VS-616G5
Option Instruction Manual
Modbus Plus Communication Card

Table of Contents

Technical References

Refer to the following Yaskawa publications for information about the VS-616G5:

?? Yaskawa VS-616G5 Installation & Quick-Start Manual
Publication YEA-TOA-S616-10.12

?? Yaskawa VS-616G5 Programming Manual
Publication YEA-TOA-S616-10.11

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

Yaskawa Support

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

Chapter 1
Introducing the MB+ Network

?? Overview
?
?? Modbus Plus Network Introduction
?
?? How the Network Operates

Overview

This manual describes the installation of a Yaskawa Modbus Plus Communication Kit, configuration of the MB+ board and programming of the master (MSTR) function blocks, necessary for network nodes (VS-616G5 drives) to process message transactions.

This manual should be used for personnel involved in developing, installing, or troubleshooting Yaskawa drives communicating via the Modbus Plus network (also referred to in this manual as the MB+ network).

Modbus Plus Network 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 VS-616G5 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.
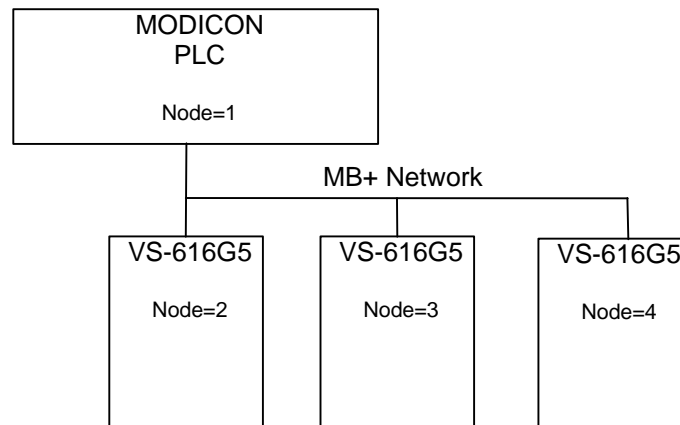
Example MB+ Network

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 Yaskawa VS-616G5 drive is capable of participating as a node on a Modbus Plus communications network.

Chapter 2
Getting Started

? VS-616G5 and Modbus Plus

? Yaskawa Modbus Plus Communications Kit

VS-616G5 and Modbus Plus

The VS-616G5 AC drive accepts Yaskawa interface boards. Installation of a Yaskawa Modbus Plus Communication Kit ensures the VS-616G5 is a MODICON certified ModConnect[?] partner with direct connection to Modbus Plus.

NOTE
This interface board will only operate with a particular version of drive software. To check software use U1-14. A " **CPF 06** " fault will appear on the display, if the wrong version of drive software is installed.

The Modbus Plus Communication Kit, Model No. UTC000019, provides a Modbus Plus Serial Communication Board Interface option (the MB+ board) which allows operation, status monitoring, and programming of a VS-616G5 drive from a MODICON Programmable Controller using the Modbus Plus local area network.

The Modbus Plus Communication Kit is available as a factory installed option for the VS-616G5 drive.

Yaskawa Modbus Plus Communication Kit

Each drive must have its own Modbus Plus kit installed to communicate via Modbus Plus. The Yaskawa Modbus Plus Communication Kit consists of the following items:

- Yaskawa MB+ board.
 A printed circuit board (see Figure 2-1) which mounts at connector 2CN inside the VS-616G5.

- VS-616G5 / Modbus Plus Instruction Manual, YEA-TOA-C736-40.22.
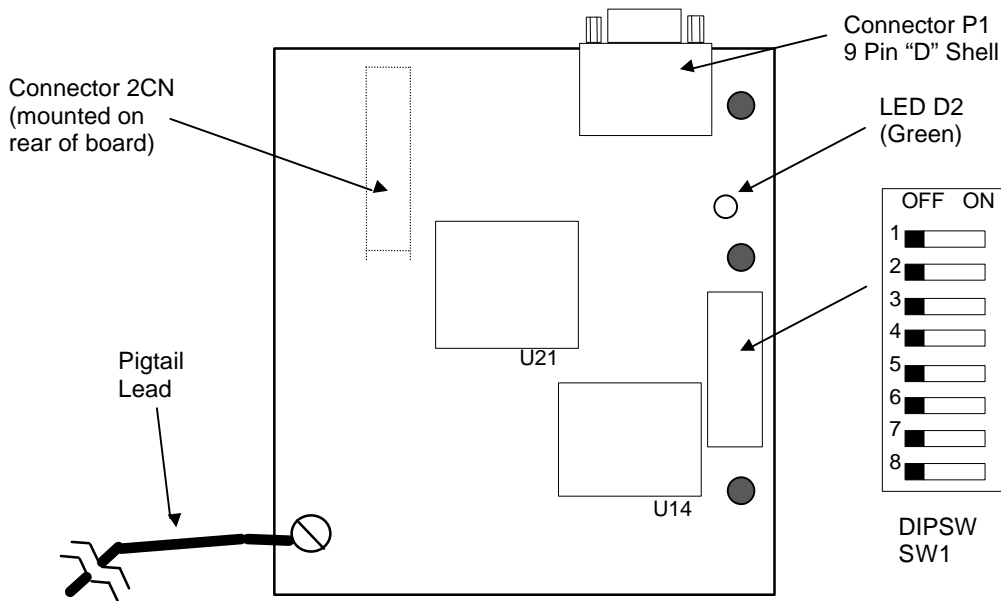
Figure 2-1. MB+ Board

Chapter 3
Installation of the MB+ Board

? Installation Notes

? Installation of the MB+ Board into the VS-616G5

? MB+ Board Configuration

? Modbus Plus Communication Connection

Installation Notes

This section provides several installation notes for the Yaskawa MB+ board. 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 VS-616G5 to the MB+ network is required. MODICON offers a full line of cables and connectors for use with Modbus Plus network devices.

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

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 LED inside the unit is off, before installing the MB+ board.

NOTE
This interface board will only operate with a particular version of drive software. To check software use U1-14. A " **CPF 06** " fault will appear on the display, if the wrong version of drive software is installed.

Installing the MB+ Board into the VS-616G5

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

1. Turn the main power OFF to the drive, and wait the specified length of time shown on the front cover.

2. Remove the front cover of the drive by removing two Phillips screws or by gently pressing the specially marked indentations on the sides of the cover. (Note: The size of the drive will determine the appropriate method.)

3. Verify the CHARGE lamp is "OFF".

4. Orient the MB+ board as shown in Figure 3-1.

5. Position the MB+ board's 2CN connector (on the underside of the printed circuit board) 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.
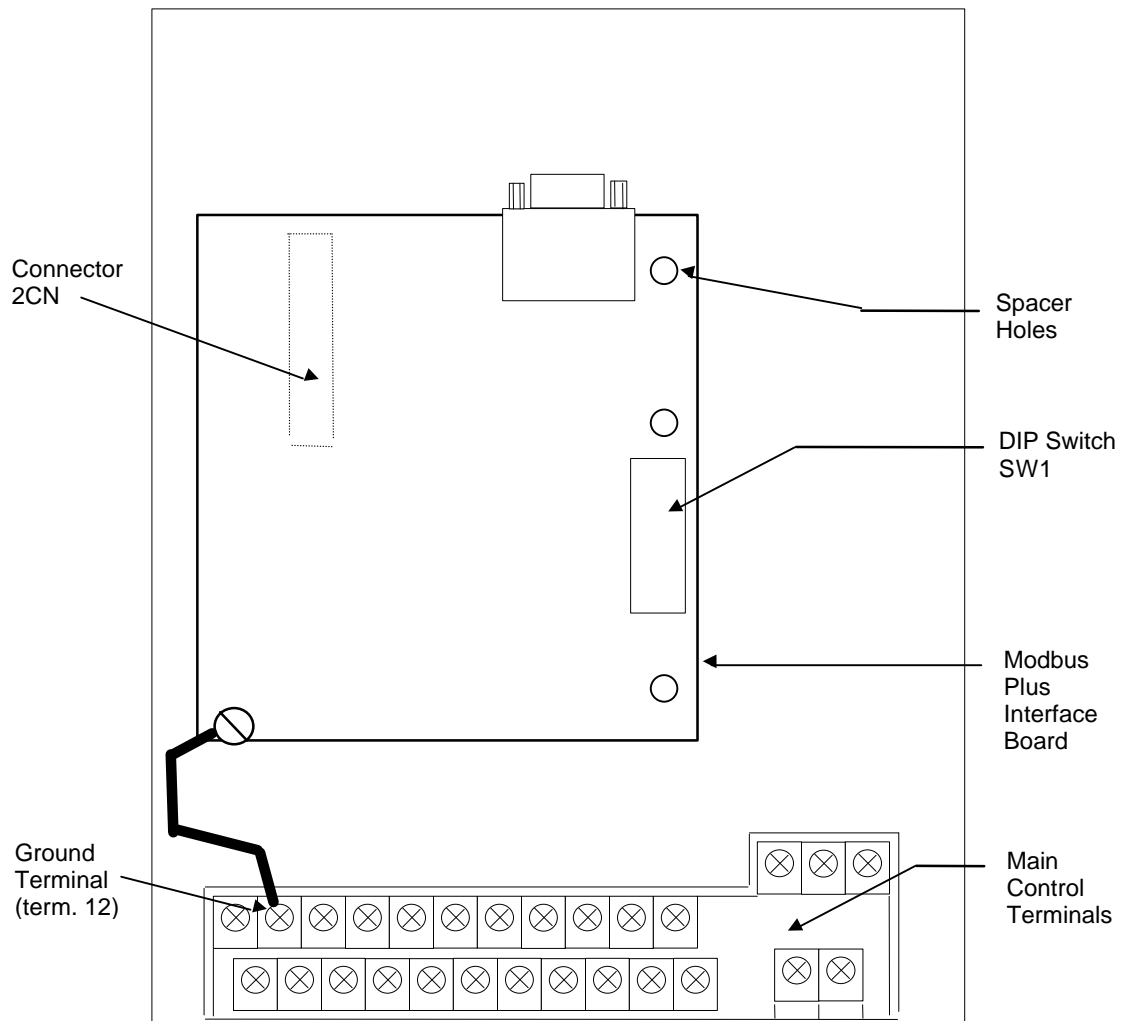
Figure 3-1. MB+ Board Mounting Position

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

8. Connect the green wire (labeled "E") to terminal 12 on the drive.

NOTE: You have completed the mechanical installation of the MB+ board. Proceed to the MB+ board configuration prior to applying input power or replacing the VS-616G5 front cover.

MB+ Board Configuration

The MB+ board requires setup prior to operation. 8-position Dip switch SW1 must be set prior to the application of input AC power to the VS-616G5. The states of these switches are read only on power-up.

The MB+ board 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 Modbus Plus address.

An example of setting SW1 to MB+ network node# 4 and enabling global reads plus cable-loss checking:

```
     OFF  ON
1  ■──────
2  ■──────
3  ──────■
4  ──────■
5  ──────■
6  ──────■
7  ──────■
8  ──────■
```

OFF = set for node address 4
OFF = set for node address 4
ON = set for node address 4
ON = set for node address 4
ON = set for node address 4
ON = set to node address 4
ON = cable loss checking
ON = global read enabled

MB+ Network 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' (controlling node which initiates transactions) drops out of the token rotation sequence. The MB+ board 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 " **EF0** " fault code on the Digital Operator.
How the VS-616G5 handles this fault is configured by setting of drive parameters F9-03 and F9-02.

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

> A Cable Loss Fault (**EF0**) is a configurable fault using the F9-xx parameters.
> ? ? If configured to F9-03 (alarm only) and F9-02 (during run), the cable loss fault (**EF0**) is disabled even with SW1-7 ON.

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 eight 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 SW1-8.

Modbus Plus Communication Connection

Communication between a VS-616G5 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+ board. Modicon offers cables and connectors for the MB+ network.

Modicon Modbus Plus Wiring:

The recommended cable for MB+ network connections is <u>Belden 9841</u>. 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 Modbus Plus 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

?? VS-616G5 Parameter Settings

?? Communication Initialization

?? Communication Error Detection

?? MB+ Network

VS-616G5 Parameter Settings

The drive can be configured to receive operation signals (Run, Stop, Forward, Reverse, ...) from the MB+ network, serial communication, the external drive terminals, or the Digital Operator. VS-616G5 Drive Register b1-02 (181h) is 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	
b1-02	**Commands from:**
0	Digital Operator
1	Terminal
2	Serial Communication
3	Option PCB (MB+ board)

The drive can be configured to receive a frequency reference from the MB+ network, serial communication, the external drive terminals, or the Digital Operator. VS-616G5 Drive Register b1-01 (180h) is 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	
b1-01	**Commands from:**
0	Digital Operator
1	Terminal
2	Serial Communication
3	Option PCB (MB+ board)

The value of VS-616G5 Drive Register b1-01 (180h) and b1-02 (181h) 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.

Although the settings of b1-01 (180h) and b1-02 (181h) set the origin of the operation and frequency reference commands, many commands may still be functional from an alternative source. Appendix B, Command Priority, illustrates the available command origins for various functions.

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

> 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.)

Communication Error Detection

If a communication fault occurs, control from the PLC is not possible. The VS-616G5 drive will display an "EF0 - DDS External Flt" fault and will then operate according the settings of parameters F9-02 and F9-03.

The flashing patterns of LED D2 on the MB+ board are described in Chapter 8 of this manual.

F9-02	Drive Detection of "EF0" Fault
0	Fault always detected
1	Fault detected during run

F9-03	Drive Reaction to Communication Error Detection
0	"EF0" is displayed on the Digital Operator, the fault contact closes, and the drive decelerates the motor to ramp to a stop.
1	"EF0" is displayed on the Digital Operator, the fault contact closes, and the motor coasts to stop (not controlled by the drive).
2	"EF0" is displayed on the Digital Operator, the fault contact closes, and the drive does a fast stop.
3	"EF0" is displayed on the Digital Operator. The fault contact does not close, and the drive continues to run at its last state. (Alarm Only)

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 VS-616G5 drive with its MB+ board 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 Modbus Plus MSTR function block and is sent from the originating node. Modbus Plus message routing is described in detail under "MSTR Control Block" in Chapter 5.

Chapter 5
Modbus Plus MSTR Function

?? Modbus Plus MSTR Function

?? MSTR Control Block

?? MSTR Data Block

?? MSTR Area Size

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 Modbus Plus message transactions. Each type of network transaction has an associated operation code. The Modbus Plus transactions supported by the VS-616G5 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:

ENABLE —— | Control Block Starting Register | —— OPERATION ACTIVE

TERMINATE —— | Data Block Starting Register | —— OPERATION TERMINATED DUE TO ERROR

MSTR Area Size —— OPERATION COMPLETED SUCCESSFULLY
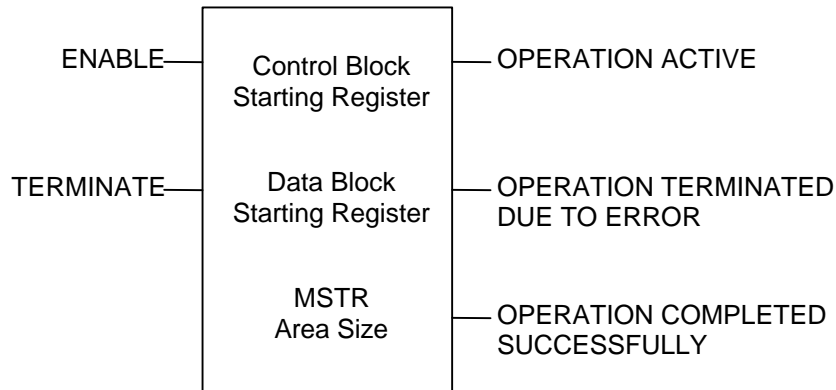
The MSTR function block has two control inputs. The ENABLE input enables the instruction when it is ON. The TERMINATE input terminates the active operation when it is ON.

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 <u>first</u> 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 logic to the MSTR include:
- ?? the type of Modbus Plus 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 Modbus Plus 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 <u>Operation Code</u> (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 <u>Network Error Code</u> (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 MSTR error codes can be found in Chapter 8.

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 VS-616G5 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 VS-616G5 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 VS-616G5 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.

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 VS-616G5 drives on MB+ this register must be '1'.

Any unused routing registers must be set to '0'.

5-4   Modbus Plus MSTR Function

```
         ┌──────────┐
         │   PLC    │
         │   Host   │
         │  Node=1  │
         └────┬─────┘
              │
──────────────┼────────────────────────────────────────────────────────
      ┌───────┴──┐      ┌──────────┐    ┌──────────┐    ┌──────────┐
A     │  Modbus  │      │ VS-616G5 │    │ VS-616G5 │    │ VS-616G5 │
      │   Plus   │      │          │    │          │    │          │
      │  Bridge  │      │  Node=6  │    │  Node=7  │    │  Node=8  │
      │  Node=5  │      └──────────┘    └──────────┘    └──────────┘
      └────┬─────┘
           │
           │
───────────┼────────────────────────────────────────────────────────────
      ┌────┴─────┐   ┌──────────┐  ┌──────────┐  ┌──────────┐  ┌──────────┐
B     │  Modbus  │   │ VS-616G5 │  │ VS-616G5 │  │ VS-616G5 │  │ VS-616G5 │
      │   Plus   │   │          │  │          │  │          │  │          │
      │  Bridge  │   │  Node=6  │  │  Node=7  │  │  Node=8  │  │  Node=9  │
      │  Node=33 │   └──────────┘  └──────────┘  └──────────┘  └──────────┘
      └────┬─────┘
           │
           │
───────────┼────────────────────────────────────────────────────────────
      ┌────┴─────┐      ┌──────────┐     ┌──────────┐
C     │  Modbus  │      │ VS-616G5 │     │ VS-616G5 │
      │   Plus   │      │          │     │          │
      │  Bridge  │      │  Node=4  │     │  Node=5  │
      │  Node=3  │      └──────────┘     └──────────┘
      └────┬─────┘
           │
           │
───────────┼────────────────────────────────────────────────────────────
      ┌────┴─────┐  ┌──────────┐  ┌──────────┐  ┌──────────┐
D     │ VS-616G5 │  │ VS-616G5 │  │ VS-616G5 │  │ VS-616G5 │
      │          │  │          │  │          │  │          │
      │  Node=2  │  │  Node=3  │  │  Node=4  │  │  Node=5  │
      └──────────┘  └──────────┘  └──────────┘  └──────────┘
```
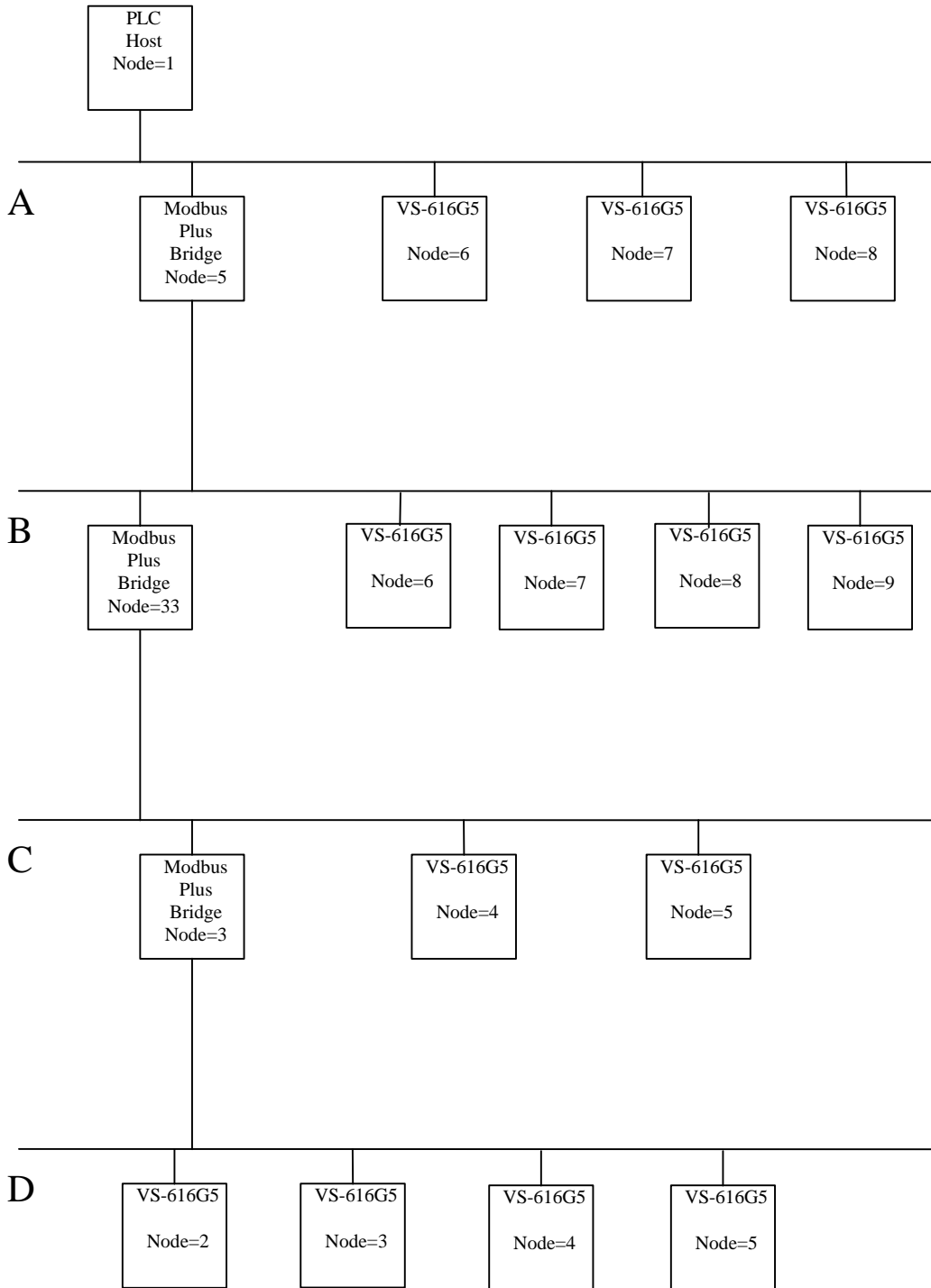
The MSTR routing path register values for the example configuration shown on the previous page are:

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 <u>Routing 1</u> serves a dual purpose. The low byte of <u>Routing 1</u> is used to specify the local node address. The high byte of <u>Routing 1</u> is used to specify which Modbus Plus 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 Modbus Plus port, the value of the high byte of <u>Routing 1</u> 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 board in a <u>984</u> chassis mount PLC, a value of 0 in the high byte indicates that the MSTR instruction is destined for the S985 board set for PLC port #2. For a <u>984</u> 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.

high byte								*low byte*							
0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1

binary value between 1 and 64
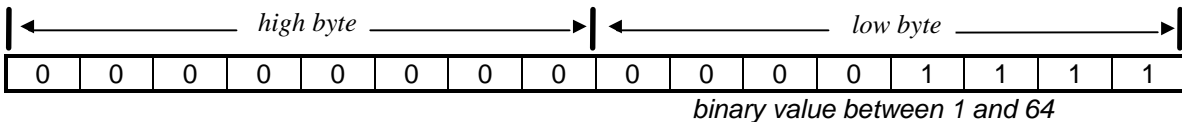
For two S985-002 boards in a <u>984</u> chassis mount PLC, a value of 1 in the high byte indicates that the MSTR instruction is destined for the second S985 board's assigned buffer space, For an S985-00 configuration in a PLC with built-in Modbus Plus, a value of 1 in the high byte indicates that the MSTR is destined for the S985 board set for comm port #2.

high byte								*low byte*							
0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1

indicating a second MB+ port   *binary value between 1 and 64*
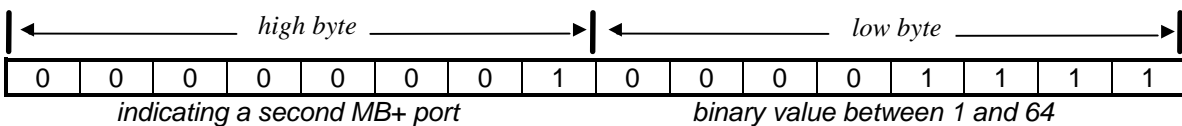
For two S985-000 boards in a <u>984</u> PLC with built-in Modbus Plus, a value of 2 in the high byte indicates that the MSTR instruction is destined for the second S985 board's assigned buffer space.

high byte								*low byte*							
0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	1

indicating a second MB+ port   *binary value between 1 and 64*
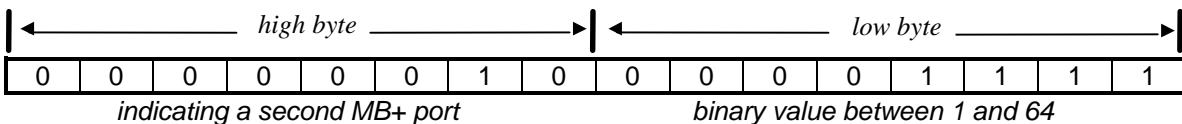
Quantum PLCs
To target a Modbus Plus Network Option Module (NOM) in a <u>Quantum</u> PLC backplane as the destination of an MSTR instruction, the value in the high byte represents the physical slot location of the NOM. For example, if the NOM resides in slot 7 in the back plane, the high byte of routing register 1 would look like this:

high byte								*low byte*							
0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1

indicating physical location   *binary value between 1 and 64*
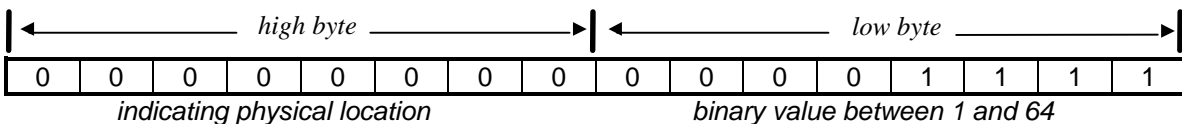
MSTR Data Block

The data entered in the middle section of the MSTR function block is the address of the <u>first</u> 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 <u>must</u> 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. VS-616G5 / Modbus Plus communication uses 16-bit holding registers. The drive's registers are divided into four functional classifications.

1. Command Data: These registers control the operation of the drive, and accept read/write commands from a network master device.

2. Parameter Data: These registers are used to configure the operation of the drive (parameter groups Ax-xx, bx-xx, Cx-xx, dx-xx, Ex-xx, Fx-xx, Hx-xx, Lx-xx, & ox-xx). They accept read/write commands from a network master device. After writing to the parameter data registers, an 'ENTER' command is required to store the data in the drive's non-volatile memory. At a minimum an 'ACCEPT' command must be issued to allow the drive to run after a parameter change.

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" Modbus Plus registers: 'ENTER' Command, 'ACCEPT' Command, Global Data, and Global Reference Multiplier.

NOTE
A listing of all the Command, Parameter, Monitor, and Special Data Codes for VS-616G5 / Modbus Plus communications can be found in 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
- ?? Parameter 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 #4 (write global run/stop and frequency reference), Example #5 (write acceleration and deceleration), Example #6 (write global frequency reference multiplier), and Example #8 (write drive parameters).

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
- ?? Parameter 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 #3 (read global data), Example #7 (read drive parameters), and Example #9 (read drive status registers).

Chapter 7
Special MB+ Functions

?? Executing a Global Write Function

?? Enabling Global Write

?? Executing a Global Read Function

?? Using the 'ACCEPT' and 'ENTER' Commands

?? Writing to the Global Frequency Reference Multiplier

?? Origin of RUN/STOP and Frequency Reference
   Commands

?? Using the VS-616G5 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 two or three Data Area Registers.

The first word of global data written to drive is used by the drive to select the commands being sent to it.
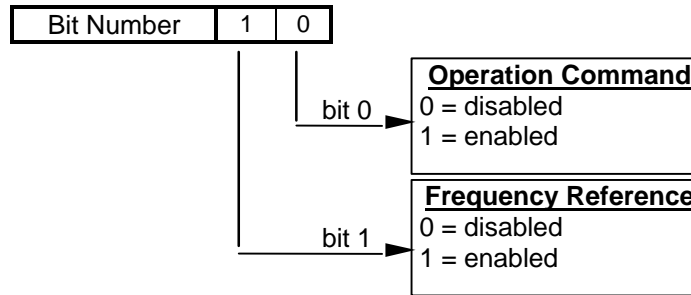
The following data are considered the three possible cases for Global Write Data:

Case 1: Using Operation Command and Frequency Reference

MSTR Function Data Area (Register Offset)	Function	VS-616G5 Drive Register Data Code
4X + 0	3	selecting both operation command and frequency reference
4X + 1	operation command	drive register (001h)
4X + 2	frequency reference	drive register (002h)

Case 2: Using Operation Command

MSTR Function Data Area (Register Offset)	Function	VS-616G5 Drive Register Data Code
4X + 0	1	selecting the operation command
4X + 1	operation command	drive register (001h)

Case 3: Using Frequency Reference

MSTR Function Data Area (Register Offset)	Function	VS-616G5 Drive Register Data Code
4X + 0	2	selecting the frequency reference
4X + 1	frequency reference	drive register (002h)

See Appendix A for additional information on data 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 Write

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 Modbus Plus special data register <u>F200h</u> indicates the Modbus Plus node address of the device (PLC) that will be sending the global data to the drive. The VS-616G5 drive will only accept global data that is sent from this device. To enable global data, write the Modbus Plus node address (1-64) of the device sending global data to register F200h. To disable global data, write a '0' to register F200h.

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 eight specific status registers. The global read function must be enabled by turning Dip switch SW1-8 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	VS-616G5 Drive Register Data Code
4X + 0	Operation Command	001h
4X + 1	Output Frequency	F005h
4X + 2	Output Current	F006h
4X + 3	DC Bus Voltage	F008h
4X + 4	Drive Status	F000h
4X + 5	Existing Fault Code 1	F009h
4X + 6	Existing Fault Code 2	F00Ah
4X + 7	Existing Fault Code 3	F00Bh

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

Using the 'ACCEPT' and 'ENTER' Commands

The VS-616G5 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 VS-616G5 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 - 00Fh) 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.

Parameter Registers:
The parameter registers (100h-125h, 180h-1A5h, 200h-240h, 280h-296h, 300h-316h, 380h-39Ch, 400h-420h, 480h-4AAh, and 500-50Dh) are stored in Non-Volatile Memory. When writing new data to parameter registers, the new data is not active.

Sending the 'ACCEPT' command will cause the new data to become active.
The 'ACCEPT' command is accomplished by writing a value of '0' to data code FFDDh.
The 'ACCEPT' command allows the drive to run with these changed parameters. It also allows parameters to again be changed from the drive keypad. The data is not saved to Non-Volatile Memory.

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 FFFDh.
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 - 097h, F000h - F00Fh, and F100h - F10Ah) 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 (F200h, F201h, FFDDh, and FFFDh) 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' and 'ACCEPT' command can be found in Chapter 9: Example #5 (Write Acceleration and Deceleration), and Example #8 (Write Drive Parameter Registers).

⚠ **CAUTION**
USE THE 'ENTER' COMMAND ONLY WHEN NECESSARY!
The life of the Non-Volatile EEPROM on the VS-616G5 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 (ERR), requiring the VS-616G5 control board to be replaced.

Writing to the Global Frequency Reference 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.

VS-616G5 Register F201h 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, VS-616G5 register F200h must be setup to enable global data.

When global data is properly initialized, the value written to VS-616G5 Register 002h (frequency reference) will be multiplied by the value of VS-616G5 Register F201h (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).

Global Frequency Reference = 30.00 Hz

VS-616G5 node #1	VS-616G5 node #2	VS-616G5 node #4
Global Frequency Reference Multiplier = 2.000	Global Frequency Reference Multiplier = 1.000	Global Frequency Reference Multiplier = 0.250
Calculated Frequency Reference = 60.00 Hz	Calculated Frequency Reference = 30.00 Hz	Calculated Frequency Reference = 7.50 Hz
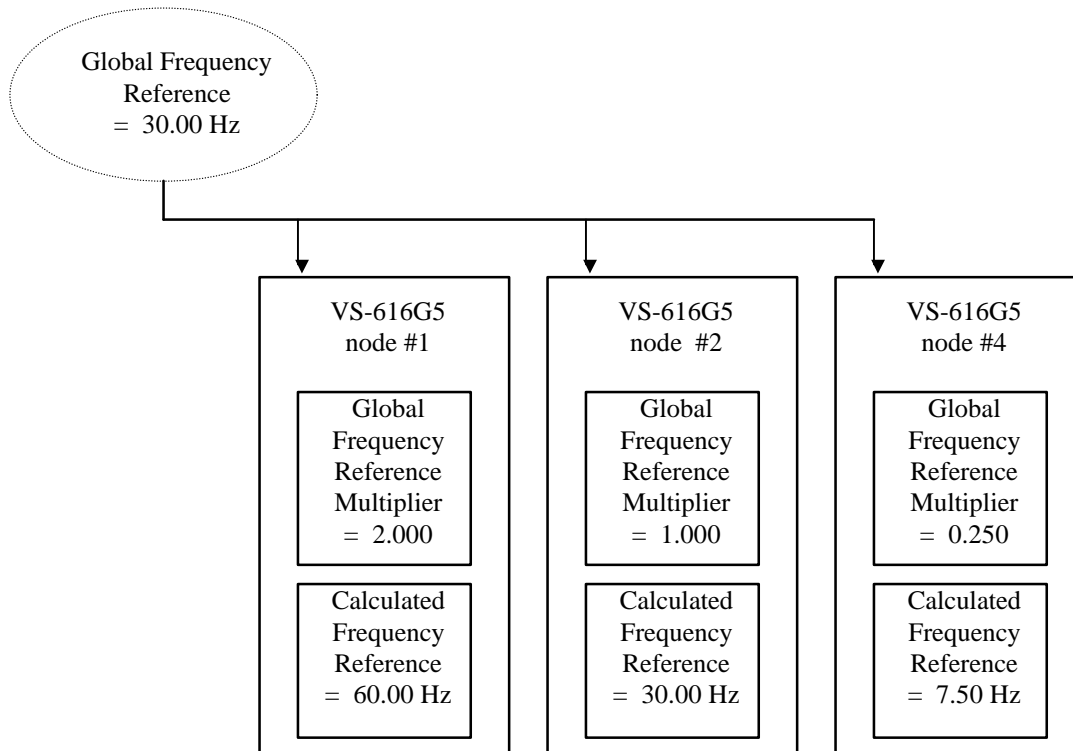
Origin of RUN/STOP and Frequency Reference Commands

The drive can be configured to receive operation signals (Run, Stop, Forward, Reverse, ...) from the MB+ network, serial communication, the external drive terminals, or the Digital Operator. VS-616G5 Drive Register b1-02 (181h) is 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	
b1-02	**Commands from:**
0	Digital Operator
1	Terminal
2	Serial Communication
3	Option PCB (MB+ board)

The drive can be configured to receive a frequency reference from the MB+ network, serial communication, the external drive terminals, or the Digital Operator. VS-616G5 Drive Register b1-01 (180h) is 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	
b1-01	**Commands from:**
0	Digital Operator
1	Terminal
2	Serial Communication
3	Option PCB (MB+ board)

The value of VS-616G5 Drive Register b1-01 (180h) and b1-02 (181h) 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.

Using VS-616G5 Drive Register 001h

When the drive is setup to receive Operation Signals from the MB+ Network, VS-616G5 Drive Register 001h is used to operate the drive. This register performs multiple functions. Each of the first 10 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 Number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

0 = stop forward
1 = run forward

0 = stop reverse
1 = run reverse

terminal 3 function

terminal 4 function

terminal 5 function

terminal 6 function

terminal 7 function

terminal 8 function

0 = no operation
1 = external fault

0 = no operation
1 = fault reset

not used
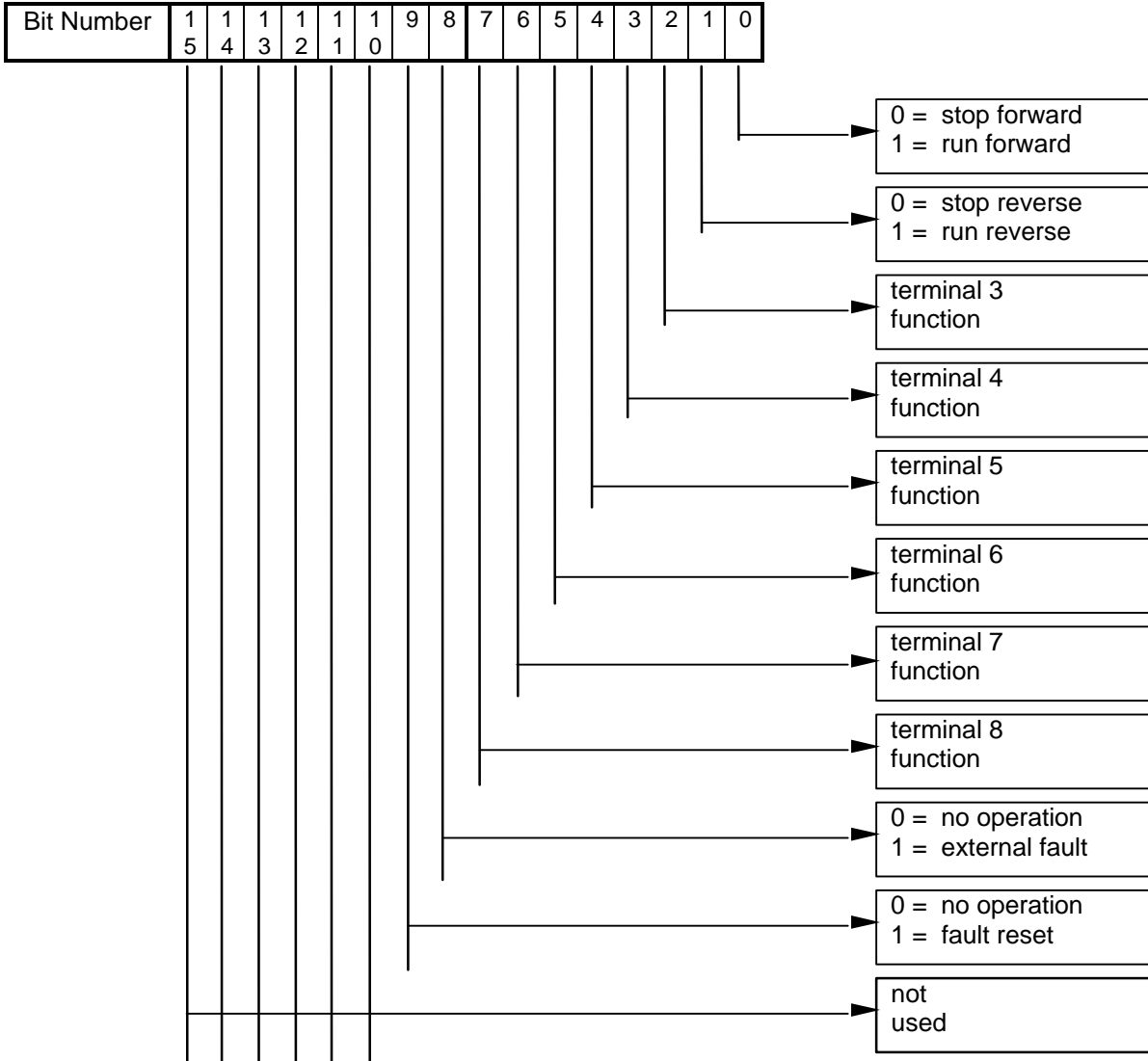
Bit 0 is used to start and stop the forward operation of the drive. To command the drive to stop forward, this bit should be set to a '0'. To command the drive to run forward, this bit should be set to a '1'.

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

Bit 2 is used to select the function for terminal 3. The function for terminal 3 is determined by the setting of parameter H1-01.

Bit 3 is used to select the function for terminal 4. The function for terminal 4 is determined by the setting of parameter H1-02.

Bit 4 is used to select the function for terminal 5. The function for terminal 5 is determined by the setting of parameter H1-03.

Bit 5 is used to select the function for terminal 6. The function for terminal 6 is determined by the setting of parameter H1-04.

Bit 6 is used to select the function for terminal 7. The function for terminal 7 is determined by the setting of parameter H1-05.

Bit 7 is used to select the function for terminal 8. The function for terminal 8 is determined by the setting of parameter H1-06.

Bit 8 is used to cause an external fault. To cause an external fault, this bit should be set to a '1'.

Bit 9 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 bits (Bit 0 and Bit 1) must also be a '0'.

7-8   Special MB+ Functions

Chapter 8
Diagnostics and Troubleshooting

?? Troubleshooting Information

?? Diagnostic LED (D2)

?? MSTR Error Codes

?? VS-616G5 Failure 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 ' **EF0 - External Flt** '. This ' **EF0** ' fault can be cleared by pressing the RESET key on the keypad, only if the cable loss condition no longer exists.

Diagnostic LED (D2)

The green diagnostic LED on the MB+ board 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 Modbus Plus 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 Modbus Plus 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 Modbus Plus node is not finding any other nodes on the Modbus Plus 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 Modbus Plus node has found another node on the Modbus Plus link which has an identical node address. This node will remain off-line, monitoring the Modbus Plus link until the duplicate node is not heard from for 5 seconds.

MSTR 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

VS-616G5 Failure Codes

The VS-616G5 drive can have a drive failure, such as undervoltage, overload, external fault, etc. When a drive failure occurs, it can be classified as an alarm, a minor fault, or a major fault. The drive reacts differently with each type of failure. An alarm displays a warning indication, however operation continues. Minor faults allow continued operation, and a contact will close only if one of the multi-function outputs is set up as a minor fault contact. The major faults cause the motor to coast to stop, and the fault signal output is present at terminals 18 - 20.

The VS-616G5's parameters U2-01 (current fault), U2-02 (last fault), and U3-01 (most recent) display a fault code representing the drive failure. Using the U2-xx and U3-xx registers can aid greatly in troubleshooting the VS-616G5.

The following table indicates the abbreviation displayed on the Digital Operator and the hexadecimal code viewed in drive parameters: U2-01, U2-02, and U3-01 when a specific drive failure occurs. The table also indicates whether the drive failure is an A-alarm, m-minor fault, or M-major fault.

Drive Failure	Digital Operator Display	Hexadecimal Code	Alarm, minor fault, or Major Fault
DC Bus Fuse Open	PUF	1	M
DC Bus Undervoltage	UV1	2	A
CTL PS Undervoltage	UV2	3	A
MC Answerback	UV3	4	A
Short Circuit	SC	5	M
Ground Fault	GF	6	M
Overcurrent	oC	7	M
Overvoltage	oV	8	M
Heatsink Overtemperature	oH	9	M
Drive Overheat	oH1	A	M
Motor Overload	oL1	B	M
Drive Overload	oL2	C	M
Overtorque 1	oL3	D	M
Overtorque 2	oL4	E	M
Dynamic Braking Transistor	RR	F	M
Dynamic Braking Resistor	RH	10	M
External Fault 3	EF3	11	M
External Fault 4	EF4	12	m
External Fault 5	EF5	13	m
External Fault 6	EF6	14	m
External Fault 7	EF7	15	m
External Fault 8	EF8	16	m
reserved		17	-
Overspeed	oS	18	M
Speed Deviation	DEV	19	m
PG Open	PGo	1A	M
Input Phase Loss	PF	1B	M
Output Phase Loss	LF	1C	M
DCCT Fault	CF	1D	M
Operator Disconnected	-	1E	m
EEPROM R/W Error	ERR	1F	m
reserved		20	-
Modbus Com Error	CE	21	M
reserved		22 - 24	-
Control Fault	CPFxx	25	M
Zero Servo Fault	SVE	26	-
DDS External Fault	EF0	27	-

Note: Further detail on drive failures and troubleshooting can be found in Chapter 4 of the VS-616G5 Installation & Quick-Start Manual, YEA-TOA-S616-10.12.

Chapter 9
Examples

Examples

In the following examples, a Modicon PLC and three VS-616G5 variable frequency drives are connected via a MB+ network that is configured as follows:
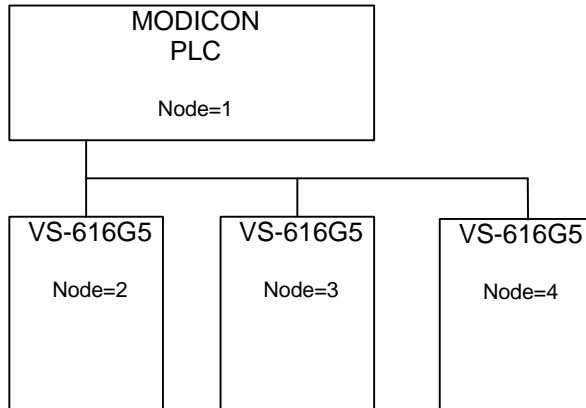
```
                    ┌─────────────────────┐
                    │      MODICON         │
                    │       PLC            │
                    │                      │
                    │      Node=1          │
                    └─────────────────────┘
                             │
              ┌──────────────┼──────────────┐
        ┌───────────┐  ┌───────────┐  ┌───────────┐
        │ VS-616G5  │  │ VS-616G5  │  │ VS-616G5  │
        │           │  │           │  │           │
        │  Node=2   │  │  Node=3   │  │  Node=4   │
        │           │  │           │  │           │
        └───────────┘  └───────────┘  └───────────┘
```

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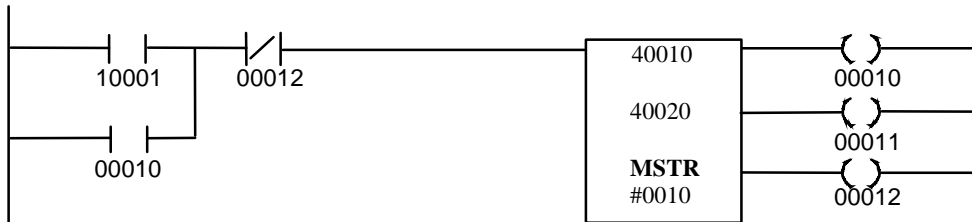
The Control Block registers must be loaded with the following data before the MSTR block is executed :

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

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

<table>
<tr><th colspan="4">DATA BLOCK</th></tr>
<tr><th>Register Number</th><th>Register Description</th><th>Register Data</th><th>Data Description</th></tr>
<tr><td>40020</td><td>Operation Signals</td><td>0001h</td><td>Run Forward = bit 0/on = 0001h</td></tr>
<tr><td>40021</td><td>Freq. Reference</td><td>1770h</td><td>60.00 Hz = 6000 (decimal) = 1770h</td></tr>
</table>

Example #2
Read Output Frequency from Drive #3

This example will show how to read the output frequency of a VS-616G5 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 F005h.

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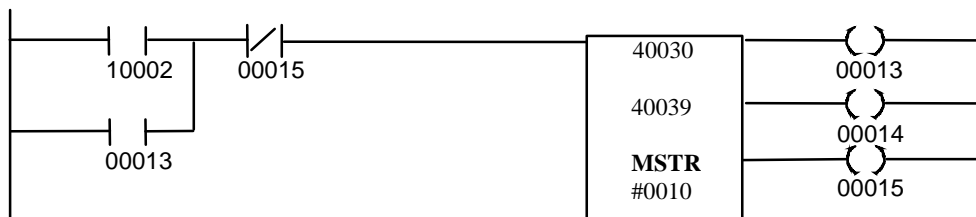
The Control Block registers must be loaded with the following data before the MSTR block is executed:

<table>
<tr><th colspan="4">CONTROL BLOCK</th></tr>
<tr><th>Register
Number</th><th>Register
Description</th><th>Register
Data</th><th>Data
Description</th></tr>
<tr><td>40030</td><td>Operation Code</td><td>0002h</td><td>0002h = Read from Multiple Registers</td></tr>
<tr><td>40031</td><td>Network Error Code</td><td>0000h</td><td>The error code returned by Modbus Plus communications</td></tr>
<tr><td>40032</td><td>Number of Registers</td><td>0001h</td><td>Read from 1 consecutive register</td></tr>
<tr><td>40033</td><td>Register Data Code</td><td>F005h</td><td>Data code for output frequency command</td></tr>
<tr><td>40034</td><td>Routing 1</td><td>0003h</td><td>Modbus Plus node address of drive = 0003h</td></tr>
<tr><td>40035</td><td>Routing 2</td><td>0001h</td><td>End of routing path = 0001h (Modbus Plus requirement)</td></tr>
<tr><td>40036</td><td>Routing 3</td><td>0000h</td><td>This routing register is not used, must be set to 0</td></tr>
<tr><td>40037</td><td>Routing 4</td><td>0000h</td><td>This routing register is not used, must be set to 0</td></tr>
<tr><td>40038</td><td>Routing 5</td><td>0000h</td><td>This routing register is not used, must be set to 0</td></tr>
</table>

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

<table>
<tr><th colspan="4">DATA BLOCK</th></tr>
<tr><th>Register
Number</th><th>Register
Description</th><th>Register
Data</th><th>Data
Description</th></tr>
<tr><td>40039</td><td>Freq. Reference</td><td>READ</td><td>60.00 Hz = 6000 (decimal) = 1770h</td></tr>
</table>

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, Dip switch SW1-8 must be turned ON for each drive. The MB+ interface provides eight 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 simultaneously. 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 Modbus Plus communications.
40042	Number of Registers	0008h	Number of words of global data requested (0-8).
40043	Available Words	0000h	The number of words available from the requested node. This value is updated for you.
40044	Routing 1	0002h	Modbus Plus node address of the drive = 0002h
40045	Routing 2	0001h	End of routing path = 0001h (Modbus Plus 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	Operation Command	READ	receives the drive's operation command (001h).
40051	Output Frequency	READ	receives the drive's output frequency (F005h).
40052	Output Current	READ	receives the drive's output current (F006h).
40053	DC Bus Voltage	READ	receives the voltage (F008h).
40054	Drive Status	READ	receives the drive status (F000h).
40055	Existing Fault Code 1	READ	recieves the drive existing fault data (F009h)
40056	Existing Fault Code 2	READ	recieves the drive existing fault data (F00Ah)
40057	Existing Fault Code 3	READ	recieves the drive existing fault data (F00Bh)

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 Modbus Plus communications.
40062	Number of Registers	0008h	Number of words of global data requested (0-8).
40063	Available Words	0000h	The number of words available from the requested node. This value is updated for you.
40064	Routing 1	0003h	Modbus Plus node address of the drive = 0003h
40065	Routing 2	0001h	End of routing path = 0001h (Modbus Plus 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	Operation Command	READ	receives the drive's operation command (001h).
40071	Output Frequency	READ	receives the drive's output frequency (F005h).
40072	Output Current	READ	receives the drive's output current (F006h).
40073	DC Bus Voltage	READ	receives the voltage (F008h).
40074	Drive Status	READ	receives the drive status (F000h).
40075	Existing Fault Code 1	READ	recieves the drive existing fault data (F009h)
40076	Existing Fault Code 2	READ	recieves the drive existing fault data (F00Ah)
40077	Existing Fault Code 3	READ	recieves the drive existing fault data (F00Bh)

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 F200h 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 F200h 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:

```
   |  | |        |/|                    ┌──────────┐       ( )
   ├──┤ ├────────┤ ├────────────────────│  40160   │───────00031
   |  00030        00033                │          │
   |  | |                               │  40170   │       ( )
   └──┤ ├────────                       │          │───────00032
      00031                            │  MSTR    │
                                        │  #0010   │       ( )
                                        └──────────┘───────00033
```
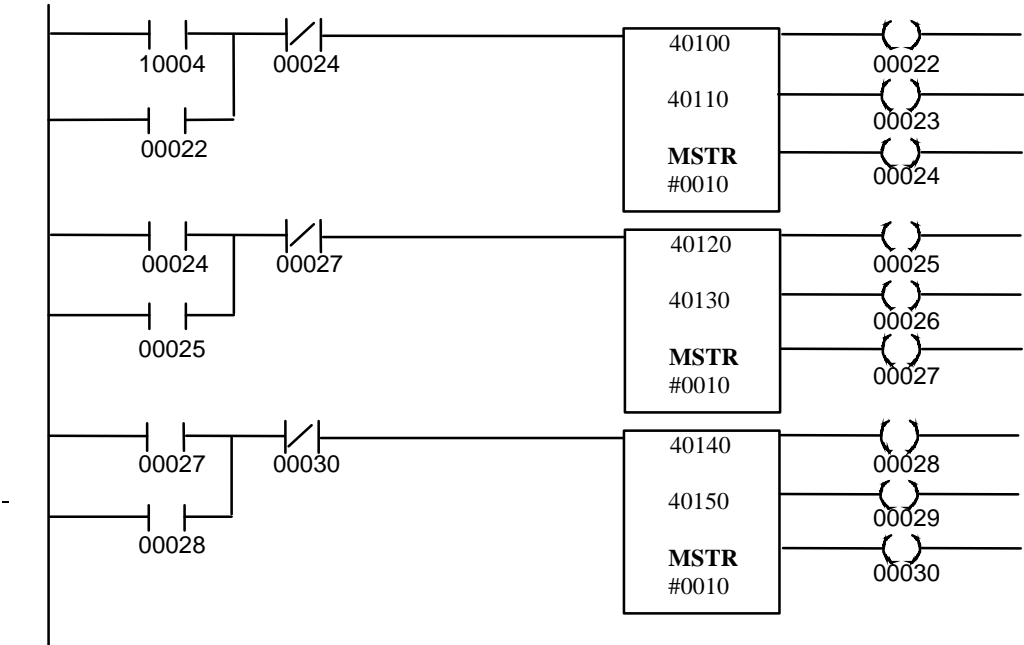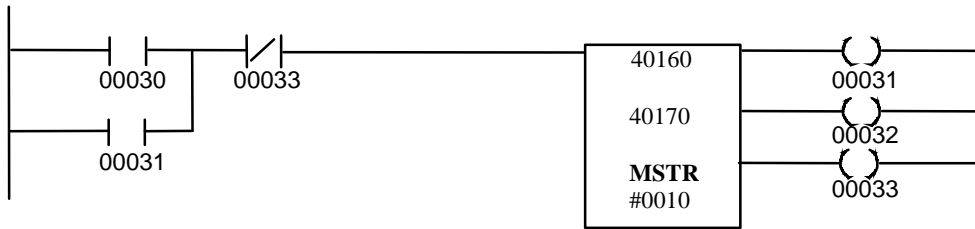
MSTR Transaction #1

This MSTR transaction writes to the F200h 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 Modbus Plus communications
40102	Number of Registers	0001h	Write to 1 register
40103	Data Register Code	F200h	Global Write Data Code
40104	Routing 1	0002h	Modbus Plus node address of drive = 0002h
40105	Routing 2	0001h	End of routing path = 0001h (Modbus Plus 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 F200h 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 Modbus Plus communications
40122	Number of Registers	0001h	Write to 1 register
40123	Data Register Code	F200h	Global Write Data Code
40124	Routing 1	0003h	Modbus Plus node address of drive = 0003h
40125	Routing 2	0001h	End of routing path = 0001h (Modbus Plus 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 F200h 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 Modbus Plus communications
40142	Number of Registers	0001h	Write to 1 register
40143	Data Register Code	F200h	Global Write Data Code
40144	Routing 1	0004h	Modbus Plus node address of drive = 0004h
40145	Routing 2	0001h	End of routing path = 0001h (Modbus Plus 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 Modbus Plus 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	0002h	Run Reverse = bit 0/off, bit 1/on = 0002h
40172	Freq. Reference	0D80h	34.56 Hz = 3456 (decimal) = 0D80h

Example #5
Write Acceleration and Deceleration Times (C1-01 and C1-02)
to a Drive

This example will show how to write acceleration time 1 and deceleration time 1 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:
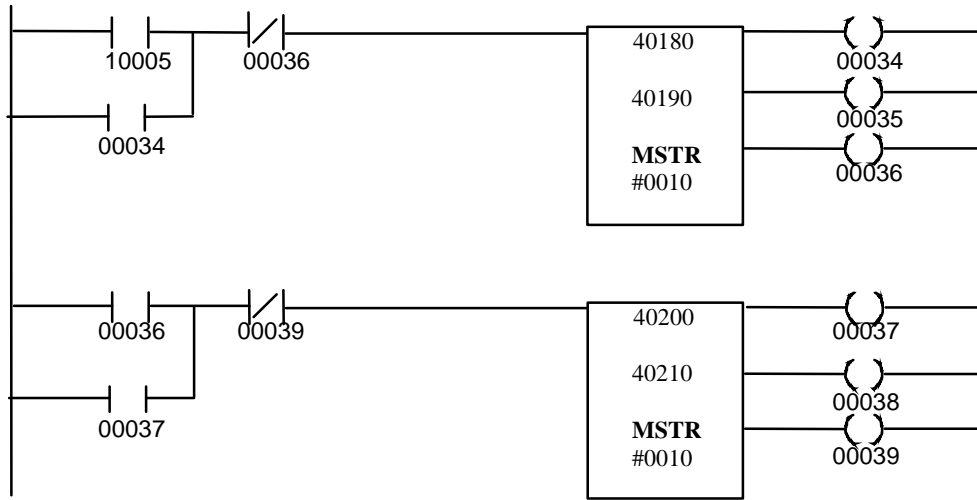
MSTR Transaction #1

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 (C1-01) and the Deceleration Time 1 register (C1-02) 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 Modbus Plus communications
40182	Number of Registers	0002h	Write to 2 consecutive registers
40183	Data Register Code	0200h	C1-01 data code
40184	Routing 1	0002h	Modbus Plus node address of drive = 0002h
40185	Routing 2	0001h	End of routing path = 0001h (Modbus Plus 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 Modbus Plus communications
40202	Number of Registers	0001h	Write to 1 register
40203	Data Register Code	FFFDh	Data code for the "ENTER" command
40204	Routing 1	0002h	Modbus Plus node address of the drive = 0002h
40205	Routing 2	0001h	End of routing path = 0001h (Modbus Plus 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'

> **CAUTION**
> USE THE 'ENTER' COMMAND ONLY WHEN NECESSARY!
> The life of the Non-Volatile EEPROM on the VS-616G5 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 (ERR), requiring the VS-616G5 control board to be replaced.

Example #6
Write a Global Frequency Reference Multiplier to Drive #2

This example will write a global frequency reference multiplier of 0.500 to drive #2. The global frequency reference multiplier register is data code F201h 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 F200h.

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

Since the Receive Global Data Register and the Global Reference Multiplier Register can only be written to one word at a time, only two MSTR transactions will be needed. The following MSTR transactions should be performed:

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

The MSTR functions inserted into the ladder logic would look like:
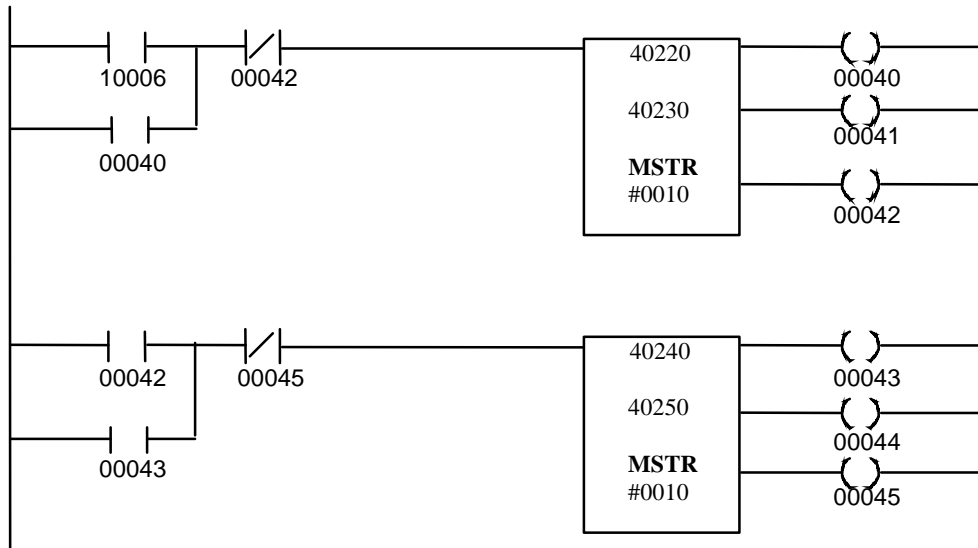
MSTR Transaction #1

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 Source Data 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 Modbus Plus communications
40222	Number of Registers	0001h	Write to 1 consecutive register
40223	Data Register Code	F200h	Global Write Data Register Code
40224	Routing 1	0002h	Modbus Plus node address of the drive = 0002h
40225	Routing 2	0001h	End of routing path = 0001h (Modbus Plus 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)

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 Global Frequency Reference Multiplier Register on drive #2.

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 Modbus Plus communications
40242	Number of Registers	0001h	Write to 1 consecutive register
40243	Data Register Code	F201h	Global Write Data Register
40244	Routing 1	0002h	Modbus Plus node address of the drive = 0002h
40245	Routing 2	0001h	End of routing path = 0001h (Modbus Plus 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	Global Frequency Reference Multiplier	01F4h	0500 (decimal) = .500 multiplier. Frequency in 002h register is multiplied by .500 on drive 2.

Example #7
Read Drive Parameter Registers (bx-xx's, Cx-xx's, dx-xxs, and Ex-xx's) from Drive #3

This example will read drive parameter registers from drive #3. In this example, an input to the PLC will be used to initiate the MSTRs that will read the drive parameters. 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 bx-xx parameters (registers 180h - 1A5h)	40260	40270
2	Read Cx-xx parameters (registers 200h - 240h)	40310	40320
3	Read dx-xx parameters (registers 280h - 296h)	40390	40400
4	Read Ex-xx parameters (registers 300h - 316h)	40430	40440

The MSTR functions inserted into the ladder logic would look like:
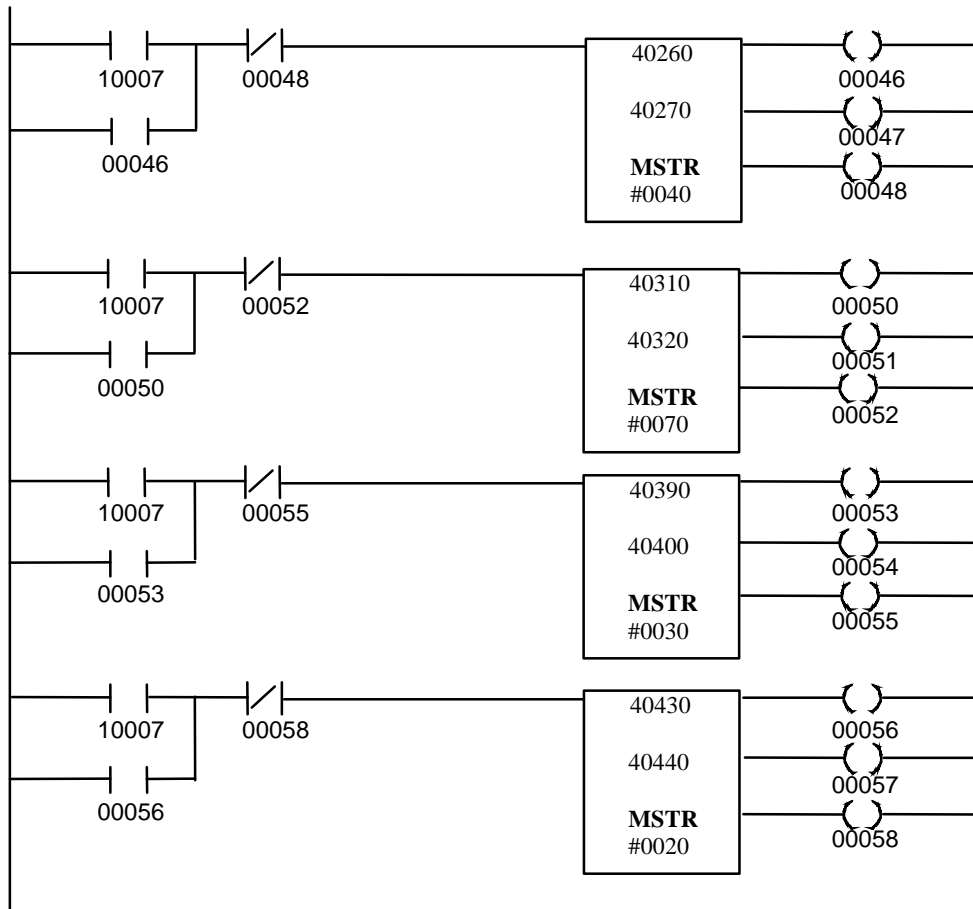
MSTR Transaction #1

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 b1-01 through b9-02.

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 Modbus Plus communications
40262	Number of Registers	0026h	Read from 38 consecutive registers
40263	Data Register Code	0180h	0180h = start of bx-xx parameters.
40264	Routing 1	0003h	Modbus Plus node address of the drive = 0003h
40265	Routing 2	0001h	End of routing path = 0001h (Modbus Plus 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	b1-01	READ	Reference Selection
40271	b1-02	READ	Operation Method Selection
?	?	?	?
40306	b9-01	READ	Zero-Servo Gain
40307	b9-02	READ	Zero-Servo Completion Width

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 C1-01 through C8-30.

CONTROL BLOCK			
Register Number	**Register Description**	**Register Data**	**Data Description**
40310	Operation Code	0002h	0002h = Read from Multiple Registers
40311	Network Error Code	0000h	The error code returned by Modbus Plus communications
40312	Number of Registers	0040h	Read from 64 consecutive registers
40313	Data Register Code	0200h	0200h = start of Cx-xx parameters
40314	Routing 1	0003h	Modbus Plus node address of drive = 0003h
40315	Routing 2	0001h	End of routing path = 0001h (Modbus Plus requirement)
40316	Routing 3	0000h	This routing register is not used, must be set to 0
40317	Routing 4	0000h	This routing register is not used, must be set to 0
40318	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**
40320	C1-01	READ	Acceleration Time 1
40321	C1-02	READ	Deceleration Time 1
?	?	?	?
40383	C8-30	READ	Carrier in Tune

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 d1-01 through d5-06.

CONTROL BLOCK			
Register Number	**Register Description**	**Register Data**	**Data Description**
40390	Operation Code	0002h	0002h = Read from Multiple Registers
40391	Network Error Code	0000h	The error code returned by Modbus Plus communications
40392	Number of Registers	0017h	Read from 23 consecutive registers
40393	Data Register Code	0280h	0280h = start of dx-xx parameters
40394	Routing 1	0003h	Modbus Plus node address of drive = 0003h
40395	Routing 2	0001h	End of routing path = 0001h (Modbus Plus requirement)
40396	Routing 3	0000h	This routing register is not used, must be set to 0
40397	Routing 4	0000h	This routing register is not used, must be set to 0
40398	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**
40400	d1-01	READ	Frequency Reference 1
40401	d1-02	READ	Frequency Reference 2
?	?	?	?
40421	d5-05	READ	Speed Limit Bias
40422	d5-06	READ	Speed/Torque Control Switching Timer

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 E1-01 through E2-05.

CONTROL BLOCK			
Register Number	**Register Description**	**Register Data**	**Data Description**
40430	Operation Code	0002h	0002h = Read from Multiple Registers
40431	Network Error Code	0000h	The error code returned by Modbus Plus communications
40432	Number of Registers	0017h	Read from 23 consecutive registers
40433	Data Register Code	0300h	0300h = start of Ex-xx parameters
40434	Routing 1	0003h	Modbus Plus node address of drive = 0003h
40435	Routing 2	0001h	End of routing path = 0001h (Modbus Plus requirement)
40436	Routing 3	0000h	This routing register is not used, must be set to 0
40437	Routing 4	0000h	This routing register is not used, must be set to 0
40438	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**
40440	E1-01	READ	Input Voltage Setting
40441	E1-02	READ	Motor Selection
?	?	?	?
40457	E2-04	READ	Number of Motor Poles
40458	E2-05	READ	Motor Line-to-Line Resistance

Example #8
Write Drive Parameter Registers (bx-xx's, Cx-xx's, dx-xx's, and Ex-xx's) to Drive #3

This example will write all of the drive parameters to drive #3. After writing the drive parameters, the new data will be stored in Volatile memory with the 'ACCEPT' command, which allows the drive to run after parameter change. In this example, an input to the PLC will be used to initiate the MSTRs that will write the drive parameters. 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 bx-xx parameters to drive at node #3	40460	40470
2	Write Cx-xx parameters to drive at node #3	40510	40520
3	Write dx-xx parameters to drive at node #3	40590	40600
4	Write Ex-xx parameters to drive at node #3	40630	40640
5	Write the ACCEPT command	40660	40670

The MSTR functions inserted into the ladder logic would look like:
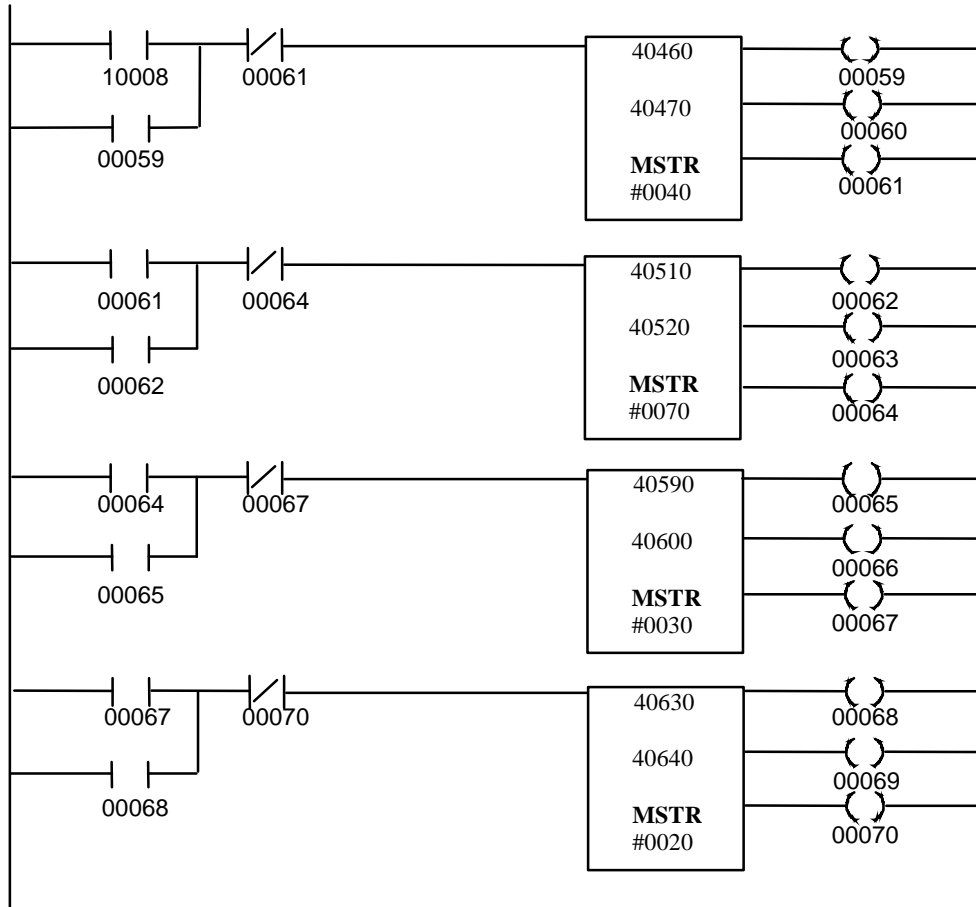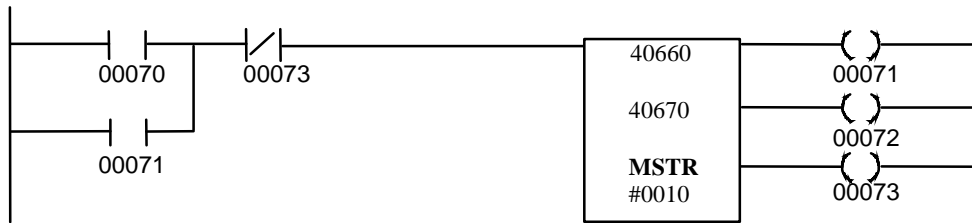
MSTR Transaction #1

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 b1-01 through b9-02.

CONTROL BLOCK			
Register Number	**Register Description**	**Register Data**	**Data Description**
40460	Operation Code	0001h	0001h = Write to Multiple Registers
40461	Network Error Code	0000h	The error code returned by Modbus Plus communications
40462	Number of Registers	0026h	Write to 38 consecutive registers
40463	Data Register Code	0180h	0180h = the start of bx-xx parameters
40464	Routing 1	0003h	Modbus Plus node address of the drive = 0003h
40465	Routing 2	0001h	End of routing path = 0001h (Modbus Plus requirement)
40466	Routing 3	0000h	This routing register is not used, must be set to 0
40467	Routing 4	0000h	This routing register is not used, must be set to 0
40468	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	**Register Description**	**Register Data**	**Data Description**
40470	b1-01	WRITE	Reference Selection
40471	b1-02	WRITE	Operation Method Selection
?	?	?	?
40506	b9-01	WRITE	Zero-Servo Gain
40507	b9-02	WRITE	Zero-Servo Completion Width

9-24   Examples

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 C1-01 through C8-30.

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 Modbus Plus communications
40512	Number of Registers	0040h	Write to 64 consecutive registers
40513	Data Register Code	0200h	0200h = start of Cx-xx parameters
40514	Routing 1	0003h	Modbus Plus node address of the drive = 0003h
40515	Routing 2	0001h	End of routing path = 0001h (Modbus Plus 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	C1-01	WRITE	Acceleration Time 1
40521	C1-02	WRITE	Deceleration Time 1
?	?	?	?
40583	C8-30	WRITE	Carrier in Tune

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 d1-01 through d5-06.

CONTROL BLOCK			
Register Number	**Register Description**	**Register Data**	**Data Description**
40590	Operation Code	0001h	0001h = Write to Multiple Registers
40591	Network Error Code	0000h	The error code returned by Modbus Plus communications
40592	Number of Registers	0017h	Write to 23 consecutive registers
40593	Data Register Code	0280h	0280h = start of dx-xx parameters
40594	Routing 1	0003h	Modbus Plus node address of the drive = 0003h
40595	Routing 2	0001h	End of routing path = 0001h (Modbus Plus requirement)
40596	Routing 3	0000h	This routing register is not used, must be set to 0
40597	Routing 4	0000h	This routing register is not used, must be set to 0
40598	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	**Register Description**	**Register Data**	**Data Description**
40600	d1-01	WRITE	Frequency Reference 1
40601	d1-02	WRITE	Frequency Reference 2
?	?	?	?
40621	d5-05	WRITE	Speed Limit Bias
40622	d5-06	WRITE	Speed/Torque Control Switching Timer

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 E1-01 through E2-05.

CONTROL BLOCK			
Register Number	Register Description	Register Data	Data Description
40630	Operation Code	0001h	0001h = Write to Multiple Registers
40631	Network Error Code	0000h	The error code returned by Modbus Plus communications
40632	Number of Registers	0017h	Write to 23 consecutive registers
40633	Data Register Code	0300h	0300h = start of Ex-xx parameters
40634	Routing 1	0003h	Modbus Plus node address of drive = 0003h
40635	Routing 2	0001h	End of routing path = 0001h (Modbus Plus requirement)
40636	Routing 3	0000h	This routing register is not used, must be set to 0
40637	Routing 4	0000h	This routing register is not used, must be set to 0
40638	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	Register Description	Register Data	Data Description
40640	E1-01	WRITE	Input Voltage Setting
40641	E1-02	WRITE	Motor Selection
?	?	?	?
40657	E2-04	WRITE	Number of Motor Poles
40658	E2-05	WRITE	Motor Line-to-Line Resistance

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 ACCEPT data into Volatile memory and allow the drive to run after a parameter change on drive #3.

CONTROL BLOCK			
Register Number	**Register Description**	**Register Data**	**Data Description**
40660	Operation Code	0001h	0001h = Write to Multiple Registers
40661	Network Error Code	0000h	The error code returned by Modbus Plus communications
40662	Number of Registers	0001h	Write to 1 register
40663	Data Register Code	FFDDh	FFDDh = ACCEPT command
40664	Routing 1	0003h	Modbus Plus node address of the drive = 0003h
40665	Routing 2	0001h	End of routing path = 0001h (Modbus Plus requirement)
40666	Routing 3	0000h	This routing register is not used, must be set to 0
40667	Routing 4	0000h	This routing register is not used, must be set to 0
40668	Routing 5	0000h	This routing register is not used, must be set to 0

DATA BLOCK			
Register Number	**Register Description**	**Register Data**	**Data Description**
40670	ACCEPT data into Volatile memory	0000h	To ACCEPT data into Volatile memory, set this register to '0'

Example #9
Read the Drive Status Registers 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 DC Bus Voltage) from all of the VS-616G5s. 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 (F000h - F00Fh) from drive #2	40680	40690
2	Read drive status (F000h - F00Fh) from drive #3	40710	40720
3	Read drive status (F000h - F00Fh) from drive #4	40740	40750

The MSTR functions inserted into the ladder logic would look like:
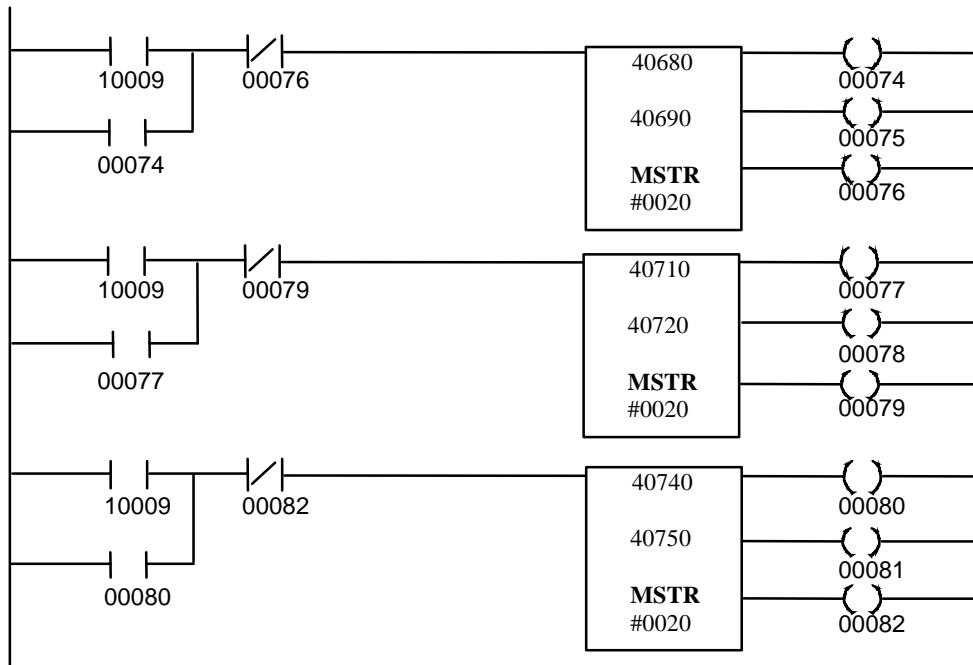
MSTR Transaction #1

In this example, the MSTR blocks are executed simultaneously. 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**
40680	Operation Code	0002h	0002h = Read from Multiple Registers
40681	Network Error Code	0000h	The error code returned by Modbus Plus communications
40682	Number of Registers	0010h	Read from 16 consecutive registers
40683	Data Register Code	F000h	F000h = Drive Status Signals
40684	Routing 1	0002h	Modbus Plus node address of the drive = 0002h
40685	Routing 2	0001h	End of routing path = 0001h (Modbus Plus requirement)
40686	Routing 3	0000h	This routing register is not used, must be set to 0
40687	Routing 4	0000h	This routing register is not used, must be set to 0
40688	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**
40690	Drive Status Signals	READ	RUN/STOP, FWD/REV, Drive Ready, etc.
40691	Motor Speed	READ	Motor Speed
40692	Torque Reference	READ	Torque Reference
40693	not used	n/a	n/a
40694	Speed Reference	READ	Frequency command to drive
40695	Output Frequency	READ	(0.1 Hz) Frequency at the drive
40696	Output Current	READ	Current at the output
40697	Analog Input	READ	Control Circuit Term 14 Input Volatge
40698	DC Bus Voltage	READ	(1.0 V) DC Bus voltage
40699	Fault Content 1	READ	Overcurrent, Overvoltage,
40700	Fault Content 2	READ	Drive Overload,
40701	Fault Content 3	READ	etc.
40702	Analog Input	READ	Control Circuit Term 16 Input Voltage
40703	Digital Input	READ	Input Terminal Status
40704	Analog Input	READ	Control Circuit Term 13 Input Voltage
40705	not used	n/a	n/a

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**
40710	Operation Code	0002h	0002h = Read from Multiple Registers
40711	Network Error Code	0000h	The error code returned by Modbus Plus communications
40712	Number of Registers	0010h	Read from 16 consecutive registers
40713	Data Register Code	F000h	F000h = Drive Status Signals
40714	Routing 1	0003h	Modbus Plus node address of the drive = 0003h
40715	Routing 2	0001h	End of routing path = 0001h (Modbus Plus requirement)
40716	Routing 3	0000h	This routing register is not used, must be set to 0
40717	Routing 4	0000h	This routing register is not used, must be set to 0
40718	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**
40720	Drive Status Signals	READ	RUN/STOP, FWD/REV, Drive Ready, etc.
40721	Motor Speed	READ	Motor Speed
40722	Torque Reference	READ	Torque Reference
40723	not used	n/a	n/a
40724	Speed Reference	READ	Frequency command to drive
40725	Output Frequency	READ	(0.1 Hz) Frequency at the drive
40726	Output Current	READ	Current at the output
40727	Analog Input	READ	Control Circuit Term 14 Input Volatge
40728	DC Bus Voltage	READ	(1.0 V) DC Bus voltage
40729	Fault Content 1	READ	Overcurrent, Overvoltage,
40730	Fault Content 2	READ	Drive Overload,
40731	Fault Content 3	READ	etc.
40732	Analog Input	READ	Control Circuit Term 16 Input Voltage
40733	Digital Input	READ	Input Terminal Status
40734	Analog Input	READ	Control Circuit Term 13 Input Voltage
40735	not used	n/a	n/a

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**
40740	Operation Code	0002h	0002h = Read from Multiple Registers
40741	Network Error Code	0000h	The error code returned by Modbus Plus communications
40742	Number of Registers	0010h	Read from 16 consecutive registers
40743	Data Register Code	F000h	F000h = Drive Status Signals
40744	Routing 1	0004h	Modbus Plus node address of the drive = 0004h
40745	Routing 2	0001h	End of routing path = 0001h (Modbus Plus requirement)
40746	Routing 3	0000h	This routing register is not used, must be set to 0
40747	Routing 4	0000h	This routing register is not used, must be set to 0
40748	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**
40750	Drive Status Signals	READ	RUN/STOP, FWD/REV, Drive Ready, etc.
40751	Motor Speed	READ	Motor Speed
40752	Torque Reference	READ	Torque Reference
40753	not used	n/a	n/a
40754	Speed Reference	READ	Frequency command to drive
40755	Output Frequency	READ	(0.1 Hz) Frequency at the drive
40756	Output Current	READ	Current at the output
40757	Analog Input	READ	Control Circuit Term 14 Input Volatge
40758	DC Bus Voltage	READ	(1.0 V) DC Bus voltage
40759	Fault Content 1	READ	Overcurrent, Overvoltage,
40760	Fault Content 2	READ	Drive Overload,
40761	Fault Content 3	READ	etc.
40762	Analog Input	READ	Control Circuit Term 16 Input Voltage
40763	Digital Input	READ	Input Terminal Status
40764	Analog Input	READ	Control Circuit Term 13 Input Voltage
40765	not used	n/a	n/a

Chapter 10
Application Notes

? Register Types

? Through-put

? Limitations

Register Types

The Modbus Plus Interface board allows the MB+ network access to a drive's internal data registers. The two different types of data registers vary in the method they use to access the drive's internal memory. The two different types are as follows:

?? **High Speed Registers** - (0001-000F, F000-F00F) allow direct access to the drive's memory via dual port RAM or shared memory. This allows for very quick access to the drive's memory. The high speed registers are shown in *italics* in Appendix A.

?? **Serial Registers** - (0020-050D, F100-F10F) allow access to the drive's memory via a serial interface. Data is transmitted to and received from the drive's memory serially, which is considerably slower than high speed registers.

Through-put

The following graphs compare the time it takes to complete the given read or write operation for a given number of data registers or block size.

High Speed Register Through-put

Serial Register Through-put
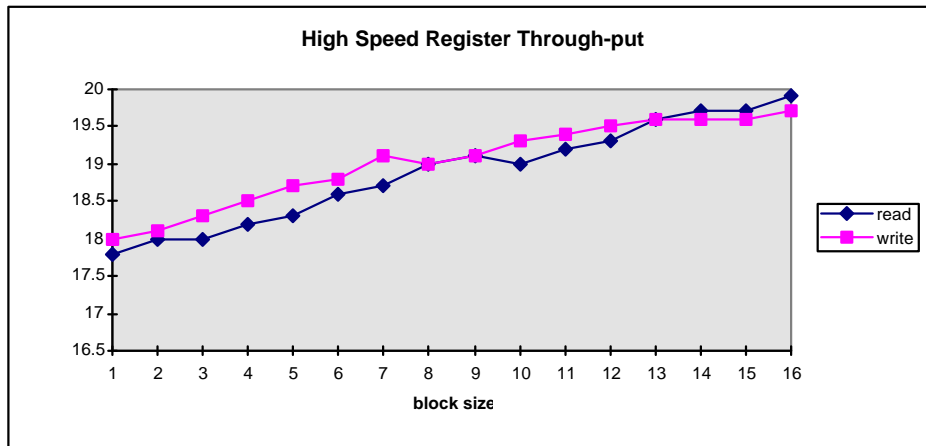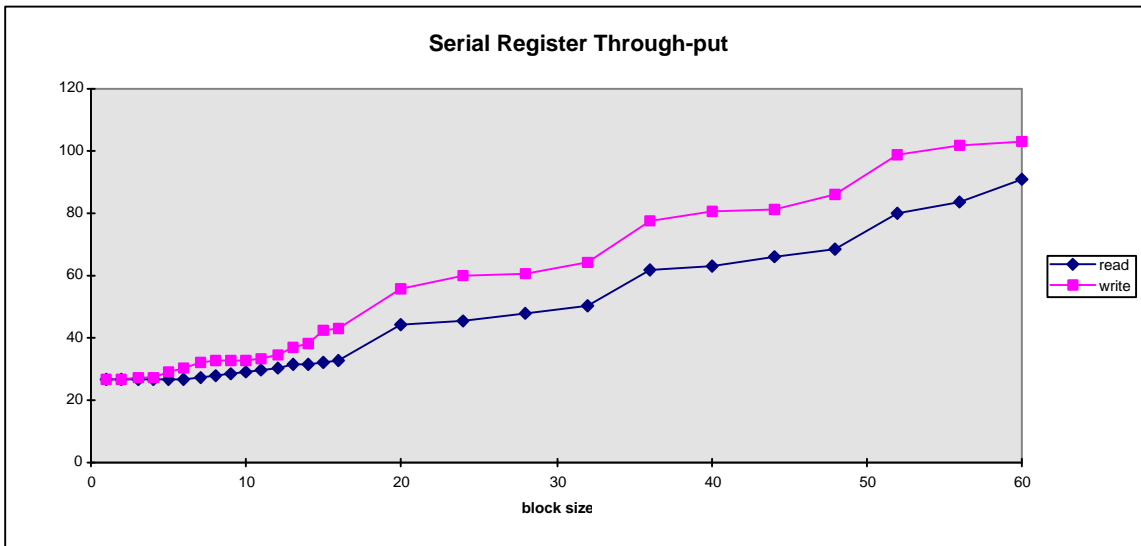
ENTER Command	ACCEPT Command
400 msec to complete	190 msec to complete

Enabling Global Data

High Speed Registers		Serial Registers	
global read enabled	global read & write enabled	global read enabled	global read & write enabled
+ 1.3 msec	+ 3 msec	+ 4 msec	+ 4 msec

Passing Data Through on Bridge (NW-BP85)

+ 5 msec

Enabling Cable Loss

no effect

Drive in RUN

no effect

Limitations

?? The VS-616G5 with the Modbus Plus Interface board is seen as a **slave device** on the MB+ network.

?? If **global write is enabled** via F200, the operation command (001h) and frequency reference (002h) must come via a global write, otherwise erratic operation of the drive could result.

?? With the cable loss detection switch on, **cable loss** is not detected, after drive power-up, until the drive's Modbus Plus Interface board receives its first MB+ command (either a non-global read or write).

?? If both run forward (word 001h - bit 0) and run reverse (word 001h - bit 1) are set to 1,   an " **EF - External Fault** " will be generated by the drive.

?? The following registers can only be accessed via one word blocks (**MSTR length=1**):

F200	r/w	Global Write Data Node Number (Global Write Enable)
F201	r/w	Global Frequency Reference Multiplier
F202	r	Model Number of Drive

?? If any registers are changed via MB+, with the exception of the Operation parameters (shown in Appendix A2 of the VS-616G5 Installation & Quick-Start Manual), an 'ACCEPT' or 'ENTER' command must be sent to the drive in order for the drive to be given a **RUN** command.

?? If any registers are changed via MB+, an 'ACCEPT' or 'ENTER' command must be sent to the drive in order for parameters to be changed via the drive's keypad. If an 'ACCEPT' or 'ENTER' command is needed, the drive will display "**Busy - Write Protected**" when a parameter is attempted to be changed via the keypad.

?? Limit your use of the **'ENTER'** command. The life of the Non-Volatile EEPROM on the VS-616G5 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 (ERR), requiring the VS-616G5 to be replaced.

Appendix A
Data Registers

?? Global Data

?? Command Data

?? Monitor Data

?? Drive Parameter Data

?? Special Data

Global Write Registers (write only)

REGISTER (in hex)	FUNCTION	BIT NO.	DATA SET	DESCRIPTION
001h *	Operational Command	0	0	Stop Forward
			1	Run Forward
		1	0	Stop Reverse
			1	Run Reverse
		2		Terminal 3 Function
		3		Terminal 4 Function
		4		Terminal 5 Function
		5		Terminal 6 Function
		6		Terminal 7 Function
		7		Terminal 8 Function
		8	1	External Fault
		9	1	Fault Reset
002h *	Frequency Reference			Frequency Reference (6000 = 60.00Hz) **(1)**

(1) Scaling depends on the setting of o1-03

 * If parameter o2-09 is not set to '1'; then the operation signals register and frequency reference register will not be '1' and '2' respectively.

Global Read Registers (read only)

REGISTER (in hex)	FUNCTION	BIT NO.	DATA SET	DESCRIPTION
001h	Operational Command	0	0	Stop Forward
			1	Run Forward
		1	0	Stop Reverse
			1	Run Reverse
		2		Terminal 3 Function
		3		Terminal 4 Function
		4		Terminal 5 Function
		5		Terminal 6 Function
		6		Terminal 7 Function
		7		Terminal 8 Function
		8	1	External Fault
		9	1	Fault Reset
F005h	Output Frequency			Output Frequency of drive (in 0.1 Hz) **(1)**
F006h	Output Current			10V/Drive rated current **(2)**
F008h	DC Bus Voltage			DC Bus Voltage (in 1 V)
F000h	Drive Status	0	1	Run
		1	1	Zero-Speed
		2	1	Reverse Run
		3	1	Reset Signal Input
		4	1	Speed Agree
		5	1	Drive Operation Ready
		6	1	Minor Fault
		7	1	Major Fault
		8	1	not used
		9	1	During Momentary Power Ride-through
		A	1	Local / Remote
		B		Terminal 9&10 Output
		C		Terminal 25 Output
		D		Terminal 26 Output
		E	1	Motor Selection
		F	1	Zero Servo Completion

(1) Scaling depends on the setting of o1-03
(2) Display unit = 0.01A for models CIMR-G5U20P4 thru 25P5 and 40P4 thru 45P5; display unit = 0.1A for models 27P5 thru 2075 and 47P5 thru 4300.

REGISTER (in hex)	FUNCTION	BIT NO.	DATA SET	DESCRIPTION
F009h	Existing Fault Code 1	0	1	FU
		1	1	UV1 - DC Bus Undervoltage
		2	1	UV2 - CTL PS Undervoltage
		3	1	UV3 - MC Answerback
		4	1	SC - Short Circuit
		5	1	GF - Ground Fault
		6	1	OC - Over Current
		7	1	OV - Overvoltage
		8	1	OH - Heatsink Overtemperature
		9	1	OH1 - Drive Overheat
		A	1	OL1 - Motor Overload
		B	1	OL2 - Drive Overload
		C	1	OL3 - Overtorque 1
		D	1	OL4 - Overtorque 2
		E	1	RR - Dynamic Braking Transistor
		F	1	RH - Dynamic Braking Resistor
F00Ah	Existing Fault Code 2	0	1	EF3 - External Fault 3
		1	1	EF4 - External Fault 4
		2	1	EF5 - External Fault 5
		3	1	EF6 - External Fault 6
		4	1	EF7 - External Fault 7
		5	1	EF8 - External Fault 8
		6	1	FAN Fault
		7	1	OS - Overspeed
		8	1	DEV - Speed Deviation
		9	1	PGO - PG Open
		A	1	PF - Input Phase Loss
		B	1	LF - Output Phase Loss
		C	1	not used
		D	1	OPR
		E	1	ERR - EEPROM R/W Error
		F	1	not used

Global Read Registers (Read only) – continued

REGISTER (in hex)	FUNCTION	BIT NO.	DATA SET	DESCRIPTION
F00Bh	Existing Fault 3	0	1	CE - Modbus Com Error
		1	1	BUS
		2	1	not used
		3	1	EF0
		4	1	SVE - Zero Servo Fault
		5	1	not used
		6	1	not used
		7	1	not used
		8	1	not used
		9	1	not used
		A	1	not used
		B	1	not used
		C	1	not used
		D	1	not used
		E	1	not used
		F	1	CPF - Control Fault

Data Registers

Command Registers (Read / Write)

REGISTER (in hex)	FUNCTION	BIT NO.	DATA SET	DESCRIPTION
001h *	Operational Command	0	0	Stop Forward
			1	Run Forward
		1	0	Stop Reverse
			1	Run Reverse
		2		Terminal 3 Function **(1)**
		3		Terminal 4 Function **(1)**
		4		Terminal 5 Function **(1)**
		5		Terminal 6 Function **(1)**
		6		Terminal 7 Function **(1)**
		7		Terminal 8 Function **(1)**
		8	1	External Fault
		9	1	Fault Reset
002h *	Frequency Reference / Output Frequency			.01 Hz **(7)**
003h	Torque Reference			Flux Vector mode only (0.1%)
004h	Torque Compensation			Flux Vector mode only (0.1%)
005h	Not Supported			
006h	Analog Output 1 Setting			-10V / -660 ? +10V / +660 analog output on terminals 21 & 22 **(5)**
007h	Analog Output 2 Setting			-10V / -660 ? +10V / +660 analog output on terminals 22 & 23 **(6)**
008h	Digital Output Setting	0		Multi-function Contact Output (terminals 9 & 10): "closed" **(2)**
		1		Multi-function Contact Output (terminals 25 & 27): "closed" **(3)**
		2		Multi-function Contact Output (terminals 26 & 27): "closed" **(4)**
		3		not used
		4		not used
		5		not used
		6		Fault Contact enable
		7		Fault Contact state (effective only when bit 6 = '1')

(1) The availability of the multi-function input terminals vary depending upon the settings of H1-01, H1-02, H1-03, H1-04, H1-05, H1-06 (the multi-function input settings)
(2) Effective when H2-01 = 0Fh.   (3) Effective when H2-02 = 0Fh.   (4) Effective when H2-03 = 0Fh.
(5) Effective when H4-01 = 1Fh.   (6) Effective when H4-04 = 1Fh.
(7) Desired frequency of 35.75 Hz requires a value of 3575 in register data code 002h. Scaling depends on the setting of o1-03
 * If parameter o2-09 is not set to '1'; then the operation signals register and frequency reference register will not be '1' and '2' respectively.

Command Registers (Read / Write) – continued

REGISTER (in hex)	FUNCTION	DESCRIPTION
009-00Fh	reserved	-
F200	Global Write Data Node Number	Source Node Number to Accept Global Write Data
F201	Global Frequency Reference Multiplier	Used as mulplier to the global frequency reference command (1000 = 1.000)

Monitor Registers (Read only)

REGISTER (in hex)	FUNCTION	BIT NO.	DATA SET	DESCRIPTION
F000h	Drive Status	0	1	Run
		1	1	Zero-Speed
		2	1	Reverse Run
		3	1	Reset Command Receiving
		4	1	Speed Agree
		5	1	Drive Operation Ready
		6	1	Minor Fault (AlarmCondition)
		7	1	Major Fault (Fault Condition)
		8	1	not used
		9	1	During Momentary Power Ride-through
		A	1	Local / Remote
		B		terminal 9&10 output **(2)**
		C		terminal 25 output **(2)**
		D		terminal 26 output **(2)**
		E	1	Motor Selection
		F	1	Zero Servo Completion
F001h	Motor Speed			Motor Speed (in 0.1 Hz) - same as U1-05 **(1)**
F002h	Torque Reference			Torque Reference - same as U1-09 **(1)**
F003h	PG Count			Speed Detection PG Count (with PG only)
F004h	Speed Reference			Frequency Reference - same as U1-01 **(1)**
F005h	Output Frequency			Output Frequency of drive (0.1 Hz) - same as U1-02 **(1)**
F006h	Output Current			Drive rating / 8192 - same as U1-03 **(1)**
F007h	AI - Control Circuit Term 14 Input Voltage			Input voltage signal at terminal 14 (+10V / +100.0% ? -10V / -100.0%) - same as U1-16
F008h	DC Bus Voltage			DC Bus Voltage (in 1 V) - same as U1-07 **(1)**

Notes:

(1) The data units depends on o1-03

(2) The availability of the muilti-function input terminals vary depending upon the settings of H1-01, H1-02, H1-03, H1-04, H1-05, H1-06 (the multi-function input settings).

Monitor Registers (Read only) – continued

REGISTER (in hex)	FUNCTION	BIT NO.	DESCRIPTION
F009h	Fault Content 1	0	Fuse Blown (FU)
		1	DC Bus Undervoltage (UV1)
		2	Control Power Supply Undervoltage (UV2)
		3	Main Circuit Answerback (UV3)
		4	Short Circuit (SC)
		5	Ground Fault (GF)
		6	Overcurrent (oC)
		7	Overvoltage (oV)
		8	Heatsink Overtemperature (oH)
		9	Drive Overheat (oH1)
		10	Motor Overload (oL1)
		11	Drive Overload (oL2)
		12	Overtorque 1 (oL3)
		13	Overtorque 2 (oL4)
		14	Dynamic Braking Transistor (RR)
		15	Dynamic Braking Resistor (RH)
F00Ah	Fault Content 2	0	External Fault 3 (EF3)
		1	External Fault 4 (EF4)
		2	External Fault 5 (EF5)
		3	External Fault 6 (EF6)
		4	External Fault 7 (EF7)
		5	External Fault 8 (EF8)
		6	FAN Fault
		7	Overspeed (oS)
		8	Speed Deviation (DEV)
		9	PG Open (PGo)
		10	Input Phase Loss (PF)
		11	Output Phase Loss (LF)
		12	not used
		13	Operator Disconnected (OPR)
		14	EEPROM Write-in Fault (ERR)
		15	not used

Data Registers

Monitor Registers (Read only) – continued

REGISTER (in hex)	FUNCTION	BIT NO.	DESCRIPTION
F00Bh	*Fault Content 3*	0	Modbus Communication Error (CE)
		1	BUS
		2	not used
		3	EF0
		4	Control Fault (CF)
		5	Zero Servo Fault (SVE)
		6	not used
		7	EF0
		8	not used
		9	not used
		10	not used
		11	not used
		12	not used
		13	not used
		14	not used
		15	CPF
F00Ch	*AI - Control Circuit Term 16 Input Voltage*		Input voltage signal at terminal 16 (+10V / +100.0% ? -10V / -100.0%) - same as U1-17
F00Dh	*DI - Input Terminal Status* *(same as U1-15)*	0	Input Terminal 1 closed
		1	Input Terminal 2 closed
		2	Input Terminal 3 closed
		3	Input Terminal 4 closed
		4	Input Terminal 5 closed
		5	Input Terminal 6 closed
		6	Input Terminal 7 closed
		7	Input Terminal 8 closed
F00Eh	*AI - Control Circuit Term 13 Input Voltage*		Input voltage signal at terminal 13 (+10V / +100.0% ? -10V / -100.0%) - same as U1-15
F00Fh	not used		-

Monitor Registers (Read only) – continued

REGISTER (in hex)	FUNCTION	BIT NO.	DESCRIPTION
F100h	Inverter Status	0	Run
		1	Zero-Speed
		2	Reverse Run
		3	Reset Signal Input
		4	Speed Agree
		5	Drive Operation Ready
		6	Minor Fault
		7	Major Fault
		8-15	will return zeros
F101h	Operator Status	0	oPE Error
		1	not used
		2	Program Mode
		3	1CN Status:
		4	01=JVOP132 / 00=JVOP130(std. operator) / 11=Personal Computer / 10=JVOP100
		5-15	not used
F102h	oPE No.		oPE Error Code (oPE01=1, oPE02=2, oPE03=3, oPE06=6, oPE10=10, oPE11=11)
F103h	not used		-
F104h	Fault Content 1	0	Fuse Blown (FU)
		1	DC Bus Undervoltage (UV1)
		2	Control Power Supply Undervoltage (UV2)
		3	Main Circuit Answerback (UV3)
		4	Short Circuit (SC)
		5	Ground Fault (GF)
		6	Overcurrent (oC)
		7	Overvoltage (oV)
		8	Heatsink Overtemperature (oH)
		9	Drive Overheat (oH1)
		10	Motor Overload (oL1)
		11	Drive Overload (oL2)
		12	Overtorque 1 (oL3)
		13	Overtorque 2 (oL4)
		14	Dynamic Braking Transistor (RR)
		15	Dynamic Braking Resistor (RH)

Data Registers

Monitor Registers (Read only) – continued

REGISTER (in hex)	FUNCTION	BIT NO.	DESCRIPTION
F105h	Fault Content 2	0	External Fault 3 (EF3)
		1	External Fault 4 (EF4)
		2	External Fault 5 (EF5)
		3	External Fault 6 (EF6)
		4	External Fault 7 (EF7)
		5	External Fault 8 (EF8)
		6	not used
		7	Overspeed (oS)
		8	Speed Deviation (DEV)
		9	PG Open (PGo)
		10	Input Phase Loss (PF)
		11	Output Phase Loss (LF)
		12	DCCT Fault (CF)
		13	Operator Disconnected (OPR)
		14	EEPROM Write-in Fault (ERR)
		15	not used
F106h	Fault Content 3	0	Modbus Communication Error (CE)
		1	not used
		2	not used
		3	not used
		4	Control Fault (CF)
		5	Zero Servo Fault (SVE)
		6-15	not used
F107h	CPF Content 1	0	not used
		1	not used
		2	CPF02 Fault
		3	CPF03 Fault
		4	CPF04 Fault
		5	CPF05 Fault
		6	CPF06 Fault
		7-15	not used

REGISTER (in hex)	FUNCTION	BIT NO.	DESCRIPTION
F108h	CPF Content 2	0	CPF20 Fault
		1	CPF21 Fault
		2	CPF22 Fault
		3	CPF23 Fault
		4-15	not used
F109h	Minor Fault Content 1	0	Undervoltage Detection (UV)
		1	Overvoltage Detection (oV)
		2	Heatsink Overtemperature (oH)
		3	Drive Overheat Alarm (oH1)
		4	Overtorque 1 Detection (oL3)
		5	Overtorque 2 Detection (oL4)
		6	2-wire Sequence Input Fault (EF)
		7	During External Baseblock (BB)
		8	External Fault 3 (EF3)
		9	External Fault 4 (EF4)
		10	External Fault 5 (EF5)
		11	External Fault 6 (EF6)
		12	External Fault 7 (EF7)
		13	External Fault 8 (EF8)
		14	Cooling Fan Fault (FAN)
		15	Overspeed (oS)
F10Ah	Minor Fault Content 2	0	Speed Deviation (DEV)
		1	PG Open (PGo)
		2	Operator Disconnected (OPR)
		3	Modbus Communication Error (CE)
		4	not used
		5	not used
		6	Motor Overload (oL1)
		7	Drive Overload (oL2)
		8-15	not used
F202h	Inverter Model Number		Model Number of drive inverter (in decimal)

Data Registers

Drive Parameter Registers (U1-xx / Monitor Only)

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	BIT NO.	LIMITS / DESCRIPTION
020h	U1-01	Frequency Reference			Frequency Reference of drive (0.1 Hz) **(1)**
021h	U1-02	Output Frequency			Output Frequency of drive (0.1 Hz) **(1)**
022h	U1-03	Output Current			10V/Drive rated current **(2)**
023h	U1-04	Control Method	0		V/f Control
			1		V/f with PG Feedback
			2		Open Loop Vector
			3		Flux Vector
024h	U1-05	Motor Speed			Motor Speed (in 0.1 Hz)
025h	U1-06	Output Voltage			Output Voltage (in 0.1 V)
026h	U1-07	DC Bus Voltage			DC Bus Voltage (in 1 V)
027h	U1-08	Output Power			Output Power (in 0.1 kW)
028h	U1-09	Torque Reference			Torque Reference (in 0.1%)
029h	U1-10	Input Terminal Status		0	Input Terminal 1 closed
				1	Input Terminal 2 closed
				2	Input Terminal 3 closed
				3	Input Terminal 4 closed
				4	Input Terminal 5 closed
				5	Input Terminal 6 closed
				6	Input Terminal 7 closed
				7	Input Terminal 8 closed
02Ah	U1-11	Output Terminal Status		0	Control Circuit terminals 9 & 10: "Closed"
				1	Control Circuit terminals 25 & 27: "Closed"
				2	Control Circuit terminals 26 & 27: "Closed"
				3-6	not used
				7	Control Circuit terminals 18 & 20: "Closed"

Notes:
(1) Scaling depends on the setting of o1-03.
(2) Display unit = 0.01A for models CIMR-G5U20P4 thru 25P5 and 40P4 thru 45P5; display unit = 0.1A for models 27P5 thru 2075 and 47P5 thru 4300.

Drive Parameter Registers (U1-xx / Monitor Only) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	BIT NO.	LIMITS / DESCRIPTION
02Bh	U1-12	Operation Status		0	Run
				1	Zero-Speed
				2	Reverse Run
				3	Reset Signal Input
				4	Speed Agree
				5	Drive Operation Ready
				6	Minor Fault
				7	Major Fault
02Ch	U1-13	Elapsed Time	Hours		
02Dh	U1-14	Software No. (CPU ID No.)	Software version number		
02Eh	U1-15	Control Circuit Term 13 Input Voltage	Input voltage signal at terminal 13 (+10V / +100.0% ? -10V / -100.0%)		
02Fh	U1-16	Control Circuit Term 14 Input Voltage	Input voltage or mAmp signal at terminal 14 (+10V / +100.0% ? -10V / -100.0%) or (4mA / 0.0% ? 20mA / 100.0%)		
030h	U1-17	Control Circuit Term 16 Input Voltage	Input voltage signal at terminal 16 (+10V / +100.0% ? -10V / -100.0%)		
031h	U1-18	Motor Secondary Current (Iq)	Motor Secondary Current-Iq (0.1%)		
032h	U1-19	Motor Exciting Current (Id)	Motor Rated Primary Current-Id (0.1%)		
033h	U1-20	Output Frequency after Soft-start	Max. Output Frequency (0.1 Hz)		
034h	U1-21	Automatic Speed Regulator (ASR) Input	ASR Input (0.01%)		
035h	U1-22	Automatic Speed Regulator (ASR) Output	ASR Output (0.01%)		
036h	U1-23	Speed Deviation Regulator Input	Speed Deviation Regulator Input (0.01%)		
037h	U1-24	PID Feedback Amount	PID Feedback Amount (0.01%)		
038h	U1-25	DI - 16 H Input Status	displays an input value according to the setting of F3-01		
039h	U1-26	Output Voltage Reference Vq	Output Voltage-Vq (0.1V)		
03Ah	U1-27	Output Voltage Reference Vd	Output Voltage-Vd (0.1V)		
03Bh	U1-28	Software No. CPU	processor version number		
03Ch	U1-32	ACR Output q Axis	ASR Output q Axis (0.1%)		
03Dh	U1-33	ACR Output d Axis	ASR Output d Axis (0.1%)		
03Fh	U1-34	OPE Detection	Parameter setting error		

Drive Parameter Registers (U2-xx / Fault Trace and U3-xx / Fault History)

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	BIT NO.	LIMITS / DESCRIPTION
080h	U2-01	Current Fault			Code of current fault **(1)**
081h	U2-02	Last Fault			Code of second to current fault **(1)**
082h	U2-03	Frequency Ref. at Fault			Frequency Reference at the time of the current fault (0.0 to 400.0 Hz)
083h	U2-04	Output Frequency at Fault			Output Frequency at the time of current fault (0.0 to 400.0 Hz)
084h	U2-05	Output Current at Fault			Output Current at the time of current fault (drive rating /8192)
085h	U2-06	Motor Speed at Fault			Motor Speed at the time of current fault (in 0.1 Hz)
086h	U2-07	Output Voltage at Fault			Output Voltage at the time of current fault (in 0.1 V)
087h	U2-08	DC Bus Voltage at Fault			Output Voltage at the time of current fault (in 1 V)
088h	U2-09	Output kWatts at Fault			Output Power at the time of current fault (in 0.1 kW)
089h	U2-10	Torque Reference at Fault			Torque Reference at the time of current fault (in 0.1%)
08Ah	U2-11	Input Terminal Status at Fault		0	Input Terminal 1 closed at time of fault
				1	Input Terminal 2 closed at time of fault
				2	Input Terminal 3 closed at time of fault
				3	Input Terminal 4 closed at time of fault
				4	Input Terminal 5 closed at time of fault
				5	Input Terminal 6 closed at time of fault
				6	Input Terminal 7 closed at time of fault
				7	Input Terminal 8 closed at time of fault
08Bh	U2-12	Output Terminal Status at Fault		0	Control Circuit terminals 9 & 10: "Closed"
				1	Control Circuit terminals 25 & 27: "Closed"
				2	Control Circuit terminals 26 & 27: "Closed"
				3-6	not used
				7	Control Circuit terminals 18 & 20: "Closed"

Notes:
(1) List of Drive Error Codes can be found in chapter 8, Error Codes and Troubleshooting.

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	BIT NO.	LIMITS / DESCRIPTION
08Ch	U2-13	Drive Status at Fault		0	Running at the time of fault
				1	Zero-Speed at the time of fault
				2	Reverse Running at the time of fault
				3	Reset Signal Input at the time of fault
				4	Speed Agree at the time of fault
				5	Drive Operation Ready at the time of fault
				6	Minor Fault
				7	Major Fault
08Dh	U2-14	Elapsed Time at Fault	Elapsed Time at the time of fault (in hrs.)		
090h	U3-01	Last Fault	Code of the most recent fault **(1)**		
091h	U3-02	Fault Message 2	Code of the second to most recent fault **(1)**		
092h	U3-03	Fault Message 3	Code of the third to most recent fault **(1)**		
093h	U3-04	Fault Message 4	Code of the fourth to most recent fault **(1)**		
094h	U3-05	Elapsed Time 1	Elapsed Time at the most recent fault occurrence		
095h	U3-06	Elapsed Time 2	Elapsed Time at the second to most recent fault occurrence		
096h	U3-07	Elapsed Time 3	Elapsed Time at the third to most recent fault occurrence		
097h	U3-08	Elapsed Time 4	Elapsed Time at the fourth to most recent fault occurrence		

Notes:
(1) List of Drive Error Codes can be found in chapter 8, Error Codes and Troubleshooting.

Drive Parameter Registers (Read/Write)

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
100h	A1-00	Language Selection	0	English	0
			1	Japanese	
101h	A1-01	Parameter Access Level	0	Monitor Only	2
			1	User Program	
			2	Quick-start	
			3	Basic	
			4	Advanced	
102h	A1-02	Control Method Selection	0	V/f Control	2
			1	V/f with PG Feedback	
			2	Open Loop Vector	
			3	Flux Vector	
103h	A1-03	Initialize Parameters	0000	No Initialize	0000
			1110	User Initialize	
			2220	2-wire Initialize	
			3330	3-wire Initialize	
104h	A1-04	Enter Password	0000 to 9999		0000
105h	not used				
106h	A2-01	User Select Parameter	384 (180h) to 1293 (50Dh) (0=not used)		0
...	through	User Select Parameter	384 (180h) to 1293 (50Dh) (0=not used)		0
125h	A2-32	User Select Parameter	384 (180h) to 1293 (50Dh) (0=not used)		0

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
180h	b1-01	Reference Selection	0	Digital Operator	1
			1	Terminal	
			2	Serial Communication	
			3	Option PCB	
181h	b1-02	Operation Method Selection	0	Digital Operator	1
			1	Terminal	
			2	Serial Communication	
			3	Option PCB	
182h	b1-03	Stopping Method Selection	0	Ramp to Stop	0
			1	Coast to Stop	
			2	DC Injection to Stop	
			3	Coast with Timer	
183h	b1-04	Reverse Operation Prohibit	0	Enable Reverse Operation	0
			1	Disable Reverse Operation	
184h	b1-05	Zero Speed Operation (level determined by E1-09)	0	Run at Frequency Reference	0
			1	Stop	
			2	Run at Min. Frequency (E1-09)	
			3	Run at Zero Speed	
185h	b1-06	Logic Input Scan Rate	0	2ms - 2 scans	1
			1	5ms - 2 scans	
186h	b1-07	Local / Remote RUN Selection	0	Cycle External Run	0
			1	Accept External Run	
187h	b2-01	DC Injection Braking Start Frequency		0.0 to 10.0 Hz	0.5
188h	b2-02	DC Injection Braking Current		0 - 100%	50
189h	b2-03	DC Injection Braking Time at Start		0.00 - 10.00 seconds	0.00
18Ah	b2-04	DC Injection Braking Time at Stop		0.00 - 10.00 seconds	0.00
18Bh-18Dh		Reserved			

Data Registers

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
18Eh	b3-01	Speed Search Selection	0	Disabled	0
			1	Enabled	
18Fh	b3-02	Speed Search Current		0 to 200 %	100 %
190h	b3-03	Speed Search Dec Time		0.1 to 10.0	2.0
191h		Reserved			
192h	b4-01	Timer Function ON-Delay Time		0.0 to 300.0 seconds	0.0
193h	b4-02	Timer Function OFF-Delay Time		0.0 to 300.0 seconds	0.0
194h	b5-01	PID Control Mode Selection	0	Disabled	0
			1	Enabled (D=Feedback)	
			2	Enabled (D=Feed Forward)	
195h	b5-02	PID Proportional Gain		0.00 to 10.00	1.00
196h	b5-03	PID Integral Time		0.0 to 360.0 seconds	1.0
197h	b5-04	PID Integral Limit		0.0 to 100.0%	100.0
198h	b5-05	PID Differential Time		0.00 to 10.00 seconds	0.00
199h	b5-06	PID Output Limit		0.0 to 100.0%	100.0
19Ah	b5-07	PID Offset Adjustment		-100.0 to +100.0%	0.0
19Bh	b5-08	PID Primary Delay		0.00 to 10.00 seconds	0.00
19Ch	b6-01	Dwell Frequency at Start		0.0 to 400.0 Hz	0.0
19Dh	b6-02	Dwell Time at Start		0.0 to 10.0 seconds	0.0
19Eh	b6-03	Dwell Frequency at Stop		0.0 to 400.0 Hz	0.0
19Fh	b6-04	Dwell Time at Stop		0.0 to 10.0 seconds	0.0
1A0h	b7-01	Droop Control Gain		0.0 to 100.0	0.0
1A1h	b7-02	Droop Control Delay Time		0.03 to 2.00 seconds	0.05
1A2h	b8-01	Energy Saving Gain		0 to 100%	80
1A3h	b8-02	Energy Saving Frequency		0.0 to 400.0 Hz	0.0
1A4h	b9-01	Zero-Servo Gain		0 to 100	5
1A5h	b9-02	Zero-Servo Completion Width		0 to 16383	10

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
200h	C1-01	Acceleration Time 1		0.00 to 600.00 or 0.0 to 6000.0 seconds **(1)**	10.0 **(1)**
201h	C1-02	Deceleration Time 1		0.00 to 600.00 or 0.0 to 6000.0 seconds **(1)**	10.0 **(1)**
202h	C1-03	Acceleration Time 2		0.00 to 600.00 or 0.0 to 6000.0 seconds **(1)**	10.0 **(1)**
203h	C1-04	Deceleration Time 2		0.00 to 600.00 or 0.0 to 6000.0 seconds **(1)**	10.0 **(1)**
204h	C1-05	Acceleration Time 3		0.00 to 600.00 or 0.0 to 6000.0 seconds **(1)**	10.0 **(1)**
205h	C1-06	Deceleration Time 3		0.00 to 600.00 or 0.0 to 6000.0 seconds **(1)**	10.0 **(1)**
206h	C1-07	Acceleration Time 4		0.00 to 600.00 or 0.0 to 6000.0 seconds **(1)**	10.0 **(1)**
207h	C1-08	Deceleration Time 4		0.00 to 600.00 or 0.0 to 6000.0 seconds **(1)**	10.0 **(1)**
208h	C1-09	Fast Stop Deceleration Time		0.00 to 600.00 or 0.0 to 6000.0 seconds **(1)**	10.0 **(1)**
209h	C1-10	Accel / Decel Time Setting Unit	0	0.01 seconds	1
			1	0.1 seconds	
20Ah	C1-11	Accel / Decel Time Switching Freq.		0.0 to 400.0 Hz	0.00
20Bh	C2-01	S-curve Characteristic at Accel Start		0.0 to 2.50 seconds	0.20
20Ch	C2-02	S-curve Characteristic at Accel End		0.0 to 2.50 seconds	0.20
20Dh	C2-03	S-curve Characteristic at Decel Start		0.0 to 2.50 seconds	0.20
20Eh	C2-04	S-curve Characteristic at Decel End		0.0 to 2.50 seconds	0.20
20Fh	C3-01	Slip Compensation Gain		0.0 to 2.5	**(2)**
210h	C3-02	Slip Compensation Primary Delay Time		0 to 10000 msec.	**(2)**
211h	C3-03	Slip Compensation Limit		0 to 250%	200
212h	C3-04	Slip Compensation Selection during Regeneration	0 1	Disabled Enabled	0

Notes (for this page only):
(1) Values are dependent upon C1-10 setting.
(2) Initial Setting differs depending on the control method (A1-02).

Data Registers

Drive Parameter Registers continued (Read/Write)

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING		LIMITS / DESCRIPTION	INITIAL VALUE
213h	C4-01	Torque Compensation Gain			0.00 to 2.50	1.00
214h	C4-02	Torque Compensation Time Constant			0 to 10000	**(1)**
215h	C5-01	ASR Proportional Gain 1			0.00 to 300.00	**(1)**
216h	C5-02	ASR Integral Time 1			0.000 to 10.000 seconds	**(1)**
217h	C5-03	ASR Proportional Gain 2			0.00 to 300.00	**(1)**
218h	C5-04	ASR Integral Time 2			0.000 to 10.000 seconds	**(1)**
219h	C5-05	Automatic Speed Regulator (ASR) Output Limit			0.0 to 20.0%	5.0
21Ah	C5-06	ASR Primary Delay Time			0.000 TO 0.500 seconds	0.004
21Bh	C5-07	ASR Switching Frequency			0.0 to 400.0 Hz	0.0
21Ch	C6-01	Carrier Frequency Upper Limit			0.4 to 15.0 kHz **(2)**	15.0 **(2)**
21Dh	C6-02	Carrier Frequency Lower Limit			0.4 to 15.0 kHz **(2)**	15.0 **(2)**
21Eh	C6-03	Carrier Frequency Proportional Gain			00 to 99 **(2)**	00 **(2)**
21Fh	C7-01	Hunting Prevention Selection			0 = disabled 1 = enabled	1
220h	C7-02	Hunting Prevention Gain			0.00 TO 2.50	1.00
221h		Reserved				
222-229h		Reserved				
22Ah	C8-08	AFR Gain			0.00 to 10.00	1.00
22B-23Fh		Reserved				
240h	C8-30	Carrier in Tune	0		Fc = 2kHz	0
			1		Fc = C6-01	

Notes (for this page only):

(1) Initial Value differs depending on the control method (A1-02).

(2) Setting range and initial value differ depending on the drive capacity and control method.

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING		LIMITS / DESCRIPTION	INITIAL VALUE
280h	d1-01	Frequency Reference 1			0.00 to 400.00 Hz **(1)**	0.00
281h	d1-02	Frequency Reference 2			0.00 to 400.00 Hz **(1)**	0.00
282h	d1-03	Frequency Reference 3			0.00 to 400.00 Hz (**1**)	0.00
283h	d1-04	Frequency Reference 4			0.00 to 400.00 Hz **(1)**	0.00
284h	d1-05	Frequency Reference 5			0.00 to 400.00 Hz **(1)**	0.00
285h	d1-06	Frequency Reference 6			0.00 to 400.00 Hz **(1)**	0.00
286h	d1-07	Frequency Reference 7			0.00 to 400.00 Hz **(1)**	0.00
287h	d1-08	Frequency Reference 8			0.00 to 400.00 Hz **(1)**	0.00
288h	d1-09	Jog Frequency Reference			0.00 to 400.00 Hz **(1)**	6.00
289h	d2-01	Frequency Reference Upper Limit			0.0 to 110.0%	100.0
28Ah	d2-02	Frequency Reference Lower Limit			0.0 to 100.0%	0.0
28Bh	d3-01	Critical Frequency Rejection 1			0.0 to 400.0 Hz	0.0
28Ch	d3-02	Critical Frequency Rejection 2			0.0 to 400.0 Hz	0.0
28Dh	d3-03	Critical Frequency Rejection 3			0.0 to 400.0 Hz	0.0
28Eh	d3-04	Critical Frequency Rejection Width			0.0 to 20.0 Hz	1.0
28Fh	d4-01	MOP Reference Memory	0		Disabled	0
			1		Enabled	
290h	d4-02	Trim Control Level			0 to 100%	25
291h	d5-01	Torque Control Selection	0		Speed Control	0
			1		Torque Control	
292h	d5-02	Torque Reference Delay Time			0 to 1000 msec.	0
293h	d5-03	Speed Limit Selection	1		Analog Input (term. 13 & 14)	1
			2		d5-04 setting	
294h	d5-04	Speed Limit			-120 to +120%	0
295h	d5-05	Speed Limit Bias			0 to 120%	10
296h	d5-06	Speed/Torque Control Switching Timer			0 to 1000 msec.	0

Notes (for this page only):
(1) Scaling depends on the setting of o1-03.

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
300h	E1-01	Input Voltage Setting		155 to 255V (230V unit)	230
				310 to 510V (460V unit)	460
301h	E1-02	Motor Selection	0	Std Fan Cooled Gen. Purpose Mtr (TEFC)	0
			1	Blower Cooled Motor (TENV or TEBC)	
302h	E1-03	V/f Pattern Selection	0 to E	15 preset V/f patterns	
			F	Custom Pattern (using E1-04 to E1-10)	F
303h	E1-04	Maximum Output Frequency		40.0 to 400.0 Hz	60.0
304h	E1-05	Maximum Voltage		0.0 to 255.0V (230V unit)	230.0
				0.0 to 510.0V (460V unit)	460.0
305h	E1-06	Base Frequency		0.0 to 400.0 Hz	60.0
306h	E1-07	Mid. Output Frequency A		0.0 to 400.0 Hz	**(1)**
307h	E1-08	Mid Output Voltage A		0.0 to 255.0V (230V unit)	**(1)**
				0.0 to 510.0V (460V unit)	
308h	E1-09	Min. Output Frequency		0.0 to 400.0 Hz	**(1)**
309h	E1-10	Min. Output Voltage		0.0 to 255.0V (230V unit)	**(1)**
				0.0 to 510.0V (460V unit)	
30Ah	E1-11	Mid Frequency B		0.0 to 400.0 Hz	0.0
30Bh	E1-12	Mid Voltage B		0.0 to 255.0 VAC	0.0
30Ch	E1-13	Base Voltage		0.0 to 255.0 VAC	0.0
30Dh		Reserved			

Notes (for this page only):
(1) Initial Value differs depending on the control method (A1-02).
(2) Initial Value differs depending on drive capacity.

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
30Eh	E2-01	Motor Rated Current		0.60 to 12.00 A	**(2)**
30Fh	E2-02	Motor Rated Slip		0.00 to 20.00 Hz	**(2)**
310h	E2-03	Motor No-Load Current		0.00 to 3.29 Amps	**(2)**
311h	E2-04	Number of Motor Poles		2 to 48 poles	4
312h	E2-05	Motor Line-to-Line Resistance		0.000 to 65.000 Ohms	**(2)**
313h	E2-06	Motor Leakage Inductance		0.0 to 30.0%	**(2)**
314h	E2-07	Motor Iron-core Saturation Coefficient 1		0.00 to 0.50	.50
315h	E2-08	Motor Iron-core Saturation Coefficient 2		0.00 to 0.75	0.75
316h	E2-09	Motor Mechanical Loss		0.0 to 10.0%	0.0

Notes (for this page only):
(1) Initial Value differs depending on the control method (A1-02).
(2) Values differs depending on the drive capacity.

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
380h	F1-01	Encoder (PG) Constant		0 to 60000 ppr	600
381h	F1-02	Operation Selection at PG Open Circuit	0	Ramp to stop	1
			1	Coast to stop	
			2	Fast-stop	
			3	Alarm only	
382h	F1-03	Operation Selection at Overspeed	0	Ramp to stop	1
			1	Coast to stop	
			2	Fast-stop	
			3	Alarm only	
383h	F1-04	Operation Selection at Speed Deviation	0	Ramp to stop	3
			1	Coast to stop	
			2	Fast-stop	
			3	Alarm only	
384h	F1-05	PG Rotation	0	Counter-clockwise	0
			1	Clockwise	
385h	F1-06	PG Division Rate (PG Pulse Monitor)		1 to 132 (effective only with PG-B2 control board)	1
386h	F1-07	Integral Value during Accel/Decel Selection	0	Disabled	0
			1	Enabled	
387h	F1-08	Overspeed Detection Level		0 to 120%	115
388h	F1-09	Overspeed Detection Delay Time		0.0 to 2.0 seconds	**(1)**
389h	F1-10	Excessive Speed Deviation Detection Level		0 to 50%	10
38Ah	F1-11	Excessive Speed Deviation Detection Delay Time		0.0 to 10.0 seconds	0.5
38Bh	F1-12	Number of PG Gear Teeth 1		0 to 1000	0
38Ch	F1-13	Number of PG Gear Teeth 2		0 to 1000	0
397h **	F1-14	PG Open Detection Time		0 to 10.0 seconds	2.0

Notes (for this page only):
(1) Initial Value differs depending on the control method (A1-02).
 ** note: out of numeric sequence

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
38Dh	F2-01	AI-14 Bi-polar or Uni-polar Input Selection	0	3-channel Individual	0
			1	3-channel Addition	
38Eh	F3-01	DI-16 Digital Input Option	0	BCD 1%	
			1	BCD 0.1%	
			2	BCD 0.01%	
			3	BCD 1 Hz	0
			4	BCD 0.1 Hz	
			5	BCD 0.01 Hz	
			6	BCD (5DG) 0.01 Hz	
			7	Binary	
38Fh	F4-01	AO-08/AO-12 Channel 1 Monitor Select.		1 to 33	2
390h	F4-02	AO-08/AO-12 Channel 1 Gain		0.00 to 2.50	1.00
391h	F4-03	AO-08/AO-12 Channel 2 Monitor Select.		1 to 33	3
392h	F4-04	AO-08/AO-12 Channel 2 Gain		0.00 to 2.50	0.50
393h	F5-01	DO-02 Channel 1 Output Selection		0 to 20h, 30h, 37h	0
394h	F5-02	DO-02 Channel 2 Output Selection		0 to 20h, 30h, 37h	1
395h	F6-01	DO-08 Output Mode Selection	0	8-channel Individual	0
			1	Binary Output	
396h	F7-01	PO-36F Frequency Multiple Selection	0	1 x Output Frequency	
			1	6 x Output Frequency	
			2	10 x Output Frequency	1
			3	12 x Output Frequency	
			4	36 x Output Frequency	
398h		Reserved			
399h	F9-01	setting		0=normally open 1=normally closed	0
39Ah	F9-02	detection		0=always detected 1=during run	0
39Bh	F9-03	fault action	0	ramp to stop	1
			1	coast to stop	
			2	fast-stop	
			3	alarm only	
39Ch	F9-13	trace sample		trace sample time	0

Data Registers

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
400h	H1-01	Multi-function Input (terminal 3)		0 to 66h	24h or 36
401h	H1-02	Multi-function Input (terminal 4)		0 to 66h	14h or 20
402h	H1-03	Multi-function Input (terminal 5)		0 to 66h	3 (or 0) **(1)**
403h	H1-04	Multi-function Input (terminal 6)		0 to 66h	4 (or 3) **(1)**
404h	H1-05	Multi-function Input (terminal 7)		0 to 66h	6 (or 4) **(1)**
405h	H1-06	Multi-function Input (terminal 8)		0 to 66h	8 (or 6) **(1)**
406h	H2-01	Multi-function Output (term. 9 & 10)		0 to 37h	0
407h	H2-02	Multi-function Output (term. 25-27)		0 to 37h	1
408h	H2-03	Multi-function Output (term. 26-27)		0 to 37h	2
409h	H3-01	Auto Speed Reference Signal Level Selection (term. 13)	0	0 to 10 V DC	0
			1	-10 to +10 V DC	
40Ah	H3-02	Auto Speed Reference Signal Gain		0.0 to 1000.0%	100.0
40Bh	H3-03	Auto Speed Reference Signal Bias		-100.0 to +100.0%	0.0
40Ch	H3-04	Multi-function Analog Input 1 Signal Level Selection (term. 16)	0	0 to 10 V DC	0
			1	-10 to +10 V DC	
40Dh	H3-05	Multi-function Analog Input 1 Select.		0 to 1F	0
40Eh	H3-06	Multi-function Analog Input 1 Gain		0.0 to 1000.0%	100.0
40Fh	H3-07	Multi-function Analog Input 1 Bias		-100.0 to +100.0%	0.0
410h	H3-08	Multi-function Analog Input 2 Signal Level Selection (term. 14)	0	0 to 10 V DC	2
			1	-10 to +10 V DC	
			2	4 to 20 mA	
411h	H3-09	Multi-function Analog Input 2 Select.		1 to 1F	1F
412h	H3-10	Multi-function Analog Input 2 Gain		0.0 to 1000.0%	100.0
413h	H3-11	Multi-function Analog Input 2 Bias		-100.0 to +100.0%	0.0
414h	H3-12	Analog Input Filter Time Constant		0.00 to 2.00 seconds	0.00

Notes (for this page only):
(1) Initial Value in the parentheses are values obtained at a 3-wire initialization.

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
415h	H4-01	Multi-function Analog Monitor 1 Selection (terminal 21)		1 to 1F (31)	2
416h	H4-02	Multi-function Analog Monitor 1 Gain		0.00 to 2.50	1.00
417h	H4-03	Multi-function Analog Monitor 1 Bias		-10.0 to +10.0%	0.0
418h	H4-04	Multi-function Analog Monitor 2 Selection (terminal 23)		1 to 1F(31)	3
419h	H4-05	Multi-function Analog Monitor 2 Gain		0.00 to 2.50	0.50
41Ah	H4-06	Multi-function Analog Monitor 2 Bias		-10.0 to +10.0%	0.0
41Bh	H4-07	Multi-function Analog Monitor Signal Level Selection (terminal 21 & 23)	0	0 to 10 V DC	0
			1	-10 to +10 V DC	
41Ch	H5-01	Serial Communication Address		0 to 1F (31)	1F
41Dh	H5-02	Serial Communication Baud Rate	0	1200 bps	3
			1	2400 bps	
			2	4800 bps	
			3	9600 bps	
41Eh	H5-03	Serial Communication Parity Selection	0	No Parity	0
			1	Even Parity	
			2	Odd Parity	
41Fh	H5-04	Stopping Method after Serial Communication Error	0	Ramp to Stop	3
			1	Coast to Stop	
			2	Fast-Stop	
			3	Alarm Only	
420h	H5-05	Communication Error (CE) Detection Selection	0	Disabled	1
			1	Enabled	

Data Registers

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
480h	L1-01	Motor Overload Protection Selection	0	Disabled	1
			1	Enabled (Coast to Stop)	
481h	L1-02	Motor Overload Protection Time Constant		0.1 to 5.0 minutes	1.0
482h	L2-01	Momentary Power Loss Detection Selection	0	Disabled	0
			1	Power Loss Ride-thru	
			2	CPU Power Active	
483h	L2-02	Momentary Power Loss Ride-thru Time		0.0 to 2.0 seconds	**(1)**
484h	L2-03	Momentary Power Loss Minimum Base Block Time		0.0 to 5.0 seconds	**(1)**
485h	L2-04	Momentary Power Loss Recovery Ramp Time		0.0 to 2.0 seconds	0.3
486h	L2-05	Undervoltage Detection Level		150 to 210V (230V unit)	190
				300 to 420V (460V unit)	380
487h	L2-06	KEB Frequency		0.0 to 100.0%	0.0
488h	L3-01	Stall Prevention Selection during Acceleration	0	Disabled	1
			1	General-purpose	
			2	Intelligent **(2)**	
489h	L3-02	Stall Prevention Level during Accel		0 to 200%	170
48Ah	L3-03	Stall Prevention Level during Accel (CHP)		0 to 100%	**(3)**
48Bh	L3-04	Stall Prevention Selection during Deceleration	0	Disabled	1
			1	General-purpose	
			2	Intelligent **(2)**	
48Ch	L3-05	Stall Prevention Selection during Running	0	Disabled	1
			1	Decel time 1	
			2	Decel time 2	

Notes (for this page only):
(1) Initial value differs depending on drive capacity.
(2) When Vector Control (A1-02 = 2 or 3) is selected, set value 2 (intelligent) cannot be used.
(3) Initial value differs depending on control method (A1-02).

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
48Dh	L3-06	Stall Prevention Level during Running		30 to 200%	160
48E-48Fh		*Reserved*			
490h	L4-01	Speed Coincidence Frequency		0.0 to 400.0 Hz	0.0
491h	L4-02	Speed Coincidence Width		0.0 to 20.0 Hz	2.0
492h	L4-03	Speed Coincidence Frequency (+/-)		-400.0 to +400.0 Hz	0.0
493h	L4-04	Speed Coincidence Width		0.0 to 20.0 Hz	2.0
494h	L4-05	Frequency Reference Loss Detection	0	Stop	0
			1	Run at 80% of Frequency Reference	
495h	L5-01	Number of Auto Restart Attempts		0 to 10	0
496h	L5-02	Auto Restart Operation Selection	0	No Fault Relay	0
			1	Fault Relay Active	
497h		not used			
498h	L6-01	Torque Detection Selection 1	0	Disabled	0
			1	Detected during Speed Agree (operation continues)	
			2	Detected during Running (operation continues)	
			3	Detected during Speed Agree (drive faults)	
			4	Detected during Running (drive faults)	
499h	L6-02	Torque Detection Level 1		0 to 300%	150
49Ah	L6-03	Torque Detection Time 1		0.0 to 10.0 seconds	0.1
49Bh	L6-04	Torque Detection Selection 2	0	Disabled	0
			1	Detected during Speed Agree (operation continues)	
			2	Detected during Running (operation continues)	
			3	Detected during Speed Agree (drive faults)	
			4	Detected during Running (drive faults)	

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION		INITIAL VALUE
49Ch	L6-05	Torque Detection Level 2		0 to 300%		150
49Dh	L6-06	Torque Detection Time 2		0.0 to 10.0 seconds		0.1
49Eh	L7-01	Forward Torque Limit		0 to 300%		200
49Fh	L7-02	Reverse Torque Limit		0 to 300%		200
4A0h	L7-03	Forward Regenerative Torque Limit		0 to 300%		200
4A1h	L7-04	Reverse Regenerative Torque Limit		0 to 300%		200
4A2-4A3h		Reserved				
4A4h	L8-01	Internal Dynamic Braking Resistor Protection	0	Not Provided		0
			1	Provided		
4A5h	L8-02	oH (Overheat) Protection Alarm Level		50 to 110 ^{o}C		95
4A6h	L8-03	Operation Selection after oH (Overheat) Pre-alarm	0	Ramp to Stop		3
			1	Coast to Stop		
			2	Fast-stop		
			3	Alarm Only		
4A7h		Reserved				
4A8h	L8-05	Input Open-phase Protection Selection	0	Disabled		0
			1	Enabled		
4A9h		Reserved				
4AAh	L8-07	Output Open-phase Protection Selection	0	Disabled		0
			1	Enabled		
4AB-4B1h		Reserved				

Drive Parameter Registers (Read/Write) – continued

REGISTER (in hex)	PARAMETER	PARAMETER FUNCTION	PARAMETER SETTING	LIMITS / DESCRIPTION	INITIAL VALUE
500h	o1-01	Monitor Selection		4 to 25, 28, 32, 33	6
501h	o1-02	Monitor Selection after Power-up	1	Frequency Reference	1
			2	Output Frequency	
			3	Output Current	
			4	Selected Monitor	
502h	o1-03	Digital Operator Display Scaling		0 to 39999	0
503h	o1-04	Digital Operator Display Units	0	Hz	0
			1	RPM	
504h	o1-05	Parameter / Address Display Selection	0	Parameter Number	0
			1	Modbus Address	
505h	o2-01	LOCAL / REMOTE Key Selection	0	Disabled	1
			1	Enabled	
506h	o2-02	STOP Key Function during Remote Run	0	Disabled	1
			1	Enabled	
507h	o2-03	User Parameter Default Value	0	Disabled	0
			1	Set Default	
			2	Clear all	
508h	o2-04	kVA Selection (Drive Model No.)		0 to FFh	**(1)**
509h	o2-05	Digital Operator "Motor Operated Pot"	0	Drive accepts freq. after ENTER key	0
			1	Drive accepts freq. immediately	
50Ah	o2-06	Operation Selection when Digital Operator is disconnected	0	Disabled (operation continues)	0
			1	Enabled (motor coast to stop; fault)	
50Bh	o2-07	Elapsed Operating Hour Timer Set		0 to 65535 hours	-
50Ch	o2-08	Elapsed Operating Hour Timer Selection	0	Timer active when power applied to drive	0
			1	Timer active when drive is in run mode	
50Dh	o2-09	Initialization Mode Selection	0	Japanese Spec.	1
			1	American Spec.	
			2	European Spec.	

Notes (for this page only):

(1) Not initialized. Initial value differs depending on the drive capacity.

Special Registers (Write only)

REGISTER (in hex)	FUNCTION	DATA SET	DESCRIPTION
F200	Global Write Enable		Global Write Source Address (0=disabled)
F201	Global Frequency Reference Multiplier		Multiplies global freq. reference before being written to drive (1000 = 1.000 multiplier)
FFDDh	'ACCEPT' Command	0	Writes data into Volatile memory
FFFDh	'ENTER' Command	0	Writes data into Non-Volatile memory

Data Registers

Appendix B
Command Priority

? Command Priority

? *Table B-1. Set up for Modbus Plus Control*

? *Table B-2. Set up for External Terminal Control*

? *Table B-3. Set up for Digital Operator Control*

Command Priority

The setting of parameter b1-02 determines the origin of operation 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 parameter b1-02, as illustrated in the tables B-1, B-2, and B-3 on the following pages.

How to use the Command Priority Tables:

First, determine the source of control you wish to use for your VS-616G5 drive. Then b1-02 should be set up for the desired control you have chosen. (See the table below for parameter 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			
b1-02	**Run/Stop from:**	**Use Table:**	**On page #:**
3	Option PCB (MB+ board)	B-1	B-3
2	Serial Communication	n/a	-
1	External Terminals	B-2	B-4
0	Digital Operator	B-3	B-5

The left hand column of the Command Priority tables is the source of the command (serial communication, external terminals, and the Digital Operator). The middle column lists the functions or commands, and the right most column indicates whether the functions are operational (O) or not available (n/a) from each source.

B-2   Command Priority

Table B-1: Set up for Modbus Plus Control

This table indicates the functions or commands that can be accessed from Modbus Plus, external terminals, or the Digital Operator when the drive's parameter b1-02 is set up for option pcb (b1-02 = 3). 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
MODBUS PLUS	001h	0	Forward Run/Stop	O
		1	Reverse Run/Stop	O
		2	multi-function input terminal 3	(2)
		3	multi-function input terminal 4	(2)
		4	multi-function input terminal 5	(2)
		5	multi-function input terminal 6	(2)
		6	multi-function input terminal 7	(2)
		7	multi-function input terminal 8	(2)
		8	External Fault	O
		9	Fault Reset	O (1)
		10-15	unused	-
	006h	0-15	Analog Output 1 Setting	O (6)
	007h	0-15	Analog Output 2 Setting	O (7)
	008h	0	Multi-function Output (terminal 9 & 10)	O (3)
		1	Multi-function Output (terminal 25 & 27)	O (4)
		2	Multi-function Output (terminal 26 & 27)	O (5)
		3-5	unused	-
		6	Fault Contact (terminal 18 & 20)	O
		7	Fault Contact Closed (effective when bit 6 =1)	O
EXTERNAL TERMINALS			Forward Run (2 wire): Run Command (3 wire)	n/a
			Reverse Run (2 wire); Stop Command (3 wire)	n/a
			multi-function input terminal 3	(2)
			multi-function input terminal 4	(2)
			multi-function input terminal 5	(2)
			multi-function input terminal 6	(2)
			multi-function input terminal 7	(2)
			multi-function input terminal 8	(2)
DIGITAL OPERATOR			Run Command	n/a
			Stop Command	O (7)
			Reverse Run Command	n/a
			Local / Remote	O (10)
			Jog Command	n/a
			Fault Reset	O (1)

Notes:
(1) Fault Reset is only effective when run command received is "0" while in stopped condition.
(2) The availability of the multi-function input terminals vary depending upon the settings of H1-01, H1-02, H1-03, H1-04, H1-05, H1-06 (the multi-function input settings), and A1-02 (Control Method). See the VS-616G5 Programming Manual (YEA-TOA-S616-10.11) for more information.
(3) Effective when H2-01 is "0F".
(4) Effective when H2-02 is "0F".
(5) Effective when H2-03 is "0F".
(6) Effective when H4-01 is "1F".
(7) Effective when H4-04 is "1F".
(8) Effective only when in the stopped condition.
(9) Effective when o2-02 is "1".
(10) Effective when o2-01 is "1".

Table B-2: Set up for External Terminals Control

This table indicates the functions or commands that can be accessed via serial communication, external terminals, or the Digital Operator when the drive's parameter b1-02 is set up for external terminal control (b1-02 = 1). 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
MODBUS PLUS	001h	0	Forward Run/Stop	n/a
		1	Reverse Run/Stop	n/a
		2	multi-function input terminal 3	(2)
		3	multi-function input terminal 4	(2)
		4	multi-function input terminal 5	(2)
		5	multi-function input terminal 6	(2)
		6	multi-function input terminal 7	(2)
		7	multi-function input terminal 8	(2)
		8	External Fault	O
		9	Fault Reset	O (1)
		10-15	unused	-
	006h	0-15	Analog Output 1 Setting	n/a
	007h	0-15	Analog Output 2 Setting	n/a
	008h	0	Multi-function Output (terminal 9 & 10)	n/a
		1	Multi-function Output (terminal 25 & 27)	n/a
		2	Multi-function Output (terminal 26 & 27)	n/a
		3-5	unused	-
		6	Fault Contact (terminal 18 & 20)	n/a
		7	Fault Contact Closed (effective when bit 6 =1)	n/a
EXTERNAL TERMINALS			Forward Run (2 wire): Run Command (3 wire)	O
			Reverse Run (2 wire); Stop Command (3 wire)	O
			multi-function input terminal 3	(2)
			multi-function input terminal 4	(2)
			multi-function input terminal 5	(2)
			multi-function input terminal 6	(2)
			multi-function input terminal 7	(2)
			multi-function input terminal 8	(2)
DIGITAL OPERATOR			Run Command	n/a
			Stop Command	O (4)
			Reverse Run Command	n/a
			Local / Remote	O (5)
			Jog Command	n/a
			Fault Reset	O (1)

Notes:
(1) Fault Reset is only 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) The availability of the multi-function input terminals vary depending upon the settings of H1-01, H1-02, H1-03, H1-04, H1-05, H1-06 (the multi-function input settings), and A1-02 (Control Method).   See the VS-616G5 Programming Manual (YEA-TOA-S616-10.11) for more information.
(3) Effective only when in stopped condition.
(4) Effective only when o2-02 is "1".
(5) Effective when o2-01 is "1".

B-4   Command Priority

Table B-3: Set up for Digital Operator Control

This table indicates the functions or commands that can be accessed via serial communication, external terminals, or the Digital Operator when the drive's parameter b1-02 is set up for Digital Operator control (b1-02 = 0). 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
MODBUS PLUS	001h	0	Forward Run/Stop	n/a
		1	Reverse Run/Stop	n/a
		2	multi-function input terminal 3	(2)
		3	multi-function input terminal 4	(2)
		4	multi-function input terminal 5	(2)
		5	multi-function input terminal 6	(2)
		6	multi-function input terminal 7	(2)
		7	multi-function input terminal 8	(2)
		8	External Fault	O
		9	Fault Reset	O (1)
		10-15	unused	-
	006h	0-15	Analog Output 1 Setting	n/a
	007h	0-15	Analog Output 2 Setting	n/a
	008h	0	Multi-function Output (terminal 9 & 10)	n/a
		1	Multi-function Output (terminal 25 & 27)	n/a
		2	Multi-function Output (terminal 26 & 27)	n/a
		3-5	unused	-
		6	Fault Contact (terminal 18 & 20)	n/a
		7	Fault Contact Closed (effective when bit 6 =1)	n/a
EXTERNAL TERMINALS			Forward Run (2 wire): Run Command (3 wire)	n/a
			Reverse Run (2 wire); Stop Command (3 wire)	n/a
			multi-function input terminal 3	(2)
			multi-function input terminal 4	(2)
			multi-function input terminal 5	(2)
			multi-function input terminal 6	(2)
			multi-function input terminal 7	(2)
			multi-function input terminal 8	(2)
DIGITAL OPERATOR			Run Command	O
			Stop Command	O
			Reverse Run Command	O
			Local / Remote	n/a
			Jog Command	O (3)
			Fault Reset	O (1)

Notes:

(1) Fault Reset is only effective only when in stopped condition.

(2) The availability of the multi-function input terminals vary depending upon the settings of H1-01, H1-02, H1-03, H1-04, H1-05, H1-06 (the multi-function input settings), and A1-02 (Control Method). See the VS-616G5 Programming Manual (YEA-TOA-S616-10.11) for more information.

(3) The jog command is only effective when in the stop condition.

Appendix C
Product Specification

VS-616G5 / MB+ Board	
Ambient Temperature	0 to +40 degrees C
Storage Temperature	0 to +60 degrees C
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

Description	Source	Part Number
VS-616G5 / Modbus Plus Communication		
VS-616G5 / Modbus Plus Communication Kit	Yaskawa	UTC000019
Modicon In-line Connector	Modicon	AS-MBKT-085
Modicon Terminating Connector	Modicon	AS-MBKT-185
VS-616G5 / Modbus Plus Instruction Manual	Yaskawa	YEA-TOA-C736-40.22
Miscellaneous		
VS-616G5 Installation & Quick-Start Manual	Yaskawa	YEA-TOA-S616-10.12
VS-616G5 Programming Manual	Yaskawa	YEA-TOA-S616-10.11

YASKAWA
Energy In Motion™

YASKAWA ELECTRIC AMERICA, INC.
Chicago-Corporate Headquarters 2942 MacArthur Blvd. Northbrook, IL 60062-2028, U.S.A.
Phone: (847) 291-2340   Fax: (847) 291-4203   Internet: http//www.yaskawa.com

Chicago-Technical Center 3160 MacArthur Blvd. Northbrook, IL 60062-1917, U.S.A.
Phone: (847) 291-0411   Fax: (847) 291-1018

MOTOMAN INC.
805 Liberty Lane West Carrollton, OH 45449, U.S.A.
Phone: (513) 847-6200   Fax: (513) 847-6277

YASKAWA ELETRICO DO BRASIL COMERCIO LTDA.
Avenida Brigadeiro Faria Lima, 1664-5° Andar, CJS 504/511 CEP 01452-001 - Sao Paulo-SP, Brasil
Phone: (011) 815-7723   Fax: (011) 210-9781   Internet: yaskawabrasil@originet.com.br

YASKAWA ELECTRIC EUROPE GmbH
Am Kronberger Hang 2, 65824 Schwalbach, Germany
Phone: (49) 6196-569-300   Fax: (49) 6196-888-301   Internet: marketing@yeg.yaskawa.de

Motoman Robotics AB
Box 130 S-38500. Torsas, Sweden
Phone: 0486-10575   Fax: 0486-11410

Motoman Robotec GmbH
Kammerfeldstrabe 1, 85391 Allershausen, Germany
Phone: 08166-900   Fax: 08166-9039

YASKAWA ELECTRIC UK LTD.
3 Drum Mains Park Orchardton Woods Cumbernauld, Scotland, G68 9LD, U.K.
Phone: (1236) 735000   Fax: (1236) 458182

YASKAWA ELECTRIC KOREA CORPORATION
Paik Nam Bldg. 901 188-3, 1-Ga Euljiro, Joong-Gu, Seoul, Korea
Phone: (02) 776-7844   Fax: (02) 753-2639

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.
Head Office: CPF Bldg. 79 Robinson Road #13-05, Singapore 0106, SINGAPORE
Phone: 221-7530   Telex: (87) 24890 YASKAWA RS   Fax: 224-5854
Service Center: 221 Henderson Road, #07-20 Henderson Building Singapore 0315, SINGAPORE
Phone: 276-7407   Fax: 276-7406

YATEC ENGINEERING CORPORATION
Shen Hsiang Tang Sung Chiang Building 10F 146 Sung Chiang Road, Taipei, Taiwan
Phone: (02) 563-0010   Fax: (02) 567-4677

SHANGHAI OFFICE Room No. 8B Wan Zhong Building 1303 Yan An Road (West), Shanghai 200050, CHINA
Phone: (86) 212-1015   Fax: (86) 212-1015

TAIPEI OFFICE Shen Hsiang Tang Sung Chiang Building 10F 146 Sung Chiang Road, Taipei, Taiwan
Phone: (02) 563-0010   Fax: (02) 567-4677

YASKAWA ELECTRIC CORPORATION
8th Floor, New Pier Takeshiba South Tower, 1-16-1, Kaigan, Minato-ku, Tokyo, 105, Japan
Phone: (03) 5402-4542   Fax: (03) 5402-4588   Internet: http//www.yaskawa.co.jp