node passes the token to the next node address in sequence

The **MagneTek GPD 503 drive** is capable of participating as a node on a Modbus Plus communications network.

Chapter 2
Getting Started

- GPD 503 and Modbus Plus
- MagneTek Modbus Plus Communications Kit

GPD503 and Modbus Plus

The GPD 503 High performance V/Hz, PWM AC drive accepts MagneTek interface boards Installation of a MagneTek, Modbus Plus Communication Kit ensures the GPD 503 is a MODICON certified ModConnect® partner with direct connection to Modbus Plus.

The Modbus Plus Communication Kit, Model No DS005 provides a Modbus Plus Serial Communication Board Interface option which allows operation, status monitoring, and programming of a GPD 503 drive from a MODICON Programmable Controller using the Modbus Plus local area network.

The Modbus Plus Communication Kit, is available as a kit or factory installed in your GPD 503 drive The following figure depicts a MagneTek Modbus Plus card

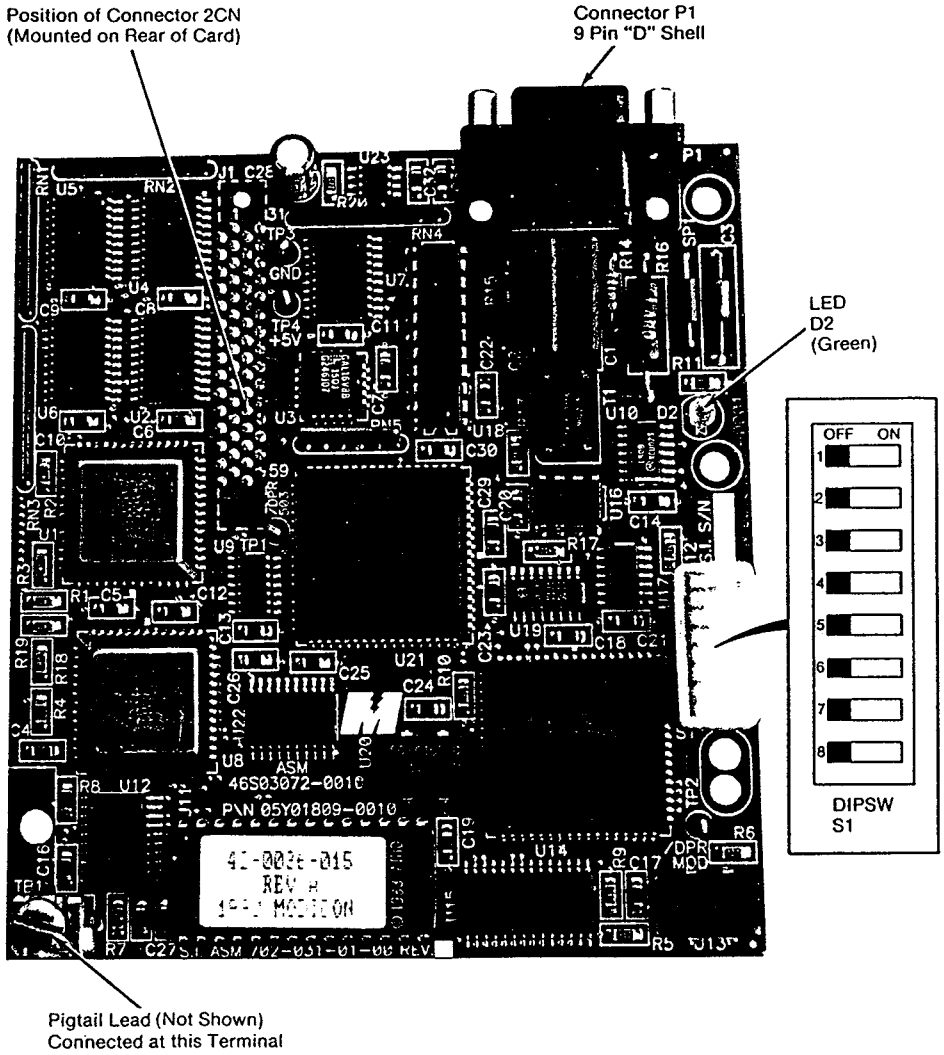


Figure 1 MB+ Board (DS005)

MagneTek Modbus Plus Communication Kit

Each drive must have its own MB+ kit installed to communicate via Modbus Plus. The DS005 MagneTek, MB+ Communication Kit consists of the following items:

- MagneTek MB+ Option card.
  A printed circuit board (MB+ card) which mounts at connector 2CN inside the GPD 503

- GPD 503 AC Drive Modbus Plus Communication Manual, P/N TM 4023

Chapter 3
Installation of the GPD503 / MB+ Board

- Installation Notes
- Installation of the MB+ Board into the GPD503
- MB+ Board Configuration
- MB+ Communication Connection

MB+ Installation Notes

This section provides several installation notes for the MagneTek MB+ card This option should be installed by a **technically qualified individual** who is familiar with this type of equipment and the hazards involved

A cable to connect the GPD 503 to the MB+ network is required. MODICON offers a full line of cables and connectors for use with Modbus Plus network devices.

NOTE: Due to physical size, once the MB+ Card is installed in the GPD 503, option cards normally mounted at the 2CN and 3CN connector, can not be used

The MB+ card employs CMOS technology which may be damaged by static electricity Use proper electrostatic discharge (ESD) procedures when handling the MB+ card.

CAUTION: **Failure to follow these installation steps may cause equipment damage or personnel injury.**

WARNING: **Hazardous voltage can cause severe injury or death. Lock all power sources feeding the drive in the "OFF" position. Ensure that the CHARGE lamp inside the unit is off, before installing the MB+ board.**

Installing the MB+ Board into the drive

Please review this procedure fully, prior to beginning the MB+ card installation

1 Disconnect all sources of input power to the drive before proceeding, with the installation of the MB+ Option card.

2 Remove the front cover of the drive by removing two Phillips screws

3 Verify the CHARGE lamp is "OFF". The CHARGE lamp is located in the lower left corner on the drive control board.

4 Orient the MB+ card as shown in figure 2.

5. Position the MB+ boards 2CN connector (on the under side of the printed circuit card) to mate with the matching 2CN connector on the drive control board.

While aligning the connectors, position the three plastic standoffs on the control board to slip through the holes on the MB+ board.

6 Ensuring proper alignment, lower the MB+ board into position and press carefully until the board is firmly seated on the standoffs, and the 2CN connectors are engaged.

7 Locate the green grounding wire with mounting lug on the MB+ board you installed. Route the green ground wire to the lower corner of the drive control board.

8 Connect the green ground wires mounting lug to either the
- Existing ground wire post labeled "E"
- Phillips head screw in the lower left corner of the GPD 503 drive
- Or terminal block screw location #(12), labeled 12(G)

NOTE: If you have completed the mechanical installation of the MB+ card. Proceed to the MB+ card configuration prior to applying input power or replacing the GPD 503 front cover

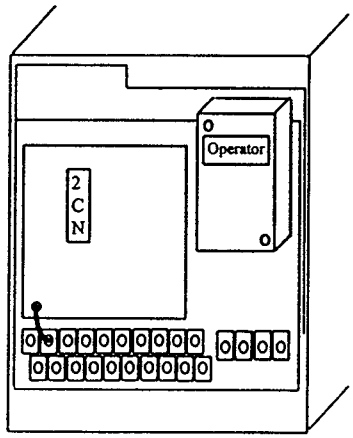


Figure 2 MB+ board Mounting Position

MB+ Board Configuration

The MB+ board requires setup prior to operation MB+ switches SW1 must be set prior to the application of input AC power to the GPD503 The states of these switches are read only on power-up

The MB+ SW1 switches are defined in the following table:

Switch Number	Switch Function
1	Drive Node Address - bit 0 / LSB
2	Drive Node Address - bit 1
3	Drive Node Address - bit 2
4	Drive Node Address - bit 3
5	Drive Node Address - bit 4
6	Drive Node Address - bit 5 / MSB
7	Cable Loss Function
8	Global Read Function

Switches 1 through 6 are used to setup the Modbus Plus network address of the drive (node) The network allows addressing from 1 to 64. The nodes do not have to be sequential, however, two nodes on the network may NOT have the same address. The table on the following page illustrates the positions of SW1-1 through SW1-6 for each corresponding MB+ address

MB+ Node Address	SW1 Position 0=off 1=on					
	6	5	4	3	2	1
01	1	1	1	1	1	1
02	1	1	1	1	1	0
03	1	1	1	1	0	1
04	1	1	1	1	0	0
05	1	1	1	0	1	1
06	1	1	1	0	1	0
07	1	1	1	0	0	1
08	1	1	1	0	0	0
09	1	1	0	1	1	1
10	1	1	0	1	1	0
11	1	1	0	1	0	1
12	1	1	0	1	0	0
13	1	1	0	0	1	1
14	1	1	0	0	1	0
15	1	1	0	0	0	1
16	1	1	0	0	0	0
17	1	0	1	1	1	1
18	1	0	1	1	1	0
19	1	0	1	1	0	1
20	1	0	1	1	0	0
21	1	0	1	0	1	1
22	1	0	1	0	1	0
23	1	0	1	0	0	1
24	1	0	1	0	0	0
25	1	0	0	1	1	1
26	1	0	0	1	1	0
27	1	0	0	1	0	1
28	1	0	0	1	0	0
29	1	0	0	0	1	1
30	1	0	0	0	1	0
31	1	0	0	0	0	1
32	1	0	0	0	0	0
33	0	1	1	1	1	1
34	0	1	1	1	1	0
35	0	1	1	1	0	1
36	0	1	1	1	0	0
37	0	1	1	0	1	1
38	0	1	1	0	1	0
39	0	1	1	0	0	1
40	0	1	1	0	0	0
41	0	1	0	1	1	1
42	0	1	0	1	1	0
43	0	1	0	1	0	1
44	0	1	0	1	0	0
45	0	1	0	0	1	1
46	0	1	0	0	1	0
47	0	1	0	0	0	1
48	0	1	0	0	0	0
49	0	0	1	1	1	1
50	0	0	1	1	1	0
51	0	0	1	1	0	1
52	0	0	1	1	0	0
53	0	0	1	0	1	1
54	0	0	1	0	1	0
55	0	0	1	0	0	1
56	0	0	1	0	0	0
57	0	0	0	1	1	1
58	0	0	0	1	1	0
59	0	0	0	1	0	1
60	0	0	0	1	0	0
61	0	0	0	0	1	1
62	0	0	0	0	1	0
63	0	0	0	0	0	1
64	0	0	0	0	0	0

Cable Loss Detection

A cable loss occurs when the 'master' (last node to initiate a transaction with a drive/slave device) drops out of the token rotation sequence. The MB+ card continuously monitors the network for the 'master' node.

Switch 7 is used to enable the Cable Loss Detection

Function Description	MB+ SW1-7 Position
Cable Loss Detection Enabled	1 = ON
Cable Loss Detection Disabled	0 = OFF

When the Cable Loss Detection is enabled, a communication loss will:

-generate a fault and display an "EF3" fault code on the digital operator

-set bit # 4 to a 1 on the Drive Status Register (020h)

Cable Loss Detection is not activated immediately on power-up. The function is enabled (with SW1-7 ON) after the first command is given to the drive

A Cable Loss Fault (EF3) is a non-recoverable fault. The drive input power must be cycled to clear the fault

When the Cable Loss Detection is disabled, a cable loss will not cause a fault condition The drive will continue to operate under the last command (frequency) received. After communication is reestablished, the drive will operate according to any new commands received

Global Read Function

Switch 8 is used to enable the Global Read Function

Function Description	MB+ SW1-8 Position
Global Read Function Enabled	1 = ON
Global Read Function Disabled	0 = OFF

When the Global Read Function is enabled, the drive provides five registers of data to the PLC on the network The drive automatically and continuously sends this Global Read Data when it has the token. The PLC only reads this data when requested by the ladder logic (through the execution of a Global Read MSTR Function) Chapter 7 expands on the details of the Global Read Function.

Note: The Global Write Function is not affected by the setting of Switch 8

Serial Communication Connection

Communication between a GPD503 drive and the MB+ network requires a physical connection from your drive to the MB+ network Connect your network communication cable into P1 (9-pin "D" shell) on the MB+ card Modicon offers cables and connectors for the MB+ network

Modicon Modbus Plus Wiring:

The recommended cable for MB+ network connections is Belden 9841 This cable consists of

- One twisted signal pair blue/white
- Drain wire· bare
- Overall aluminized mylar shield

This cable is available from Modicon as the following part numbers·

- 97-9841-100 MBPlus 100 Foot Reel
- 97-9841-500 MBPlus 500 Foot Reel
- 97-9841-01K MBPlus 1000 Foot Reel

Two types of connectors are available from Modicon for connecting devices to the network Each in line drop requires an in line connector The two drops at the ends of the Modbus Plus network cable each require a terminating connector. When the terminating connectors are installed on the two extreme ends of the cable, no other termination is required

- AS-MBKT-085 MBPlus In line Connector (quantity 1)
- AS-MBKT-185 MBPlus Terminating Connector (quantity 1)
- AS-MBPL-001 MBPlus Connector Assembly Tool

Route the MB+ cable out of the bottom of the drive enclosure Select a cable routing method to protect the cable from physical damage and potential electrical interference sources

Note Avoid sources of electrical interference capable of inducing noise into the cable If a cable must cross power wiring, it must cross only at a right angle

Chapter 4
Establishing Communications

- GPD503 Constant Settings
- Communications Initialization
- MB+ Network

Setting the GPD503 Constants

The first and second digits of constants Sn-04 and Sn-08 determine the origin of the drive's operation commands and frequency reference as indicated in the tables below·

RUN / STOP		
Sn-08	**Sn-04**	**Run/Stop Commands from:**
XX0X	XX0X	MB+ Option Card
XX0X	XX1X	MB+ Option Card
XX1X	XX0X	External Terminals
XX1X	XX1X	Digital Operator

FREQUENCY REFERENCE		
Sn-08	**Sn-04**	**Frequency Reference From:**
XXX0	XXX0	MB+ Option Card
XXX0	XXX1	MB+ Option Card
XXX1	XXX0	Analog Input
XXX1	XXX1	Digital Operator

The shaded rows above indicate the default settings of these constants.

Although the setting of the first two digits of Sn-04 and Sn-08 sets the origin of the operation and frequency reference commands, many commands may still be functional from an alternative source Appendix B, the Command Priority Chart illustrates the available command origins for various functions

Communication Error Detection

If a communication fault occurs, control from the PLC is not possible The GPD503 drive will operate according to the dip switch S1-7 and the constant Sn-08 setting (Communication Error Detection)

When MB+ data is received by a particular drive on the network, it is checked for accuracy, parity, overrun, framing, and receiving buffer overflow. If all checked items passed, the data has been received normally. If all items are not received within two seconds, a communication error is declared.

When a communication error is detected, the Drive Status Register (02Ch) bit # 16 is set to 1. To determine the cause of a communication error, examine the LED D2 or the MB+ Data Link Status Register (022h) The flashing patterns of LED D2 are described in Chapter 8 of this manual. The MB+ Data Link Status Register is shown in Appendix A of this manual.

The third and fourth digits of the constant Sn-08 determine how the drive will react when a communication error is detected. The following table illustrates the Sn-08 setting and the corresponding reaction of the drive

Sn-08	Drive Reaction to Communication Error Detection
00xx	"bus" is displayed on the digital operator, the fault contact closes, and the drive decelerates the motor to a stop per Bn-02 deceleration time.
01xx	"bus" is displayed on the digital operator, the fault contact closes, and the motor coasts to stop (not controlled by the drive)
10xx	"bus" is displayed on the digital operator, the fault contact closes, and the drive decelerates the motor to a stop per Bn-04 deceleration time.
11xx	"bus" is displayed (blinking) on the digital operator The fault contact does not close, and the drive continues to run at its last state.

The shaded row indicates the default setting

Communication Initialization

When input power is applied to the drive, it will recognize the presence of the MB+ board, and prepare for serial communications. The digital operator will display "CALL".

If dip switch S1-8 (Global Read Function) is ON, the "CALL" display will be removed after the first Global Read information is transmitted from the drive. This should occur shortly after power up.

If dip switch S1-8 (Global Read Function) is OFF, the "CALL" display will remain until the PLC establishes communication with the drive. This is accomplished when the PLC performs an MSTR read or write function with a particular drive node

The green LED indicator (D2), on the MB+ card is used to indicate the MB+ card has established communications with a PLC. The green LED will react as follows:

Slow Blink rate = This node is off-line and is not allowed to transmit data across the link. It does hear all other active nodes on the link, and builds an active node table.

Rapid Blink rate = This node is operating normally It is successfully receiving and passing the token

(additional blink patterns shown in Chapter 8, Diagnostics and Troubleshooting)

MB+ Network

A single MB+ network can have up to 64 addressable devices (nodes). Each device requires a unique node address One node is allocated for each GPD503 drive with its MB+ card installed. No duplicate node addresses should exist.

Up to 32 nodes can be connected directly to the network bus over a length of 1500 feet (450 meters). Repeater devices can extend the cable distance a maximum of 6000 feet (1800 meters), and node count of 64 If more than 64 devices are to be connected, multiple networks can be joined through "bridge devices" Nodes address each other across a bridge device by specifying routing paths. The routing path is embedded in the control block section of the MB+ MSTR function block and is sent from the originating node. MB+ message routing is described in detail in Chapter 5, Modbus Plus MSTR Function.

Chapter 5
Modbus Plus MSTR Function

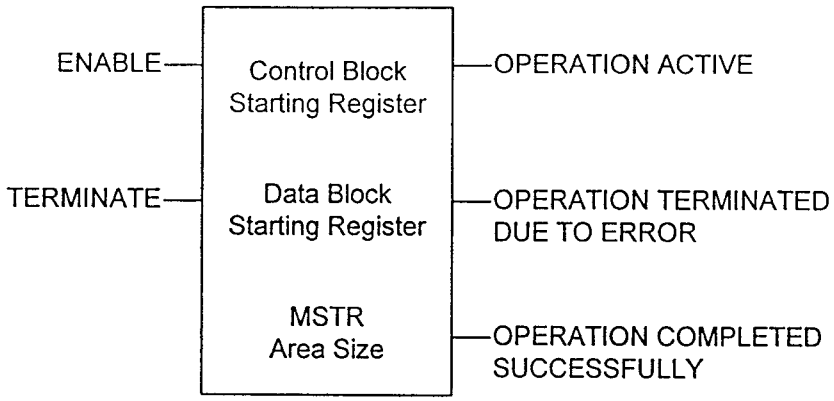
- MSTR Control Block
- MSTR Data Block
- MSTR Area Size
- Types of Data

Modbus Plus MSTR Function

When using a Modicon programmable logic controller to access registers from a node on the MB+ network, an MSTR function block must be used. All Modicon controllers supporting the Modbus Plus communication protocol have a MSTR (Master) function block. The MSTR function block is used to initiate MB+ message transactions. Each type of network transaction has an associated operation code The Modbus Plus transactions supported by the GPD503 drives are

MSTR Function	Operation Code
Write Data	1
Read Data	2
Write Global Data	5
Read Global Data	6

The MSTR function block is a three section function block as shown below·



The MSTR function block has two control inputs The ENABLE input enables the instruction when it is ON The TERMINATE input terminates the active operation when it is ON

The MSTR function block can produce three possible outputs The OPERATION ACTIVE output goes ON while the instruction is active The OPERATION TERMINATED output goes ON if an error occurs during the transaction or if the MSTR operation is terminated prior to completion The OPERATION SUCCESSFUL output goes ON when an MSTR operation has been completed successfully

When inserting a MSTR function block into the ladder logic, three pieces of data are required:

1 Control Block starting address
2. Data Block starting address
3. Maximum number of Data Block registers

MSTR Control Block

The data entered in the top section of the MSTR function block is the address of the first register in the Control Block The Control Block is a sequential group of nine registers in the PLC The Control Block registers are used to transfer information between the ladder logic and the MSTR function block

Information transferred from the ladder to the MSTR include

- the type of MB+ transaction (read, write, global write, global read)
- the address of the drive (node)
- the data code of the first register to be transferred
- the number of registers that will be transferred
- the routing path to the drive

Information transferred from the MSTR to the ladder logic include:

- the status of the MB+ transaction

The Control Block registers must have an address in the 4X range.

The Control Block registers are defined as

CONTROL BLOCK		
Control Block Offset	MSTR Word Description	Comments
4X + 0	Operation Code	1 = Multiple Register Write 5= Write Global Data 2 = Multiple Register Read 6= Read Global Data
4X + 1	Network Error Code	Communication link status - returned from MB+ link
4X + 2	Number of Registers	Length of the data area
4X + 3	Drive Register Data Code	Register of the requested/written information
4X + 4	Routing 1	Routing register #1 / local network
4X + 5	Routing 2	Routing register #2
4X + 6	Routing 3	Routing register #3
4X + 7	Routing 4	Routing register #4
4X + 8	Routing 5	Routing register #5

The Operation Code (4X + 0) is used by the ladder logic to indicate the type of transaction that will be performed Valid operation codes are defined in the following table:

MSTR Function	Operation Code
Write Data	1
Read Data	2
Write Global Data	5
Read Global Data	6

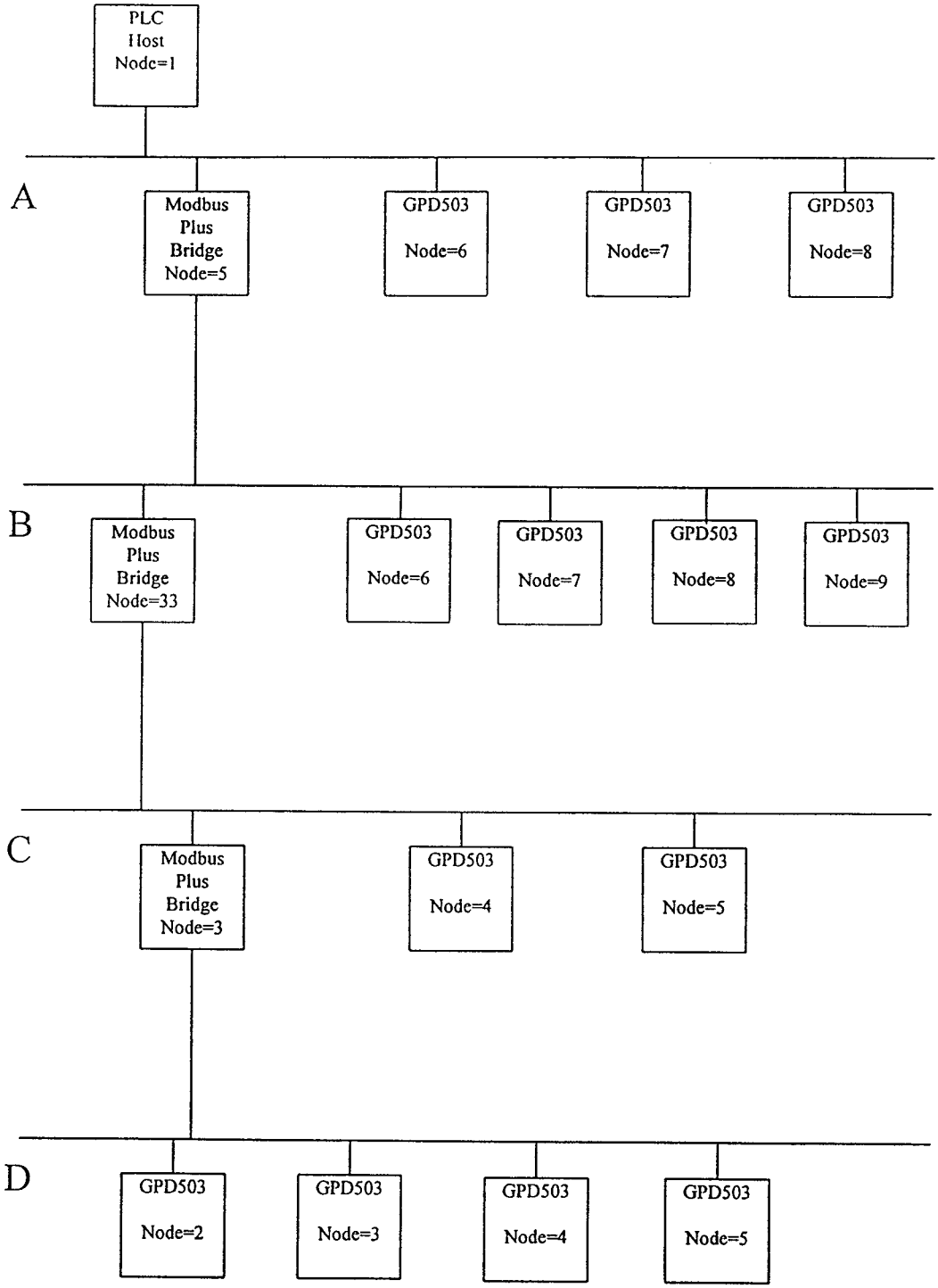
The Network Error Code (4X + 1) is used by the MSTR to indicate the status of the transaction If any error occurs during the transaction, an error code will be transferred into this register A list of MB+ network error codes can be found in Chapter 8.

The Number of Registers (4X + 2) is used by the ladder logic to indicate the number of registers that will be transferred during this transaction When writing multiple registers to the drive, the number in this register will indicate how many sequential registers will be written to. When reading multiple registers from the drive, the number in this register will indicate how many sequential registers will be read from

The Drive Register Data Code (4X + 3) is used by the ladder logic to indicate the address of the drive register in which to read/write This information is called the 'Data Code'. When 4X + 2 register value is 1, there will only be one drive register data code utilized for the MSTR operation When 4X + 2 register value is greater than 1, the value in the 4X + 3 register is the first GPD503 drive register data code

The Routing Address (4X + 4) is used by the ladder logic to determine the network routing path to a device. Each GPD503 drive will occupy one node on the Modbus Plus network A single Modbus Plus network can have up to 64 addressable devices (nodes). Each device must have a unique node address between 1 and 64. If more than 64 devices are to be connected, multiple networks can be joined through bridge devices. A node can be addressed across bridge devices by specifying a network routing path. The Routing 1, Routing 2, Routing 3, Routing 4, and Routing 5 (4X + 4, + 5, + 6, + 7, + 8) registers are used by the ladder logic to indicate the network routing path to a device

The example on the following two pages illustrates the routing of GPD503 drives on a bridged network system The example consists of a bridged network system diagram and routing tables with the appropriate node address assigned to routings 1 through 5.


PLC
Host
Node=1
A
Modbus
Plus
Bridge
Node=5
GPD503
Node=6
GPD503
Node=7
GPD503
Node=8
B
Modbus
Plus
Bridge
Node=33
GPD503
Node=6
GPD503
Node=7
GPD503
Node=8
GPD503
Node=9
C
Modbus
Plus
Bridge
Node=3
GPD503
Node=4
GPD503
Node=5
D
GPD503
Node=2
GPD503
Node=3
GPD503
Node=4
GPD503
Node=5

The last routing register used must be set to '1' This last routing register is used to specify a task number (0 to 7) to which the message is assigned For the GPD503 drives on MB+ this register must be '1'

Any unused routing registers must be set to '0'

The MSTR routing path register values for the example configuration shown on the previous page are

Network A Routing				
Register Description		1st drive	2nd drive	3rd drive
Routing 1	Network A	6	7	8
Routing 2	Task# = 1	1	1	1
Routing 3	Not Used	0	0	0
Routing 4	Not Used	0	0	0
Routing 5	Not Used	0	0	0

Network B Routing					
Register Description		1st drive	2nd drive	3rd drive	4th drive
Routing 1	Network A	5	5	5	5
Routing 2	Network B	6	7	8	9
Routing 3	Task # = 1	1	1	1	1
Routing 4	Not Used	0	0	0	0
Routing 5	Not Used	0	0	0	0

Network C Routing			
Register Description		1st drive	2nd drive
Routing 1	Network A	5	5
Routing 2	Network B	33	33
Routing 3	Network C	4	5
Routing 4	Task # = 1	1	1
Routing 5	Not Used	0	0

Network D Routing					
Register Description		1st drive	2nd drive	3rd drive	4th drive
Routing 1	Network A	5	5	5	5
Routing 2	Network B	33	33	33	33
Routing 3	Network C	3	3	3	3
Routing 4	Network D	2	3	4	5
Routing 5	Task# = 1	1	1	1	1

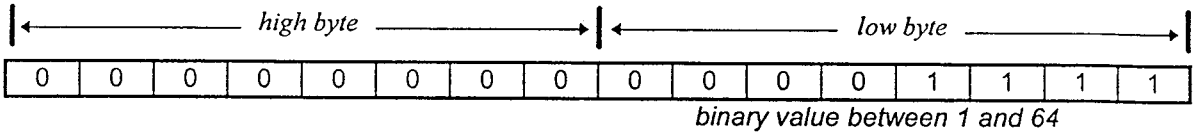
NOTE
The Routing 1 serves a dual purpose. The low byte of Routing 1 is used to specify the local node address The high byte of Routing 1 is used to specify which MB+ port on the PLC is to be accessed

The routing 1 register, used to designate the address of the destination node for a network transaction. The register display is implemented logically in the 984 PLCs and physically for the Quantum PLCs·

984 PLCs

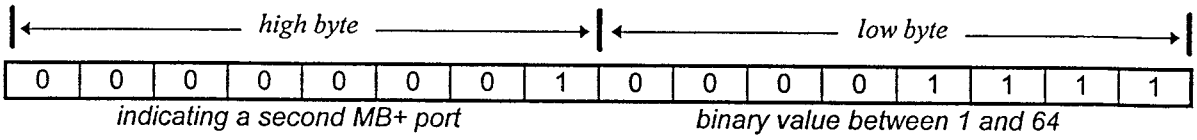
For a PLC with only one MB+ port, the value of the high byte of Routing 1 should be set to zero If you are using a PLC with more than one MB+ port the high byte is used to indicate which port will be accessed.

For an S985-002 card in a 984 chassis mount PLC, a value of 0 in the high byte indicates that the MSTR instruction is destined for the S985 card set for PLC port #2. For a 984 PLC with built-in Modbus Plus , a value of 0 in the high byte indicates that the MSTR is destined for the on-board Modbus Plus port



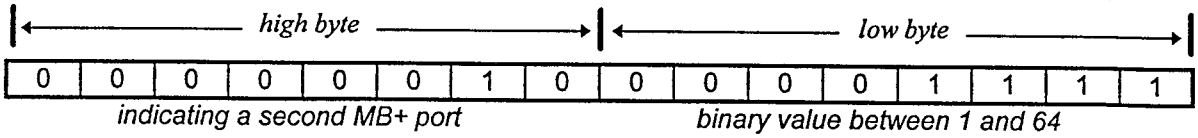
binary value between 1 and 64

For two S985-002 cards in a 984 chassis mount PLC, a value of 1 in the high byte indicates that the MSTR instruction is destined for the second S985 card's assigned buffer space, For an S985-00 configuration in a PLC with built-in Modbus Plus, a value of 1 in the high byte indicates that the MSTR is destined for the S985 card set for comm port #2.



indicating a second MB+ port *binary value between 1 and 64*

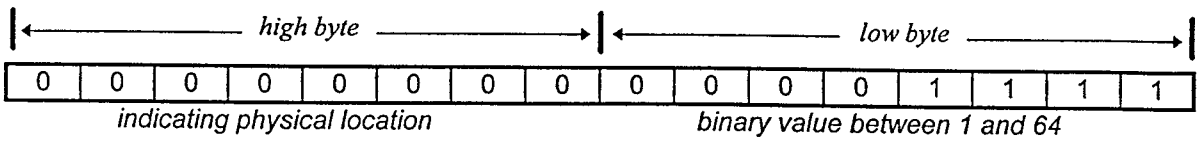
For two S985-000 cards in a 984 PLC with built-in Modbus Plus, a value of 2 in the high byte indicates that the MSTR instruction is destined for the second S985 card's assigned buffer space.



indicating a second MB+ port *binary value between 1 and 64*

Quantum PLCs

To target a Modbus Plus Network Option Module (NOM) in a Quantum PLC backplane as the destination of an MSTR instruction, the value in the high byte represents the physical slot location of the NOM. For example, if the NOM resides in slot 7 in the back plane, the high byte of routing register 1 would look like this.



indicating physical location *binary value between 1 and 64*

MSTR Data Block

The data entered in the middle section of the MSTR function block is the address of the first register in the Data Block The Data Block is a sequential group of registers in the PLC. The Data Block registers are used to hold the data that will be transferred by the MSTR function block For write operations, the Data Block is the source of the data For read operations, the Data Block is the destination of the data

The Data Block registers must have an address in the 4X range

The size of the Data Block can range from 1 to 100 sequential registers

MSTR Area Size

The data entered in the bottom section of the MSTR function block is the Area Size. The Area Size is an integer number that specifies the maximum number of registers that will be contained in the Data Block Area Size must be a constant value ranging from 1 to 100.

The 'Number of Registers' that is stored in the Control Block register 4X + 2 must be equal to or less than the Area Size If this is not the case, the MSTR function will return an error.

Chapter 6
Basic MSTR Functions

- Types of Data
- Write Function
- Read Function

Types of Data

The MB+ network allows for reading and writing to a drive(s) internal data registers. The MB+/GPD503 communication uses 16-bit holding registers The drive's registers are divided into three functional classifications.

1. Command Data	These registers control the operation of the drive, and accept read/write commands from a network master device
2 Constant Data	These registers are used to configure the operations of the drive (constants An's, Bn's, Cn's, and Sn's). They accept read/write commands from a network master device. After writing to the constant data registers, an "ENTER" command is required to store the data in the drive's non-volatile memory
3 Monitor Data	These registers are used to monitor the operation of the drive, and may only be read by a network master device
4 Special Data	These are "special" MB+ registers "ENTER" Command, Global Data, and Global Reference Multiplier They can accept read/write commands

NOTE
A listing of all the Command, Constant, Monitor, and Special Data Codes for the MB+/GPD503 communications can be found in the Appendix A of this manual

Write Function

An MSTR write function (operation code = 1) will write data to one slave device on the network When using a MB+ network, an MSTR write function can be used to send the following types of data:

- Command Data Registers
- Constant Data Registers
- Special Data Registers

An MSTR write function may take multiple scans of the PLC ladder logic to complete Examples of writing drive registers can be found in Chapter 9, Example #.1 (write run/stop and frequency reference), Example #5 (write acceleration and deceleration), Example #6 (write global frequency reference multiplier), and Example #8 (write all drive constants).

Read Function

An MSTR read function (operation code = 2) will read data from one slave device on the network When using an MB+ network, an MSTR read function can be used to acquire the following types of data

- Command Data Registers
- Constant Data Registers
- Monitor Data Registers
- Special Data Registers

An MSTR read function may take multiple scans of the PLC ladder to complete. Examples of reading drive registers can be found in Chapter 9, Example #2 (read output frequency), Example #7 (read all drive constants), and Example #9 (read drive status registers).

Chapter 7
Special MB+ Registers

- Executing a Global Write Function
- Enabling Global Data
- Executing a Global Read Function
- Activating and Saving Data with the ENTER Command
- Writing to the Global Frequency Reference Multiplier
- Origin of RUN/STOP and Frequency Reference Commands
- Using the GPD503 Drive Register 001h

Executing a Global Write Function

An MSTR global write function (operation code = 5) will write data to all slave devices on the network The global write function allows all slave devices on the MB+ network to receive the data at the same time When using a MB+ network, an MSTR write function can provide up to three Data Area Registers. The following data are considered Global Write Data·

MSTR Function Data Area (Register Offset)	Function	GPD503 Drive Register Data Code
4X + 0	xxxx xxxx xxxx xxZY	"x" = not used "Y" = Register offset + 1 "Z' = Register offset + 2
4X + 1	0 = register disabled 1 = register enabled	If Y=1; then register is interpreted as 001h
4X + 2	0 = register disabled 1 = register enabled	If Z=1; then register is interpreted as 002h

See Appendix A for additional information on data code registers 001h and 002h

An MSTR global write function will take one scan of the PLC ladder logic to complete An example of globally writing drive registers can be found in Chapter 9, Example #4 (write global run/stop and frequency reference)

Enabling Global Data

Each drive that will receive global write data must be initialized to do so. If a drive is not initialized to receive global write data, it will ignore any global data that is transmitted on the MB+ network

The data held in the MB+ special data register 0910h indicates the MB+ node address of the device (PLC) that will be sending the global data to the drive The GPD503 drive will only accept global data that is sent from this device. To enable global data, write the MB+ node address (1-64) of the device sending global data to register 0910h To disable global data, write a '0' to register 0910h.

An example of enabling global data can be found in Chapter 9, Example #4 write global run/stop and frequency reference)

Executing a Global Read Function

An MSTR global read function (operation code = 6) will read five specific status registers. The global read function must be enable by turning Dip switch S1-8 ON The status data can be read by any PLC connected to a local MB+ network.

The following registers are considered the "Global Read Data"

MSTR Function Data Area	Function	GPD503 Drive Register Data Code
4X + 0	Drive Status Signals	020h
4X + 1	Output Frequency	024h
4X + 2	Output Current	027h
4X + 3	Output Motor Voltage	028h
4X + 4	Drive Status	02Ch

See Appendix A for more details on these Data Codes. An example of reading global registers is shown in Chapter 9, Example #3 (Read Global Registers).

Activating and Saving Data with the ENTER Command

The GPD503 has two types of memory. 'Volatile' and 'Non-Volatile'. Data held in Volatile memory will be lost when power is removed from the drive Data held in Non-Volatile memory will be retained when power is removed from the drive. The GPD503 also has 'active' and 'inactive' areas of memory. The different registers are saved and activated differently, as described below.

Command Registers:
The command registers (001h through 00Ah) are stored in Volatile Memory When writing to a command register the new data becomes active immediately. In the case of a power loss all data stored in these registers will not be retained

Constant Registers:
The constant registers (101h-11Bh, 200h-229h, 400h-408h and 500-50Bh) are stored in Non-Volatile Memory. When writing new data to constant registers, the new data is not active. Sending the 'ENTER' command will cause the new data to become active AND to be saved in Non-Volatile memory.

The 'ENTER' command is accomplished by writing a value of '0' to data code 900h.

If a power loss occurs after the new data has been saved (by using the ENTER command) into Non-Volatile Memory, the data will be retained .

Monitor Registers:
The monitor registers (020h through 033h) are stored in Volatile Memory These registers can not be written to (read only registers). Any data read from the monitor registers will not be retained during a power loss situation.

Special Registers:
The special registers (900h, 910h, and 911h) are in Volatile Memory. These registers will not be retained during a power loss situation When writing to a special register, the new data becomes active immediately.

Examples of writing the 'ENTER' command can be found in chapter 9, Example #5 (write acceleration and deceleration), and Example #8 (write all drive constants).

NOTE
USE THE 'ENTER' COMMAND ONLY WHEN NECESSARY! The life of the Non-Volatile EEPROM on the GPD503 will support a finite number of operations. This means that the 'ENTER' command can only be used a maximum of 100,000 times to store data in the EEPROM. After the specified number of operations, the EEPROM may fault (CPF03) requiring the GPD503 to be replaced.

Writing to the Global Frequency Multiplier

In some applications, it will be necessary to change the frequency of multiple drives at the same time The global write function can easily be used to write a single value for frequency reference to all of the drives connected on the MB+ network In this way, all the selected drives can receive the same frequency reference value at the same time

System or process applications may require each drive to run at a different output frequency while changing speed simultaneously with other drives. For systems that require this feature, the Global Frequency Reference Multiplier can be used

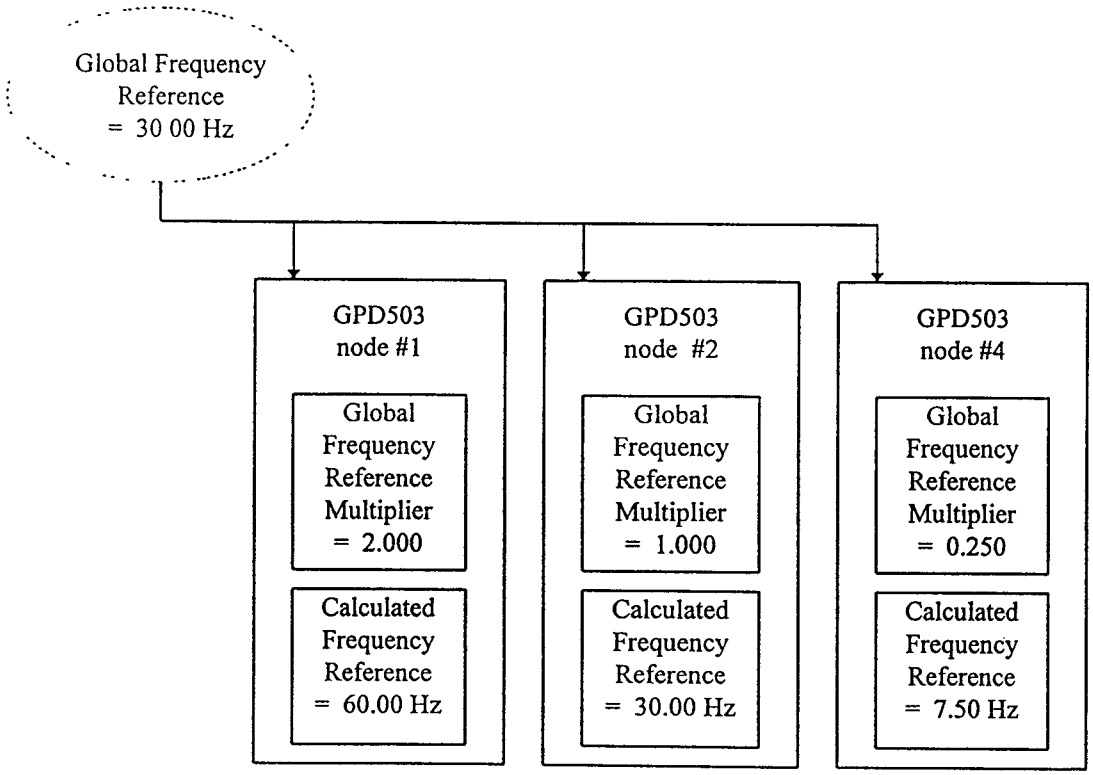
The GPD503 Register 911h is the Global Frequency Reference Multiplier register. The power-up default value of this register is '1.000'

To make use of the Global Frequency Reference Multiplier, the GPD503 register 910h must be setup to enable global data.

When global data is properly initialized, the value written to GPD503's Register 002h (frequency reference) will be multiplied by the value of GPD503's Register 911h (global frequency reference multiplier) to produce the frequency reference value This will allow each drive on the network to scale the global frequency reference that it receives

The diagram below shows a global frequency reference value of 30 00 Hz being written to 3 drives Each drive has a different Global Frequency Reference Multiplier value.

An example of using the Global Frequency Reference Multiplier can be found in Chapter 9, Example #6 (global frequency multiplier).



Origin of RUN/STOP and Frequency Reference Commands

The drive can be configured to receive operation signals (Run, Stop, Forward, Reverse,) from the MB+ network, the external drive terminals, or the digital operator. The second digit of GPD503 Drive Register Sn-04 (103h) and the second digit of GPD503 Drive Register Sn-08 (107h) are used to setup the source of the operation signals The following table indicates the possible configurations for the origin of the operation signals:

RUN / STOP		
Sn-08	**Sn-04**	**Run/Stop Commands from:**
XX0X	XX0X	MB+ Option Card
XX0X	XX1X	MB+ Option Card
XX1X	XX0X	External terminals
XX1X	XX1X	Digital Operator

The drive can be configured to receive a frequency reference value from the MB+ network, the external drive terminals, or the digital operator. The first digit of GPD503 Drive Register Sn-04 (103h) and the first digit of GPD503 Drive Register Sn-08 (107h) are used to setup the source of the frequency reference. The following table indicates the possible configurations for the origin of the frequency reference:

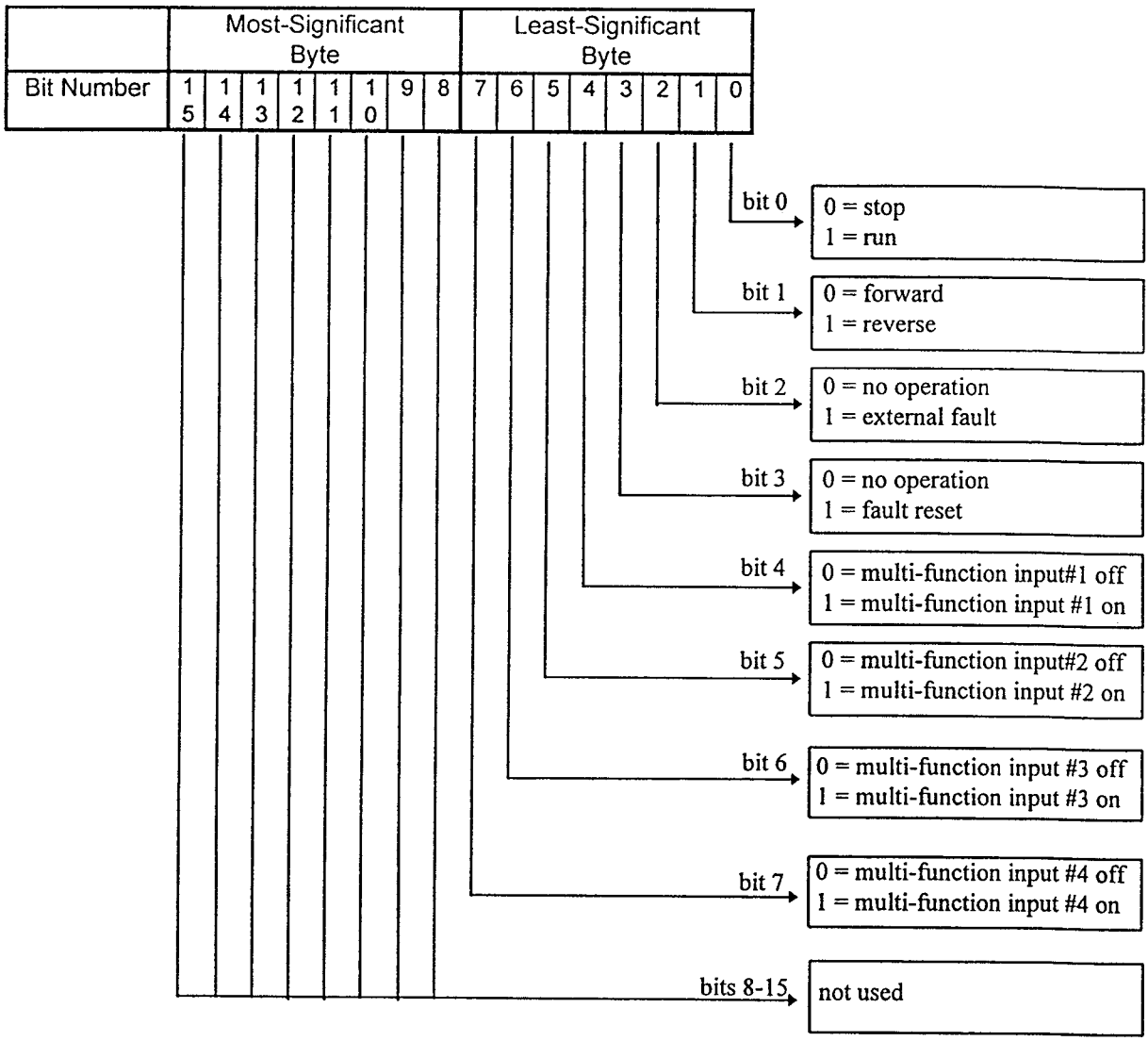
FREQUENCY REFERENCE		
Sn-08	**Sn-04**	**Run/Stop Commands from:**
XXX0	XXX0	MB+ Option Card
XXX0	XXX1	MB+ Option Card
XXX1	XXX0	Analog Input
XXX1	XXX1	Digital Operator

The value of the GPD503 Drive Register Sn-08 (107h) and Sn-04 (103h) may be stored in Non-Volatile RAM memory on the drive by use of the ENTER command. After the value has been 'entered', that value will be retained if the drive unit is powered down.

The default value of these register Sn-04 (103h) is '0011', and the default value of register 107h (Sn-08) is '0100'. Therefore both the operation commands and frequency reference are set up for the MB+ network

Using GPD503 Drive Register 001h

When the drive is setup to receive Operation Signals from the MB+ Network, the GPD503 drive Register 001h is used to operate the drive. This register performs multiple functions. Each of the first 8 bits of this register serves a different purpose. The remaining bits of this register are not used The following diagram shows the function of each of the bits of this register Bit 0 is the least significant bit of the register. Bit 15 is the most significant bit of the register.



Bit 0 is used to start and stop the drive To command the drive to stop, this bit should be set to a '0'. To command the drive to run, this bit should be set to a '1'.

Bit 1 is used to determine the direction of motion. To command the drive in the forward direction, this bit should be set to a '0'. To command the drive in the reverse direction, this bit should be set to a '1'

Bit 2 is used to turn external fault on and off To turn the external fault off, this bit should be set to a '0' To turn external fault on, this bit should be set to a '1'

Bit 3 is used to reset drive faults that have occurred To allow the drive to run, this bit should be set to a '0'. To reset a drive fault, this bit should be momentarily set to a '1' To reset a fault, the run/stop bit (Bit 0) must also be a '0'.

Bit 4 is used to turn multi-function input #1 on and off. To turn multi-function input #1 off, this bit should be set to a '0' To turn multi-function input #1 on, this bit should be set to a '1' The function of multi-function input #1 is determined by the setting of drive constant Sn-15

NOTE
For a description of the operation of the multi-function inputs refer to the GPD 503 Technical Manual (TM 4231).

Bit 5 is used to turn multi-function input #2 on and off. To turn multi-function input #2 off, this bit should be set to a '0'. To turn multi-function input #2 on, this bit should be set to a '1'. The function of multi-function input #2 is determined by the setting of drive constant Sn-16

Bit 6 is used to turn multi-function input #3 on and off To turn multi-function input #3 off, this but should be set to a'0' To turn multi-function input #3 on, this bit should be set to a '1' The function of multi-function input #3 is determined by the setting of drive constant Sn-17.

Bit 7 is used to turn multi-function input #4 on and off To turn multi-function input #4 off, this but should be set to a'0' To turn multi-function input #4 on, this bit should be set to a '1' The function of multi-function input #4 is determined by the setting of drive constant Sn-18

Some examples of using this register are shown in the following table

Function	Binary Value	Decimal	Hex
Stop	0000 0000 0000 0000	0	0000
Run Forward	0000 0000 0000 0001	1	0001
Run Reverse	0000 0000 0000 0011	3	0003
Cause a Drive Fault	0000 0000 0000 0100	4	0004
Reset a Drive Fault	0000 0000 0000 1000	8	0008
Turn On Multi-function Input#1	0000 0000 0001 0000	16	0010
Turn On Multi-function Input#2 while running	0000 0000 0010 0001	33	0021
Turn On Multi-function Input#3 while running reverse	0000 0000 0100 0011	67	0043
Turn On Multi-function Input#4	0000 0000 1000 0000	128	0080

Chapter 8
Diagnostics and Troubleshooting

- Troubleshooting Information
- Diagnostic LED (D2)
- MB+ MSTR Error Codes

Troubleshooting Information

If the "Cable Loss" is enabled and a situation causing a cable loss occurs, the drive will generate a cable loss fault. This fault will be displayed on the digital operator as 'EF3'. The 'EF3' fault is a non-recoverable fault, and input power to the drive must be cycled to clear it

Diagnostic LED (D2)

The green diagnostic LED on the MB+ card is not visible with the drive cover in place. This LED's output is controlled by the on-board peer processor and displays node status by flashing repetitive patterns The following is a listing of the LED flashing patterns, and an explanation of each.

STATUS				
Blink Pattern		Timing		Status
Green	Continuous Slow Blinks	ON OFF	340 msec 640 msec	This node is off-line and is not allowed to transmit data across the link It does hear all other active nodes on the link, and builds an active node table
Green	Continuous Rapid Blinks	ON OFF	80 msec 80 msec	This MB+ node is operating normally It is successfully receiving and passing the token.
Green	Two Rapid Blinks	ON OFF	160 msec 160 msec	This MB+ node is permanently in the idle state. It is monitoring other nodes on the MB+ link pass the token, but the token is never passed to this node This node may have a bad transmitter
Green	Three Rapid Blinks	ON OFF	160 msec 160 msec	This MB+ node is not finding any other nodes on the MB+ link. It is claiming and winning the token, but has no other node to pass it to. This node can periodically disrupt communication on the link. This condition can indicate a problem with the communication wiring.
Green	Four Rapid Blinks	ON OFF	160 msec 160 msec	This MB+ node has found another node on the MB+ link which has an identical node address. This node will remain off-line, monitoring the MB+ link until the duplicate node is not heard from for 5 seconds.

MSTR Function Error Codes

If an error occurs during an MSTR operation, a hexadecimal error code will be displayed in the second register of the control block (the top section) The form of the code is Mmss, where

- **M** represents the major code
- **m** represents the minor code
- **ss** represents a subcode

A list of error codes appears in the following table

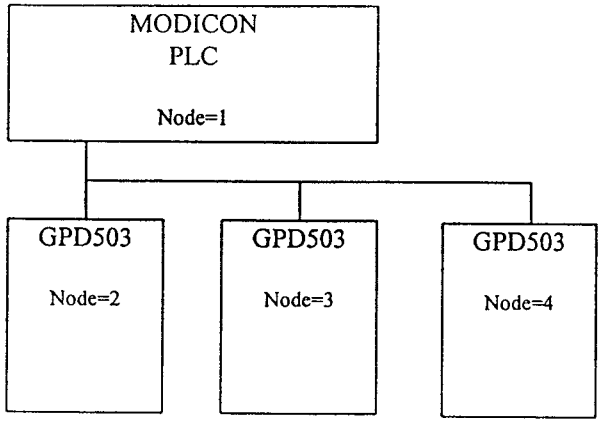
Error Code (Hex)	DEFINITION	
1001	User-initiated abort	
2001	Invalid operation type	
2002	User parameter changed	
2003	Invalid length	
2004	Invalid offset	
2005	Invalid length + offset	
2006	Invalid slave device data area	
2007	Invalid slave device network area	
2008	Invalid slave device network routing	
2009	Route equal to your own address	
200A	Attempting to obtain more global data words than available	
30ss	Modbus slave exception response	
	ss	**DEFINITION**
	01	Slave device does not support the requested operation
	02	Nonexistent slave device registers requested
	03	Invalid data value requested
	04	*Unassigned*
	05	Slave has accepted long-duration program command
	06	Function cannot be performed - a long duration command is in effect
	08-FF	*Unassigned*
4001	Inconsistent Modbus slave response	
5001	Inconsistent network response	
6mss	Routing failure	
	m	**DEFINITION**
	0 or 1	Routing register 1 (local network)
	2	Routing register 2
	3	Routing register 3
	4	Routing register 4
	5	Routing register 5
	ss	**DEFINITION**
	01	No response received
	02	Program access denied
	03	Node off-line and unable to communicate
	04	Exception response received
	05	Router node data paths busy
	06	Slave device down
	07	Bad destination address
	08	Invalid node type in routing path
	10	Slave has rejected the command
	20	Initiated transaction forgotten by slave device
	40	Unexpected master output path received
	80	Unexpected response received

Chapter 9
Examples

- Example #1 Write RUN/STOP and Frequency Reference
- Example #2 Read Output Frequency
- Example #3 Read Global Data
- Example #4 Enable Global Data and Write Global RUN/STOP and Frequency Reference
- Example #5 Write Acceleration and Deceleration Times
- Example #6 Write a Global Frequency Reference Multiplier
- Example #7 Read all Drive Constants
- Example #8 Write all Drive Constants
- Example #9 Read Drive Status Registers

Examples

In the following examples, a Modicon PLC and three GPD503 variable frequency drives are connected via a MB+ network that is configured as follows



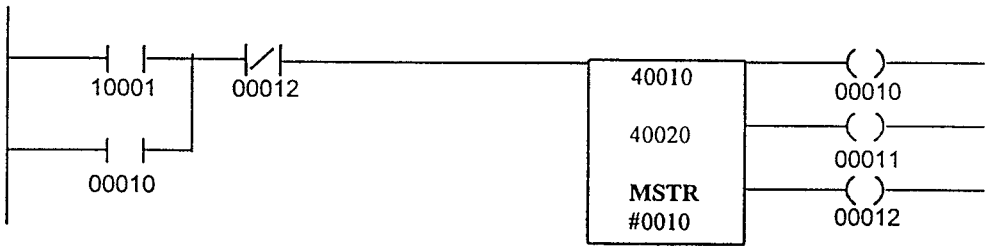
Example #1
Write RUN/STOP and Frequency Reference to a Drive

This example will show how to write a RUN FORWARD command and a 60 00 Hz frequency reference to a drive This example assumes that the drive is located at node 3

In this example, an input to the PLC will be used to initiate the MSTR that will write the 'Operation Command' and 'Frequency Reference' This input will be addressed at 10001

Since the 'Operation Command' register (001h) and the 'Frequency Reference' register (002h) are consecutive registers, one MSTR function can be used to write to both registers

In this example, the MSTR control registers will start at register 40010. The MSTR data registers will start at register 40020 There will be 2 MSTR data registers The MSTR function inserted into the ladder logic would look like



The Control Block registers must be loaded with the following data before the MSTR block is executed .

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40010	Operation Code	0001h	0001h = Write to Multiple Registers
40011	Network Error Code	0000h	The error code returned by MB+ communications
40012	Number of Registers	0002h	Write to 2 consecutive registers
40013	Register Data Code	0001h	Data code for run/stop command
40014	Routing 1	0003h	MB+ node address of drive = 0003h
40015	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40016	Routing 3	0000h	This routing register is not used, must be set to 0
40017	Routing 4	0000h	This routing register is not used, must be set to 0
40018	Routing 5	0000h	This routing register is not used, must be set to 0

The Data Block registers must be loaded with the appropriate RUN/STOP and Frequency Reference data before the MSTR block is executed.

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40020	Operation Signals	0001h	Run Forward = bit 0/on = 0001h
40021	Freq. Reference	1770h	60 00 Hz = 6000 (decimal) = 1770h

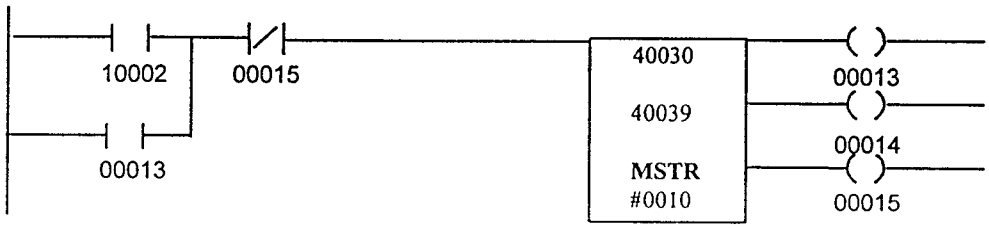
Example #2
Read Output Frequency from Drive #3

This example will show how to read the output frequency of a GPD503 drive on the MB+ network

In this example, an input to the PLC will be used to initiate the MSTR that will read the output frequency This input will be addressed at 10002

The Output Frequency is held in the register with data code 024h

In this example, the MSTR control registers will start at register 40030. The MSTR data register will start at register 40039. There will be 1 MSTR data register. The MSTR function inserted into the ladder logic would look like·



The Control Block registers must be loaded with the following data before the MSTR block is executed

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40030	Operation Code	0002h	0002h = Read from Multiple Registers
40031	Network Error Code	0000h	The error code returned by MB+ communications
40032	Number of Registers	0001h	Read from 1 consecutive register
40033	Register Data Code	0024h	Data code for output frequency command
40034	Routing 1	0003h	MB+ node address of drive = 0003h
40035	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40036	Routing 3	0000h	This routing register is not used, must be set to 0
40037	Routing 4	0000h	This routing register is not used, must be set to 0
40038	Routing 5	0000h	This routing register is not used, must be set to 0

The Data Block register will be filled by the PLC with the Drive #3 Output Frequency data after the MSTR block has been executed

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40039	Freq Reference	READ	60.00 Hz = 6000 (decimal) = 1770h

Example #3
Read Global Data from Drives #2 and #3

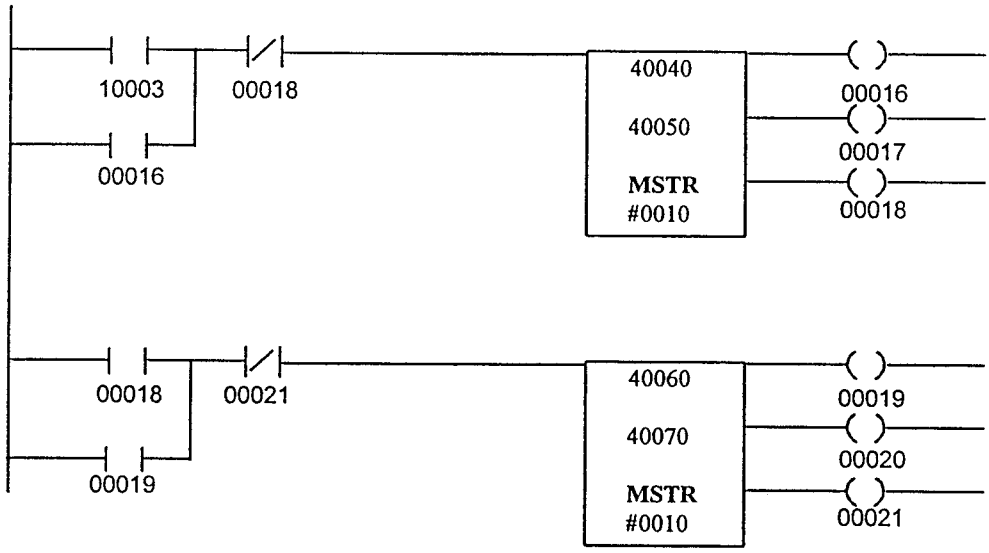
This example will read global data from drive #2 and drive #3. To enable a global read the dip switch S1-8 must be turned on for each drive The MB+ interface provides five specific registers that can be read by the PLC. This is done via the "Read Global Data MSTR Function (operation code #6) The PLC can only read global data from one drive at a time; therefore multiple MSTR transactions will be required

In this example, an input to the PLC will be used to initiate the MSTRs that will read the global data This input will be addressed at 10003

This example requires multiple MSTR transactions The following MSTR transactions will be performed:

	MSTR Transaction	Control Registers	Data Registers
1	Read global data from drive #2	40040	40050
2	Read global data from drive #3	40060	40070

The MSTR functions inserted into the ladder logic would look like:



MSTR Transaction #1

In this example, the MSTR blocks are executed sequentially. The Control Block and Data Block registers for the first MSTR must be loaded with the following data before the MSTR block is executed This MSTR transaction reads global data from drive #2

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40040	Operation Code	0006h	0006h = Read Global Data MSTR Function
40041	Network Error Code	0000h	The error code returned by MB+ communications
40042	Number of Registers	0005h	Number of words of global data requested (0-5).
40043	Available Words	0000h	The number of words available from the requested node This value is updated for you.
40044	Routing 1	0002h	MB+ node address of the drive = 0002h
40045	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40046	Routing 3	0000h	This routing register is not used, must be set to 0
40047	Routing 4	0000h	This routing register is not used, must be set to 0
40048	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40050	Drive Status Signals	READ	receives the drive status signals (020h)
40051	Output Frequency	READ	receives the drive's output frequency (024h)
40052	Output Current	READ	receives the drive's output current (027h)
40053	Output Motor Voltage	READ	receives the motor voltage (028h)
40054	Drive Status	READ	receives the drive status (02Ch)

MSTR Transaction #2

The Control Block and Data Block registers for the second MSTR must be loaded with the following data before the MSTR block is executed. This MSTR transaction reads global data from drive #3.

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40060	Operation Code	0006h	0006h = Read Global Data MSTR Function
40061	Network Error Code	0000h	The error code returned by MB+ communications
40062	Number of Registers	0005h	Number of words of global data requested (0-5).
40063	Available Words	0000h	The number of words available from the requested node. This value is updated for you.
40064	Routing 1	0003h	MB+ node address of the drive = 0003h
40065	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40066	Routing 3	0000h	This routing register is not used, must be set to 0
40067	Routing 4	0000h	This routing register is not used, must be set to 0
40068	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40070	Drive Status Signals	READ	receives the drive status signals (020h)
40071	Output Frequency	READ	receives the drive's output frequency (024h)
40072	Output Current	READ	receives the drive's output current (027h)
40073	Output Motor Voltage	READ	receives the motor voltage (028h).
40074	Drive Status	READ	receives the drive status (02Ch)

Example #4
Write Global RUN/STOP and Frequency Reference

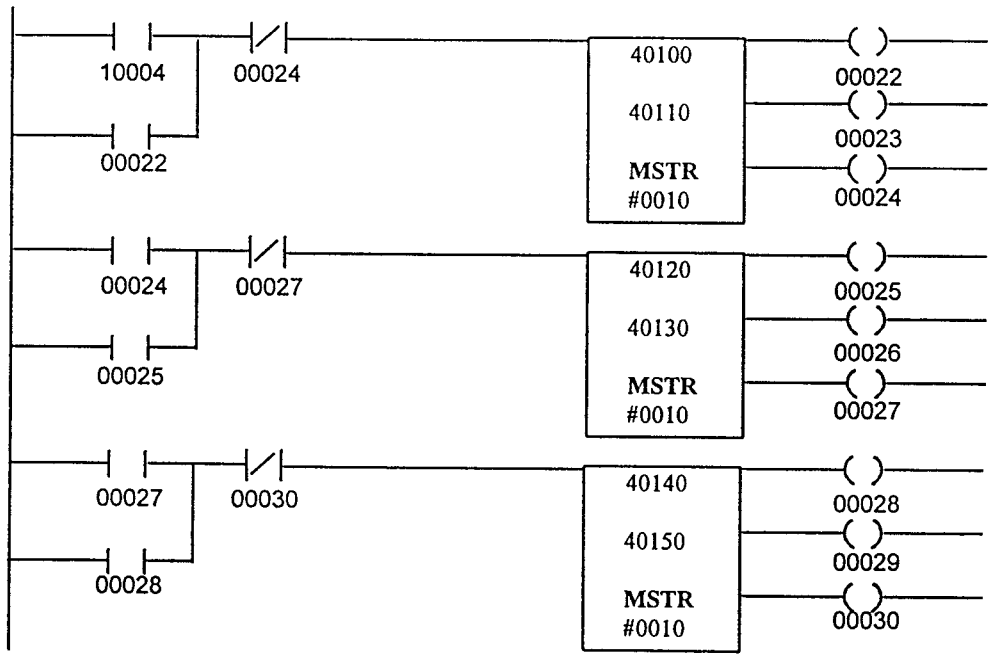
This example will show how to write a global RUN REVERSE command and a 34 56 Hz frequency reference to all drives on the MB+ network To enable this global write function, the address of the active local network PLC/host device (the source of global data) must be written to data register code 910h for each drive receiving global data

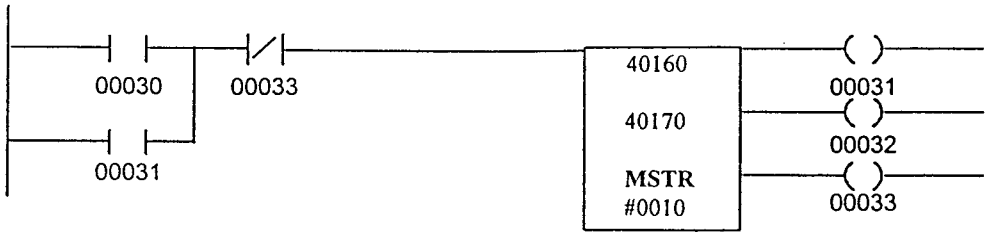
In this example, an input to the PLC will be used to initiate the MSTRs that will write to the 910h register This input will be 10004

This example requires multiple MSTR transactions The following MSTR transactions will be performed

	MSTR Transaction	Control Registers	Data Registers
1	Enable Global Data to the drive at node #2	40100	40110
2	Enable Global Data to the drive at node #3	40120	40130
3	Enable Global Data to the drive at node #4	40140	40150
4	Write Global Data to the drives	40160	40170

The MSTR functions inserted into the ladder logic would look like





MSTR Transaction #1

This MSTR transaction writes to the 910h register of the drive on node #2. The Control Block registers must be loaded with the following data before the MSTR block is executed

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40100	Operation Code	0001h	0001h = Write to Multiple Registers
40101	Network Error Code	0000h	The error code returned by MB+ communications
40102	Number of Registers	0001h	Write to 1 register
40103	Data Register Code	0910h	Global Write Data Code
40104	Routing 1	0002h	MB+ node address of drive = 0002h
40105	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40106	Routing 3	0000h	This routing register is not used, must be set to 0
40107	Routing 4	0000h	This routing register is not used, must be set to 0
40108	Routing 5	0000h	This routing register is not used, must be set to 0

The Data Block registers must be loaded with the appropriate PLC address before the MSTR block is executed

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40110	Receive Global Data	0001h	0001h = the PLC/host device (source of global data) address

MSTR Transaction #2

This MSTR transaction writes to the 910h register of the drive on node #3. The Control Block registers must be loaded with the following data before the MSTR block is executed

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40120	Operation Code	0001h	0001h = Write to Multiple Registers
40121	Network Error Code	0000h	The error code returned by MB+ communications
40122	Number of Registers	0001h	Write to 1 register
40123	Data Register Code	0910h	Global Write Data Code
40124	Routing 1	0003h	MB+ node address of drive = 0003h
40125	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40126	Routing 3	0000h	This routing register is not used, must be set to 0
40127	Routing 4	0000h	This routing register is not used, must be set to 0
40128	Routing 5	0000h	This routing register is not used, must be set to 0

The Data Block registers must be loaded with the appropriate PLC address before the MSTR block is executed

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40130	Receive Global Data	0001h	0001h = the PLC/host device (source of global data) address.

MSTR Transaction #3

This MSTR transaction writes to the 910h register of the drive on node #4. The Control Block registers must be loaded with the following data before the MSTR block is executed:

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40140	Operation Code	0001h	0001h = Write to Multiple Registers
40141	Network Error Code	0000h	The error code returned by MB+ communications
40142	Number of Registers	0001h	Write to 1 register
40143	Data Register Code	0910h	Global Write Data Code
40144	Routing 1	0004h	MB+ node address of drive = 0004h
40145	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40146	Routing 3	0000h	This routing register is not used, must be set to 0
40147	Routing 4	0000h	This routing register is not used, must be set to 0
40148	Routing 5	0000h	This routing register is not used, must be set to 0

The Data Block registers must be loaded with the appropriate PLC address before the MSTR block is executed.

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40150	Receive Global Data	0001h	0001h = the PLC/host device (source of global data) address

MSTR Transaction #4

This MSTR transaction writes the global data to all drives that have enabled global data The Control Block registers must be loaded with the following data before the MSTR function is executed

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40160	Operation Code	0005h	0005h = Global Write
40161	Network Error Code	0000h	The error code returned by MB+ communications
40162	Number of Registers	0003h	Write to 3 consecutive registers
40163	Data Register Code	XXXX	This register is not used when writing global data
40164	Routing 1	XXXX	This register is not used when writing global data
40165	Routing 2	XXXX	This register is not used when writing global data
40166	Routing 3	XXXX	This register is not used when writing global data
40167	Routing 4	XXXX	This register is not used when writing global data
40168	Routing 5	XXXX	This register is not used when writing global data

The Data Block registers must be loaded with the appropriate Global RUN/STOP and Frequency Reference data before the MSTR block is executed.

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40170	Activation Bit Map Register	0003h	bit 0/on = Operation Signals activated bit 1/on = Frequency Reference activated
40171	Operation Signals	0003h	Run Reverse = bit 0/on, bit 1/on = 0003h
40172	Freq. Reference	0D80h	34.56 Hz = 3456 (decimal) = 0D80h

Example #5
Write Acceleration and Deceleration (Bn-01 and Bn-02) to a Drive

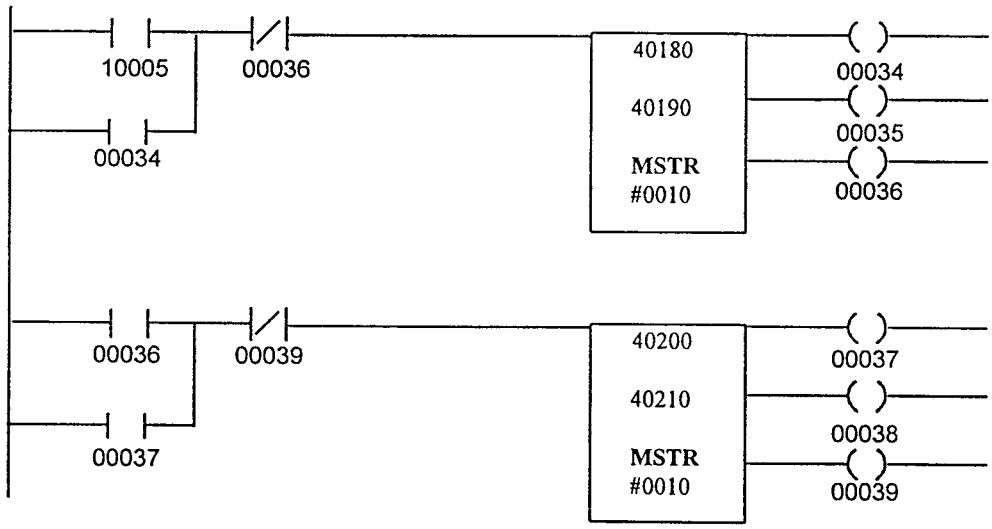
This example will show how to write acceleration and deceleration times to a drive on the MB+ network After writing the new acceleration and deceleration times, the new data will be stored in Non-Volatile memory with the ENTER command

In this example, an input to the PLC will be used to initiate the MSTRs that will write the acceleration and deceleration times This input will be addressed at 10005.

This example requires multiple MSTR transactions. The following MSTR transactions will be performed·

	MSTR Transaction	Control Registers	Data Registers
1	Write Accel and Decel registers	40180	40190
2	Write the ENTER command	40200	40210

The MSTR functions inserted into the ladder logic would look like



MSTR Transaction #1

In this example, the MSTR blocks are executed sequentially. The Control Block and Data Block registers for the first MSTR must be loaded with the following data before the MSTR block is executed This MSTR writes to the Acceleration Time 1 register (Bn-01) and the Deceleration Time 1 register (Bn-02) to drive (at node 2)

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40180	Operation Code	0001h	0001h = Write to Multiple Registers
40181	Network Error Code	0000h	The error code returned by MB+ communications
40182	Number of Registers	0002h	Write to 2 consecutive registers
40183	Data Register Code	0500h	Bn-01 data code
40184	Routing 1	0002h	MB+ node address of drive = 0002h
40185	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40186	Routing 3	0000h	This routing register is not used, must be set to 0
40187	Routing 4	0000h	This routing register is not used, must be set to 0
40188	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40190	Acceleration Time 1	000Ah	1 0 sec = 10 (decimal) = 000Ah
40191	Deceleration Time 1	0014h	2 0 sec = 20 (decimal) = 0014h

MSTR Transaction #2

The Control Block and Data Block registers for the second MSTR must be loaded with the following data before the MSTR block is executed This MSTR will ENTER data into Non-Volatile memory on the drive at node #2

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40200	Operation Code	0001h	0001h = Write to Multiple Registers
40201	Network Error Code	0000h	The error code returned by MB+ communications
40202	Number of Registers	0001h	Write to 1 register
40203	Data Register Code	0900h	Data code for the "ENTER" command
40204	Routing 1	0002h	MB+ node address of the drive = 0002h
40205	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40206	Routing 3	0000h	This routing register is not used, must be set to 0
40207	Routing 4	0000h	This routing register is not used, must be set to 0
40208	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40210	ENTER data into Non-Volatile memory	0000h	To ENTER data into Non-Volatile memory, set this register to '0'

Example #6

Write a Global Frequency Reference Multiplier to Drives #2 & #3

This example will write a global frequency reference multiplier of 0 500 to drive #2 and 0.250 to drive #3 The global frequency reference multiplier register is data code 911h in the Satellite Internal Register Group The value of the multiplier can range from 0 001 to 9 999 Each drive that receives a global frequency reference will multiply the value received by the value in their Register 002h

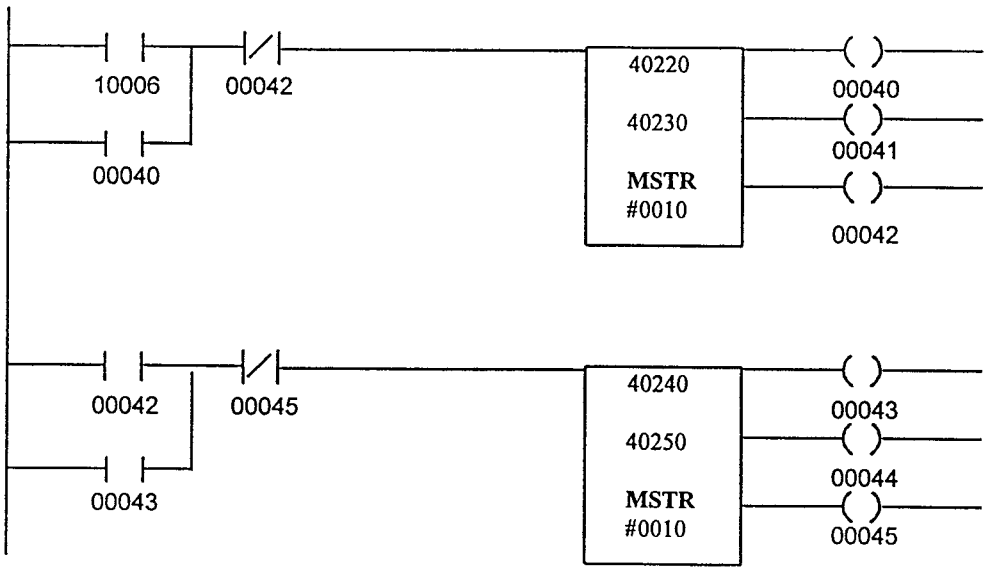
NOTE
For this operation to be valid, each drive must be initialized to receive global data This is done by sending the address of the PLC/host device (source of global data) to 910h.

In this example, an input to the PLC will be used to initiate the MSTRs that will write the reference multiplier to drives #2 and #3. The input will be addressed at 10006

Since the Receive Global Data Register and the Global Reference Multiplier Register are consecutive, only one MSTR transaction will be needed per drive The following MSTR transactions should be performed

	MSTR Transaction	Control Registers	Data Registers
1	Write to the Global Write Data Register and the Global Reference Multiplier Register on drive #2	40220	40230
2	Write to the Global Write Data Register and the Global Reference Multiplier Register on drive #3	40240	40250

The MSTR functions inserted into the ladder logic would look like



MSTR Transaction #1

In this example, the MSTR blocks are executed sequentially The Control Block and Data Block registers for the first MSTR must be loaded with the following data before the MSTR block is executed This MSTR writes to the Receive Global Data Register and the Global Frequency Reference Multiplier Register on drive #2.

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40220	Operation Code	0001h	0001h = Write to Multiple Registers
40221	Network Error Code	0000h	The error code returned by MB+ communications
40222	Number of Registers	0002h	Write to 2 consecutive registers
40223	Data Register Code	0910h	Global Write Data Register Code
40224	Routing 1	0002h	MB+ node address of the drive = 0002h
40225	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40226	Routing 3	0000h	This routing register is not used, must be set to 0
40227	Routing 4	0000h	This routing register is not used, must be set to 0
40228	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40230	Receive Global Data	0001h	0001h = address of the PLC/host device (the source of global data)
40231	Global Frequency Reference Multiplier	01F4h	0500 (decimal) = .500 multiplier. Frequency in 002h register is multiplied by .500 on drive 2

MSTR Transaction #2

The Control Block and Data Block registers for the second MSTR must be loaded with the following data before the MSTR block is executed This MSTR writes to the Receive Global Data Register and the Global Frequency Reference Multiplier Register on drive #3

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40240	Operation Code	0001h	0001h = Write to Multiple Registers
40241	Network Error Code	0000h	The error code returned by MB+ communications
40242	Number of Registers	0002h	Write to 2 consecutive registers
40243	Data Register Code	0910h	Global Write Data Register
40244	Routing 1	0003h	MB+ node address of the drive = 0003h
40245	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40246	Routing 3	0000h	This routing register is not used, must be set to 0
40247	Routing 4	0000h	This routing register is not used, must be set to 0
40248	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40250	Receive Global Data	0001h	0001h = address of the PLC/host device (the source of global data)
40251	Global Frequency Reference Multiplier	00FAh	0250 (decimal) = .250 multiplier. Frequency in 002h register is multiplied by 250 on drive # 3

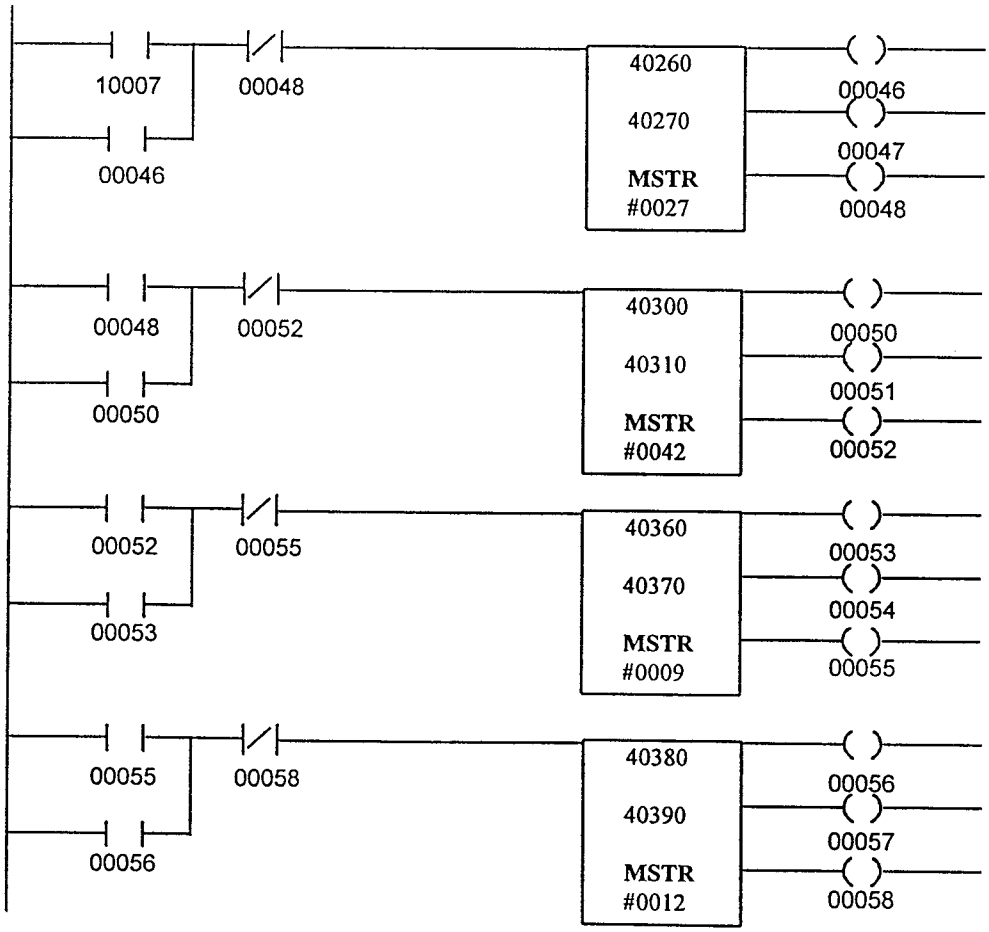
Example #7
Read all Drive Constants (Sn's, Cn's, An's, and Bn's) from Drive #3

This example will read all of the drive constants from drive #3. In this example, an input to the PLC will be used to initiate the MSTRs that will read the drive constants This input will be addressed at 10007

This example requires multiple MSTR transactions The following MSTR transactions will be performed

	MSTR Transaction	Control Registers	Data Registers
1	Read Sn constants (registers 101h - 11Bh)	40260	40270
2	Read Cn constants (registers 200h - 229h)	40300	40310
3	Read An constants (registers 400h - 408h)	40360	40370
4	Read Bn constants (registers 500h - 50Bh)	40380	40390

The MSTR functions inserted into the ladder logic would look like:



MSTR Transaction #1

In this example, the MSTR blocks are executed sequentially. The Control Block registers for the first MSTR must be loaded with the following data before the MSTR block is executed This MSTR reads Sn-02 through Sn-28

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40260	Operation Code	0002h	0002h = Read from Multiple Registers
40261	Network Error Code	0000h	The error code returned by MB+ communications
40262	Number of Registers	001Bh	Read from 27 consecutive registers
40263	Data Register Code	0101h	0101h = start of Sn constants.
40264	Routing 1	0003h	MB+ node address of the drive = 0003h
40265	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40266	Routing 3	0000h	This routing register is not used, must be set to 0
40267	Routing 4	0000h	This routing register is not used, must be set to 0
40268	Routing 5	0000h	This routing register is not used, must be set to 0

The Data Block registers for the first MSTR will be filled with the following data after the MSTR is completed

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40270	kVA (HP) Select	READ	GPD503 capacity selection
40271	V/f Select	READ	V/f pattern selection
⇓	⇓	⇓	⇓
40295	Digital Output Card	READ	Output signal selection
40296	Analog Monitor	READ	Output channel & format

MSTR Transaction #2

The Control Block registers for the second MSTR must be loaded with the following data before the MSTR block is executed This MSTR reads Cn-01 through Cn-42

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40300	Operation Code	0002h	0002h = Read from Multiple Registers
40301	Network Error Code	0000h	The error code returned by MB+ communications
40302	Number of Registers	002Ah	Read from 42 consecutive registers
40303	Data Register Code	0200h	0200 = start of Cn constants
40304	Routing 1	0003h	MB+ node address of drive = 0003h
40305	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40306	Routing 3	0000h	This routing register is not used, must be set to 0
40307	Routing 4	0000h	This routing register is not used, must be set to 0
40308	Routing 5	0000h	This routing register is not used, must be set to 0

The Data Block registers for the second MSTR will be filled with the following data when the MSTR is completed.

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40310	Output Voltage Regulator	READ	Output voltage
40311	Frequency - Max	READ	50 - 400 Hz
⇓	⇓	⇓	⇓
40350	V/f During Speed Search	READ	0 - 100 V/f patterns
40351	Voltage Recovery Time	READ	0 1 - 5.0 seconds

MSTR Transaction #3

The Control Block registers for the third MSTR must be loaded with the following data before the MSTR block is executed This MSTR reads An-01 through An-09

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40360	Operation Code	0002h	0002h = Read from Multiple Registers
40361	Network Error Code	0000h	The error code returned by MB+ communications
40362	Number of Registers	0009h	Read from 9 consecutive registers
40363	Data Register Code	0400h	0400 = start of An constants
40364	Routing 1	0003h	MB+ node address of drive = 0003h
40365	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40366	Routing 3	0000h	This routing register is not used, must be set to 0
40367	Routing 4	0000h	This routing register is not used, must be set to 0
40368	Routing 5	0000h	This routing register is not used, must be set to 0

The Data Block registers for the third MSTR will be filled with the following data when the MSTR is completed

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40370	Frequency Reference 1	READ	0 00 - 400.00 Hz
40371	Frequency Reference 2	READ	0.00 - 400.00 Hz
⇓	⇓	⇓	⇓
40377	Frequency Reference 8	READ	0.00 - 400.00 Hz
40378	Jog Reference	READ	0 00 - 400.00 Hz

MSTR Transaction #4

The Control Block registers for the fourth MSTR must be loaded with the following data before the MSTR block is executed. This MSTR reads BN-01 through Bn-12

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40380	Operation Code	0002h	0002h = Read from Multiple Registers
40381	Network Error Code	0000h	The error code returned by MB+ communications
40382	Number of Registers	000Ch	Read from 12 consecutive registers
40383	Data Register Code	0500h	0500 = start of Bn constants
40384	Routing 1	0003h	MB+ node address of drive = 0003h
40385	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40386	Routing 3	0000h	This routing register is not used, must be set to 0
40387	Routing 4	0000h	This routing register is not used, must be set to 0
40388	Routing 5	0000h	This routing register is not used, must be set to 0

The Data Block registers for the fourth MSTR will be filled with the following data when the MSTR is completed

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40390	Accel Time 1	READ	0 0 - 6000.0 seconds
40391	Decel Time 1	READ	0 0 - 6000 0 seconds
⇓	⇓	⇓	⇓
40400	Analog Monitor Channel	READ	(1 Gain) 0 01 - 2.55
40401	Analog Monitor Channel	READ	(2 Gain) 0 01 - 2 55

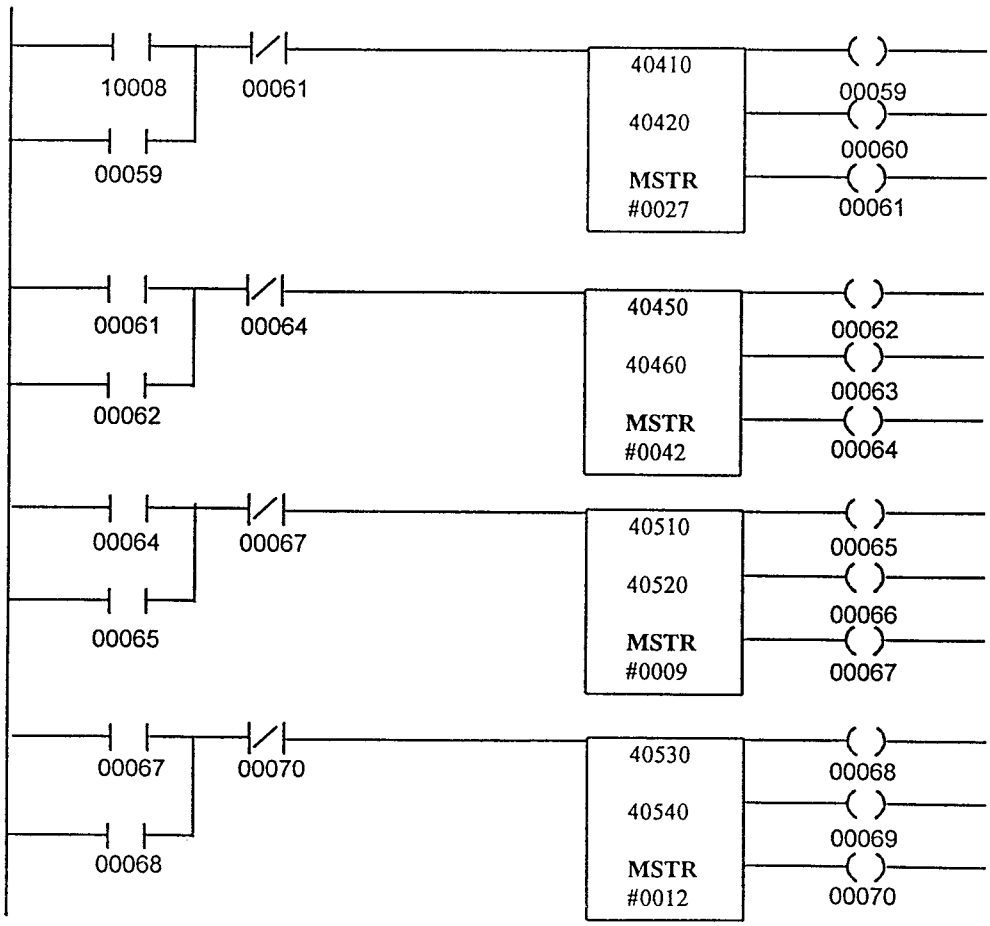
Example #8
Write all Drive Constants (Sn's, Cn's, An's, and Bn's) to Drive #3

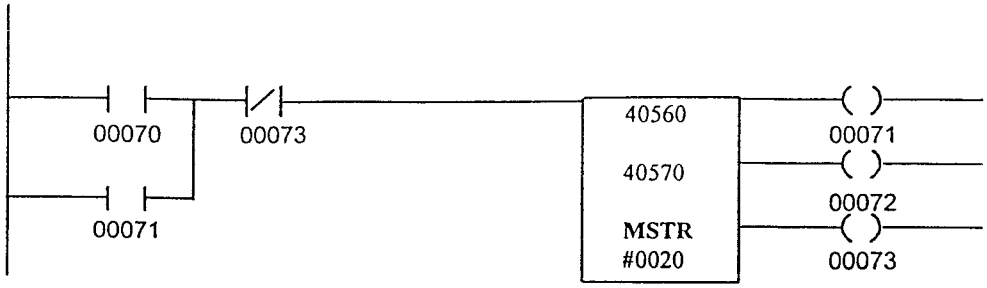
This example will write all of the drive constants to drive #3 After writing the drive constants, the new data will be stored in Non-Volatile memory with the ENTER command In this example, an input to the PLC will be used to initiate the MSTRs that will write the drive constants This input will be addressed at 10008

This example requires multiple MSTR transactions The following MSTR transactions will be performed

	MSTR Transaction	Control Registers	Data Registers
1	Write Sn Constants to drive at node #3	40410	40420
2	Write Cn Constants to drive at node #3	40450	40460
3	Write An Constants to drive at node #3	40510	40520
4	Write Bn Constants to drive at node #3	40530	40540
5	Write the ENTER command	40560	40570

The MSTR functions inserted into the ladder logic would look like.





MSTR Transaction #1

In this example, the MSTR blocks are executed sequentially The Control Block and Data Block registers for the first MSTR must be loaded with the following data before the MSTR block is executed This MSTR writes Sn-02 through Sn-28.

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40410	Operation Code	0001h	0001h = Write to Multiple Registers
40411	Network Error Code	0000h	The error code returned by MB+ communications
40412	Number of Registers	001Bh	Write to 27 consecutive registers
40413	Data Register Code	0101h	0101h = the start of Sn constants
40414	Routing 1	0003h	MB+ node address of the drive = 0003h
40415	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40416	Routing 3	0000h	This routing register is not used, must be set to 0
40417	Routing 4	0000h	This routing register is not used, must be set to 0
40418	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40420	kVA (HP) Select	WRITE	GPD503 capacity selection
40421	V/f Select	WRITE	V/f pattern selection
⇓	⇓	⇓	⇓
40445	Digital Output Card	WRITE	Output signal selection
40446	Analog Monitor	WRITE	Output channel & format

MSTR Transaction #2

The Control Block and Data Block registers for the second MSTR must be loaded with the following data before the MSTR block is executed This MSTR writes Cn-01 through Cn-42

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40450	Operation Code	0001h	0001h = Write to Multiple Registers
40451	Network Error Code	0000h	The error code returned by MB+ communications
40452	Number of Registers	002Ah	Write to 42 consecutive registers
40453	Data Register Code	0200h	0200h = start of Cn constants
40454	Routing 1	0003h	MB+ node address of the drive = 0003h
40455	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40456	Routing 3	0000h	This routing register is not used, must be set to 0
40457	Routing 4	0000h	This routing register is not used, must be set to 0
40458	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40460	Output Voltage Regulator	WRITE	Output voltage
40461	Frequency - Max	WRITE	50 - 400 Hz
⇓	⇓	⇓	⇓
40500	V/f During Speed Search	WRITE	0 - 100 V/f patterns
40501	Voltage Recovery Time	WRITE	0 1 - 5 0 seconds

MSTR Transaction #3

The Control Block and Data Block registers for the third MSTR must be loaded with the following data before the MSTR block is executed This MSTR writes An-01 through An-09

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40510	Operation Code	0001h	0001h = Write to Multiple Registers
40511	Network Error Code	0000h	The error code returned by MB+ communications
40512	Number of Registers	0009h	Write to 9 consecutive registers
40513	Data Register Code	0400h	0400h = start of An constants
40514	Routing 1	0003h	MB+ node address of the drive = 0003h
40515	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40516	Routing 3	0000h	This routing register is not used, must be set to 0
40517	Routing 4	0000h	This routing register is not used, must be set to 0
40518	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40520	Frequency Reference 1	WRITE	0.00 - 400.00 Hz
40521	Frequency Reference 2	WRITE	0.00 - 400.00 Hz
⇓	⇓	⇓	⇓
40527	Frequency Reference 8	WRITE	0 00 - 400.00 Hz
40528	Jog Reference	WRITE	0.00 - 400.00 Hz

MSTR Transaction #4

The Control Block registers for the fourth MSTR must be loaded with the following data before the MSTR block is executed This MSTR writes to BN-01 through Bn-12

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40530	Operation Code	0001h	0001h = Write to Multiple Registers
40531	Network Error Code	0000h	The error code returned by MB+ communications
40532	Number of Registers	000Ch	Read from 12 consecutive registers
40533	Data Register Code	0500h	0500 = start of Bn constants
40534	Routing 1	0003h	MB+ node address of drive = 0003h
40535	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40536	Routing 3	0000h	This routing register is not used, must be set to 0
40537	Routing 4	0000h	This routing register is not used, must be set to 0
40538	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40540	Accel Time 1	WRITE	0.0 - 6000 0 seconds
40541	Decel Time 1	WRITE	0 0 - 6000 0 seconds
⇓	⇓	⇓	⇓
40550	Analog Monitor Channel	WRITE	(1 Gain) 0.01 - 2.55
40551	Analog Monitor Channel	WRITE	(2 Gain) 0.01 - 2.55

MSTR Transaction #5

The Control Block and Data Block registers for the fifth MSTR must be loaded with the following data before the MSTR block is executed. This MSTR will ENTER data into Non-Volatile memory on drive #3.

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40560	Operation Code	0001h	0001h = Write to Multiple Registers
40561	Network Error Code	0000h	The error code returned by MB+ communications
40562	Number of Registers	0001h	Write to 1 registers
40563	Data Register Code	0900h	0900h = ENTER command
40564	Routing 1	0003h	MB+ node address of the drive = 0003h
40565	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40566	Routing 3	0000h	This routing register is not used, must be set to 0
40567	Routing 4	0000h	This routing register is not used, must be set to 0
40568	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40570	ENTER data into Non-Volatile memory	0000h	To ENTER data into Non-Volatile memory, set this register to '0'

Example #9

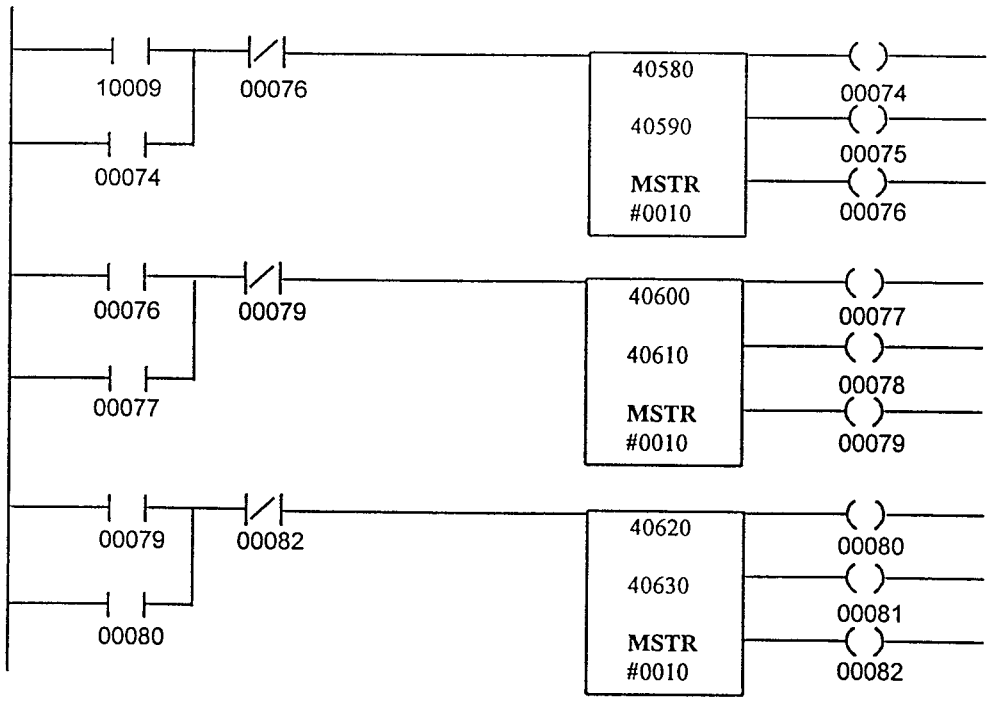
Read the Drive Status register from Drive #2, #3, and #4

This example will read the various drive status registers (such as Drive Status Signals, Drive Fault Contents, Communication Data Link Status, Frequency Reference, Output Reference, Output Current, and Output Motor Voltage) from all of the GPD503s In this example, an input to the PLC will be used to initiate the MSTRs that will read the drive status This input will be addressed at 10009

Since all of these drive status registers are consecutive, this example only requires one read MSTR transactions per drive The following MSTR transactions will be performed

	MSTR Transaction	Control Registers	Data Registers
1	Read drive status (020h - 028h) from drive #2	40580	40590
2	Read drive status (020h - 028h) from drive #3	40600	40610
3	Read drive status (020h - 028h) from drive #4	40620	40630

The MSTR functions inserted into the ladder logic would look like



MSTR Transaction #1

In this example, the MSTR blocks are executed sequentially The Control Block registers for the first MSTR must be loaded with the following data before the MSTR block is executed This MSTR reads drive status from drive #2

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40580	Operation Code	0002h	0002h = Read from Multiple Registers
40581	Network Error Code	0000h	The error code returned by MB+ communications
40582	Number of Registers	0009h	Read from 9 consecutive registers
40583	Data Register Code	0020h	020h = Drive Status Signals
40584	Routing 1	0002h	MB+ node address of the drive = 0002h
40585	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40586	Routing 3	0000h	This routing register is not used, must be set to 0
40587	Routing 4	0000h	This routing register is not used, must be set to 0
40588	Routing 5	0000h	This routing register is not used, must be set to 0

The Data Block registers for the first MSTR will be filled with the following data after the MSTR is completed.

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40590	Drive Status Signals	READ	RUN/STOP, FWD/REV, Drive Ready, etc
40591	Drive Fault Contents	READ	Overcurrent, Overvoltage, Drive Overload, etc
40592	Communication Data Link Status	READ	Data Writing, Write-In Mode Error, Register No Fault, Upper/Lower Fault, etc.
40593	Frequency Reference	READ	(100/1 00 Hz) frequency command to drive
40594	Output Frequency	READ	(100/1.00 Hz) frequency at the drive
40595	not used	n/a	n/a
40596	not used	n/a	n/a
40597	Output Current	READ	(10/1.0 A) current at the output
40598	Output Motor Voltage	READ	(1/1.0 V) voltage going to motor

MSTR Transaction #2

The Control Block registers for the second MSTR must be loaded with the following data before the MSTR block is executed. This MSTR reads the drive status from drive #3

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40600	Operation Code	0002h	0002h = Read from Multiple Registers
40601	Network Error Code	0000h	The error code returned by MB+ communications
40602	Number of Registers	0009h	Read from 9 consecutive registers
40603	Data Register Code	0020h	020h = Drive Status Signals
40604	Routing 1	0003h	MB+ node address of the drive = 0003h
40605	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40606	Routing 3	0000h	This routing register is not used, must be set to 0
40607	Routing 4	0000h	This routing register is not used, must be set to 0
40608	Routing 5	0000h	This routing register is not used, must be set to 0

The Data Block registers for the second MSTR will be filled with the following data after the MSTR is completed

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40610	Drive Status Signals	READ	RUN/STOP, FWD/REV, Drive Ready, etc
40611	Drive Fault Contents	READ	Overcurrent, Overvoltage, Drive Overload, etc.
40612	Communication Data Link Status	READ	Data Writing, Write-In Mode Error, Register No Fault, Upper/Lower Fault, etc
40613	Frequency Reference	READ	(100/1.00 Hz) frequency command to drive
40614	Output Frequency	READ	(100/1.00 Hz) frequency at the drive
40615	not used	n/a	n/a
40616	not used	n/a	n/a
40617	Output Current	READ	(10/1 0 A) current at the output
40618	Output Motor Voltage	READ	(1/1.0 V) voltage going to motor

MSTR Transaction #3

The Control Block registers for the third MSTR must be loaded with the following data before the MSTR block is executed This MSTR reads drive status from drive #4

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40620	Operation Code	0002h	0002h = Read from Multiple Registers
40621	Network Error Code	0000h	The error code returned by MB+ communications
40622	Number of Registers	0009h	Read from 9 consecutive registers
40623	Data Register Code	0020h	020h = Drive Status Signals
40624	Routing 1	0004h	MB+ node address of the drive = 0004h
40625	Routing 2	0001h	End of routing path = 0001h (MB+ requirement)
40626	Routing 3	0000h	This routing register is not used, must be set to 0
40627	Routing 4	0000h	This routing register is not used, must be set to 0
40628	Routing 5	0000h	This routing register is not used, must be set to 0

The Data Block registers for the third MSTR will be filled with the following data after the MSTR is completed

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40630	Drive Status Signals	READ	RUN/STOP, FWD/REV, Drive Ready, etc
40631	Drive Fault Contents	READ	Overcurrent, Overvoltage, Drive Overload, etc
40632	Communication Data Link Status	READ	Data Writing, Write-In Mode Error, Register No Fault, Upper/Lower Fault, etc
40633	Frequency Reference	READ	(100/1.00 Hz) frequency command to drive
40634	Output Frequency	READ	(100/1 00 Hz) frequency at the drive
40635	not used	n/a	n/a
40636	not used	n/a	n/a
40637	Output Current	READ	(10/1.0 A) current at the output
40638	Output Motor Voltage	READ	(1/1.0 V) voltage going to motor

Appendix A
Data Codes

- Command Data
- Monitor Data
- Constant Data
- Special Data

Command Drive Register Data Codes (Read / Write)

DATA CODE	FUNCTION	BIT NO.	DATA SET	DESCRIPTION	
001	Operational Signals			**Write Function**	**Read Function**
		0	0	Stop	Stop
			1	Run	Run
		1	0	Forward Run	Forward Run
			1	Reverse Run	Reverse Run
		2	1	External Fault	Drive Ready
		3	1	Fault Reset	Fault
		4	1	Multi-function Input 1 is selected	Data Setting Error
		5	1	Multi-function Input 2 is selected	Multi-function Output Setting
		6	1	Multi-function Input 3 is selected	Multi-function Output Setting
		7	1	Multi-function Input 4 is selected	Multi-function Output Setting
002	Frequency Reference / Output Frequency			0.00 - 400.00 (Hz) (100/1.00 Hz)	
003	Not Supported		0	will return zeros	
004	Not Supported		0	will return zeros	
005	Not Supported		0	will return zeros	
006	Not Supported		0	will return zeros	
007	Not Supported		0	will return zeros	
008	Not Supported		0	will return zeros	
009	Multi-function Contact Output	0	1	Multi-function Output of Terminal 9, 10 **(2)**	
		1	1	Multi-function Output of Terminal 25 **(3)**	
		2	1	Multi-function Output of Terminal 26 **(4)**	
		3-15		Not Used	
00A	Multi-function Analog Output	0-15		0-10V DC analog output on terminals 21 and 22 **(5)**	
00B-01F	Not Supported			will return zeros	

Notes:
1. Desired frequency of 35.75 Hz requires a value of 3575 in register data code 002h.
2. PLC forceable when Sn-20 = '0F'.
3. PLC forceable when Sn-21 = '0F'
4. PLC forceable when Sn-22 = '0F'
5. PLC forceable when 1st digit of Sn-09 is '1' (Sn-09 = xxx1).

Monitor Drive Register Data Codes (Read only)

DATA CODE	FUNCTION	BIT NO.	DATA SET	DESCRIPTION
020h	Drive Status Signals	0	0	Stop Command
			1	Run Command
		1	0	Forward Command
			1	Reverse Command
		2	1	Drive Ready
		3	1	Drive Faulted
		4	1	Data Setting Error
		5	1	Multi-function Output Set 1
		6	1	Multi-function Output Set 2
		7	1	Multi-function Output Set 3
		8-15		will return zeros
021h	Drive Fault Contents	0	1	Overcurrent
		1	1	Overvoltage
		2	1	Drive Overload
		3	1	Drive Overheat
		4		Not Used
		5	1	Fuse Blown
		6		Not Used
		7	1	External Fault
		8	1	Hardware Fault
		9	1	Motor Overload
		10		Not Used
		11	1	DB Resistor Fault
		12	1	Power Loss
		13-15		Not Used

Monitor Drive Register Data Codes (continued)

DATA	FUNCTION	BIT	DATA	DESCRIPTION
022h	Communication Data Link Status	0	1	Write in Progress
		1	1	Write-In Mode Error
		2	1	Data Code Fault
		3	1	Upper/Lower Fault
		4	1	Consistency Fault
		5	1	NV-RAM Write-In Error
		6	1	Enter Command Not Received
		7	1	BCC Error
		8	1	DP-RAM Fault
		9-15	N/A	will return zeros
023h	Frequency Reference	0-15		(100/1.00 Hz) **(1)**
024h	Output Frequency	0-15		(100/1.00 Hz) **(1)**
025h	Not Used			will return zeros
026h	Not Used			will return zeros
027h	Output Current	0-15		(10/1.0 Amps) **(2)**
028h	Output Motor Voltage	0-15		(1/1.0 Volts)
029h	Main Speed A/D Converted Value	0-15		(1023=10.0 Volts) **(3)**
02Ah	Auxiliary Speed A/D Converted Value	0-15		(1023=10.0 Volts) **(3)**
02Bh	Sequence Input Value	0	1	input terminal 1 used with reference to ground
		1	1	input terminal 2 used with reference to ground
		2	1	input terminal 3 used with reference to ground
		3	1	input terminal 4 used with reference to ground
		4	1	input terminal 5 used with reference to ground
		5	1	input terminal 6 used with reference to ground
		6	1	input terminal 7 used with reference to ground
		7	1	input terminal 8 used with reference to ground

Notes:

1. Actual frequency value of 35.75 Hz is represented by a value of 3575 in register data code locations 023h and 024h.
2. Value in register divided by 10 equals actual amps.
3. A value of 1023 in register data code locations 029h and 02Ah equals a 10.0 Volt value.

Monitor Drive Register Data Codes (continued)

DATA	FUNCTION	BIT	DATA	DESCRIPTION		
02Ch	Drive Status	0	1	Run Command Received		
		1	1	During Zero Speed		
		2	1	During Frequency Coincidence		
		3	1	Arbitrary Frequency Coincidence		
		4	1	Frequency Detection -Low		
		5	1	Frequency Detection - High		
		6	1	Drive Ready		
		7	1	Undervoltage Detected		
		8	1	Output Off		
		9	1	Frequency Reference Mode		
		10	1	Run Command Mode		
		11	1	Overtorque Detection		
		12	1	Frequency Reference Missing		
		13	1	Braking Resistor Fault		
		14	1	Major Fault		
		15	1	Communication Error		
02Dh	Multi-function Output Terminal Monitor	0		Multi-function Output #1 Status		
		1		Multi-function Output #2 Status		
		2		Multi-function Output #3 Status		
		3		Multi-function Output #4 Status		
		4-15		will return zeros		
02E, 2Fh,	Not Used			will return zeros		
030h	Not Used			will return zeros		
031h	Main CKT DC Voltage	0-15		(1/1.0 Volts)		
032h	Output Power	0-15		(10/1.0 kW) **(1)**		
033h	Fault Sequence	0-3		Fault at Present		
		4-7		Former Fault (one time before)		
		8-11		Former Fault (two times before)		
		12-15		Former Fault (three times before)		
	Four Bit Fault Code	0000	No Fault		1000	External Fault (EFxx)
		0001	Overcurrent (OC)		1001	Control Circuit Fault (CPFxx)
		0010	Overvoltage (OV)		1010	Motor Overload (OL1)
		0011	Drive Overload (OL2)		1011	reserve
		0100	Drive Overheat (OH)		1100	Power loss (includes momentary) (UV)
		0101	reserve		1101	reserve
		0110	Fuse Blow (FU)		1110	reserve
		0111	Braking transistor, resistor overheat		1111	reserve

Notes: 1 Value in register divided by 10 equals actual kW.

Drive Constant Register Data Codes (Read/Write)

DATA CODE	CONSTANT NUMBER	CONSTANT FUNCTION
101h	Sn-02	V/f Selection
102h	Sn-03	Operator Status
103h	Sn-04	Operation Mode Select 1
104h	Sn-05	Operation Mode Select 2
105h	Sn-06	Operation Mode Select 3
106h	Sn-07	Overtorque Detection
107h	Sn-08	Option Reference Select
108h	Sn-09	Analog Monitor Selection
109h	Sn-10	Protective Characteristics Select 1
10Ah	Sn-11	Protective Characteristics Select 2
10Bh	Sn-12	Protective Characteristics Select 3
10Ch	Sn-13	Protective Characteristics Select 4
10Dh	Sn-14	Protective Characteristics Select 5
10Eh	Sn-15	Terminal 5 Function
10Fh	Sn-16	Terminal 6 Function
110h	Sn-17	Terminal 7 Function
111h	Sn-18	Terminal 8 Function
112h	Sn-19	Multi-function Analog Input (term. 16)
113h	Sn-20	Multi-function Output 1
114h	Sn-21	Multi-function Output 2
115h	Sn-22	Multi-function Output 3
*116h	Sn-23	only used with PID EEPROMS
*117h	Sn-24	only used with PID EEPROMS
118h	Sn-25	Analog Speed Setter
119h	Sn-26	Digital Speed Reference (DI-08)
11Ah	Sn-27	Digital Output Card (DO-08) Pulse Monitor (PO-36F)
11Bh	Sn-28	Analog Monitor (AO-08 or AO-12)

* used with PID EPROMS only

Note: The Sn Constants can NOT be written to when the drive is running.

Drive Constant Register Data Codes (continued)

DATA CODE	CONSTANT NUMBER	CONSTANT FUNCTION
200h	Cn-01	Output Voltage Regulator
201h	Cn-02	Frequency - Maximum
202h	Cn-03	Voltage - Maximum
203h	Cn-04	Frequency - Maximum Voltage Point
204h	Cn-05	Frequency - Midpoint
205h	Cn-06	Voltage - Midpoint
206h	Cn-07	Frequency - Minimum
207h	Cn-08	Voltage - Minimum
208h	Cn-09	Motor Rated Current
209h	Cn-10	DC Injection Braking Start Frequency
20Ah	Cn-11	DC Injection Braking Current
20Bh	Cn-12	DC Injection Time at Stop
20Ch	Cn-13	DC Injection Time at Start
20Dh	Cn-14	Frequency Command Upper Limit
20Eh	Cn-15	Frequency Command Lower Limit
20Fh	Cn-16	Prohibit Frequency 1
210h	Cn-17	Prohibit Frequency 2
211h	Cn-18	Prohibit Frequency 3
212h	Cn-19	Prohibit Frequency Deadband
213h	Cn-20	Operator Display Mode (Reference and Indicator)
214h	Cn-21	Speed Coincidence Frequency
215h	Cn-22	Speed Coincidence Bandwidth
216h	Cn-23	Carrier Frequency Upper Limit
217h	Cn-24	Carrier Frequency Lower Limit
218h	Cn-25	Frequency Proportion Gain
219h	Cn-26	Overtorque Detection Level
21Ah	Cn-27	Overtorque Detection Time
21Bh	Cn-28	Stall Prevention Level during Acceleration (Constant Torque Region)

Drive Constant Register Data Codes (continued)

DATA CODE	CONSTANT NUMBER	CONSTANT FUNCTION
21Ch	Cn-29	Stall Prevention Level during Acceleration (Constant HP Region)
21Dh	Cn-30	Stall Prevention Level at Set Frequency
21Eh	Cn-31	Motor-to-Motor Cable Resistance
21Fh	Cn-32	Torque Compensation Iron Loss
220h	Cn-33	Torque Compensation Limiter
221h	Cn-34	Motor No-Load Current
222h	Cn-35	Slip Compensation Primary Delay Time
223h	Cn-36	No. of Auto-Restart Attempts
224h	Cn-37	Momentary Power Failure Ride-through Time
225h	Cn-38	speed Search Operation Level
226h	Cn-39	Speed Search Deceleration Time
227h	Cn-40	Minimum Base Block Time
228h	Cn-41	V/f During Speed Search
*229h	Cn-42	Voltage Recovery Time

* Additional Cn constants are available with PID EPROMS.
Note: The Cn Constants can NOT be written to when the drive is running.

DATA CODE	CONSTANT NUMBER	CONSTANT FUNCTION
400h	An-01	Frequency Reference 1
401h	An-02	Frequency Reference 2
402h	An-03	Frequency Reference 3
403h	An-04	Frequency Reference 4
*404h	An-05	Frequency Reference 5
*405h	An-06	Frequency Reference 6
*406h	An-07	Frequency Reference 7
*407h	An-08	Frequency Reference 8
*408h	An-09	Jog Reference

* When using PID EPROMS these An constants functionality is different.
Note: The An Constants can be written to while the drive is running, unless PID is selected.

Drive Constant Register Data Codes (continued)

DATA CODE	CONSTANT NUMBER	CONSTANT FUNCTION
500h	Bn-01	Acceleration Time 1
501h	Bn-02	Deceleration Time 1
502h	Bn-03	Acceleration Time 2
503h	Bn-04	Deceleration Time 2
504h	Bn-05	Frequency Command Gain
505h	Bn-06	Frequency Command Bias
506h	Bn-07	Torque Compensation Gain
*507h	Bn-08	Slip Compensation Gain (Motor Rated Slip)
508h	Bn-09	Energy Saving Gain
509h	Bn-10	Monitor No. After Power-up
50Ah	Bn-11	Analog Monitor Channel 1 Gain
*50Bh	Bn-12	Analog Monitor Channel 2 Gain

* When using PID EPROMS: Bn-08 has different functionality, and additional Bn constants are available.
Note: The Bn Constants can be written to while the drive is running, unless PID is selected.

Special Drive Register Data Codes

DATA	FUNCTION	READ/WRITE	DATA	VALUE AT	DESCRIPTION
900h	ENTER Command	R/W	0	0	Write zero to data code to store Drive Constants in Non-
910h	Global Write Data Enable/Disable	R/W	1-64	0	Global Data is Disabled
					Write the node address of PLC to data code to enable Global
911h	Global Reference Multiplier	R/W	0.000 -9999	1000	Global Frequency Reference Multiplier (1000/1.0)

Additional or Changed Registers with PID EEPROMS

PID EEPROMS alter some of the drive constant registers. The table below indicates which registers are changed or added with PID EEPROMS (NSG618430-1) .

DATA CODE	CONSTANT NUMBER	CONSTANT FUNCTION
116h	Sn-23	PID Control Selection
117h	Sn-24	Frequency Output Display
221h	Cn-34	Feedback Detection
23Ah	Cn-43	PID Value Limit Level
23Bh	Cn-44	PID Value Output Delay Time
23Ch	Cn-45	Integration Value Limit Level
404h	An-05	not used
405h	An-06	not used
406h	An-07	not used
407h	An-08	not used
408h	An-09	Frequency Reference 9
507h	Bn-08	not used
50Ch	Bn-13	Feedback Signal Calibration Gain
50Dh	Bn-14	Proportional Gain
50Eh	Bn-15	Integral Time
50Fh	Bn-16	Derivative Time
510h	Bn-17	Offset Compensation
025h	Un-11	PID Feedback
026h	Un-12	PID Output %

Notes:
When PID EPROMS are being used, the An and Bn constants can NOT be written to while the drive is running.

Appendix B
Command Priority

Command Priority

The settings of constants Sn-08 and Sn-04 determine the origin of operation and frequency reference commands. This was discussed in detail in chapter 4, Establishing Communications Some commands may be accessed by a source other than the one set up by constants Sn-08 and Sn-04, as illustrated in the tables 1, 2, and 3 on the following pages

How to use the Command Priority Tables:

First, determine the source of control you wish to use for your GPD503 drive Then Sn-08 and Sn-04 constants should be set up for the desired control you have chosen. (See the table below for constant settings.) Select the appropriate Command Priority table on the following pages based upon what type of operation your drive is set up for.

OPERATION COMMANDS				
Sn-08	**Sn-04**	**Run/Stop & Frequency Ref. from:**	**Use Table:**	**On page #:**
XX00	XX00	MB+ Option Card	1	B-3
XX00	XX11	MB+ Option Card	1	B-3
XX11	XX00	Analog Input	2	B-4
XX11	XX11	Digital Operator	3	B-5

The left hand column of the Command Priority tables is the source of the command (PLC, external terminals, and the digital operator). The middle column lists the functions or commands, and the right most column indicates whether the functions are **O**perational or **n**ot **a**vailable from each source

Table 1: Set up for PLC Operation

The first table indicates the functions or commands that can be accessed from your PLC, external terminals, or digital operator when the drive's constants Sn-08 and Sn-04 are set up for PLC control (Sn-08 = xx00; Sn-04 = xxxx). The "O" indicates that the function is Operable from that source, and "n/a" indicates that the function is not available from that source.

From	Data Code	Bit No.	Data Description	Function Availability
PLC	001h	0	Run Command	O
		1	Forward / Reverse	O
		2	External Fault	O
		3	Fault Reset	O
		4	Multi-function Command 1	O (1)
		5	Multi-function Command 2	O
		6	Multi-function Command 3	O
		7	Multi-function Command 4	O
		8-15	unused	-
	002h	0-15	Frequency Reference	O
	003h-		unused	-
	009h	0	Multi-function Output 1	O (2)
		1	Multi-function Output 2	O (3)
		2	Multi-function Output 3	O (4)
		3-15	unused	-
	010h	0-15	Drive Analog Monitor Output Value	O (5)
EXTERNAL TERMINALS	Forward Run (2 wire); Run Command (3 wire)			n/a
	Reverse Run (2 wire); Stop Command (3 wire)			n/a
	External Fault			O
	External Reset			O (1)
	Forward / Reverse Run Selection (3 wire)			n/a
	Run Signal Selection			O (6)
	Option / Drive Command Selection			O (6)
	Multi-step Speed Reference Selection			O
	Jog Command Selection			O
	Acceleration / Deceleration Time Selection			O
	External Baseblock A			O
	External Baseblock B			O
	Acceleration / Deceleration Stop Command (Hold)			O
	Drive Overheat Prediction			O
	Auxiliary Analog Reference Input Effective			O
	External Fault Signal Selection			O
	Dynamic Brake Command			O
	Speed Search 1			O
	Speed Search 2			O
	Energy Saving Operation			O
DIGITAL OPERATOR	Run Command			n/a
	Stop Command			O (7)
	Reverse Run Command			n/a
	Jog Command			n/a
	Fault Reset			n/a

Notes:

1 Effective when run command received from PLC is "0" while in stopped condition
2 Effective when Sn-20 is "F".
3 Effective when Sn-21 is "F"
4 Effective when Sn-22 is "F"
5 Effective when the first digit of Sn-09 is "1"
6 Effective only when in the stopped condition
7 Effective when the first digit of Sn-05 is "0"

Table 2: Set up for External Terminals Operation

Table two indicates the functions or commands that can be accessed from your PLC, external terminals, or digital operator when the drive's constants Sn-08 and Sn-04 are set up for external terminal control The "O" indicates that the function is Operable from that source, and "n/a" indicates that the function is not available from that source.

From	Data Code	Bit No.	Data Description	Function Availability
PLC	001h	0	Run Command	n/a
		1	Forward / Reverse	n/a
		2	External Fault	O
		3	Fault Reset	O (1)
		4	Multi-function Command 1	O
		5	Multi-function Command 2	O
		6	Multi-function Command 3	O
		7	Multi-function Command 4	O
		8-15	unused	-
	002h	0-15	Frequency Reference	n/a
	003h-		unused	-
	009h	0	Multi-function Output 1	n/a
		1	Multi-function Output 2	n/a
		2	Multi-function Output 3	n/a
		3-15	unused	-
	010h	0-15	Drive Analog Monitor Output Value	n/a
EXTERNAL TERMINALS	Forward Run (2 wire); Run Command (3 wire)			O
	Reverse Run (2 wire); Stop Command (3 wire)			O
	External Fault			O
	External Reset			O (1)
	Forward / Reverse Run Selection (3 wire)			O
	Run Signal Selection			O (2)
	Option / Drive Command Selection			O (2)
	Multi-step Speed Reference Selection			O
	Jog Command Selection			O
	Acceleration / Deceleration Time Selection			O
	External Baseblock A			O
	External Baseblock B			O
	Acceleration / Deceleration Stop Command (Hold)			O
	Drive Overheat Prediction			O
	Auxiliary Analog Reference Input Effective			O
	External Fault Signal Selection			O
	Dynamic Brake Command			O
	Speed Search 1			O
	Speed Search 2			O
	Energy Saving Operation			O
DIGITAL OPERATOR	Run Command			n/a
	Stop Command			O (3)
	Reverse Run Command			n/a
	Jog Command			n/a
	Fault Reset			O

Notes:

1. Effective only when external terminal satisfies the following conditions:
   2 wire mode - Both forward run (term 1) and reverse run (term 2) commands are closed, or open in stopped condition
   3 wire mode - Run command (term 1) or stop command (term 2) is open in stopped condition
2. Effective only when in stopped condition
3. Effective only when the first digit of Sn-05 is "0"

Table 3: Set up for Digital Operator Operation

Table three indicates the functions or commands that can be accessed from your PLC, external terminals, or digital operator when the drive's constants Sn-08 and Sn-04 are set up for digital operator control The "O" indicates that the function is Operable from that source, and "n/a" indicates that the function is not available from that source.

From	Data Code	Bit No.	Data Description	Function Availability
PLC	001h	0	Run Command	n/a
		1	Forward / Reverse	n/a
		2	External Fault	O
		3	Fault Reset	O
		4	Multi-function Command 1	O
		5	Multi-function Command 2	O
		6	Multi-function Command 3	O
		7	Multi-function Command 4	O
		8-15	unused	-
	002h	0-15	Frequency Reference	n/a
	003h-		unused	-
	009h	0	Multi-function Output 1	n/a
		1	Multi-function Output 2	n/a
		2	Multi-function Output 3	n/a
		3-15	unused	-
	010h	0-15	Drive Analog Monitor Output Value	n/a
EXTERNAL TERMINALS	Forward Run (2 wire); Run Command (3 wire)			n/a
	Reverse Run (2 wire); Stop Command (3 wire)			n/a
	External Fault			O
	External Reset			O (1)
	Forward / Reverse Run Selection (3 wire)			n/a
	Run Signal Selection			O (1)
	Option / Drive Command Selection			O (1)
	Multi-step Speed Reference Selection			O
	Jog Command Selection			O
	Acceleration / Deceleration Time Selection			O
	External Baseblock A			O
	External Baseblock B			O
	Acceleration / Deceleration Stop Command (Hold)			O
	Drive Overheat Prediction			O
	Auxiliary Analog Reference Input Effective			O
	External Fault Signal Selection			O
	Dynamic Brake Command			O
	Speed Search 1			O
	Speed Search 2			O
	Energy Saving Operation			O
DIGITAL OPERATOR	Run Command			O
	Stop Command			O
	Reverse Run Command			O
	Jog Command			O (1)
	Fault Reset			O

Notes:

1 Effective only when in stopped condition

Appendix C
Product Specifications

Specifications

MB + / GPD503 Board (DS005)	
Ambient Temperature	-10 to +40 degrees C (+14 to +104 degrees F)
Storage Temperature	-20 to +60 degrees C (-4 to +140 degrees F)
Relative Humidity	90% noncondensing
Altitude	3300 feet
Vibration	1G at less than 20 Hz, 0 2 G at 20 - 50 Hz

Appendix D
Spare Parts List

Spare Parts List

Description	Source	Part Number
GPD503 / MB+		
GPD503 / MB+ Board	MagneTek	DS005
Modicon Inline Connector	Modicon	AS-MBKT-085
Modicon Terminating Connector	Modicon	AS-MBKT-185
GPD503 / MB+ Technical Manual	MagneTek	TM4023
Miscellaneous		
GPD503 Technical Manual	MagneTek	TM4231

Appendix E
Product Support

MagneTek Support

MagneTek's Drives and Systems Division offer support services with over 26 sales/support offices, and 145 distributors throughout the United States.

If you should need further technical assistance, after reviewing this manual please contact your local MagneTek representative

Additional Services available

Technical Support Center-

Provide telephone assistance to customer related to installation, start-up, programming, and troubleshooting on MagneTek drives and communication products For technical phone support call 1-800-541-0939

Field Service Support -

Provide on-site technical assistance Contact your local MagneTek representative for field service, or call 1-800-541-0939

GPD 503 / Modbus Plus

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