MagneTek

# NCL® Network Communications Technical Manual

This Manual also available on www.drives.com

# Technical References

Refer to the following publications for further information about the GPD333 and Modicon programmable controllers.

- MagneTek GPD333 Technical Manual
  Publication TM4333

- MagneTek GPD333 NCL Satellite Board Installation Sheet
  Publication 02Y00025-0385

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

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

# MagneTek Support

MagneTekís Drives and Systems Division offers support services with over 26 sales/support offices, and 145 distributors throughout the United States.

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

Additional Services available:

Technical Support Center-

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

Field Service Support-

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

# Contents

# Chapter 1
# Introducing the NCL Network

- Overview
- How the Network Operates
- Major Components of the Network

# Overview

This manual describes the set-up and programming of the MagneTek NCL/Modbus Plus (MB+) communications hardware. The NCL/MB+ communication hardware will allow communication between a MODICON MB+ Communication Network and multiple MagneTek GPD333 drives.

# How the Network Operates

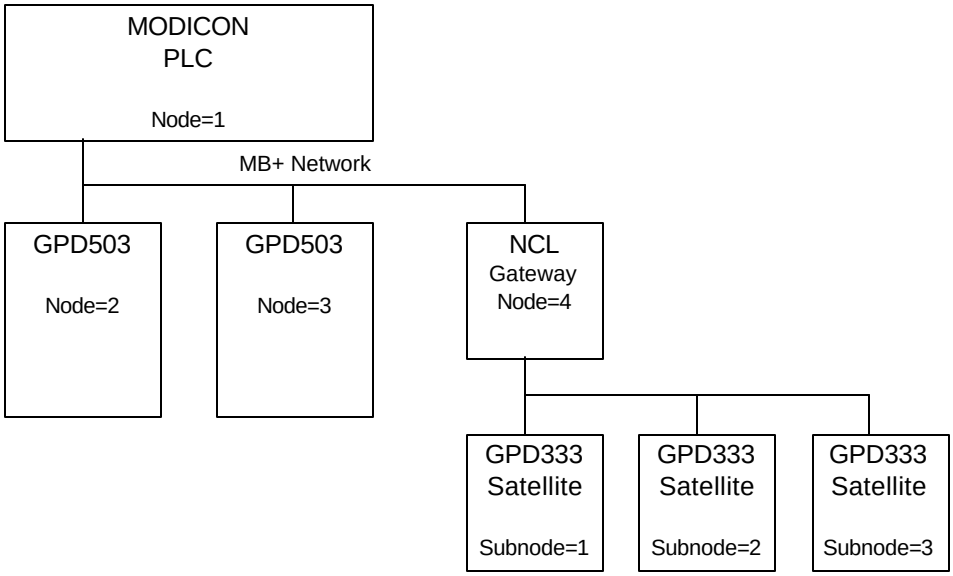
NCL accommodates multiple devices (drives) on a single MB+ network node. From the MB+ network's perspective, up to 30 MagneTek drives are seen as one node, yet all are individually addressable. All drive control constants, status registers, and diagnostic registers are addressable via the NCL network. Each drive can receive individual read and write commands. Additionally, any or all drives on the network can be configured via software to receive global write commands.

The communications platform for the NCL network is based on the CAN (Controller Area Network) technology, which was first developed by Bosch for the automotive industry. Some of the benefits of this protocol are high noise immunity and high temperature operation. Because it uses a serial bus, it reduces signal wiring complexity and cost while providing high speed digital control for optimum performance. These benefits make NCL especially suitable for the industrial automation environment.

# Major Components of the Network

An NCL network consists of two components:

- NCL Gateway module (quantity 1)
- NCL Satellite board (quantity 1 per drive)




Example NCL Network

The NCL Gateway module (MagneTek part number CM005) is a stand-alone, panel-mountable unit. The NCL Gateway provides the hardware and firmware required for connection and communication on a MB+ network. The Gateway module acts as a slave device on the MB+ network. A Gateway module will occupy one node on the MB+ network. The Gateway acts as a bridge between the MB+ network and the NCL network. The Gateway acts as a master to all of the Satellite boards (subnodes) on the NCL network.

One NCL Satellite board is installed in each drive. The NCL Satellite board provides the GPD333 drive with the ability to be communicate on the NCL network. The Satellite board acts as a slave device on the NCL network. A Satellite board will occupy one subnode on the NCL network. On the GPD333 (MagneTek part number CM006), it resides on the front of the drive in the location normally used by the status plate or the Digital Operator. Up to 30 NCL Satellite boards (drives) can be connected to one Gateway module. The Satellite board is powered from both the 24VDC NCL bus power and the drive that it is connected to.

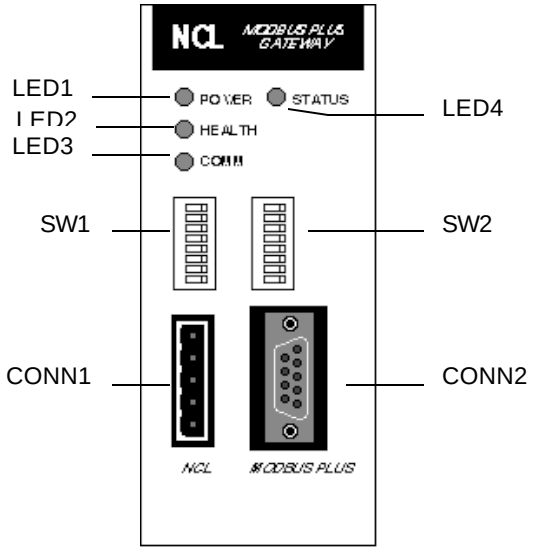
The NCL network requires a user-supplied 24 VDC regulated power supply.

# Chapter 2
# Installation of MB+/NCL Gateway

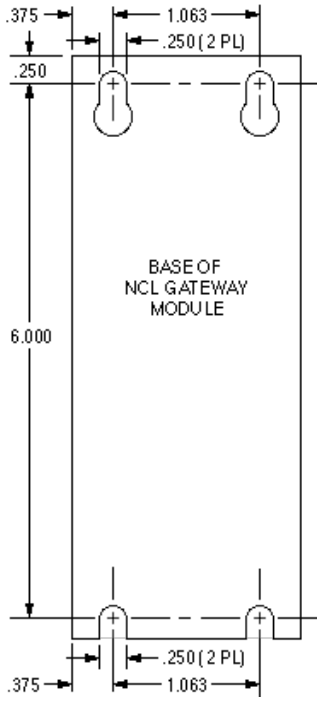
- Gateway Hardware Components
- Gateway Mounting Dimensions
- Gateway Setup

# Gateway Hardware Components

The figure below shows the MB+ / NCL Gateway module. CONN1 is used for connection of the NCL network wiring. CONN2 is used for connection of the MB+ network wiring. SW1 is used to setup the NCL network baud rate and Gateway address. SW2 is used to setup of the MB+ network node number and cable loss behavior.




# Gateway Mounting Dimensions




NOTE: All dimensions shown are in decimal inches.

# Gateway Setup

The MB+ / NCL Gateway module requires setup prior to operation. Gateway SW1 and SW2 switches must be set prior to the application of 24 VDC power to the Gateway module. The states of these switches are read only on power-up.

## Gateway SW1 Settings

The Gateway SW1 switch is used to setup NCL Network characteristics. The SW1 functions are defined in the following table:

| Switch Number | Switch Function |
|---|---|
| 1 | Baud Rate - bit 0 |
| 2 | Baud Rate - bit 1 |
| 3 | NCL Gateway Address - bit 0 |
| 4 | NCL Gateway Address - bit 1 |
| 5 | NCL Gateway Address - bit 2 |
| 6 | NCL Gateway Address - bit 3 |
| 7 | Not used |
| 8 | Not used |

SW1 switches 1 and 2 are used to setup the baud rate of the NCL network. The baud rate setting of the Gateway module must match the baud rate setting of the Satellite boards that are connected on the NCL network. The available baud rates are defined in the following table. The following table also specifies the maximum total cable length of the NCL network that will be supported at each baud rate.

| NCL Baud Rate (KBaud) | Gateway SW1 Position 0=off 1=on | | Maximum Total Cable Length |
|---|---|---|---|
| | 2 | 1 | |
| 125 | 0 | 0 | 500 meters |
| 250 | 0 | 1 | 200meters |
| 500 | 1 | 0 | 100 meters |
| | 1 | 1 | |

SW1 switches 3, 4, 5, and 6 are used to setup the NCL Address of the Gateway module. Each NCL Gateway module on one NCL network must have a unique address. In the most common applications, there will be only one Gateway module per NCL network. The available address settings are defined in the following table.

| NCL Gateway Address | Gateway SW1 Position 0=off 1=on | | | |
|---|---|---|---|---|
| | 6 | 5 | 4 | 3 |
| 01 | 0 | 0 | 0 | 1 |
| 02 | 0 | 0 | 1 | 0 |
| 03 | 0 | 0 | 1 | 1 |
| 04 | 0 | 1 | 0 | 0 |
| 05 | 0 | 1 | 0 | 1 |
| 06 | 0 | 1 | 1 | 0 |
| 07 | 0 | 1 | 1 | 1 |
| 08 | 1 | 0 | 0 | 0 |
| 09 | 1 | 0 | 0 | 1 |
| 10 | 1 | 0 | 1 | 0 |
| 11 | 1 | 0 | 1 | 1 |
| 12 | 1 | 1 | 0 | 0 |
| 13 | 1 | 1 | 0 | 1 |
| 14 | 1 | 1 | 1 | 0 |

## Gateway SW2 Settings

The Gateway SW2 switch is used to setup the MB+ Network characteristics. The SW2 functions are defined in the following table:

| Switch Number | Switch Function |
|---|---|
| 1 | MB+ Node Address - bit 0 / LSB |
| 2 | MB+ Node Address - bit 1 |
| 3 | MB+ Node Address - bit 2 |
| 4 | MB+ Node Address - bit 3 |
| 5 | MB+ Node Address - bit 4 |
| 6 | MB+ Node Address - bit 5 / MSB |
| 7 | Cable Loss Enable |
| 8 | Not Used |

SW2 switches 1 through 6 are used to setup the MB+ Node Address of the Gateway module. A MB+ Network can have up to 64 nodes. The available MB+ Node Address settings are defined in the following table.

| Gateway MB+ Node Address | Gateway SW2 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 |

SW2 switch 7 is used to enable or disable the cable loss feature. If cable loss is enabled, the Gateway will store the MB+ node number of the node which sent the last command to the Gateway module (acting as a ëmasterí to the Gateway module) The Gateway module will monitor the MB+ network for the activity of the ëmasterí node. If the ëmasterí node stops communicating on the MB+ network, the Gateway module will broadcast a stop command to all of the NCL Satellite boards which are connected. This stop command will cause all connected drives to stop. If cable loss is disabled and the ëmasterí node stops communicating, the drive will continue in its last state of operation. The following table specifies the applicable switch settings:

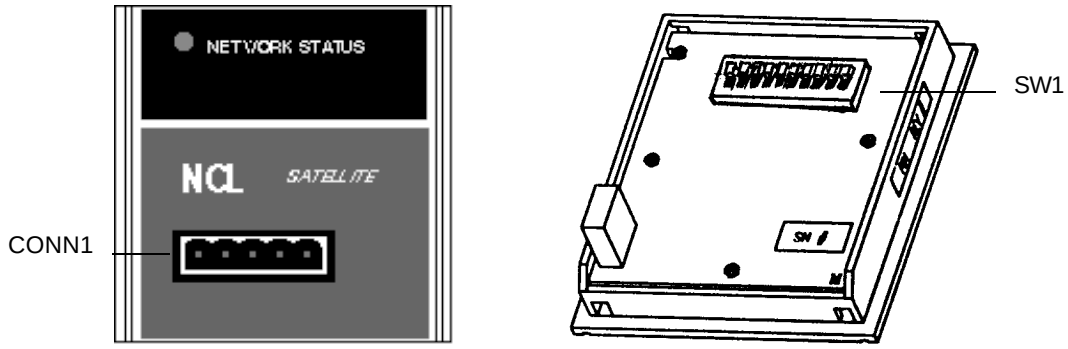
| Gateway SW2 Position<br>0=off 1=on | |
|---|---|
| Switch 7 | |
| Cable Loss Disabled | 0 |
| Cable Loss Enabled | 1 |

# Chapter 3
# Installation of the NCL Satellite Board

- Satellite Hardware Components
- Satellite Setup
- Satellite Installation into the GPD333

# Satellite Hardware Components

The figure below shows the NCL Satellite board. CONN1 is used for connection of the NCL network wiring. SW1 is used to setup the NCL network baud rate, the Satellite subnode number, and the power-up default for run/stop and frequency reference.




Front View Rear VIew

# Satellite Setup

The NCL Satellite board requires setup prior to operation. Satellite SW1 switches must be set prior to the application of input AC power to the GPD333. The states of these switches are read only on power-up.

## Satellite Board SW1 Settings

The Satellite SW1 switch is used to setup NCL Network characteristics. The SW1 functions are defined in the following table:

| Switch Number | Switch Function |
|---|---|
| 1 | Baud Rate - bit 0 |
| 2 | Baud Rate - bit 1 |
| 3 | Operation and Frequency Remote/Local |
| 4 | Not Used |
| 5 | NCL Drive Subnode Address - bit 0 / LSB |
| 6 | NCL Drive Subnode Address - bit 1 |
| 7 | NCL Drive Subnode Address - bit 2 |
| 8 | NCL Drive Subnode Address - bit 3 |
| 9 | NCL Drive Subnode Address - bit 4 / MSB |
| 10 | Not Used |

SW1 switches 1 and 2 are used to select the baud rate of the NCL network. The baud rate setting of the Satellite board must match the baud rate setting of the Gateway module. The available baud rates are defined in the following table. The following table specifies the maximum total cable length of the NCL network supported at each baud rate.

| NCL Baud Rate (KBaud) | Satellite SW1 Position 0=off 1=on | | Maximum Total Cable Length |
|---|---|---|---|
| | 2 | 1 | |
| 125 | 0 | 0 | 500 meters |
| 250 | 0 | 1 | 200 meters |
| 500 | 1 | 0 | 100 meters |
| | 1 | 1 | |

SW1 switch 3 is used to determine the power-up setting for satellite drive register 1Fh. Satellite drive register 1Fh is used along with drive register 31h to determine the origin for the Operation Signals (Run, Stop, Forward, Reverse, ...) and the Frequency Reference. The operation of registers 1Fh and 31h are explained in detail in chapter 8, ì Origin of the RUN/STOP and Frequency Referenceî.

When ëRemoteí mode is selected with switch 3, satellite drive register 1Fh will be set to a value of 3 on power-up. In ëRemoteí mode, the operation signals and frequency reference will be received from the NCL network.

When ëLocalí mode is selected with switch 3, satellite drive register 1Fh will be set to a value of 0 on power-up. In ëLocalí mode, the operation signals and frequency reference will be received from the digital operator or the external terminals.

| Operation Signal and Frequency Reference Source | | Satellite SW1 Position 3 | Register 1Fh Value at Power-Up |
|---|---|---|---|
| Remote | From NCL Network | 0 | 3 |
| Local | From External Terminals OR Digital Operator | 1 | 0 |

SW1 switches 5 through 9 are used to setup the NCL Subnode Address of the Satellite board. An NCL network can have up to 30 subnodes. The available NCL Subnode Address settings are defined in the following table.

| Drive Subnode Address | Satellite SW1 Position 0=off 1=on | | | | |
|---|---|---|---|---|---|
| | 9 | 8 | 7 | 6 | 5 |
| 01 | 0 | 0 | 0 | 0 | 1 |
| 02 | 0 | 0 | 0 | 1 | 0 |
| 03 | 0 | 0 | 0 | 1 | 1 |
| 04 | 0 | 0 | 1 | 0 | 0 |
| 05 | 0 | 0 | 1 | 0 | 1 |
| 06 | 0 | 0 | 1 | 1 | 0 |
| 07 | 0 | 0 | 1 | 1 | 1 |
| 08 | 0 | 1 | 0 | 0 | 0 |
| 09 | 0 | 1 | 0 | 0 | 1 |
| 10 | 0 | 1 | 0 | 1 | 0 |
| 11 | 0 | 1 | 0 | 1 | 1 |
| 12 | 0 | 1 | 1 | 0 | 0 |
| 13 | 0 | 1 | 1 | 0 | 1 |
| 14 | 0 | 1 | 1 | 1 | 0 |
| 15 | 0 | 1 | 1 | 1 | 1 |
| 16 | 1 | 0 | 0 | 0 | 0 |
| 17 | 1 | 0 | 0 | 0 | 1 |
| 18 | 1 | 0 | 0 | 1 | 0 |
| 19 | 1 | 0 | 0 | 1 | 1 |
| 20 | 1 | 0 | 1 | 0 | 0 |
| 21 | 1 | 0 | 1 | 0 | 1 |
| 22 | 1 | 0 | 1 | 1 | 0 |
| 23 | 1 | 0 | 1 | 1 | 1 |
| 24 | 1 | 1 | 0 | 0 | 0 |
| 25 | 1 | 1 | 0 | 0 | 1 |
| 26 | 1 | 1 | 0 | 1 | 0 |
| 27 | 1 | 1 | 0 | 1 | 1 |
| 28 | 1 | 1 | 1 | 0 | 0 |
| 29 | 1 | 1 | 1 | 0 | 1 |
| 30 | 1 | 1 | 1 | 1 | 0 |

# Satellite Installation into the GPD333

The NCL Satellite installs directly on the GPD333 drive in place of the standard status plate or optional Digital Operator display.

1. Disconnect all electrical power to the GPD333.

2. Remove the GPD333 access cover located on the bottom front of the drive (View A).

3. Check to ensure that the CHARGE indicator lamp (located inside the GPD333 on the bottom left corner) is not lit.

4. Verify that voltage has been disconnected by using a voltmeter to check for power at incoming power terminals (L1, L2, L3).

5. Gently press down on the plastic terminal board label strip located just below the status plate or Digital Operator (View B). Carefully lift upward on the bottom edge of the status plate/Digital Operator until the connector located on its back is released from the drive.

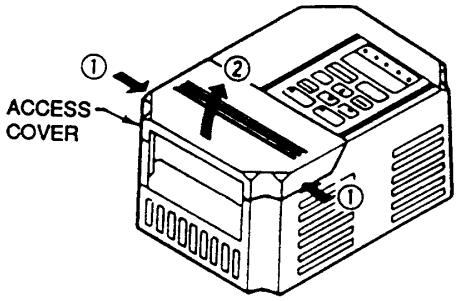
6. Verify that the ten-position dipswitch located on the back of the NCL Satellite board has been properly set up for your application.

7. Route the green pigtail ground wire of the NCL Satellite board through the rectangular opening in the drive chassis located in the area from which the status plate/Digital Operator was removed (View C). This ground wire should be connected to one of the drive ground terminals marked 'G'. The two drive ground terminals are located at the lower right and left corners of the GPD333.

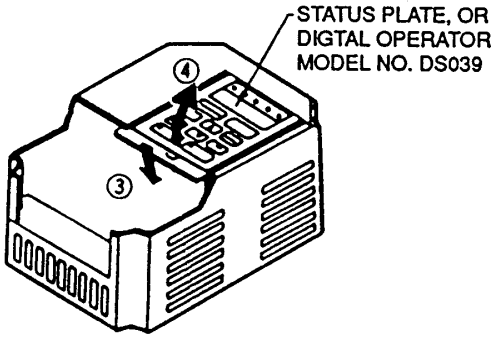
8. Install the NCL Satellite board in the mounting recess (View C).

9. Replace the GPD333 access cover.

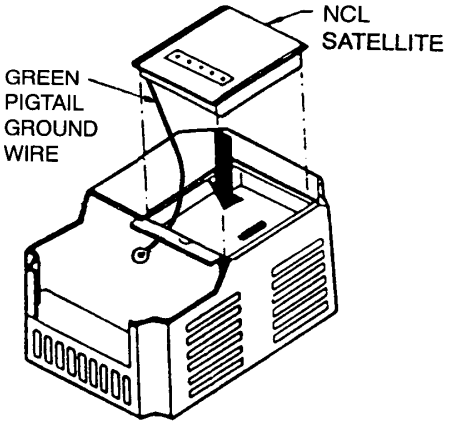
10. Insert the NCL network connector into CONN1 on the front of the NCL Satellite.




View A




View B




View C

# Chapter 4
# NCL Network Wiring

- Maximum Cable Length
- Wire Specification
- Gateway Connector Pinout and Orientation
- Satellite Connector Pinout and Orientation
- Installation of Terminating Resistor

# Maximum Cable Length

The NCL Network has a linear bus topology. The total length of cable allowed in the network depends on the baud rate of data transmission. The cumulative cable length between any two points in the cable system must not exceed the Maximum Total Cable Length specified in the following table.

| NCL Baud Rate (KBaud) | Gateway SW1 Position 0=off 1=on | | Maximum Total Cable Length |
|---|---|---|---|
| | 2 | 1 | |
| 125 | 0 | 0 | 500 meters |
| 250 | 0 | 1 | 200 meters |
| 500 | 1 | 0 | 100 meters |
| | 1 | 1 | |

# Wire Specification

The cable specified for NCL network connections is Belden 3084A. This cable consists of:

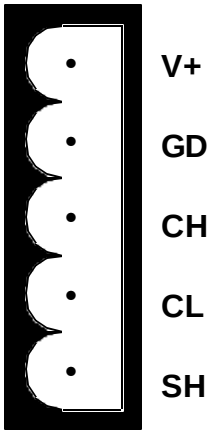
- One twisted signal pair (#24): blue/white
- One twisted power pair (#22): black/red
- Separate aluminized mylar shields around power pair and signal pair
- Overall foil/braid shield with drain wire (#22): bare

# Connector Pinout and Orientation

The following table shows the pinout used by the Gateway Module and the Satellite boards. The network is powered by a user-supplied 24VDC regulated power supply connected between pins V+ and GD. Power requirements for the Gateway and Satellite can be found in Appendix B, ì Specificationsî .

| Gateway CONN1 Pin | Satellite CONN1 Pin | DEFINITION | Belden 3084A Wire Color |
|---|---|---|---|
| SH | SH | Shield | Bare |
| CL | CL | CAN Low | Blue |
| CH | CH | CAN High | White |
| GD | GD | GND | Black |
| V+ | V+ | +24 VDC | Red |

The following figures show the pinout and orientation of the NCL network connectors. The Gateway connector is shown as it appears as CONN1 on the face of the Gateway module. The Satellite connector is shown as it appears as CONN1 on the face of the Satellite board.




Gateway Connector Pinout and Orientation


Satellite Connector Pinout and Orientation

# Installation of Terminating Resistor

Two terminating resistors must be installed between CAN Low ( pin CL ) and CAN High ( pin CH ) at the far ends of the NCL network. For example, in the NCL network shown in chapter 1, one terminating resistor must be installed between pins CL and CH on the Gateway module. The second terminating resistor should be installed between pins CL and CH on the Satellite board that is addressed as subnode 3.

The requirements for the terminating resistors are : 121 ohm, 1%, 1/4 Watt.

# Chapter 5
# MB+ Network Wiring

The Gateway module will be connected to the MB+ network via the 9 pin D-shell connector CONN2.

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

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

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

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

Two types of connectors are available from Modicon for connecting devices to the network. Each inline drop requires an inline 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 Inline Connector (quantity 1)
- AS-MBKT-185 MBPlus Terminating Connector (quantity 1)
- AS-MBPL-001 MBPlus Connector Assembly Tool

# Chapter 6
# Types of Data

- Types of Data Avaialble via NCL
- Satellite Groups of Memory
- Satellite Drive Registers
- Satellite Internal Registers
- Satellite Diagnostic Registers
- Gateway Groups of Memory
- Gateway Internal Registers
- Gateway Diagnostic Registers

# Types of Data Available via NCL

NCL allows access to the five groups of data shown below.

| Group Name | Group Location |
|---|---|
| Satellite Drive Registers | Satellite (per Subnode) |
| Satellite Internal Registers | |
| Satellite Diagnostic Registers | |
| Gateway Internal Registers | Gateway (per Node) |
| Gateway Diagnostic Registers | |

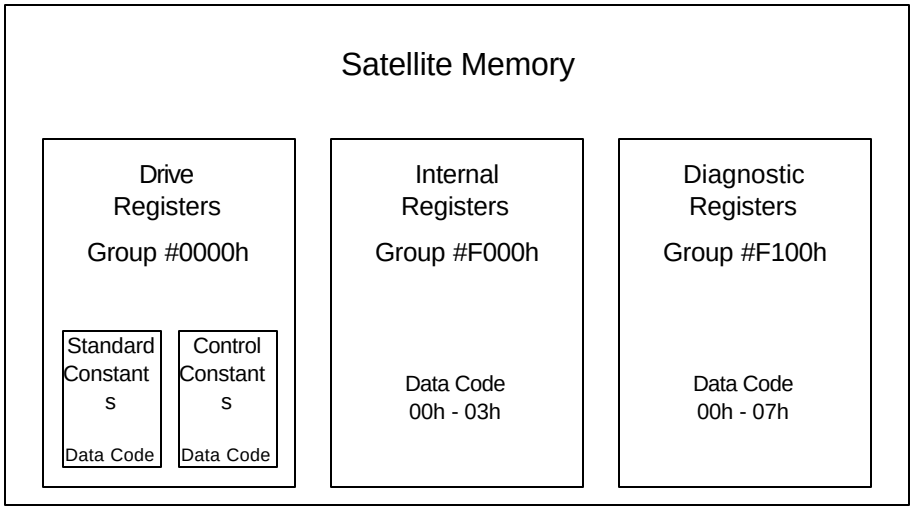
A list of the registers contained in each group can be found in Appendix A of this manual.

# Satellite Groups of Memory

Each Satellite board (subnode) on the NCL network will have three groups of data that can be accessed from the NCL network. These groups are referred to as Satellite Drive Registers, Satellite Internal Registers, and Satellite Diagnostic Registers. Each of the three groups has a unique group number. Each register in a group has a unique data code number. Therefore, to address any register on a Satellite, the following information must be known:

- MB+ Routing Path/Address of the Gateway Module
- Subnode Address of the Satellite Board
- Group Number of the Register
- Data Code Number of the Register

The following diagram illustrates how the satellite register groups are arranged in memory.



## Satellite Drive Registers

Satellite Drive Registers are registers used to configure the operation of a drive or monitor the status of a drive. In the case of the GPD333, the Satellite Drive Registers consist of the standard constants (no-01 through no-65) and the control constants. The group number for the Satellite Drive Registers is 0000h.

## Satellite Internal Registers

Satellite Internal Registers are registers used to configure the operation of an individual satellite board. Satellite Internal Registers are used to enable global data capability and to setup a global frequency reference multiplier. The group number for the Satellite Internal Registers is F000h.

## Satellite Diagnostic Registers

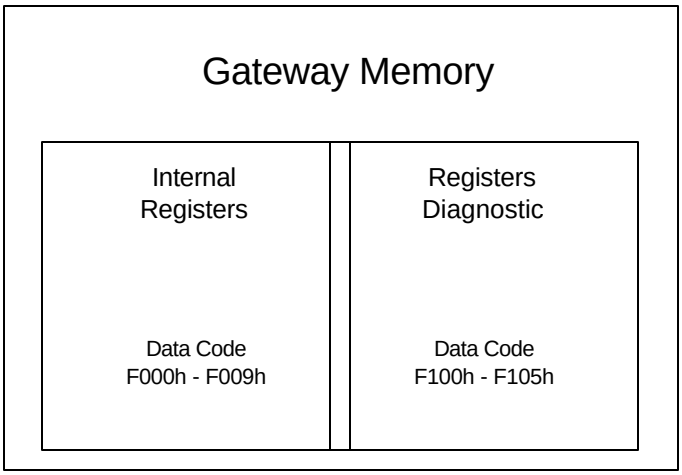
Satellite Diagnostic Registers are registers used to monitor the operation of an individual satellite board. Satellite Diagnostic Registers provide information on satellite run time, number of message transactions, number of message errors, and the nature of message errors. The group number for the Satellite Diagnostic Registers is F100h.

| NOTE |
| --- |
| A lisintg of all data codes for Satellite and Gateway registers can be found in Appendix A of this manual. |

# Gateway Groups of Memory

Each Gateway module (node) on the MB+ network will have two groups of data that can be accessed from the network. These groups are referred to as Gateway Internal Registers, and Gateway Diagnostic Registers. Each register in the Gateway has a unique data code number. Therefore, to address any register on a Gateway, the following information must be known:

- MB+ Routing Path/Address of the Gateway Module
- Data Code of the register




# Gateway Internal Registers

Gateway Internal Registers are registers used to configure the operation of an individual Gateway module. Gateway Internal Registers are used to configure global data registers and to monitor the setup of the Gateway hardware switches.

# Gateway Diagnostic Registers

Gateway Diagnostic Registers are registers used to monitor the operation of an individual Gateway module. Gateway Diagnostic Registers provide information on Gateway run time, number of message transactions, number of message errors, and type of messages.

| NOTE |
| --- |
| A lisintg of all data codes for Satellite and Gateway registers can be found in Appendix A of this manual. |

# Chapter 7
# Modbus Plus MSTR Function

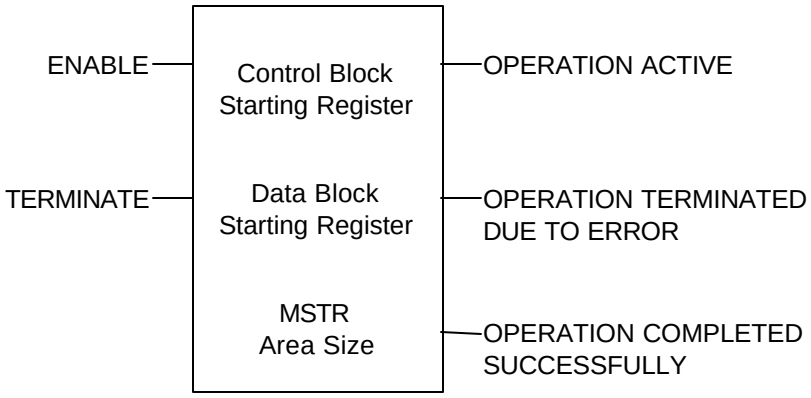
- MSTR Control Block
- MSTR Data Block
- MSTR Area Size
- Read Function
- Write Function
- Global Write Function

# Modbus Plus MSTR Function

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

| MSTR Function | Operation Code |
|---|---|
| Write Data | 1 |
| Read Data | 2 |
| Write Global Data | 5 |

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




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

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

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

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

# MSTR Control Block

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

Information transferred from the ladder to the MSTR include:

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

Information transferred from the MSTR to the ladder logic include:

- the status of the MB+ transaction.

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

The Control Block registers are defined as:

| CONTROL BLOCK | | | |
|---|---|---|---|
| Control Block Offset | MSTR Word Description | Comments | |
| | | | |
| 4X + 0 | Operation Code | 1 = Multiple Register Write<br>2 = Multiple Register Read<br>5 = Write 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 | Register Address | Satellite Register | AADDh<br>AA = Address of Satellite (subnode)<br>DD = Data code for Satellite register |
| | | Gateway Register | DDDDh<br>DDDD = Data code for Gateway register |
| 4X + 4 | Routing 1 | Routing register #1 / local network | |
| 4X + 5 | Routing 2 | Routing register #2 | |
| 4X + 6 | Routing 3 | Routing register #3 | |
| 4X + 7 | Routing 4 | Routing register #4 | |
| 4X + 8 | Routing 5 | Routing register #5 | |
| | | | |

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

| MSTR Function | Operation Code |
|---|---|
| Write Data | 1 |
| Read Data | 2 |
| Write Global Data | 5 |

The Network Error Code (4X + 1) is used by the MSTR to indicate the status of the transaction. If any error occurs during the transaction, an error code will be transferred into this register. A list of MB+ network error codes can be found in Chapter 10.

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

The Register Address (4X + 3) is used by the ladder logic to indicate the address of the register to read/write. This PLC register is a two byte register. The most significant byte of this PLC register indicates the address of the Satellite subnode. The least significant byte of this PLC register indicates which register in the subnode to read/write. This byte of information is called the ëData Codeí. When accessing Gateway Registers, both bytes are used to indicate which register in the Gateway to read/write. This two byte value is also called the ëData Codeí. A list of data codes for the GPD333 Satellite board and Gateway module can be found in Appendix A.

The example shown below shows how to setup the Register Address to access acceleration time 1 (no-09) on the GPD333 Satellite with a subnode address of 5.

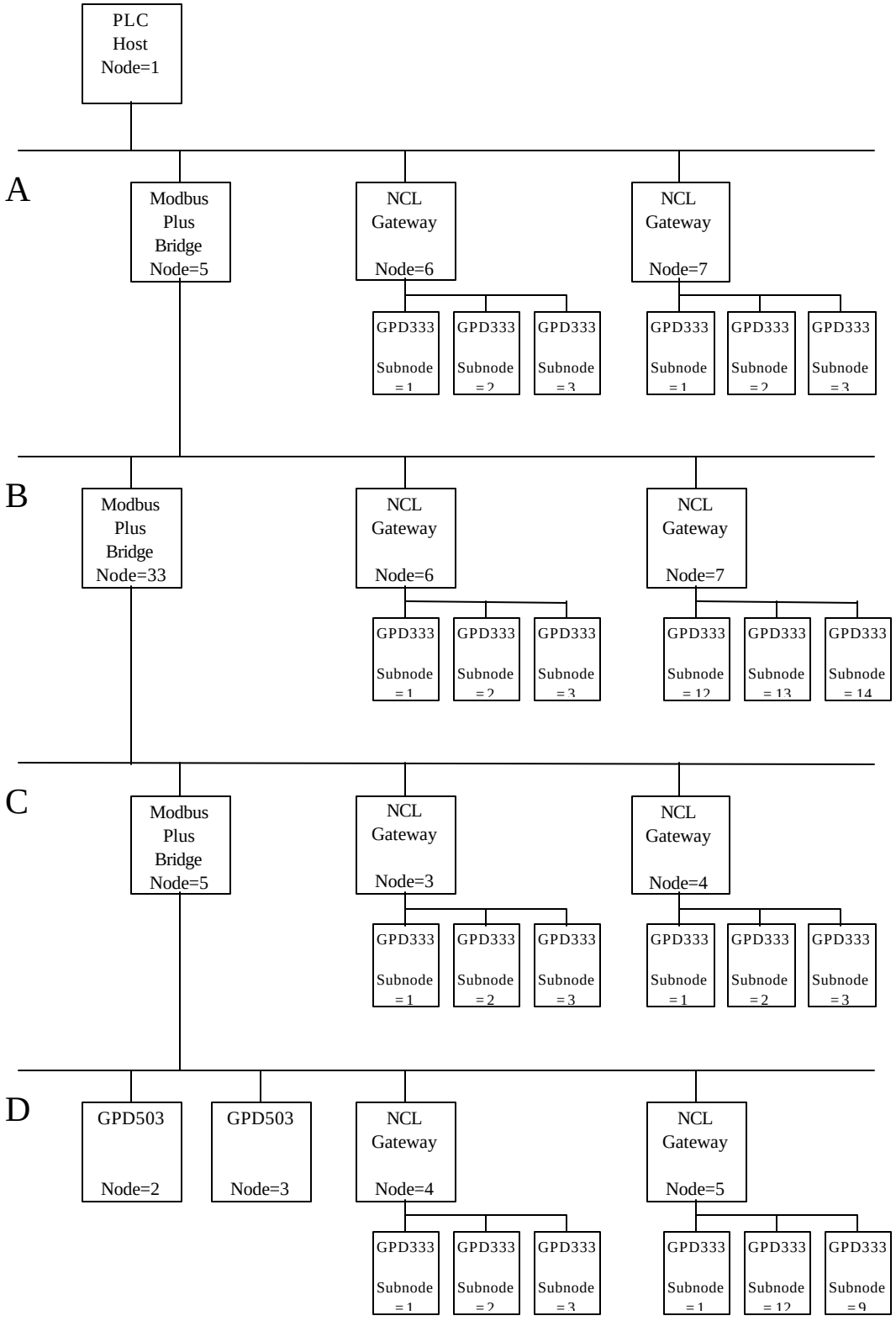
| | MSB NCL Satellite Address | | | | | | | | LSB Satellite Register Data Code | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit Number | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Hex Value | 0 | | | | 5 | | | | 3 | | | | 9 | | | |

The example shown below shows how to setup the Register Address to access the Global Master Node Number register on the Gateway module.

| | MSB Gateway Data Code | | | | | | | | LSB Gateway Data Code | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit Number | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Hex Value | F | | | | 0 | | | | 0 | | | | 0 | | | |

Each NCL Gateway module 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 diagram on the following page illustrates an example network with NCL Gateway modules on a bridged network system.


PLC
Host
Node=1
A
Modbus
Plus
Bridge
Node=5
NCL
Gateway
Node=6
NCL
Gateway
Node=7
GPD333
Subnode
=1
GPD333
Subnode
=2
GPD333
Subnode
=3
GPD333
Subnode
=1
GPD333
Subnode
=2
GPD333
Subnode
=3
B
Modbus
Plus
Bridge
Node=33
NCL
Gateway
Node=6
NCL
Gateway
Node=7
GPD333
Subnode
=1
GPD333
Subnode
=2
GPD333
Subnode
=3
GPD333
Subnode
=12
GPD333
Subnode
=13
GPD333
Subnode
=14
C
Modbus
Plus
Bridge
Node=5
NCL
Gateway
Node=3
NCL
Gateway
Node=4
GPD333
Subnode
=1
GPD333
Subnode
=2
GPD333
Subnode
=3
GPD333
Subnode
=1
GPD333
Subnode
=2
GPD333
Subnode
=3
D
GPD503
Node=2
GPD503
Node=3
NCL
Gateway
Node=4
NCL
Gateway
Node=5
GPD333
Subnode
=1
GPD333
Subnode
=2
GPD333
Subnode
=3
GPD333
Subnode
=1
GPD333
Subnode
=12
GPD333
Subnode
=9

The last routing register used must be set to ë1í. For host-based network adapters (such as the NCL Gateway module), this last routing register is used to specify a task number (0 to 7) to which the message is assigned. For the NCL Gateway this register must be ë1í.

Any unused routing registers must be set to ë0í.

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

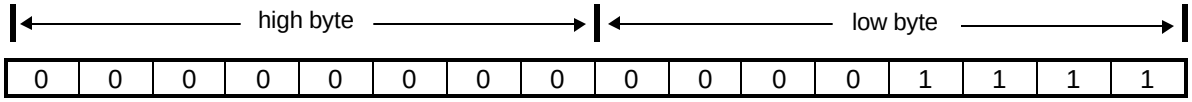
| Network A Routing | | | |
|---|---|---|---|
| Register Description | | 1st NCL Gateway | 2nd NCL Gateway |
| Routing 1 | Network A | 6 | 7 |
| Routing 2 | Task # = 1 | 1 | 1 |
| Routing 3 | Not Used | 0 | 0 |
| Routing 4 | Not Used | 0 | 0 |
| Routing 5 | Not Used | 0 | 0 |

| Network B Routing | | | |
|---|---|---|---|
| Register Description | | 1st NCL Gateway | 2nd NCL Gateway |
| Routing 1 | Network A | 5 | 5 |
| Routing 2 | Network B | 6 | 7 |
| Routing 3 | Task # = 1 | 1 | 1 |
| Routing 4 | Not Used | 0 | 0 |
| Routing 5 | Not Used | 0 | 0 |

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

| Network D Routing | | | | | |
|---|---|---|---|---|---|
| Register Description | | 1st GPD503 | 2nd GPD503 | 1st NCL Gateway | 2nd NCL Gateway |
| Routing 1 | Network A | 5 | 5 | 5 | 5 |
| Routing 2 | Network B | 33 | 33 | 33 | 33 |
| Routing 3 | Network C | 5 | 5 | 5 | 5 |
| Routing 4 | Network D | 2 | 3 | 4 | 5 |
| Routing 5 | Task# = 1 | 1 | 1 | 1 | 1 |

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




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

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

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

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

To target a Modbus Plus Network Option Module (NOM) in a Quantum PLC backplane as the destination of an MSTR instruction, the value in the high byte represents the physical slot location of the NOM.

## MSTR Data Block

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

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

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

## MSTR Area Size

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

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

# Read Function

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

- Satellite Drive Registers
- Satellite Internal Registers
- Satellite Diagnostic Registers
- Gateway Internal Registers
- Gateway Diagnostic Registers

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

When reading from Satellite registers, the appropriate Satellite group must be selected before attempting the read. See Chapter 8 for details on selecting Satellite groups.

# Write Function

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

- Satellite Drive Registers
- Satellite Internal Registers
- Satellite Diagnostic Registers
- Gateway Internal Registers
- Gateway Diagnostic Registers

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

When writing to Satellite registers, the appropriate Satellite group must be selected before attempting the write. See Chapter 8 for details on selecting Satellite groups.

# 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. The Gateway module is a slave device on the MB+ network. When a Gateway module receives a global write command, it will pass the global write data to all slave devices (Satellite boards) on the NCL network. Therefore, the global write function allows all Satellite boards to receive data at the same time. NCL allows for a maximum of 3 global data registers. The global data registers must be sequential registers.

When using an NCL network, an MSTR global write function can be used to send the following types of data:

- Satellite Drive Registers

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).

Each Satellite that will receive global data must be initialized to do so. If a Satellite is not initialized to receive global data, it will ignore any global data that is transmitted on the NCL network. In addition to enabling global data on each Satellite, the Gateway module must also be initialized to receive global data. If a Gateway is not initialized to receive global data, it will ignore any global data that is transmitted on the MB+ network. For more information on enabling global data on the Gateway module and Satellite board, see Chapter 8.

# Chapter 8
# Special NCL Registers

- Selecting Satellite Groups
- Saving Data with the ENTER Command
- Using Satellite Data Code 00h
- Enabling the Gateway Module to Receive Global Data
- Enabling the Satellite Board to Receive Global Data
- Writing to the Global Frequency Reference Multiplier
- Origin of RUN/STOP and Frequency Reference Commands
- Using Satellite Drive Register 01h

# Special NCL Registers

The function of some of the registers associated with NCL require further explanation. This chapter will explain the following topics:

- Selecting Satellite Groups
- Saving Data with the ENTER Command
- Using Satellite Data Code 00h
- Enabling the Gateway Module to Receive Global Data
- Enabling the Satellite Board to Receive Global Data
- Writing to the Global Frequency Reference Multiplier
- Origin of RUN/STOP and Frequency Reference Commands
- Using Satellite Data Code 01h

# Selecting Satellite Groups

The Satellite board has three groups of registers: Satellite Drive Registers, Satellite Internal Registers, and Satellite Diagnostic Registers. See chapter 6 for a description of each of the Satellite groups.

Before accessing a register from one of the Satellite groups, the correct group must be selected. Each group has been assigned a group number. Group numbers are shown in the following table.

| Group Name | Group Number (hex) | |
|---|---|---|
| Satellite Drive Registers | 0000h | ⇐ power-up default |
| Satellite Internal Registers | F000h | |
| Satellite Diagnostic Registers | F100h | |

To select a Satellite group, the group number must be written to the Satellite data code 00h. Therefore, to select the Satellite Drive group, a value of 0000h must be written to data code 00h. To select the Satellite Internal group, a value of F000h must be written to data code 00h. To select the Satellite Diagnostic group, a value of F100h must be written to data code 00h.

After a Satellite group has been selected, registers in that group can be accessed by the data codes which are listed in Appendix A.

Examples of selecting Satellite groups can be found in chapter 9: Example #3 (enable global data), and Example #6 (write global frequency reference multiplier).

On power-up, the default group is the Satellite Drive group.

# Saving Data with the ENTER Command

The GPD333 has two types of memory: ëVolatileí and ëNon-Volatileí. 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 or the satellite is removed from the drive. The following table shows where GPD333 data is held in memory.

<table>
<tr><th>Volatile Memory</th><th>Transfers</th><th>Non-Volatile Memory</th></tr>
<tr><td>Control Constants<br>Data Codes 00h through 1Fh</td><td></td><td></td></tr>
<tr><td rowspan="2">Standard Constants<br>no-01 through no-65<br>Data Codes 30h through 71h</td><td>⇐<br>Power-Up</td><td rowspan="2">Standard Constants<br>no-01 through no-65<br>Data Codes 30h through 71h</td></tr>
<tr><td>⇒<br>ëENTERí Command</td></tr>
<tr><td>Satellite Internal Registers<br>Data Codes 00h through 03h</td><td></td><td></td></tr>
<tr><td>Satellite Diagnostic Registers<br>Data Codes 00h through 07h</td><td></td><td></td></tr>
</table>

The table above shows the Standard Constants residing in both Volatile and Non-Volatile memory. The data held in Volatile memory is the data that is used by the drive when running. The data held in Non-Volatile memory is only used for data storage during a drive power loss.

On power-up, the Standard Constants stored in Non-Volatile memory are transferred to Volatile memory.

If writing to the Standard Constants via NCL, the new data will be placed into Volatile memory. At this point, the new data will not be retained if a drive power loss occurs. In order for the new data to be retained, the ëENTERí command must be written to the drive. This would be synonymous to using the ENTER key on the optional drive keypad.

When the ëENTERí command is written, the Standard Constant data in Volatile memory is transferred to Non-Volatile memory.

The ëENTERí command is accomplished by writing a value of ë0í to data code 00h when the Satellite Drive group (group # 0000h) is selected.

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

| NOTE |
| --- |
| USE THE ëENTERí COMMAND ONLY WHEN NECESSARY!<br>The life of the Non-Volatile EEPROM on the GPD333 will support a finite number of operations. This means that the ëENTERí 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 (CPF04) requiring the GPD333 to be replaced. |

# Using Satellite Data Code 00h

After reading the previous two sections of this chapter, the operation of Satellite data code 00h may be confusing. Satellite data code 00h is a register that serves two purposes:

- ENTER Command
- Satellite Group Select

No matter which Satellite group is selected, data code 00h can be used to select another group. To select a new Satellite group, the group number is written to data code 00h.

The ENTER command is only possible when the Satellite Drive group (group # 0000) is selected. If the Satellite Drive group is selected, writing a value of ë0000í to data code 00h will execute an ENTER command.

The following table summarizes the possibilities:

| If this ⇓ group is selected... | writing this ⇓ ... | will do this ⇓ ... |
|---|---|---|
| Satellite Drive Group Group # 0000h | 0000h | execute the ENTER command |
| | F000h | select the Satellite Internal group |
| | F100h | select the Satellite Diagnostic group |
| | Any other value | no operation |
| Satellite Internal Group Group #F000h | 0000h | select the Satellite Drive group |
| | F000h | no operation |
| | F100h | select the Satellite Diagnostic group |
| | Any other value | no operation |
| Satellite Diagnostic Group Group #F100h | 0000h | select the Satellite Drive group |
| | F000h | select the Satellite Internal group |
| | F100h | no operation |
| | Any other value | no operation |

# Enabling the Gateway Module to Receive Global Data

The 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. The Gateway module is a slave device on the MB+ network. When a Gateway module receives a global write command, it will pass the global write data to all slave devices (Satellite boards) on the NCL network. Therefore, the global write function allows all Satellite boards to receive data at the same time.

The Gateway module must be initialized to receive global data on the MB+ network. If a Gateway module is not initialized to receive global data, it will ignore any global data that is transmitted on the MB+ network.

Three of the Gateway Internal Registers are used to configure the Gateway module to receive global data. These registers are listed in the following table.

| Gateway Internal Register | Power-Up Value | Register Description |
|---|---|---|
| F000h | 0 | Global Master Node Number |
| F001h | 2 | Global Number of Registers |
| F002h | 01h | Global Starting Register |

The data held in Gateway Internal Register F000h indicates the MB+ node address of the device (PLC) that will be sending global data to the Gateway module. The Gateway module will only accept global data that is sent from this device. To enable global data, write the MB+ node address (1-64) of the device sending global data to register F000h. To disable global data, write a ë0í to register F000h.

The data held in Gateway Internal Register F001h indicates the quantity of global registers that will be sent by the master node. NCL allows for a maximum of 3 global data registers. The global data registers must be sequential registers.

The data held in Gateway Internal Register F002h indicates the data code of the first Satellite Drive Register that will receive the global data. This register indicates the first of three (maximum) sequential registers.

The default values for F001h and F002h will configure Satellite Drive Registers 01h (operation command) and 02h(frequency reference) as the global data registers.

The Gateway Internal Registers are stored in Volatile memory. The power-up default value for Gateway Internal Register F000h is ë0í. This means that after a power loss, global data will be disabled at the Gateway module.

An example of enabling global data on the Gateway module can be found in Chapter 9, Example #3 (enable global data).

# Enabling Global the Satellite Board to Receive Global Data

The 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. The Gateway module is a slave device on the MB+ network. When a Gateway module receives a global write command, it will pass the global write data to all slave devices (Satellite boards) on the NCL network. Therefore, the global write function allows all Satellite boards to receive data at the same time.

The Satellite module must be initialized to receive global data on the NCL network. If a Satellite is not initialized to receive global data, it will ignore any global data that is transmitted on the NCL network.

Satellite Internal Register 01h is used to enable the Satellite board to receive global data. To enable global data, write a value of ë1í to this register. To disable global data, write a value of ë0í to this register. The power-up default value for Satellite Internal Register 01h is ë0í.

Satellite Internal Registers are stored in Volatile memory. The power-up default value for Satellite Internal Register 01h is ë0í. This means that after a power loss, global data will be disabled at the Satellite board.

An example of enabling global data on the Satellite board can be found in Chapter 9, Example #3 (enable global data).

# 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 NCL 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.

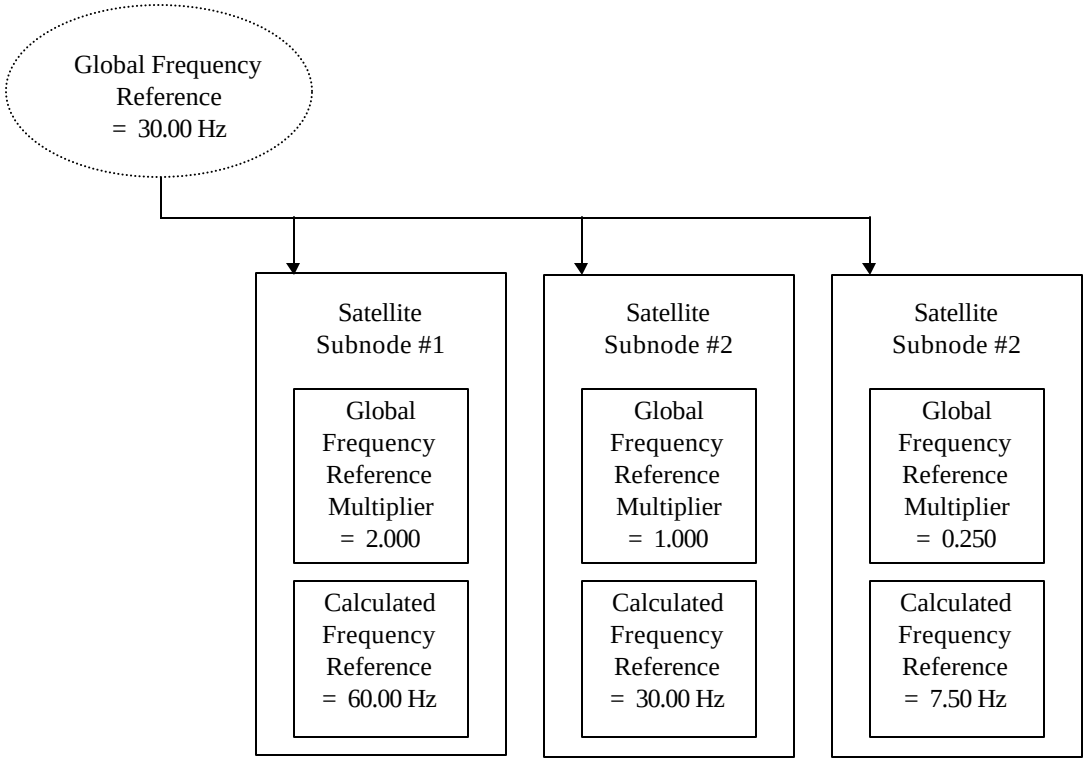
Satellite Internal Register 02h is the Global Frequency Reference Multiplier register. The power-up default value of this register is ë1.000í.

To make use of the Global Frequency Reference Multiplier, the Gateway registers F000h, F001h, and F002h must be setup to enable globally writing to Satellite Drive Register 02h (frequency reference) and Satellite Internal Register 01h must be a ë1í to enable global data.

When global data is properly initialized, the value written to Satellite Drive Register 02h (frequency reference) will be multiplied by the value of Satellite Internal Register 02h (global frequency reference multiplier) to produce the frequency reference value. This will allow each drive on the network to scale the global frequency reference that it receives.

The diagram below shows a global frequency reference value of 30.00 Hz being written to 3 drives. Each drive has a different Global Frequency Reference Multiplier value.

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



# Origin of RUN/STOP and Frequency Reference Commands

The drive can be configured to receive operation signals ( Run, Stop, Forward, Reverse, ... ) from the NCL network, the external drive terminals, or the digital operator. The second digit (bit 1) of Satellite Drive Register 1Fh and the second digit (bit 1) of Satellite Drive Register 31h (no-01) are used to setup the source of the operation signals. The following table indicates the possible binary configurations for the origin of the operation signals:

| OPERATION SIGNALS ORIGIN | | |
|---|---|---|
| 1Fh | 31h | Source |
| XX0X | XX0X | External Inputs - terminals 1, 2, and 3 |
| XX0X | XX1X | Digital Operator |
| XX1X | XX0X | NCL Network (Data Code 01h) |
| XX1X | XX1X | NCL Network (Data Code 01h) |

The drive can be configured to receive a frequency reference value from the NCL network, the external drive terminals, or the digital operator. The first digit (bit 0) of Satellite Drive Register 1Fh and the first digit (bit 0) of Satellite Drive Register 31h (no-01) are used to setup the source of the frequency reference. The following table indicates the possible binary configurations for the origin of the frequency reference:

| FREQUENCY REFERENCE ORIGIN | | |
|---|---|---|
| 1Fh | 31h | Source |
| XXX0 | XXX0 | Analog Input - terminals 8,9, and 11 |
| XXX0 | XXX1 | Digital Operator (Data Code 3Dh / no-13) |
| XXX1 | XXX0 | NCL Network (Data Code 02h) |
| XXX1 | XXX1 | NCL Network (Data Code 02h) |

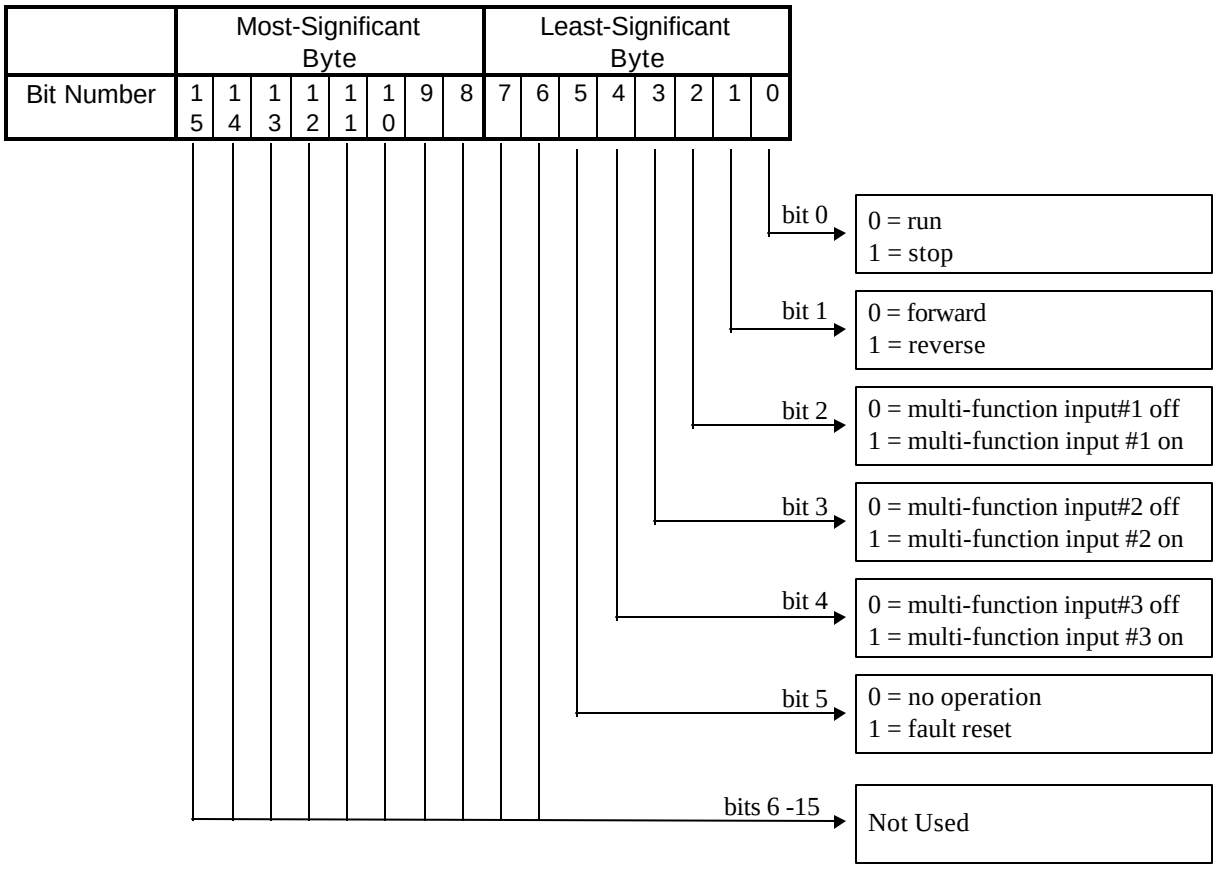
The value of Satellite Drive Register 31h (no-01) may be stored in Non-Volatile RAM memory on the drive by use of the ENTER command. After the value has been ëenteredí, that value will be retained if the drive unit is powered down.

The value of Satellite Drive Register 1Fh is <u>not</u> stored in Non-Volatile RAM, and therefore, will <u>not</u> be remembered if the drive unit is powered down. The value of register 1Fh at power-up is determined by the position of Satellite SW1 switch 3. When switch 3 is off, drive register 1Fh will be set to a value of 3 ( 0011 ) on power-up. When switch 3 is on, drive register 1Fh will be set to a value of 0 (0000) on power-up. The setting of SW1 switch 3 is explained in detail in chapter 3.

| NOTE |
|---|
| Although Run/Stop and Frequency Reference control are possible over the network, hard-wired Estop circuitry should always be present. |

# Using Satellite Drive Register 01h

When the drive is setup to receive Operation Signals from the NCL Network, Satellite Drive Register 01h is used to operate the drive. This register performs multiple functions. Each of the first 6 bits of this register serves a different purpose. The remaining bits of this register are not used. The following diagram shows the function of each of the bits of this register. Bit 0 is the least significant bit of the register. Bit 15 is the most significant bit of the register.




Bit 0 is used to start and stop the drive. To command the drive to stop, this bit should be set to a ë0í. To command the drive to run, this bit should be set to a ë1í.

Bit 1 is used to determine the direction of motion. To command the drive in the forward direction, this bit should be set to a ë0í. To command the drive in the reverse direction, this bit should be set to a ë1í.

Bit 2 is used to turn multi-function input #1 on and off. To turn multi-function input #1 off, this bit should be set to a ë0í. To turn multi-function input #1 on, this bit should be set to a ë1í. The function of multi-function input #1 is determined by the setting of drive constant no-32.

Bit 3 is used to turn multi-function input #2 on and off. To turn multi-function input #2 off, this bit should be set to a ë0í. To turn multi-function input #2 on, this bit should be set to a ë1í. The function of multi-function input #2 is determined by the setting of drive constant no-33.

Bit 4 is used to turn multi-function input #3 on and off. To turn multi-function input #3 off, this bit should be set to a ë0í. To turn multi-function input #3 on, this bit should be set to a ë1í. The function of multi-function input #3 is determined by the setting of drive constant no-34.

| NOTE |
| --- |
| For a description of the operation of the multi-function inputs, no-32, no-33, and no-34 refer to the GPD 333 Technical Manual (TM 4333). |

Bit 5 is used to reset drive faults that have occurred. To allow the drive to run, this bit should be set to a ë0í. To reset a drive fault, this bit should be momentarily set to a ë1í. To reset a fault, the run/stop bit (Bit 0) must also be a ë0í.

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

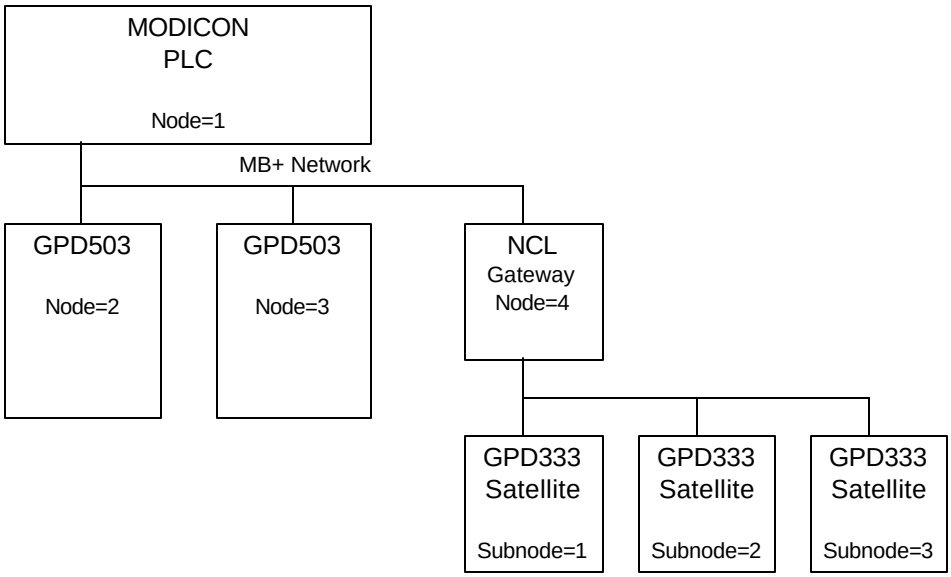
| Function | Binary Value | Decimal | Hex |
| --- | --- | --- | --- |
| Stop | 0000 0000 0000 0000 | 0 | 0000 |
| Run Forward | 0000 0000 0000 0001 | 1 | 0001 |
| Run Reverse | 0000 0000 0000 0011 | 3 | 0003 |
| Turn On Multi-Function Input#1 | 0000 0000 0000 0100 | 4 | 0004 |
| Turn On Multi-Function Input#2 while running | 0000 0000 0000 1001 | 9 | 0009 |
| Turn On Multi-Function Input#3 while running reverse | 0000 0000 0001 0011 | 19 | 0013 |
| Reset Drive Fault | 0000 0000 0010 0000 | 32 | 0020 |

# Chapter 9
# Examples

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

# Examples

In the following examples, a Modicon PLC, two GPD503 variable frequency drives, and three GPD333 drives are connected via a MB+ network that is configured as follows:



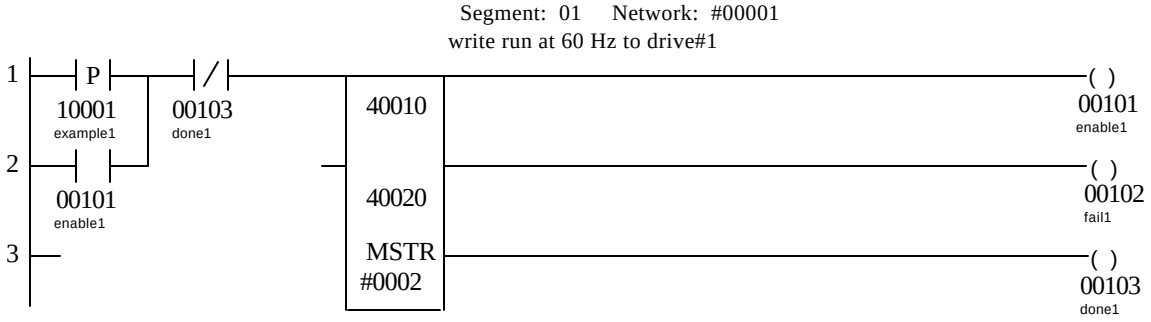
# Example #1
## Write RUN/STOP and Frequency Reference to Drive #1

This example will show how to write a RUN FORWARD command and a 60.00 Hz frequency reference to a drive on the NCL network. This example assumes that the drive has been configured to accept Operation Signals and Frequency Reference from the NCL Network (Satellite Drive Registers 01h and 02h respectively).

In this example, an input to the PLC will be used to initiate the MSTR that will write the ëOperation Commandí and ëFrequency Referenceí. This input will be addressed at 10001.

The ëOperation Commandí register and the ëFrequency Referenceí register are sequential registers (see the Satellite Drive Register Table in Appendix A) . Since these two registers are sequential registers, one MSTR function can be used to write to both registers.

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




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

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40010 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40011 | Network Error Code | 0000h | Zero the error code |
| 40012 | Number of Registers | 0002h | Write to 2 consecutive registers |
| 40013 | Drive Address / Data Code | 0101h | 01XX = address of drive Satellite is 01h<br>XX01 = data code of ëoperation signalí register is 01h. |
| 40014 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40015 | Routing 2 | 0001h | End of routing path = 0001h (NCL requirement) |
| 40016 | Routing 3 | 0000h | This routing register is not used, must be set to 0 |
| 40017 | Routing 4 | 0000h | This routing register is not used, must be set to 0 |
| 40018 | Routing 5 | 0000h | This routing register is not used, must be set to 0 |

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

| DATA BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40020 | Operation Signals | 0001h | Run Forward = bit 0/on = 0001h |
| 40021 | Freq. Reference | 1770h | 60.00 Hz = 6000 (decimal) = 1770h |

## 9-4 Examples

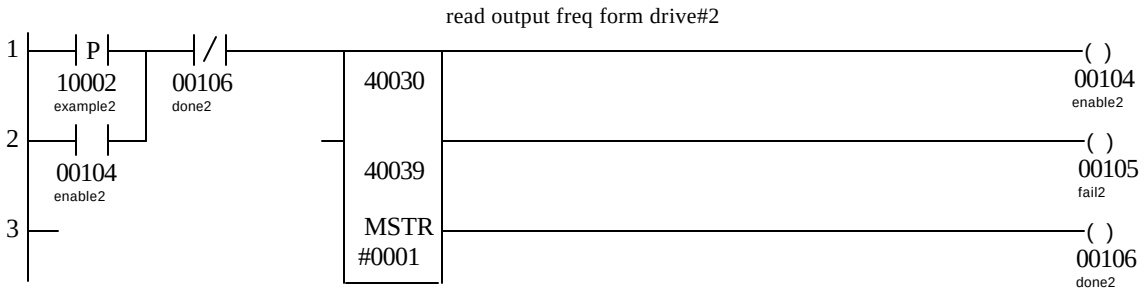
# Example #2
## Read Output Frequency from Drive #3

This example will show how to read the output frequency of a GPD333 drive on the NCL 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 02h.

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




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

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40030 | Operation Code | 0002h | 0002h = Read from Multiple Registers |
| 40031 | Network Error Code | 0000h | Zero the error code |
| 40032 | Number of Registers | 0001h | Read from 1 consecutive register |
| 40033 | Drive Address / Data Code | 0302h | 03XX = address of drive Satellite is 03h<br>XX02 = data code of ëoutput frequencyí register is 02h |
| 40034 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40035 | Routing 2 | 0001h | End of routing path = 0001h (NCL requirement) |
| 40036 | Routing 3 | 0000h | This routing register is not used, must be set to 0 |
| 40037 | Routing 4 | 0000h | This routing register is not used, must be set to 0 |
| 40038 | Routing 5 | 0000h | This routing register is not used, must be set to 0 |

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

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

# Example #3
## Enable Global Data for Drive #2 and Drive #3

This example will enable drive #2, drive #3, and the Gateway to receive global data. The global data registers will be the Operation Command register (data code 01h) and the Frequency Reference register (data code 02h).

In this example, an input to the PLC will be used to initiate the MSTRs that will configure the Satellite boards and the Gateway. This input will be addressed at 10003.

Each Satellite that will receive global data must be initialized to accept global data. If a Satellite is not initialized to receive global data, it will ignore any global data that is transmitted on the NCL network. To enable global data at the Satellite, the following MSTR transactions should be performed:

- Select the Satellite Internal Register Group by writing a F000h to data code 00h
- Enable global data by writing a ë1í to Satellite internal register 01h
- Select the Satellite Drive Register Group by writing 0000h to data code 00h

In this example, drive #2 and drive #3 will be initialized to receive global data.

In addition to enabling global data on each Satellite, the Gateway module must be initialized to receive global data on the MB+ network. If a Gateway is not initialized to receive global data, it will ignore any global data that is transmitted on the MB+ network.. To enable global data at the Gateway, the following MSTR transaction should be performed:

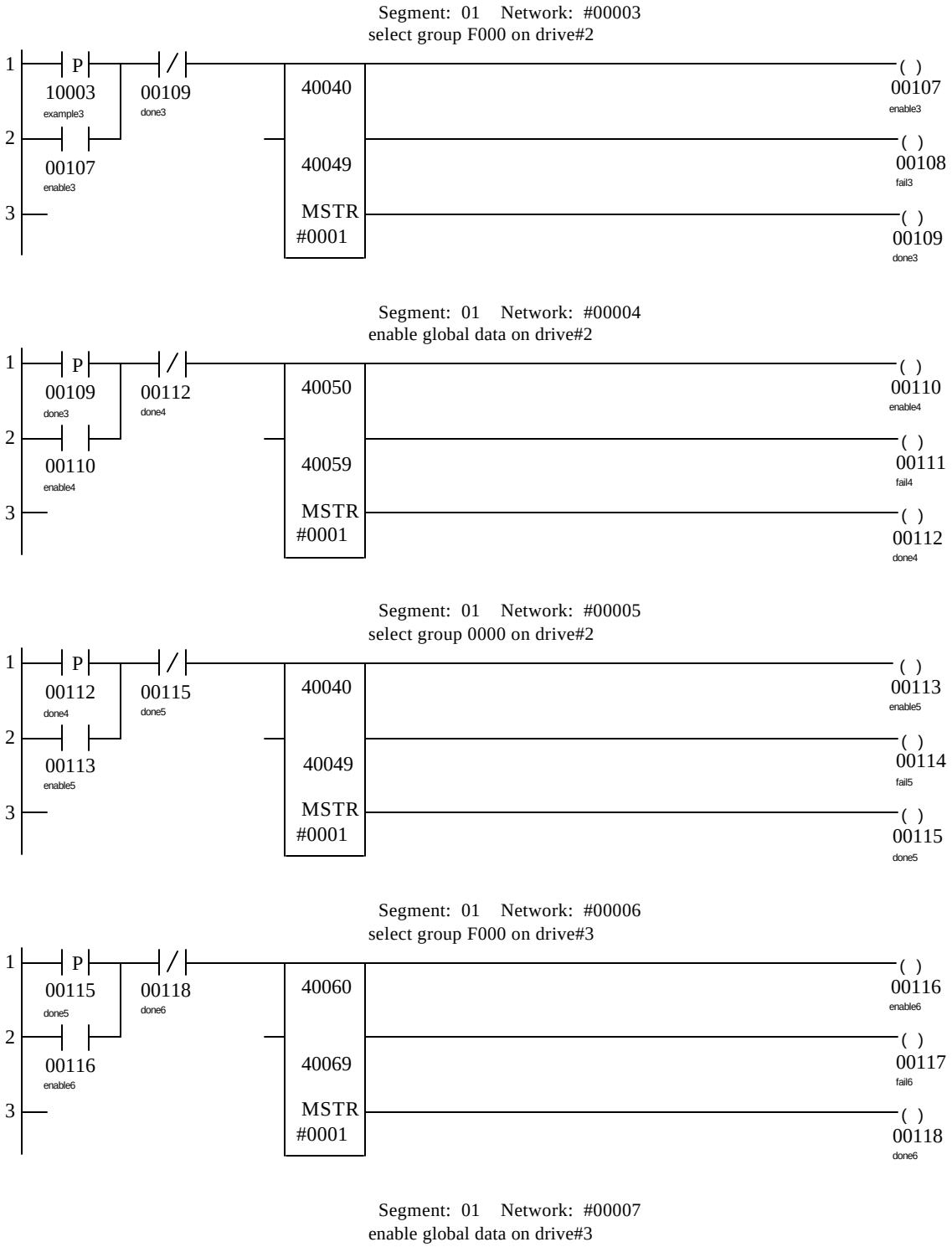
- Write to the Gatewayís Internal Registers at data codes F000h, F001h, and F002h

The data written to F000h will indicate which MB+ node will be sending global data to the Gateway. In this example, the Gateway will be accepting global data from the PLC which is addressed at MB+ node 1. The data written to Gateway Internal Registers F001h and F002h is used to indicate which drive registers will receive the global data.. The data code of the first global Satellite Drive Register must be written to F002h. The number of global registers must be written to F001h.

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

| | MSTR Transaction | Control Registers | Data Registers |
|---|---|---|---|
| 1 | Select the Satellite Internal Group on Satellite #2 | 40040 | 40049 |
| 2 | Write Satellite #2 global data enable | 40050 | 40059 |
| 3 | Select the Satellite Drive Group on Satellite #2 | 40040 | 40049 |
| 4 | Select the Satellite Internal Group on Satellite #3 | 40060 | 40069 |
| 5 | Write Satellite #3 global data enable | 40070 | 40079 |
| 6 | Select the Satellite Drive Group on Satellite #3 | 40060 | 40069 |
| 7 | Write Gateway Internal global data enable registers | 40080 | 40090 |

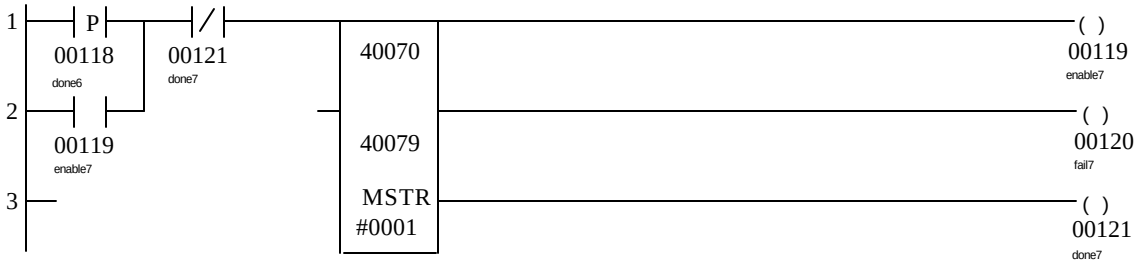
The MSTR functions inserted into the ladder logic would look like:



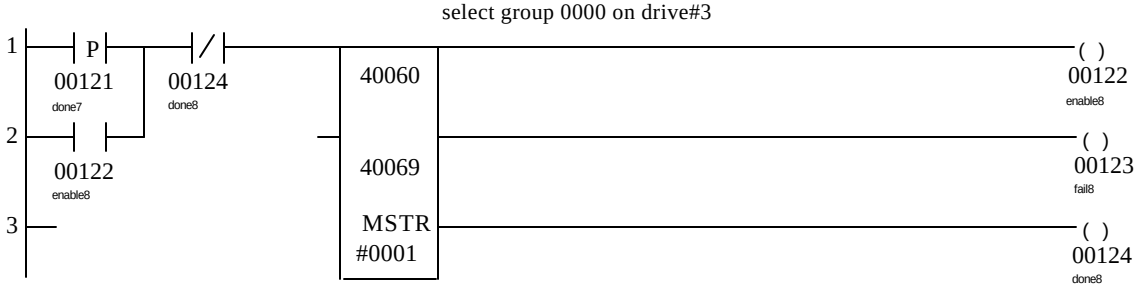

(Ladder logic contiinued on next page)

(Ladder logic continued from preceding page)

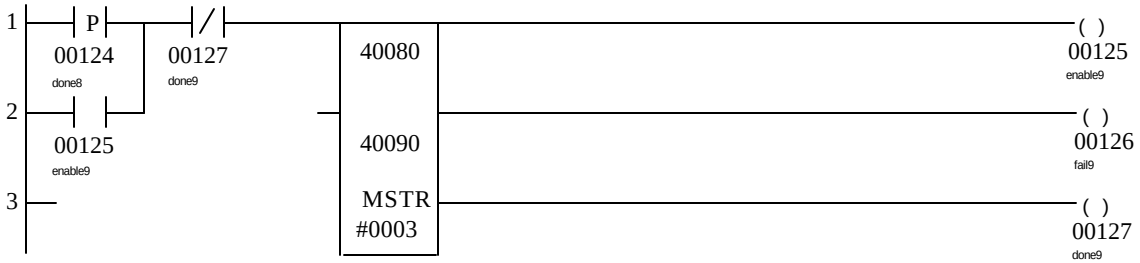
Segment: 01 Network: #00007
enable global data on drive#3




Segment: 01 Network: #00008
select group 0000 on drive#3




Segment: 01 Network: #00009
enable global data at gateway



## 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 selects the Satellite Internal Register Group on drive #2.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40040 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40041 | Network Error Code | 0000h | Zero the error code |
| 40042 | Number of Registers | 0001h | Write to 1 register |
| 40043 | Drive Address / Data Code | 0200h | 02XX = address of drive Satellite is 02h<br>XX00 = data code of Group Select register is 00h. |
| 40044 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40045 | Routing 2 | 0001h | End of routing path = 0001h (NCL 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 |
| 40049 | Group Select | F000h | F000h selects the Satellite Internal Register Group |

## 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 enables global data on drive #2.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40050 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40051 | Network Error Code | 0000h | Zero the error code |
| 40052 | Number of Registers | 0001h | Write to 1 register |
| 40053 | Drive Address / Data Code | 0201h | 02XX = address of drive Satellite is 02h<br>XX01 = data code of ëglobal enableí is 01h. |
| 40054 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40055 | Routing 2 | 0001h | End of routing path = 0001h (NCL requirement) |
| 40056 | Routing 3 | 0000h | This routing register is not used, must be set to 0 |
| 40057 | Routing 4 | 0000h | This routing register is not used, must be set to 0 |
| 40058 | Routing 5 | 0000h | This routing register is not used, must be set to 0 |

| DATA BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40059 | Internal: Global Enable | 0001h | To enable global data, set this register to ë1í<br>To disable global data, set this register to ë0í |

## 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 selects the Satellite Drive Register Group on drive #2.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40040 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40041 | Network Error Code | 0000h | Zero the error code |
| 40042 | Number of Registers | 0001h | Write to 1 register |
| 40043 | Drive Address / Data Code | 0200h | 02XX = address of drive Satellite is 02h<br>XX00 = data code of Group Select register is 00h. |
| 40044 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40045 | Routing 2 | 0001h | End of routing path = 0001h (NCL 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 |
| 40049 | Group Select | 0000h | 0000h selects the Satellite Drive Register Group |

## MSTR Transaction #4

The Control Block and Data Block registers for the fourth MSTR must be loaded with the following data before the MSTR block is executed. This MSTR changes to the Satellite Internal Register Group on drive #3.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40060 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40061 | Network Error Code | 0000h | Zero the error code |
| 40062 | Number of Registers | 0001h | Write to 1 register |
| 40063 | Drive Address / Data Code | 0300h | 03XX = address of drive Satellite is 03h<br>XX00 = data code of Group Select register is 00h. |
| 40064 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40065 | Routing 2 | 0001h | End of routing path = 0001h (NCL 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 |
| 40069 | Group Select | F000h | F000h selects the Satellite Internal Register Group |

## 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 enables global data on drive #3.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40070 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40071 | Network Error Code | 0000h | Zero the error code |
| 40072 | Number of Registers | 0001h | Write to 1 register |
| 40073 | Drive Address / Data Code | 0301h | 03XX = address of drive Satellite is 03h<br>XX01 = data code of ëglobal enableí register is 01h. |
| 40074 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40075 | Routing 2 | 0001h | End of routing path = 0001h (NCL requirement) |
| 40076 | Routing 3 | 0000h | This routing register is not used, must be set to 0 |
| 40077 | Routing 4 | 0000h | This routing register is not used, must be set to 0 |
| 40078 | Routing 5 | 0000h | This routing register is not used, must be set to 0 |

| DATA BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40079 | Internal: Global Enable | 0001h | To enable global data, set this register to ë1í<br>To disable global data, set this register to ë0í |

## MSTR Transaction #6

The Control Block and Data Block registers for the sixth MSTR must be loaded with the following data before the MSTR block is executed. This MSTR selects the Satellite Drive Register Group on drive #3.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40060 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40061 | Network Error Code | 0000h | Zero the error code |
| 40062 | Number of Registers | 0001h | Write to 1 register |
| 40063 | Drive Address / Data Code | 0300h | 03XX = address of drive Satellite is 03h<br>XX00 = data code of Group Select register is 00h. |
| 40064 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40065 | Routing 2 | 0001h | End of routing path = 0001h (NCL 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 |
| 40069 | Group Select | 0000h | 0000h selects the Satellite Drive Register Group |

## MSTR Transaction #7

The Control Block and Data Block registers for the seventh MSTR must be loaded with the following data before the MSTR block is executed. This MSTR enables global data at the Gateway by writing to the Gateway internal registers.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40080 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40081 | Network Error Code | 0000h | Zero the error code |
| 40082 | Number of Registers | 0003h | Write to 3 consecutive registers |
| 40083 | Drive Address / Data Code | F000h | Data code of Gateway Internal register. This internal register is the ëglobal master MB+ node numberí. |
| 40084 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40085 | Routing 2 | 0001h | End of routing path = 0001h (NCL requirement) |
| 40086 | Routing 3 | 0000h | This routing register is not used, must be set to 0 |
| 40087 | Routing 4 | 0000h | This routing register is not used, must be set to 0 |
| 40088 | Routing 5 | 0000h | This routing register is not used, must be set to 0 |

| DATA BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40090 | Global Master Node Number | 0001h | The MB+ node address of the PLC is 1<br>NOTE: To disable global data at the Gateway, write a value of 0000h to Gateway Internal Register F000h |
| 40091 | Global Number of Registers | 0002h | This example will write to 2 global registers |
| 40092 | Global Starting Register | 0001h | The 2 global data registers will start at data code 00h. The 2 global data registers are :<br>01h --- Operations Signals<br>02h --- Frequency Reference |

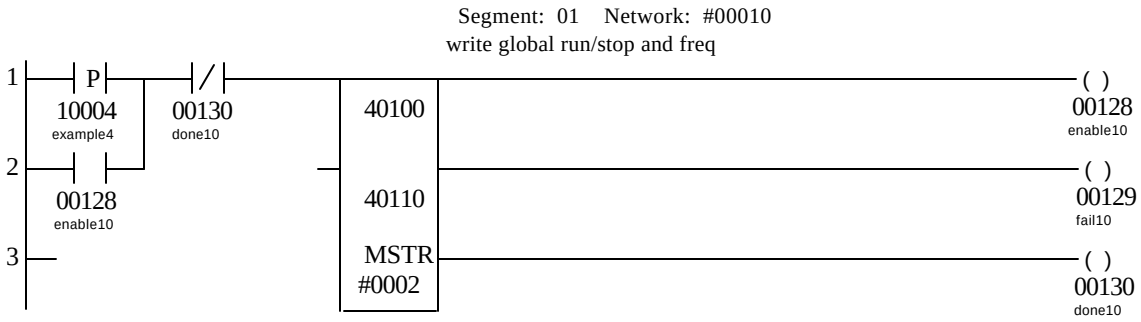
# Example #4
## Write Global RUN/STOP and Frequency Reference

This example will show how to write a global RUN REVERSE command and a 34.56 Hz frequency reference to all drives on the NCL network. This example assumes that the drive has been configured to accept Operation Signals and Frequency Reference from the NCL Network (Satellite Drive Registers 01h and 02h respectively).

| NOTE |
|---|
| For this operation to be valid, the Gateway module and Satellite boards must be initialized to receive global data. Example #3 in this chapter discusses enabling global data. |

In this example, an input to the PLC will be used to initiate the MSTR that will write the Global ëOperation Commandí and ëFrequency Referenceí. This input will be addressed at 10004.

In this example, the MSTR control registers will start at register 40100. The MSTR data registers will start at register 40110. There will be 2 MSTR data registers. The MSTR function inserted into the ladder logic would look like:




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

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40100 | Operation Code | 0005h | 0005h = Global Write |
| 40101 | Network Error Code | 0000h | Zero the error code |
| 40102 | Number of Registers | 0002h | Write to 2 consecutive registers |
| 40103 | Drive Address / Data Code | XXXX | This register is not used when writing global data |
| 40104 | Routing 1 | XXXX | This register is not used when writing global data |
| 40105 | Routing 2 | XXXX | This register is not used when writing global data |
| 40106 | Routing 3 | XXXX | This register is not used when writing global data |
| 40107 | Routing 4 | XXXX | This register is not used when writing global data |
| 40108 | 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 |
| 40110 | Operation Signals | 0003h | Run Reverse = bit0/on, bit 1/on = 0003h |
| 40111 | Freq. Reference | 0D80h | 34.56 Hz = 3456 (decimal) = 0D80h |

# Example #5
## Write Acceleration and Deceleration (no-09 and no-10) to Drive #1

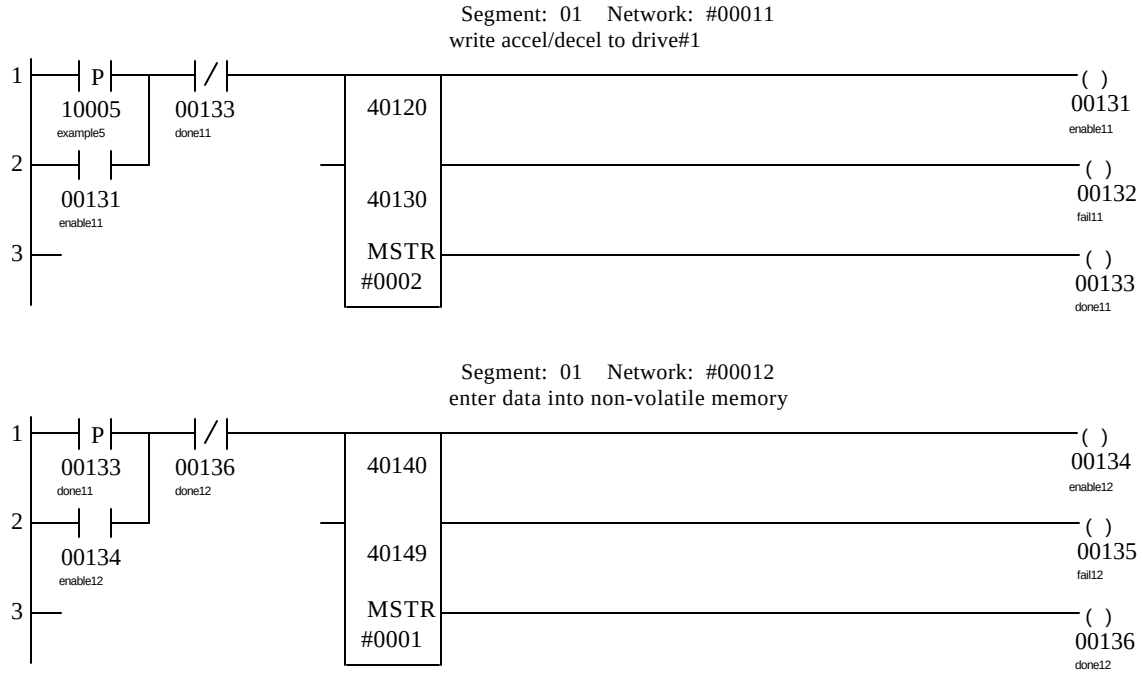
This example will show how to write acceleration and deceleration times to a drive on the NCL network. After writing the new acceleration and deceleration times, the new data will be stored in Non-Volatile memory with the ENTER command.

In this example, an input to the PLC will be used to initiate the MSTRs that will write the acceleration and deceleration times (no-09 and no-10). 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 | 40120 | 40130 |
| 2 | Write the ENTER command | 40140 | 40149 |

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 and the Deceleration Time 1 register to drive #1.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40120 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40121 | Network Error Code | 0000h | Zero the error code |
| 40122 | Number of Registers | 0002h | Write to 2 consecutive registers |
| 40123 | Drive Address / Data Code | 0139h | 01XX = address of drive Satellite is 01h<br>XX39 = data code of accel register is 39h. |
| 40124 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40125 | Routing 2 | 0001h | End of routing path = 0001h (NCL 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 |

| DATA BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40130 | Acceleration Time 1 | 000Ah | 1.0 sec = 10 (decimal) = 000Ah |
| 40131 | 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 drive #1.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40140 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40141 | Network Error Code | 0000h | Zero the error code |
| 40142 | Number of Registers | 0001h | Write to 1 register |
| 40143 | Drive Address / Data Code | 0100h | 01XX = address of drive Satellite is 01h<br>XX00 = data code of ENTER register is 00h. |
| 40144 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40145 | Routing 2 | 0001h | End of routing path = 0001h (NCL 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 |

| DATA BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40149 | ENTER data into Non-Volatile memory | 0000h | To ENTER data into Non-Volatile memory, set this register to ë0í |

# 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 02h in the Satellite Internal Register Group. The value of the multiplier can range from 0.001 to 9.999. Each Satellite that receives a global frequency reference will multiply the value received by the value in Satellite Internal Register 02h.

| NOTE |
| --- |
| For this operation to be valid, the Gateway module and Satellite boards must be initialized to receive global data. Example #3 in this chapter discusses enabling global data. |

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

To write the global frequency reference multiplier, the following MSTR transactions should be performed:

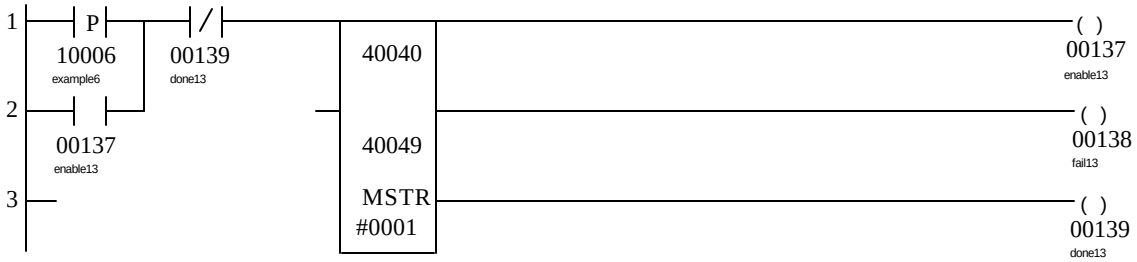
- Select the Satellite Internal Register Group by writing F000h to data code 00h
- Change the multiplier by writing to Satellite Internal Register 02h
- Select the Satellite Drive Register Group by writing 0000h to data code 00h

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

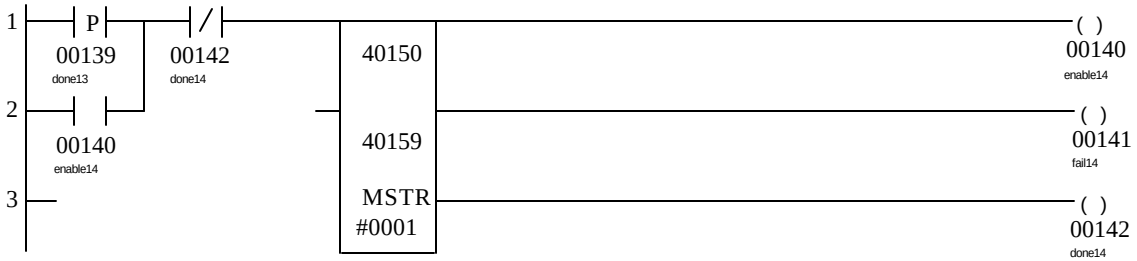
| | MSTR Transaction | Control Registers | Data Registers |
| --- | --- | --- | --- |
| 1 | Select the Satellite Internal Register Group on Satellite #2 | 40040 | 40049 |
| 2 | Write to global reference multiplier register on Satellite #2 | 40150 | 40159 |
| 3 | Select the Satellite Drive Register Group on Satellite #2 | 40040 | 40049 |

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

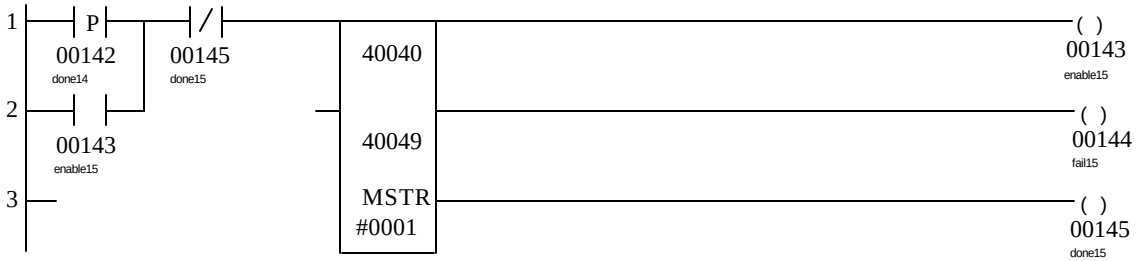
Segment: 01 Network: #00013
select group F000 on drive#2




Segment: 01 Network: #00014
write global ref. mult. drive#2




Segment: 01 Network: #00015
select group 0000 on drive#2



## 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 selects the Satellite Internal Register Group on drive #2.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40040 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40041 | Network Error Code | 0000h | Zero the error code |
| 40042 | Number of Registers | 0001h | Write to 1 register |
| 40043 | Drive Address / Data Code | 0200h | 02XX = address of drive Satellite is 02h<br>XX00 = data code of Group Select register is 00h. |
| 40044 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40045 | Routing 2 | 0001h | End of routing path = 0001h (NCL 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 |
| 40049 | Group Select | F000h | F000h selects the Satellite Internal Register Group |

## 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 the reference multiplier to drive #2.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40150 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40151 | Network Error Code | 0000h | Zero the error code |
| 40152 | Number of Registers | 0001h | Write to 1 register |
| 40153 | Drive Address / Data Code | 0202h | 02XX = address of drive Satellite is 02h<br>XX02 = data code of reference multiplier is 02h. |
| 40154 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40155 | Routing 2 | 0001h | End of routing path = 0001h (NCL requirement) |
| 40016 | Routing 3 | 0000h | This routing register is not used, must be set to 0 |
| 40157 | Routing 4 | 0000h | This routing register is not used, must be set to 0 |
| 40158 | Routing 5 | 0000h | This routing register is not used, must be set to 0 |

| DATA BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40159 | Global Frequency Reference Multiplier | 01F4h | 0.500 = 500 (decimal) = 01F4h |

## 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 selects the Satellite Drive Register Group on drive #2.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40040 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40041 | Network Error Code | 0000h | Zero the error code |
| 40042 | Number of Registers | 0001h | Write to 1 register |
| 40043 | Drive Address / Data Code | 0200h | 02XX = address of drive Satellite is 02h<br>XX00 = data code of Group Select register is 00h. |
| 40044 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40045 | Routing 2 | 0001h | End of routing path = 0001h (NCL 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 |
| 40049 | Group Select | 0000h | 0000h selects the Satellite Drive Register Group |

# Example #7
## Read all Drive Constants (no-00 through no-51) from Drive #3

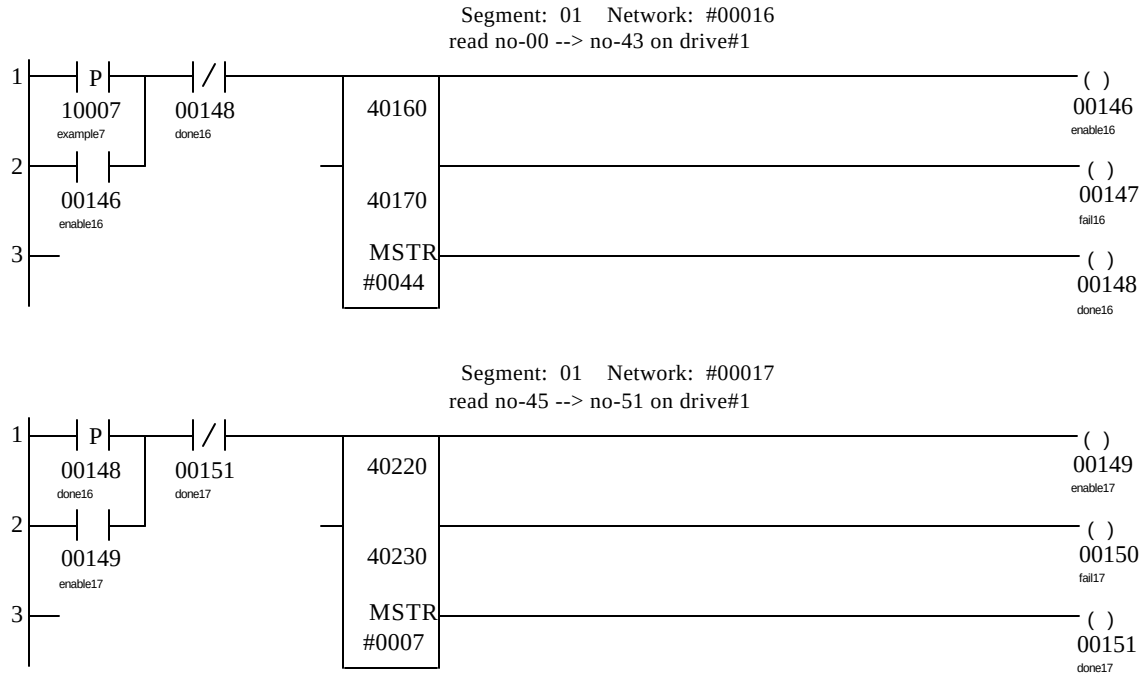
This example will read all of the drive constants (no-00 through no-51) from drive #3. In this example, an input to the PLC will be used to initiate the MSTRs that will read the drive constants. This input will be addressed at 10007.

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

| | MSTR Transaction | Control Registers | Data Registers |
|---|---|---|---|
| 1 | Read no-00 through no-43 | 40160 | 40170 |
| 2 | Read no-45 through no-51 | 40220 | 40230 |

The reason that two MSTR transactions are required to read all of the drive constants, is that drive constant no-44 is an undefined constant. If an attempt is made to read any undefined drive, internal, or diagnostic register the MSTR function will return an error.

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 no-00 through no-43.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40160 | Operation Code | 0002h | 0002h = Read from Multiple Registers |
| 40161 | Network Error Code | 0000h | Zero the error code |
| 40162 | Number of Registers | 002Ch | Read from 44 (= 2Ch) registers |
| 40163 | Drive Address / Data Code | 0330h | 03XX = address of drive Satellite is 03h<br>XX30 = data code of drive constant no-00 is 30h. |
| 40164 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40165 | Routing 2 | 0001h | End of routing path = 0001h (NCL requirement) |
| 40166 | Routing 3 | 0000h | This routing register is not used, must be set to 0 |
| 40167 | Routing 4 | 0000h | This routing register is not used, must be set to 0 |
| 40168 | 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 |
| 40170 | Initialization / Access Limits | READ | Which drive registers can be read / set |
| 40171 | Operation Signal Select | READ | Origin of RUN/STOP and Freq. Ref. |
| ⇓ | ⇓ | ⇓ | ⇓ |
| 40212 | Overtorque Detection Time | READ | 10.0 sec = 100 (decimal) = 0064h |
| 40213 | Carrier Frequency | READ | 1 - 6 ( x 2.5 kHz ) |

## 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 no-45 through no-51.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40220 | Operation Code | 0002h | 0002h = Read from Multiple Registers |
| 40221 | Network Error Code | 0000h | Zero the error code |
| 40222 | Number of Registers | 0007h | Read from 7 registers |
| 40223 | Drive Address / Data Code | 035Dh | 03XX = address of drive Satellite is 03h<br>XX5D = data code of drive constant no-45 is 5Dh. |
| 40224 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40225 | Routing 2 | 0001h | End of routing path = 0001h (NCL 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 |

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 |
| 40230 | Analog Monitor Gain | READ | 2.00 gain = 200 (decimal) = 00C8h |
| 40231 | Power Loss Function | READ | Enable/Disable Power Loss Ride-Thru |
| ⇓ | ⇓ | ⇓ | ⇓ |
| 40235 | Prohibited Frequency | READ | 400.0 Hz = 4000 (decimal) = 0FA0h |
| 40236 | Prohibited Freq. Deadband | READ | 25.5 Hz = 255(decimal) = 00FFh |

# Example #8
## Write all Drive Constants (no-00 through no-51) to Drive #3

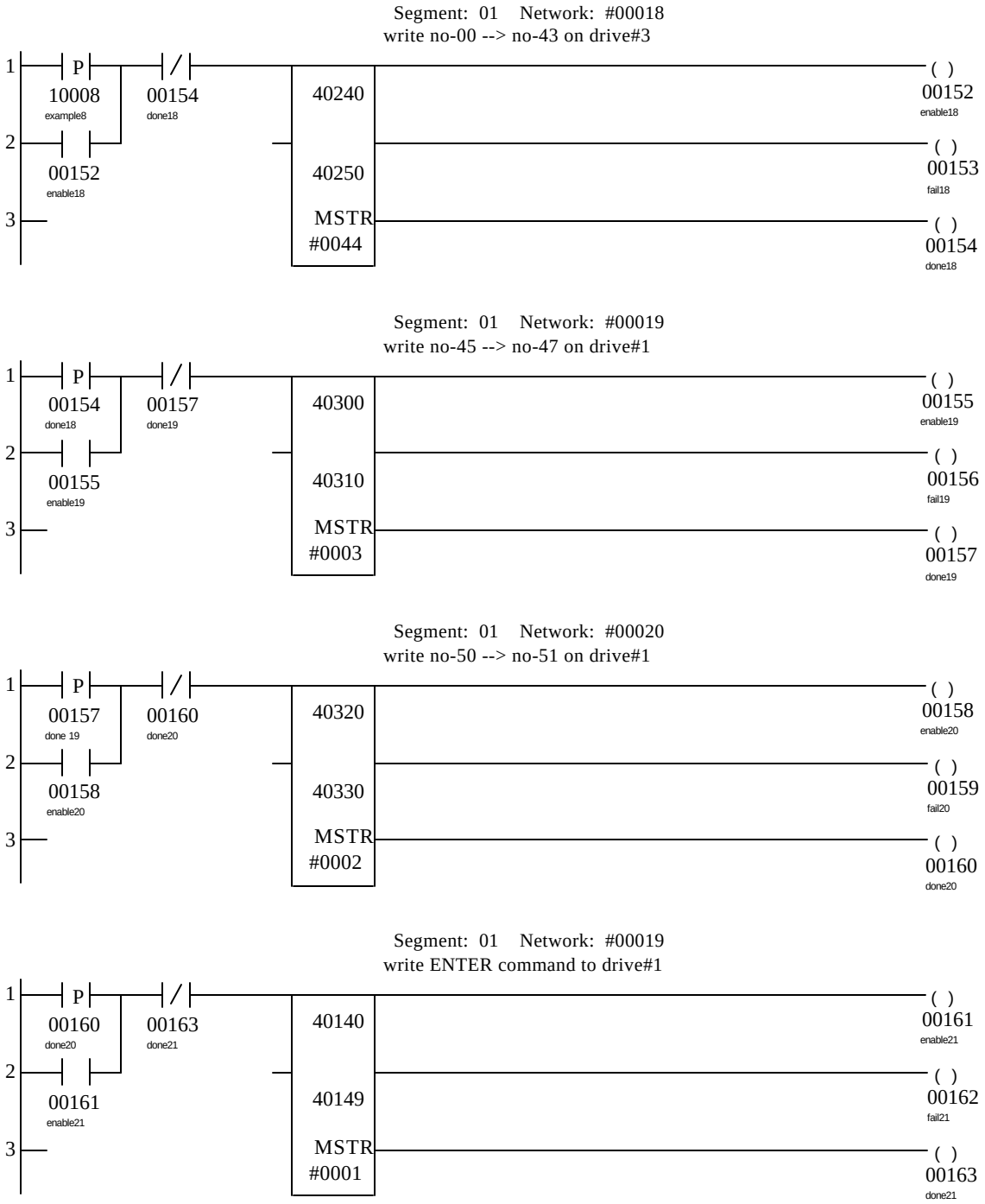
This example will write all of the drive constants (no-00 through no-51) to drive #3. After writing the drive constants, the new data will be stored in Non-Volatile memory with the ENTER command. In this example, an input to the PLC will be used to initiate the MSTRs that will write the drive constants. This input will be addressed at 10008.

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

| | MSTR Transaction | Control Registers | Data Registers |
|---|---|---|---|
| 1 | Write no-00 through no-43 | 40240 | 40250 |
| 2 | Write no-45 through no-47 | 40300 | 40310 |
| 3 | Write no-50 through no-51 | 40320 | 40330 |
| 4 | Write the ENTER command | 40140 | 40149 |

The reason that three MSTR transactions are required to write all of the drive constants, is that drive constant no-44 is an undefined constant and drive constants no-48 and no-49 are read-only. If an attempt is made to write to any undefined or read-only register the MSTR function will return an error. The fourth MSTR transaction transfers the data into Non-Volatile memory.

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 no-00 through no-43.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40240 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40241 | Network Error Code | 0000h | Zero the error code |
| 40242 | Number of Registers | 002Ch | Write to 44 (= 2Ch) registers |
| 40243 | Drive Address / Data Code | 0330h | 03XX = address of drive Satellite is 03h<br>XX30 = data code of drive constant no-00 is 30h. |
| 40244 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40245 | Routing 2 | 0001h | End of routing path = 0001h (NCL 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 | Initialization / Access limits | WRITE | Which drive registers can be read / set |
| 40251 | Operation Signal Select | WRITE | Origin of RUN/STOP and Freq. Ref. |
| ⇓ | ⇓ | ⇓ | ⇓ |
| 40292 | Overtorque Detection Time | WRITE | 10.0 sec = 100 (decimal) = 0064h |
| 40293 | Carrier Frequency | WRITE | 1 - 6 ( x 2.5 kHz ) |

## 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 no-45 through no-47.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40300 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40301 | Network Error Code | 0000h | Zero the error code |
| 40302 | Number of Registers | 0003h | Write to 3 registers |
| 40303 | Drive Address / Data Code | 035Dh | 03XX = address of drive Satellite is 03h<br>XX5D = data code of drive constant no-45 is 5Dh. |
| 40304 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40305 | Routing 2 | 0001h | End of routing path = 0001h (NCL requirement) |
| 40306 | Routing 3 | 0000h | This routing register is not used, must be set to 0 |
| 40307 | Routing 4 | 0000h | This routing register is not used, must be set to 0 |
| 40308 | Routing 5 | 0000h | This routing register is not used, must be set to 0 |

| DATA BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40310 | Analog Monitor Gain | WRITE | 2.00 gain = 200 (decimal) = 00C8h |
| 40311 | Power Loss Function Select | WRITE | Enable/Disable Power Loss Ride-Thru |
| 40312 | # of Auto Restart Attempts | WRITE | Number of Auto Restart Attempts (1-10) |

## 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 no-50 through no-51.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40320 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40321 | Network Error Code | 0000h | Zero the error code |
| 40322 | Number of Registers | 0002h | Write to 2 registers |
| 40323 | Drive Address / Data Code | 0362h | 03XX = address of drive Satellite is 03h<br>XX62 = data code of drive constant no-50 is 62h. |
| 40324 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40325 | Routing 2 | 0001h | End of routing path = 0001h (NCL requirement) |
| 40326 | Routing 3 | 0000h | This routing register is not used, must be set to 0 |
| 40327 | Routing 4 | 0000h | This routing register is not used, must be set to 0 |
| 40328 | Routing 5 | 0000h | This routing register is not used, must be set to 0 |

| DATA BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40330 | Prohibited Frequency | WRITE | 400.0 Hz = 4000 (decimal) = 0FA0h |
| 40331 | Prohibited Freq. Deadband | WRITE | 25.5 Hz = 255(decimal) = 00FFh |

## MSTR Transaction #4

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

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40140 | Operation Code | 0001h | 0001h = Write to Multiple Registers |
| 40141 | Network Error Code | 0000h | Zero the error code |
| 40142 | Number of Registers | 0001h | Write to 1 register |
| 40143 | Drive Address / Data Code | 0300h | 03XX = address of drive Satellite is 03h<br>XX00 = data code of ENTER register is 00h. |
| 40144 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40145 | Routing 2 | 0001h | End of routing path = 0001h (NCL 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 |

| DATA BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40149 | ENTER data into Non-Volatile memory | 0000h | To ENTER data into Non-Volatile memory, set this register to ë0í |

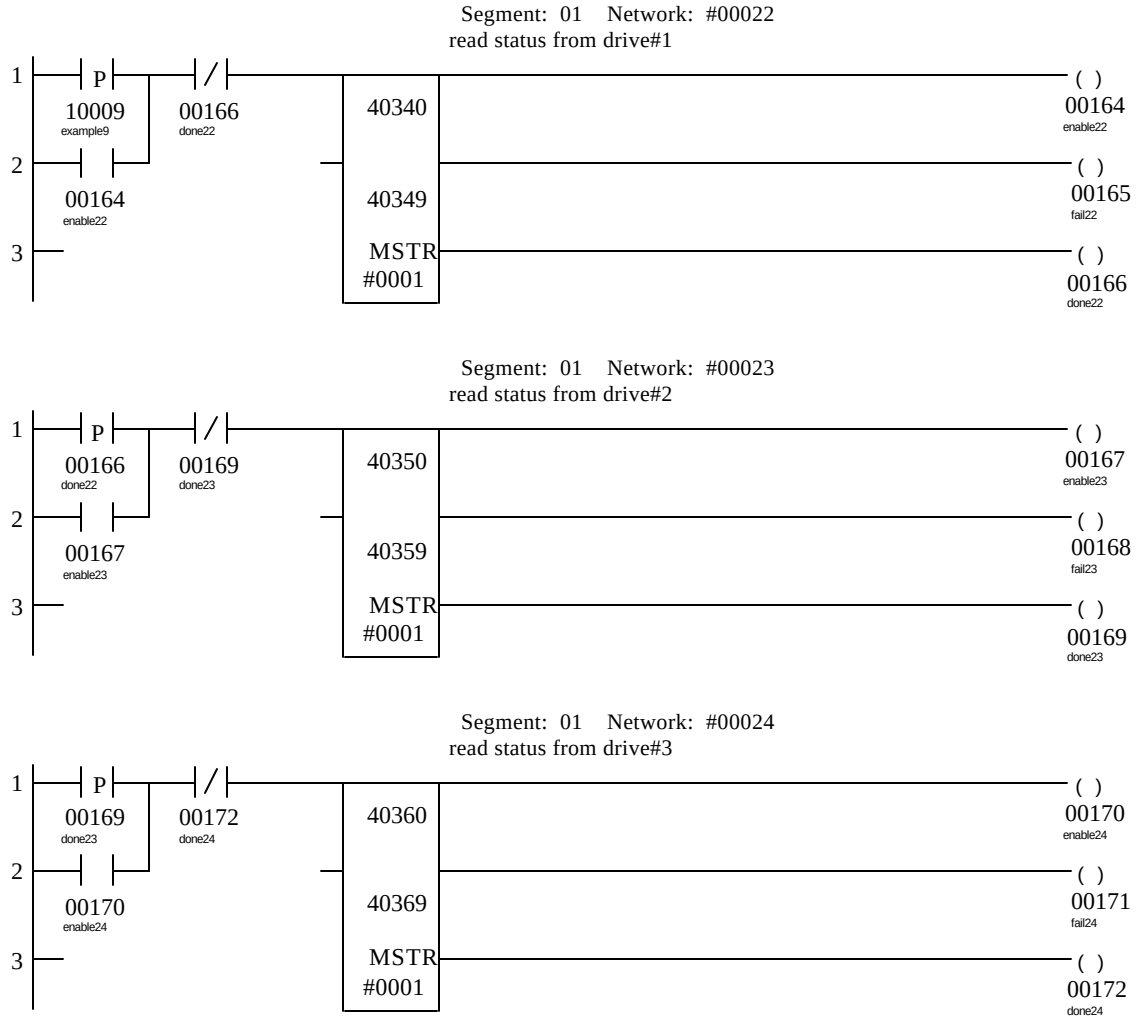
# Example #9
## Read the Drive Status register from Drive #1, #2, and #3

This example will read the drive status register from all of the GPD333s. 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.

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

| | MSTR Transaction | Control Registers | Data Registers |
|---|---|---|---|
| 1 | Read drive status from drive #1 | 40340 | 40349 |
| 2 | Read drive status from drive #2 | 40350 | 40359 |
| 3 | Read drive status from drive #3 | 40360 | 40369 |

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



## MSTR Transaction #1

In this example, the MSTR blocks are executed sequentially. The Control Block registers for the first MSTR must be loaded with the following data before the MSTR block is executed. This MSTR reads drive status from drive #1.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40340 | Operation Code | 0002h | 0002h = Read from Multiple Registers |
| 40341 | Network Error Code | 0000h | Zero the error code |
| 40342 | Number of Registers | 0001h | Read from 1 register |
| 40343 | Drive Address / Data Code | 0105h | 01XX = address of drive Satellite is 01h<br>XX05 = data code of drive status register is 05h |
| 40344 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40345 | Routing 2 | 0001h | End of routing path = 0001h (NCL requirement) |
| 40346 | Routing 3 | 0000h | This routing register is not used, must be set to 0 |
| 40347 | Routing 4 | 0000h | This routing register is not used, must be set to 0 |
| 40348 | 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 |
| 40349 | Drive Status | READ | RUN/STOP, FWD/REV, Fault Status of Drive #1 |

## 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 #2.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40350 | Operation Code | 0002h | 0002h = Read from Multiple Registers |
| 40351 | Network Error Code | 0000h | Zero the error code |
| 40352 | Number of Registers | 0001h | Read from 1 register |
| 40353 | Drive Address / Data Code | 0205h | 02XX = address of drive Satellite is 02h<br>XX05 = data code of drive status register is 05h |
| 40354 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40355 | Routing 2 | 0001h | End of routing path = 0001h (NCL requirement) |
| 40356 | Routing 3 | 0000h | This routing register is not used, must be set to 0 |
| 40357 | Routing 4 | 0000h | This routing register is not used, must be set to 0 |
| 40358 | 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 |
| 40359 | Drive Status | READ | RUN/STOP, FWD/REV, Fault Status of Drive #2 |

## 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 #3.

| CONTROL BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40360 | Operation Code | 0002h | 0002h = Read from Multiple Registers |
| 40361 | Network Error Code | 0000h | Zero the error code |
| 40362 | Number of Registers | 0001h | Read from 1 register |
| 40363 | Drive Address / Data Code | 0305h | 03XX = address of drive Satellite is 03h<br>XX05 = data code of drive status register is 05h |
| 40364 | Routing 1 | 0004h | MB+ node address of Gateway module = 0004h |
| 40365 | Routing 2 | 0001h | End of routing path = 0001h (NCL requirement) |
| 40366 | Routing 3 | 0000h | This routing register is not used, must be set to 0 |
| 40367 | Routing 4 | 0000h | This routing register is not used, must be set to 0 |
| 40368 | Routing 5 | 0000h | This routing register is not used, must be set to 0 |

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

| DATA BLOCK | | | |
|---|---|---|---|
| Register Number | Register Description | Register Data | Data Description |
| 40369 | Drive Status | READ | RUN/STOP, FWD/REV, Fault Status of Drive #3 |

# Chapter 10
# Diagnostics and Troubleshooting

- Gateway LEDs
- Satellite LED
- MB+ MSTR Error Codes

# Gateway LEDs

The Gateway module has four LEDs. The activity of these LEDs is explained in the following tables.

| POWER | | | |
|---|---|---|---|
| Blink Pattern | | Timing | Status |
| Green | Solid | - | 24 VDC power is applied to the Gateway module |

| HEALTH | | | | |
|---|---|---|---|---|
| Blink Pattern | | Timing | | Status |
| Green | Continuous Slow Blinks | ON<br>OFF | 640 msec<br>640 msec | The Gateway module is executing a power-up sequence |
| Green | Continuous Moderate Blinks | ON<br>OFF | 320 msec<br>640 msec | The Gateway module is in normal operating mode.<br>No MB+ transactions are currently being processed. |
| Green | Continuous Fast Blinks | ON<br>OFF | 160 msec<br>320 msec | A ëcable lossí situation has occurred. All drives are commanded to stop. Power cycle is required to reset this condition. (ëCable lossí must be enabled for this situation to occur - See chapter 2) |
| Green | Two Blinks | ON<br>OFF | 160 msec<br>160 msec | The Gateway module is in normal operating mode.<br>A MB+ transaction is currently being processed. |
| Red | One Blink | ON<br>OFF | 160 msec<br>1120 msec | An error response was received from a Satellite subnode. |
| Red | Two Blinks | ON<br>OFF | 160 msec<br>320 msec | A time-out error has occurred while the Gateway was waiting for a response from a Satellite board. |
| Red | Three Blinks | ON<br>OFF | 160 msec<br>320 msec | A CAN transmission error has occurred. |
| Red | Solid | - | | Invalid Gateway switch setting |

| COMM | | | | |
|---|---|---|---|---|
| Blink Pattern | | Timing | | Status |
| Off | | - | | No activity is present on the NCL CAN data bus |
| Green | One Blink | ON | 160 msec | Activity is present on the NCL CAN data bus |
| Red | Continuous Fast Blinks | ON<br>OFF | 160 msec<br>320 msec | A ëcable lossí situation has occurred. All drives are commanded to stop. Power cycle is required to reset this condition. (ëCable lossí must be enabled for this situation to occur - See chapter 2) |

| STATUS | | | | |
|---|---|---|---|---|
| Blink Pattern | | Timing | | Status |
| Green | ContinuousSlow Blinks | ON<br>OFF | 340 msec<br>640 msec | This MB+ node is monitoring the MB+ link. It must monitor the MB+ link (offline) for 5 seconds. During this time it monitors all other active nodes on the link and builds the active station table. |
| Green | ContinuousRapid Blinks | ON<br>OFF | 80 msec<br>80 msec | This MB+ node is operating normally. It is successfully receiving and passing the token. |
| Green | Two Rapid Blinks | ON<br>OFF | 160 msec<br>160 msec | This MB+ node is permanently in the idle state. It is monitoring other nodes on the MB+ link pass the token, but the token is never passed to this node. This node may have a bad transmitter. |
| Green | Three Rapid Blinks | ON<br>OFF | 160 msec<br>160 msec | This MB+ node is not finding any other nodes on the MB+ link. It is claiming and winning the token, but has no other node to pass it to. This node can periodically disrupt communication on the link. This condition can indicates a problem with the communication wiring. |
| Green | Four Rapid Blinks | ON<br>OFF | 160 msec<br>160 msec | This MB+ node has found another node on the MB+ link which has an identical node address. This node will remain offline, monitoring the MB+ link until the duplicate node is not heard from for 5 seconds |

## Satellite LED

The Satellite board has one LED. The activity of this LED is explained in the following table.

| NETWORK STATUS | | | | |
|---|---|---|---|---|
| Blink Pattern | | Timing | | Status |
| Green | Continuous Slow Blinks | ON<br>OFF | 640 msec<br>640 msec | The Satellite board is executing a power-up sequence |
| Green | Continuous Moderate Blinks | ON<br>OFF | 320 msec<br>960 msec | The Satellite board is in normal operating mode.<br>No NCL transactions are currently being processed. |
| Green | Three Fast Blinks | ON<br>OFF | 160 msec<br>160 msec | The Satellite board is in normal operating mode.<br>A valid NCL transaction is currently being processed. |
| Red | One Blink | ON<br>OFF | 160 msec<br>1120 msec | An invalid data code has been received by the satellite |
| Red | Two Blinks | ON<br>OFF | 160 msec<br>320 msec | A time-out error has occurred while the satellite was waiting for a response from the drive. |
| Red | Three Blinks | ON<br>OFF | 160 msec<br>320 msec | A CAN transmission error has occurred. |
| Red | Solid | - | | Invalid Satellite switch setting |

# MSTR Function Error Codes

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

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

A list of error codes appears in the following table.

| Error Code (Hex) | Definition | |
|---|---|---|
| 1001 | User-initiated abort | |
| 2001 | Invalid operation type | |
| 2002 | User parameter changed | |
| 2003 | Invalid length | |
| 2004 | Invalid offset | |
| 2005 | Invalid length + offset | |
| 2006 | Invalid slave device data area | |
| 2007 | Invalid slave device network area | |
| 2008 | Invalid slave device network routing | |
| 2009 | Route equal to your own address | |
| 200A | Attempting to obtain more global data words than available | |
| 30ss | Modbus slave exception response | |
| | ss | DEFINITION |
| | 01 | Slave device does not support the requested operation |
| | 02 | Nonexistent slave device registers requested OR satellite did not respond |
| | 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 |
| | 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 |

# Appendix A
# Data Codes

- Satellite Drive Registers
- Satellite Internal Registers
- Satellite Diagnostic Registers
- Gateway Internal Registers
- Gateway Diagnostic Registers

# Satellite Drive Register Data Codes

| DATA CODE | FUNCTION | BIT NO. | DATA SET | DESCRIPTION |
|---|---|---|---|---|
| 00 | NCL Satellite Memory Group | | 0000 | Drive Registers Group / NVRAM ENTER |
| | | | F000 | Satellite Internal Registers Group |
| | | | F100 | Satellite Diagnostic Registers Group |
| 01 | Operational Signals | 0 | 0 | Stop |
| | | | 1 | Run |
| | | 1 | 0 | Forward Run |
| | | | 1 | Reverse Run |
| | | 2 | 1 | Multi-Function Input 1 is selected |
| | | 3 | 1 | Multi-Function Input 2 is selected |
| | | 4 | 1 | Multi-Function Input 3 is selected |
| | | 5 | 1 | Fault Reset |
| | | 6 | 1 | Not Used |
| | | 7 | 1 | Not Used |
| 02 | Frequency Reference / Output Frequency | | | 0.00 - 400.00 (Hz)<br>Writing to this register will provide a frequency reference to the drive.<br>Reading from this register will return the actual output frequency to the PLC. |
| 03 | Not Supported | | | |
| 04 | Not Supported | | | |
| 05 | Status ( Read Only ) | 0 | 1 | Drive Running |
| | | 1 | 1 | Reverse Running |
| | | 2 | 1 | Inverter Operation is Ready |
| | | 3 | 1 | Fault Occurring |
| | | 4 | 1 | Not Used |
| | | 5 | 1 | Multi-Function Output 1 is closed |
| | | 6 | 1 | Multi-Function Output 2 is closed |
| | | 7 | 1 | Multi-Function Output 3 is closed |

Satellite Drive Register Data Codes (continued)

| DATA CODE | FUNCTION | BIT NO. | DATA SET | DESCRIPTION |
|---|---|---|---|---|
| 06 | Fault Status 1 ( Read Only ) | 0 | 1 | UV1 - Undervoltage |
| | | 1 | 1 | OV - Overcurrent |
| | | 2 | 1 | GF - Ground fault |
| | | 3 | 1 | OV - Overvoltage |
| | | 4 | 1 | OH - Heatsink Overheat |
| | | 5 | 1 | OL1 - Electronic Thermal Overload detected |
| | | 6 | 1 | OL2 - E.T.O.L. Operated at 150% for 1 min. |
| | | 7 | 1 | OL3 - Overtorque Detection |
| 07 | Fault Status 2 ( Read Only ) | 0 | 1 | EF3 - External Fault at terminal 3 |
| | | 1 | 1 | EF4 - External Fault at terminal 4 |
| | | 2 | 1 | EF5 - External Fault at terminal 5 |
| 08 | Frequency Reference / Output Frequency | | | 0.00 - 400.00 (Hz)<br>Writing to this register will provide a frequency reference to the drive.<br>Reading from this register will return the actual output frequency to the PLC. |
| 09 | Not Supported | | | |
| 0A | Not Supported | | | |
| 0B | Output Current | | | 1000 = 100% of rated output current |
| 0C | Not Supported | | | |
| 0D | Not Supported | | | |
| 0E | Main Speed Reference Input<br>(A/D Converted Value) | | | 0 - 2048 = 0.0 - 10.0 volts at terminal 8<br>0 - 2048 = 4 mAmps - 20 mAmps at terminal 9 |
| 0F | Not Supported | | | |
| 10 | Sequence Input Signal Status ( Read only ) | 0 | 1 | Terminal 1 |
| | | 1 | 1 | Terminal 2 |
| | 1= Closed, 0= Open | 2 | 1 | Terminal 3 |
| | | 3 | 1 | Terminal 4 |
| | | 4 | 1 | Terminal 5 |
| | | 5 - 7 | N/A | Not Used |

Satellite Drive Register Data Codes (continued)

| DATA CODE | FUNCTION | BIT NO. | DATA SET | DESCRIPTION |
|---|---|---|---|---|
| 11 | Alarm Status ( Read only ) | 0 | 1 | UV - Undervoltage |
| | | 1 | 1 | OV - Overvoltage |
| | | 2 | 1 | OH - Thermistor exceeded rating |
| | | 3 | 1 | BB - Baseblock |
| | | 4 | 1 | EF - External Fault |
| | | 5 - 7 | N/A | Not Used |
| 12 | CPF Contents ( Read only ) | 0 | N/A | Not Used |
| | | 1 | N/A | Not Used |
| | | 2 | N/A | Not Used |
| | | 3 | N/A | Not Used |
| | | 4 | 1 | CPF04 ( Constant fault ) |
| | | 5 | 1 | CPF05 ( A/D converter fault ) |
| | | 6 | 1 | CPF06 ( Option fault ) |
| | | 7 | N/A | Not Used |
| 1F | Operational Command 1 | 0 | Frequency Reference Origin - see Chapter 8 for details | |
| | | 1 | Operation Signal Origin - see Chapter 8 for details | |
| | | 2 | N/A | Not Used |
| | | 3 | N/A | Not Used |
| | | 4 | N/A | Do Not Use with NCL [Write - in to EEPROM] |
| | | 5 | N/A | Not Used |
| | | 6 | 1 | Do Not Use with NCL [Initialize ( 2- wire sequence )] |
| | | 7 | 1 | Do Not Use with NCL [Initialize ( 3- wire sequence )] |

Satellite Drive Register Data Codes (continued)

| DATA CODE | CONST. no - | CONSTANT FUNCTION | BIT NO. | DATA SET | LIMITS | INIT-IAL | INCRE MENT | REFERENCE SECTION |
|---|---|---|---|---|---|---|---|---|
| 30 | no-00 | Initialization/ Access limits | | | 00 - 09 | 01 | | 3.2 |
| 31 | no-01 | Operation Signal Selection 1 | 0 | Frequency Reference Origin - see Chapter 8 | | 0000 | | 3.3 |
| | | | 1 | Operation Signal Origin - see Chapter 8 | | | | |
| | | | 2 | 0 | Ramp to Stop | | | |
| | | | | 1 | Coast to Stop | | | |
| | | | 3 | 0 | Enable Output Voltage Limit | | | |
| | | | | 1 | Disable Output Voltage Limiter | | | |
| 32 | no-02 | Maximum Output Frequency | | | 50.0-400.0 (Hz) | 60.0 | | 3.4 |
| 33 | no-03 | Maximum Output Voltage | | | 0.1-255.0 (V) | 230.0 | | |
| | | | | | 0.1-510.0 (V) | 460.0 | | |
| 34 | no-04 | Output Frequency at Max. voltage | | | 0.2-400.0 (Hz) | 60.0 | | |
| 35 | no-05 | Midpoint Output Frequency | | | 0.1-399.9 (Hz) | 01.5 | 0.1 | |
| 36 | no-06 | Midpoint Output Voltage | | | 0.1-255.0 (V) | 12.0 | | |
| | | | | | 0.1-510.0 (V) | 24.0 | | |
| 37 | no-07 | Minimum Output Frequency | | | 0.1-10.0 (Hz) | 01.5 | | |
| 38 | no-08 | Output Voltage at Minimum | | | 0.1-50.0 (V) | 12.0 | | |
| | | Output Frequency | | | 0.1-100.0 (V) | 24.0 | | |
| 39 | no-09 | Acceleration time 1 | | | 0.0-600.0 (s) | | | 3.5 |
| 3A | no-10 | Deceleration Time 1 | | | | 10.0 | 0.1 | |
| 3B | no-11 | Acceleration Time 2 | | | | | | |
| 3C | no-12 | Deceleration Time 2 | | | | | | |
| 3D | no-13 | Frequency Reference 1 | | | 0.0-400.0 (Hz) | | | 3.6 |
| 3E | no-14 | Frequency Reference 2 | | | | | | |
| 3F | no-15 | Frequency Reference 3 | | | | 0.0 | 0.1 | |
| 40 | no-16 | Frequency Reference 4 | | | | | | |
| 41 | no-17 | Jog Reference Frequency | | | | 6.0 | | 3.7 |

Satellite Drive Register Data Codes (continued)

| DATA CODE | CONST. no - | CONSTANT FUNCTION | BIT NO. | DATA SET | LIMITS | INITIAL SET | INCREMENT | REFERENCE SECTION |
|---|---|---|---|---|---|---|---|---|
| 42 | no-18 | Motor Protection Selection | 0 | 0 | Enable Elect. Therm. Motor O.L. | 0000 | | 3.7 |
| | | | | 1 | Disable Elect. Therm. Motor O.L. | | | |
| | | | 1 | 0 | Variable Torq. Elect. Therm. Motor O.L. | | | |
| | | | | 1 | Constant Torq. Elect. Therm. Motor O.L. | | | |
| | | | 2 | | Not Used | | | |
| | | | 3 | | Not Used | | | |
| 43 | no-19 | Motor Rated Current | | | 10% to 120% of GPD333 Rated Output Current | | 0.1 | 3.8 |
| 44 | no-20 | Operation Signal Selection 2 | 0 | 0 | Enable Reverse Run | 0000 | | 3.9 |
| | | | | 1 | Disable Reverse Run | | | |
| | | | 1 | | Not Used | | | |
| | | | 2 | | Not Used | | | |
| | | | 3 | 0 | Enable Stall Prevent on Decel. | | | |
| | | | | 1 | Enable Stall Prevent on Decel. | | | |
| 45 | no-21 | Output Monitor / S-Curve Enable | 0 | | Not Used | 0000 | | 3.10 |
| | | | 1 | 0 | Monitor Output Freq. ( Term 11 & 12 ) | | | |
| | | | | 1 | Monitor Output Current ( Term 11 & 12 ) | | | |
| | | | 2 | 0 | Disable S-curve | | | |
| | | | | 1 | Enable S-curve .2 sec | | | |
| | | | 3 | | Not Used | | | |
| 46 | no-22 | Command Signal Gain | | | 0.01-2.00 | 1.00 | 0.01 | 3.11 |
| 47 | no-23 | Command signal Bias | | | -1.00 - 1.00 | 0.00 | | |
| 48 | no-24 | Command Signal Upper Limit | | | 0 - 110 (%) | 100 | 1 | |
| 49 | no-25 | Command Signal Lower Limit | | | | 0 | | |

Satellite Drive Register Data Codes (continued)

| DATA CODE | CONST. no - | CONSTANT FUNCTION | BIT NO. | DATA SET | LIMITS | INITIAL SET | INCREMENT | REFERENCE SECTION |
|---|---|---|---|---|---|---|---|---|
| 4A | no-26 | DC Injection Braking Current | | | 0-100 (%) | 50 | 1 | 3.12 |
| 4B | no-27 | DC Injection Braking Time at Stop | | | 0.0 - 5.0 (s) | 0.0 | 0.1 | 3.12 |
| 4C | no-28 | DC Injection Braking Time at Start | | | 0.0 - 5.0 (s) | 0.0 | 0.1 | 3.12 |
| 4D | no-29 | Auto Torque Boost Gain | | | 0.0 - 3.0 | 1.0 | 0.1 | 3.13 |
| 4E | no-30 | Stall Prevent Level During Accel | | | 30 - 200 (%) | 170 | 1 | 3.14 |
| 4F | no-31 | Stall Prevent Level at Set Speed | | | 30 - 200 (%) | 160 | 1 | 3.14 |
| 50 | no-32 | Multi-function Input - Terminal 3 | | | 00 - 13 | 13 | 1 | 3.15 |
| 51 | no-33 | Multi-function Input - Terminal 4 | | | 01 - 13 | 01 | 1 | 3.15 |
| 52 | no-34 | Multi-function Input - Terminal 5 | | | 01 - 14 | 03 | 1 | 3.15 |
| 53 | no-35 | Multi-function Analog Input | | | 00 - 04 | 00 | 1 | 3.16 |
| 54 | no-36 | Multi-function Output Relay | | | 00 - 10 | 05 | 1 | 3.17 |
| 55 | no-37 | Multi-function Output - Terminal 13 | | | 00 - 10 | 00 | 1 | 3.18 |
| 56 | no-38 | Multi-function Output - Terminal 14 | | | 00 - 10 | 01 | 1 | 3.18 |
| 57 | no-39 | Frequency Detection Level | | | 0.0 - 400.0 (Hz) | 0.0 | 0.1 | 3.19 |
| 58 | no-40 | Overtorque Detection Function Select | 0 | 0 | Disable Overtorque Detection ( OTD ) | 0000 | | 3.20 |
| | | | | 1 | Enable Overtorque Detection ( OTD ) | | | |
| | | | 1 | 0 | OTD only at set Frequency | | | |
| | | | | 1 | OTD always except during Stop | | | |
| | | | 2 | 0 | Continued Operation after Detection | | | |
| | | | | 1 | Coast to Stop after Detection | | | |
| | | | 3 | N/A | Not Used | | | |
| 59 | no-41 | Overtorque Detection Level | | | 30 - 200 (%) | 160 | 1 | 3.20 |
| 5A | no-42 | Overtorque Detection Time | | | 0.1 - 10.0 (s) | 0.1 | 0.1 | 3.20 |
| 5B | no-43 | Carrier Frequency | | | 1-6(x 2.5kHz) | 4 | 1 | 3.21 |
| 5C | no-44 | Not Used | | | | | | |
| 5D | no-45 | Analog Monitor Gain | | | 0.01 - 2.00 | 1.00 | 0.01 | 3.10 |

Satellite Drive Register Data Codes (continued)

| DATA CODE | CONST. no - | CONSTANT FUNCTION | BIT NO. | DATA SET | LIMITS | INITIAL SET | INCREMENT | REFERENCE SECTION |
|---|---|---|---|---|---|---|---|---|
| 5E | no-46 | Power Loss Function Select | 0 | 0 | Disable Power loss Ride-thru | 0000 | | 3.22 |
| | | | | 1 | Enable Power Loss Ride-thru | | | |
| | | | 1 | N/A | Not Used | | | |
| | | | 2 | N/A | Not Used | | | |
| | | | 3 | N/A | Not Used | | | |
| 5F | no-47 | No. Auto- restart Attempts | | | 0 - 10 | 0 | 1 | 3.23 |
| 60 | no-48 | Fault Record (read only) | | | | | | 3.24 |
| 61 | no-49 | E-PROM Number (read only) | | | | | | 3.25 |
| 62 | no-50 | Prohibited Frequency | | | 0.0 -400.0(Hz) | 0.0 | 0.1 | 3.26 |
| 63 | no-51 | Prohibited Frequency Deadband | | | 0.0 - 25.5(Hz) | 1.0 | 0.1 | 3.26 |
| 64 | no-52 | Not Used | | | | | | |
| 65 | no-53 | Not Used | | | | | | |
| 66 | no-54 | Not Used | | | | | | |
| 67 | no-55 | Not Used | | | | | | |
| 68 | no-56 | Not Used | | | | | | |
| 69 | no-57 | Not Used | | | | | | |
| 6A | no-58 | Not Used | | | | | | |
| 6B | no-59 | Not Used | | | | | | |
| 6C | no-60 | Not Used | | | | | | |
| 6D | no-61 | Not Used | | | | | | |
| 6E | no-62 | Not Used | | | | | | |
| 6F | no-63 | Not Used | | | | | | |
| 70 | no-64 | Not Used | | | | | | |
| 71 | no-65 | Not Used | | | | | | |

## Satellite Internal Registers

| DATA CODE | FUNCTION | READ/WRITE STATUS | DATA RANGE | VALUE AT POWER-UP | DESCRIPTION |
|---|---|---|---|---|---|
| 00 | NCL Satellite Memory Group | R/W | 0000h | 0000h | Drive Registers Group |
| | | | F000h | | Satellite Internal Registers Group |
| | | | F100h | | Satellite Diagnostic Registers Group |
| 01 | Global Data Enable/Disable | R/W | 0 | 0 | Global Data is Disabled |
| | | | 1 | | Global Data is Enabled |
| 02 | Global Reference Multiplier | R/W | 0.000 -9.999 | 1.000 | Global Frequency Reference Multiplier |
| 03 | Satellite Version and Revision | R | VVRRh | - | VV = Satellite Software Version Number<br>RR = Satellite Software Revision Number |

## Satellite Diagnostic Registers

| DATA CODE | FUNCTION | READ/WRITE STATUS | DATA RANGE | VALUE AT POWER-UP | DESCRIPTION |
|---|---|---|---|---|---|
| 00 | NCL Satellite Memory Group | R/W | 0000h | 0000h | Drive Registers Group |
| | | | F000h | | Satellite Internal Registers Group |
| | | | F100h | | Satellite Diagnostic Registers Group |
| 01 | Satellite Run Time | R/W | - | 0 | Number of minutes the satellite has been running since power-up |
| 02 | Number of Standard Message Blocks | R/W | - | 0 | Number of standard message blocks that have been attempted by the satellite |
| 03 | Number of Global Message Blocks | R/W | - | 0 | Number of global message blocks that have been attempted by the satellite |
| 04 | Number of CAN Status Errors | R/W | - | 0 | Number of CAN status errors |
| 05 | Number of CAN Overrun Errors | R/W | - | 0 | Number of CAN overrun errors |
| 06 | Number of Incomplete Communications | R/W | - | 0 | Number of times NCL data communications were incomplete |
| 07 | Number of CAN Transmit Interrupts | R/W | - | 0 | Number of CAN transmit interrupts that have occurred |

| DATA CODE | REGISTER FUNCTION | READ/WRITE STATUS | DATA RANGE | VALUE AT POWER-UP | DESCRIPTION |
|---|---|---|---|---|---|
| F000 | Global Master Node Number | R/W | 1 - 64 | 0 | This register indicates the MB+ node address of the node that will be sending global write data.. The gateway will only accept global write data from this node. |
| F001 | Global Number of Registers | R/W | 1 - 3 | 2 | This register indicates the quantity of global write registers (max number of registers = 3) |
| F002 | Global Starting Register | R/W | 00h - 71h | 01h | This register indicates the drive data code for the starting global write register |
| F003 | Gateway Address | R | 1 - 14 | - | This register indicates the NCL address of this gateway |
| F004 | Gateway Baudrate | R | - | - | This register indicates the baudrate of this gateway<br>500 = 500 kbaud<br>250 = 250 kbaud<br>125 = 125 kbaud |
| F005 | Gateway Docking Dip Switch | R | - | - | This register contains the state of the 8 position switch located on the gateway docking board. The most significant byte is set to zero. The least significant byte is mapped as indicated at the right. |
| F006 | NCL Standard Message Timeout | R/W | 1 - 255 | 200 | Sets the maximum time a standard message can take to complete before a timeout error occurs. The value has a range of 1 to 255. The actual timeout value is the value of this register multiplied by 10 msec. This register defaults to 200 (2 second) at power-up. |
| F007 | NCL Internal Register Timeout | R/W | 1 - 255 | 50 | Sets the maximum time an internal register message can take to complete before a timeout error occurs.<br>The value has a range of 1 to 255. The actual timeout value is the value of this register multiplied<br>by 10 msec. This register defaults to 50 (500 msec) at power-up. |

| BIT# | SWITCH# |
|---|---|
| 0 | 1 |
| 1 | 2 |
| 2 | 3 |
| 3 | 4 |
| 4 | 5 |
| 5 | 6 |
| 6 | 7 |
| 7 | 8 |

Gateway Internal Registers (continued)

| DATA CODE | REGISTER FUNCTION | READ/WRITE STATUS | DATA RANGE | VALUE AT POWER-UP | DESCRIPTION |
|---|---|---|---|---|---|
| F008 | NCL Diagnostic Register Timeout | R/W | 1 - 255 | 50 | Sets the maximum time a diagnostic register message can take to complete before a timeout error occurs. The value has a rage of 1 to 255. The actual timeout value is the value of this register multiplied by 10 msec. This register defaults to 50 (500 msec) at power-up. |
| F009 | Gateway Software Version / Revision | R | VVRRh | - | VV = Gateway Software Version Number<br>RR = Gateway Software Revision Number |

## Gateway Diagnostic Registers

| DATA CODE | REGISTER FUNCTION | READ/WRITE STATUS | DATA RANGE | VALUE AT POWER-UP | REGISTER DESCRIPTION |
|---|---|---|---|---|---|
| F100 | Gateway Run Time | R/W | - | 0 | Number of minutes the gateway has been running since power-up |
| F101 | Number of Failed Message Blocks | R/W | - | 0 | Number of failed message blocks (total) processed by the gateway (set to zero at power-up) |
| F102 | Number of Standard Message Blocks | R/W | - | 0 | Number of standard message blocks processed by the gateway (set to zero at power-up) |
| F103 | Number of Internal Message Blocks | R/W | - | 0 | Number of internal message blocks processed by the gateway (set to zero at power-up) |
| F104 | Number of Global Message Blocks | R/W | - | 0 | Number of global message blocks processed by the gateway (set to zero at power-up) |
| F105 | Number of Diagnostic Message Blocks | R/W | - | 0 | Number of diagnostic message blocks processed by the gateway (set to zero at power-up) |

# Appendix B
# Product Specifications

| MB + / NCL Gateway Module | |
|---|---|
| Ambient Temperature | -10 to +40 degrees C (+14 to +104 degrees F) |
| Storage Temperature | -20 to +60 degrees C (-4 to +140 degrees F) |
| Relative Humidity | 90% noncondensing |
| Altitude | 3300 feet |
| Vibration | 1G at less than 20 Hz, 0.2 G at 20 - 50 Hz |
| Input Power | Voltage:<br>11 - 25 VDC<br>Current:<br>220 mAmps |

| GPD333 Satellite Board | |
|---|---|
| Ambient Temperature | -10 to +40 degrees C (+14 to +104 degrees F) |
| Storage Temperature | -20 to +60 degrees C (-4 to +140 degrees F) |
| Relative Humidity | 90% noncondensing |
| Altitude | 3300 feet |
| Vibration | 1G at less than 20 Hz, 0.2 G at 20 - 50 Hz |
| Input Power | Voltage:<br>11 - 25 VDC<br>Current:<br>40 mAmps |

# Appendix C
# Spare Parts List

| Description | Source | Part Number |
|---|---|---|
| MB+ / NCL Gateway Module | | |
| MB+ / NCL Gateway Kit | MagneTek | CM005 |
| Gateway Module NCL Mating Connector | Phoenix | 1757048 MSTBR2.5/5-ST-5.08 |
| MB+ / NCL Technical Manual | MagneTek | TM4334 |
| GPD333 NCL Satellite Board | | |
| GPD333 NCL Satellite Kit | MagneTek | CM006 |
| GPD333 NCL Satellite Mating Connector | Phoenix | 1792278 MVSTBR2.5/5-ST5.08 |
| GPD333 NCL Satellite Installation Sheets | MagneTek | 02Y00025-0385 |
| Miscellaneous | | |
| NCL Network Terminating Resistors | MagneTek | 05P00349-0001 |

# MagneTek NCL

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