3300 - MBP
PLC Platform
Modbus Plus Interface
Module
Revision 1.13

USER MANUAL

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Please Read This Notice

Successful application of the MBP module requires a reasonable working knowledge of the Allen-Bradley PLC hardware and the application in which the combination is to be used. For this reason, it is important that those responsible for implementing the MBP satisfy themselves that the combination will meet the needs of the application without exposing personnel or equipment to unsafe or inappropriate working conditions.

This manual is provided to assist the user. Every attempt has been made to assure that the information provided is accurate and a true reflection of the product's installation requirements. In order to assure a complete understanding of the operation of the product, the user should read all applicable Allen-Bradley documentation on the operation of the A-B hardware.

Under no conditions will ProSoft Technology, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of the product.

Information in this manual is subject to change without notice and does not represent a commitment on the part of ProSoft Technology, Inc. Improvements and/or changes in this manual or the product may be made at any time. These changes will be made periodically to correct technical inaccuracies or typographical errors.

Installation Instructions:

Power, input and output wiring must be in accordance with Class I, Division 2 wiring methods – Article 501-4 (b) of the National Electrical Code, NFPA 70 and in accordance with the authority having jurisdiction. The following warnings must also be heeded:

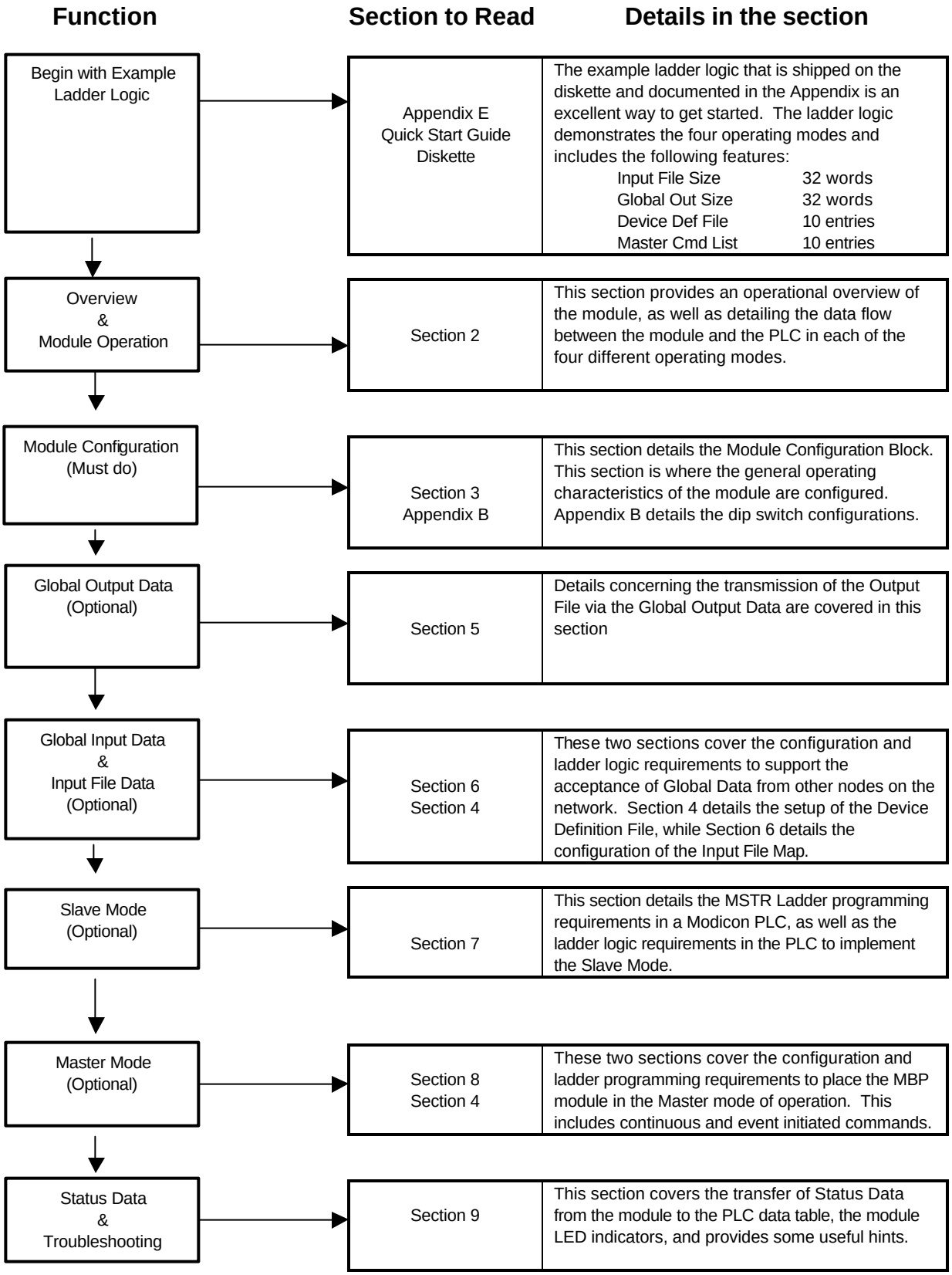
A. WARNING – EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIV. 2;

B. WARNING – EXPLOSION HAZARD – WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES, and

C. WARNING – EXPLOSION HAZARD – DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.

D. “THIS DEVICE SHALL BE POWERED BY CLASS 2 OUTPUTS ONLY.”

Guide to the User Manual



Quick Start Implementation Guide

Integration of the 3300-MBP module into an PLC application is easier if a series of steps are followed. In order to assist the first time users of our products in getting operational quickly, we have come up with this step-by-step implementation guide.

First Time Users

Although the following steps are to assist you in implementing the module, we recommend that you attempt to experiment with the example logic provided on disk with the module or available off our FTP site before laying out your application. This step will allow you to gain insight into how the module works prior to making decisions that will impact the long term success of the installation.

Starting with the ladder logic program provided on disk with the module, complete the following steps:
If hand entering the ladder logic by hand for the PLC, remember the following:

a) Edit the ladder logic provided on disk as needed for the application
Verify slot location and modify ladder (BTR/BTW Rack/Module/Group) as needed

b) Set the Node Address dip switches on the top of the module to match the value entered in the Module Configuration data table (N20:1). Default from factory is Node Address 2. See Appendix B.

c) Install the module in the correct slot location

d) Connect the Modbus Plus network to the module

e) Power up the module

f) Monitor the data table for data values

g) The example ladder logic provided with the module can serve as a building block for your specific application. The following capabilities have been built into the example ladder logic and can be taken advantage of without any ladder logic changes:

Input File Size	32 words
Global Output Size	32 words
Device Definition File	10 entries (other units on Modbus Plus network)
Master Command List	10 entries (up to 10 commands to other nodes on the network)
Node Address	2 (User must change dip switches and data table N20:1 to Modify node address)
Data from module	350 words (from registers 0 to 349)
Data to Module	200 words (to registers 500 to 699)

Table of Contents

1 Product Specifications

The 3300-MBP ("Modbus Plus Communication Module") product allows Allen-Bradley 1771 I/O compatible processors to easily interface with other Modbus Plus protocol compatible devices. Compatible devices include not only Modicon PLCs (which all support Modbus Plus) but also a wide assortment of end devices licensed through the ModConnect Program. For a full list of these devices, see Modicon's Web Site (http://www.modicon.com).

1.1 General Specifications

The MBP module acts as a gateway between the Modbus Plus network and the Allen-Bradley backplane. The data transfer from the PLC is asynchronous from the actions on the Modbus Plus Network. A 4000 word register space in the module is used to exchange data between the PLC and the Modbus Plus network.

Some of the general specifications include:

- Available in two hardware configurations, single port and redundant port (two Modbus Plus ports in parallel for redundant Modbus Plus configurations)
- Support for the storage and transfer of up to 4000 registers to/from the PLC /PLC data tables
- Module memory usage is completely user definable
- Supports five(5) levels of Modbus Plus network routing
- Configurable parameters:

Node Address	:	1 to 64 (dip switch configurable)
Global Out Size	:	0, or 1 to 32
Global In Size	:	0, or 1 to 32
Number of Master Commands	:	0, or 1 to 100
Number of Data Output Paths	:	0, or 1 to 8

Global Data Functional Specifications

The MBP module actively exchanges Global In and Out Data with the Modbus Plus network. Priority is given to these data types to provide a high speed mechanism for the transfer of control data.

- Global Output Data from PLC to Modbus Plus network
  Up to 32 words
- Global Input Data from Modbus Plus network to PLC
  Module accepts up to 32 words per node from up to 32 nodes

Slave Functional Specifications

The MBP module accepts register read and write commands from other Modbus Plus devices. These commands are issued by Modicon PLCs in the form of MSTR commands.

- Supported Modbus Plus Functions:
  Write Multiple Registers (Function Code 16) - MSTR 1
  Read Multiple Registers (Function Code 3) - MSTR 2
  Read Inputs (Function Code 1)
  Read Outputs (Function Code 2)
  Read Input Registers (Function Code 4)
  Set Coil (Function Code 5)
  Write Register (Function Code 6)
- Up to 100 words per command
- Supports eight (8) Data Input Paths

Modbus Master Specifications

The MBP module will actively issue Modbus Plus commands to other nodes on the Modbus Plus network.

- Supported Modbus Plus Function Codes:
  - Function Code 16 Write Multiple Registers
  - Function Code 3 Read Multiple Registers
- Up to 100 words per command
- Supports up to eight (8) Data Output Paths (These paths are auto selected by module on an as available basis)
- Supports up to 100 Master Command List entries, each individually configurable with the following parameters:
  - Enable - Continuous or Conditional
  - Function Code (Read or Write)
  - Routing Address [5 entries]
  - Number of words to transfer (1 to 100)
  - Source and Destination register addresses
- Supports five(5) ladder logic initiated command (Event Commands) slots allowing an unlimited number of commands
- Individual Command Status Codes returned to PLC

Physical

These modules are designed by ProSoft Technology and incorporate licensed technology from Schneider Automation (Modbus Plus technology) and from Allen-Bradley (PLC backplane technology).

- 1771 Form Factor - Single Slot
- Connections :
  - 2 – DB9 Female Standard Modbus Plus connector
  - 1 – DB-9 RS-232 Configuration Tool Connector

PLC Interface

- Operation via simple ladder logic
- PLC backplane interface via standard BTR/BTW commands
- Module configuration and Communication configuration data is transferred to the 3300-MBP from the PLC Data files

1.2 Hardware Specifications

These modules are designed by ProSoft Technology and incorporate licensed technology from Schneider Automation (Modbus Plus technology) and from Allen-Bradley (PLC backplane technology).

- Current Loads: 300 ma @ 5V (from backplane)
- Operating Temperature: 0 to 60 Deg C
  32 to 140 Deg F
- Storage Temperature: -40 to 85 Deg C
  -40 to 185 Deg F
- Relative Humidity: 5-95% (w/o condensation)
- Modbus Plus Connector: Two (2) DB-9 Female Standard Modbus Plus connectors
- Configuration Connector: DB-9 RS-232 Connector

2 Functional Overview

This section is intended to give the reader a functional overview of the 3300-MBP module. Details associated with the ladder logic and the memory map are not covered in this section, but can be found in later Sections of the manual and in the Appendix.

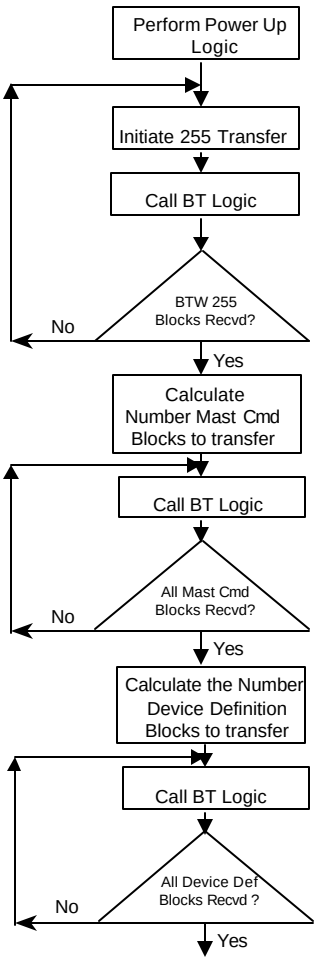
2.1 General Concepts

The following discussion covers several concepts which are key to understanding the operation of the MBP module.

2.1.1 Module Power Up and Reset

On power up, or after pressing the reset pushbutton, the module begins performing its logical functions. These funcions shown in the flow chart include:

1 Initialize hardware components
   - Initialize backplane chip
   - Test and Clear all RAM
   - Reset Modbus Plus Chipset
2 Wait for Module Configuration from PLC
3 Initialize Module Register space
4 Initialize Modbus Plus Chipset
5 Enable Modbus Plus Drivers



Power Up
- Initialize module registers
- Initialize hardware
- Setup the interrupts

Get Module Configuration Block
The module generates a request for the 255 block. This request is maintained until the ladder logic executes a BTW insruction with the BTW Block ID of 255.

Get Master Command List
Based on the *Number of Master Commands* configuration value in the Module Configuration Block, the module will calculate the number of Master Command Blocks (220 - 239) to transfer from the PLC.

Get Device Definition File
Based on the *Number of Nodes* configuration value in the Module Configuration Block, the module will calculate the number of Device Definition File Blocks (240 - 247) to transfer from the PLC.

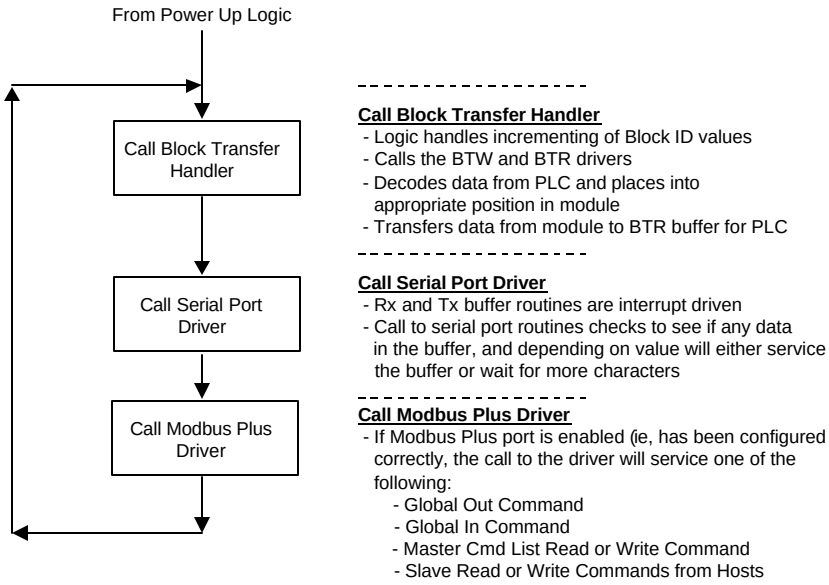
Get Input File Map
The module will generate a request for the Input File Map with a Block ID 250.

Get Register Data Blocks
Once the module has received all of the configuration blocks, requests are generated for data blocks (0-79) based on the *Read* and *Write Block Start* and *Count* configuration values.

Once the module has received the configuration data from the PLC (Block ID 220 to 255), the Modbus Plus chipset will be enabled (presuming valid configuration values were received), and will begin communicating with other nodes on the network, depending on the configuration. Once the module is configured, it will begin the Main Logic Loop.

2.1.2 Main Logic Loop

Upon completing the power up configuration process, the module jumps into an infinite loop that performs the following functions:



2.1.3 PLC Processor in PGM or Fault Mode

Anytime the module detects that the PLC has gone out of the Run mode (i.e, Fault or PGM), all Block Transfer activity will cease. The MBP module's response to this condition is User selectable. The *PLC Fault Mode* value in the Module Configuration Block determines if the Modbus Plus port will be forced into a reset state or allowed to continue running.

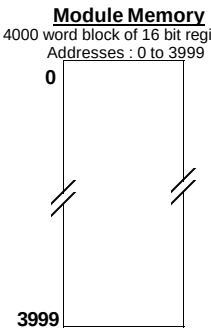
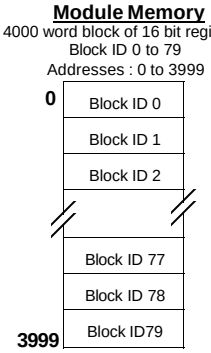
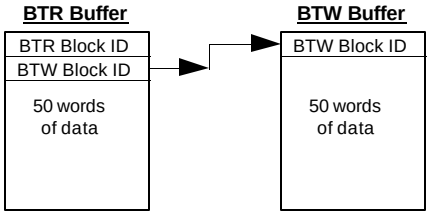
When the module detects that the PLC is not in RUN, the module initiates a Configuration Request to the PLC (i.e., turns on CFG LED and waits for successful Block Transfers from PLC). The module will stay in this state until the PLC is placed back in the Run mode and all of the Configuration Blocks are transferred to the module.

2.1.4 The Data Space in the Module

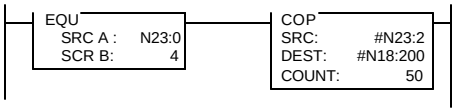
One of the concepts which is important to develop an understanding of is the relationship between the data space in the module and how this data can be moved between the module and the PLC/SLC processor.

The following discussion explains the data structure in the module and how this data can be moved between the module and the ladder program. Some key points to understand:

Key Point	Description
Size of data register space in the module	The module maintains a 4000 word data space which can be used as needed by the application for data storage

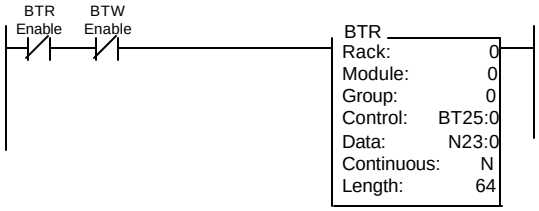
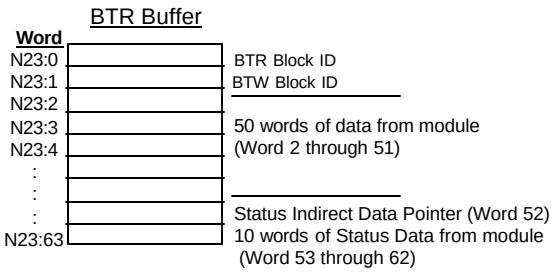
	
How 4000 word module data space is broken down in blocks	This 4000 words block of data is logically broken down into 80 fifty (50) word blocks: 80 blks x 50 wrds/blk=4000 words 
How data is 'paged' between the module and processor	Via the data transfer sequence outlined in the next section, 50 word blocks of data (or 'pages') are transferred bi-directionally between the module and the PLC processor. 

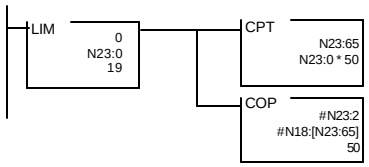
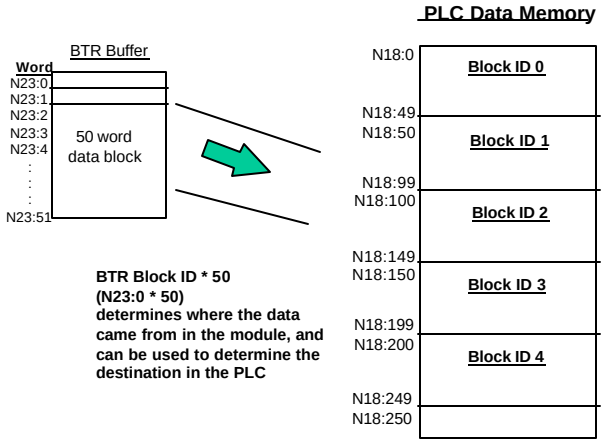
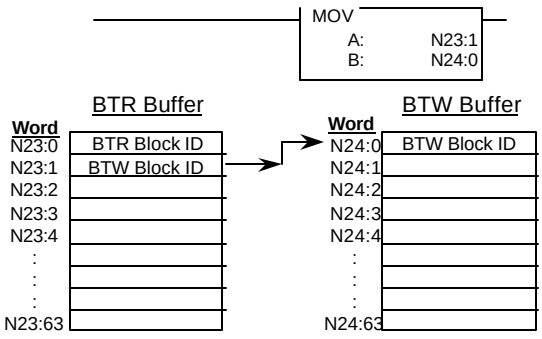
(Continued)

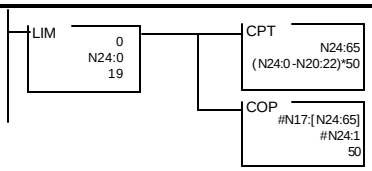
Key Point	Description
How data 'page' is placed in the processor's data table	The placement of data in the PLC processor is controlled by the user and the application ladder logic. Any available data file in the processor can be used as a source of data for the module and as a destination for data from the module. 

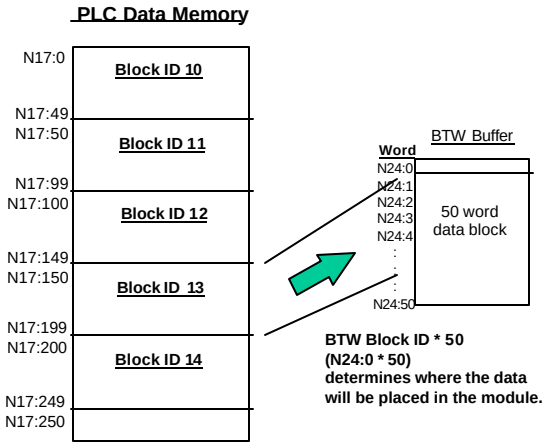
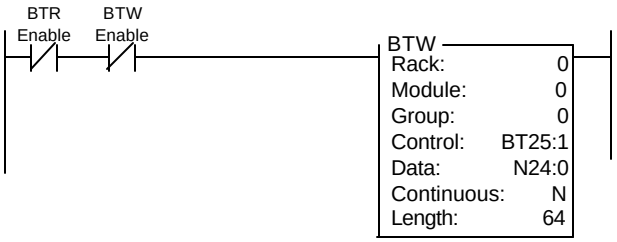
2.1.4 Backplane Data Transfer

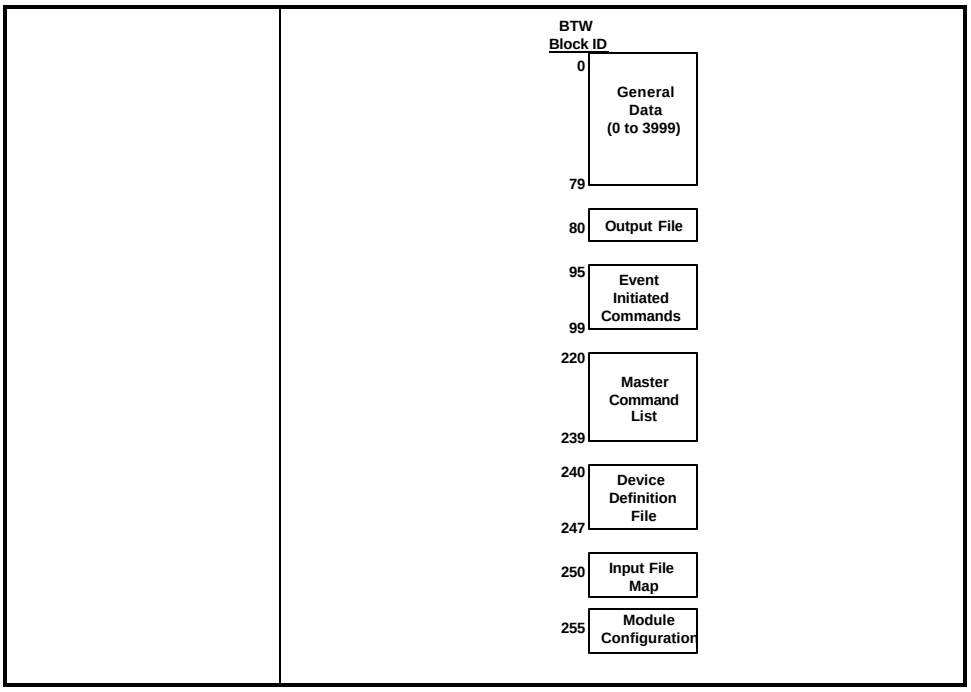
The following table provides an overview of the data transfer process between the A-B processor and the module. This process is effectively controlled by the ladder logic in the processor. The following provides some insight into the steps that occur in the module and in the ladder to effect a successful data transfer. Reference can be made to the example logic in Appendix E to see an actual implementation.

Step Number	Description
Step 1	Module generates BTR and BTW Block ID numbers based on the following logic: BTW Block ID *if (BTW_Block_ID >= Write_Block_Start + Write_Block_Cnt) then* *BTW_Block_ID = Write_Block_Start* *else BTW_ Block_ID = BTW_Block_ID + 1* BTR Block ID *if (BTR_Block_ID >= Read_Block_Start + Read_Block_Cnt) then* *BTR_Block_ID = Read_Block_Start* *else BTR_Block_ID = BTR_Block_ID + 1*
Step 2	Module executes a BTR command with the A-B Processor.  The structure of the BTR buffer being transferred from the module is: 

Step Number	Description
Step 3	The ladder logic decodes the BTR Block ID and copies the data from the BTR buffer into the ladder data table based on the value of the BTR Block ID.  
Step 4	Transfer the BTW Block ID from the BTR Buffer to the BTW buffer. 
Step 5	Copy ladder data memory, whether Data, Command List or Configuration, to the BTW buffer. The actual data copied depends on the decoding of the BTW Block ID number. The example ladder logic included here and in the Appendix assumes that the data to be written to the module is



Step Number	Description
Step 5 (Continued)	
Step 6	Execute the BTW Command 
Step 7	The module receives the BTW data. After decoding the BTW Block ID number, the module will transfer the BTW buffer data into the correct location in the modules memory.



2.1.4 Interlocking the Block Transfers

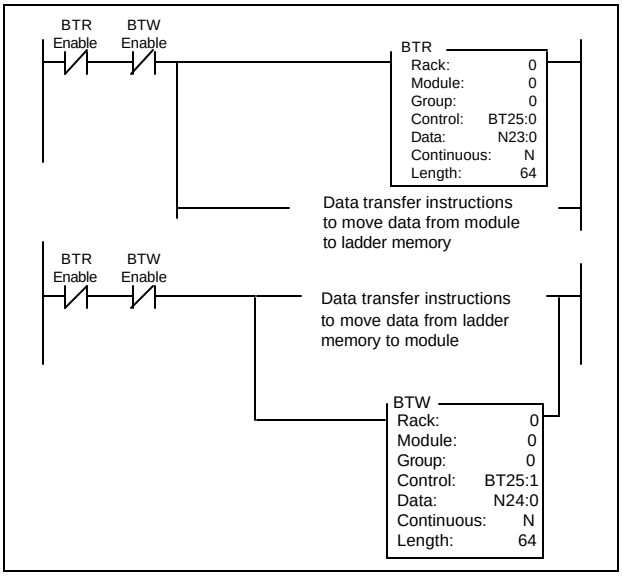
One of the fundamental assumptions that the module makes is that there will be one BTR per one BTW command. In the module, upon completing the BTR instruction, the module jumps immediately to the BTW instruction. To the programmer who follows our example logic this has rather minor implications.

Problems arise however when a ladder logic implementation is attempted which does not meet the module's block transfer expectations. Specifically, the following must be adhered to when programming the ladder logic for the module:

PLC Program using BTR/BTW Instructions

In the 1771 types of processors (PLC 2, PLC 3 and PLC 5), the BTR and BTW Enable bits must be used to enable the Block Transfer Instructions. With this type of programming, the PLC is guaranteed not to execute two block transfers at the same time and the BTR and BTW instructions are guaranteed to alternate.

Ample examples of this type of block transfer programming are available in A-B documentation as well as in the example ladder logic program in the Appendix.



2.2 Data Flow between MBP Module and the PLC

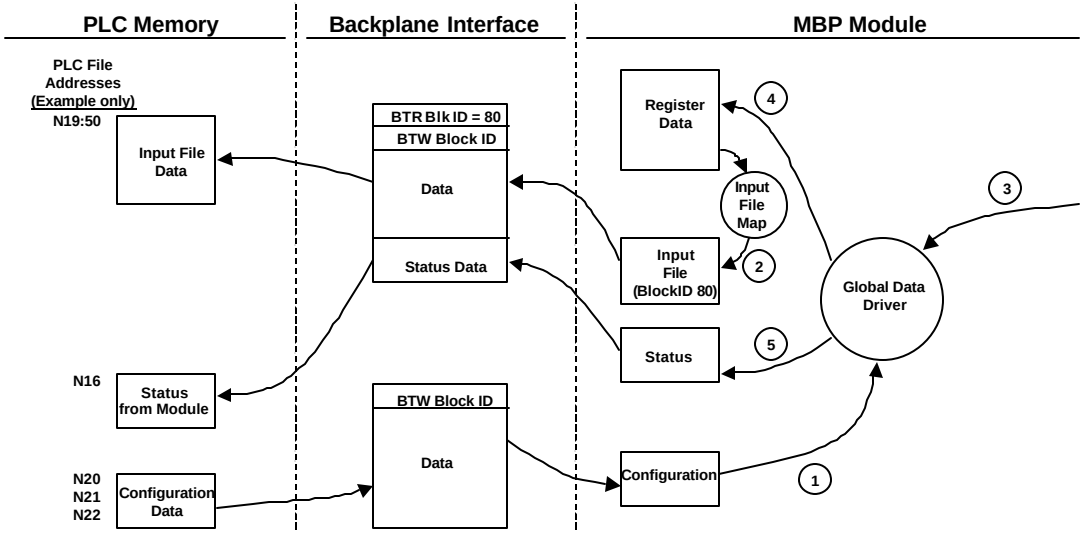
The following discussion details the flow of data between the two pieces of hardware and other nodes on the Modbus Plus network under the module's different operating modes. Note that all four modes can be operating effectively simultaneously if desired. Under most likely operating cases, the Global In and Global Out will be operating in conjunction with either the Master or the Slave driver.

2.2.1 Global Data In Mode

When the Global Data In mode is operational, the MBP module is receiving Global In data from up to 32 other nodes on the Modbus Plus network. Each node is capable of transferring up to 32 words, therefore the MBP is capable of accepting up to 1024 data words in this manner.

The amount of data and from which slaves to collect it from is all User determined through the setup of a configuration block called the Device Definition File, detailed later in Section 4.

The following flow chart and associated table detail the flow of data into and out of the module.



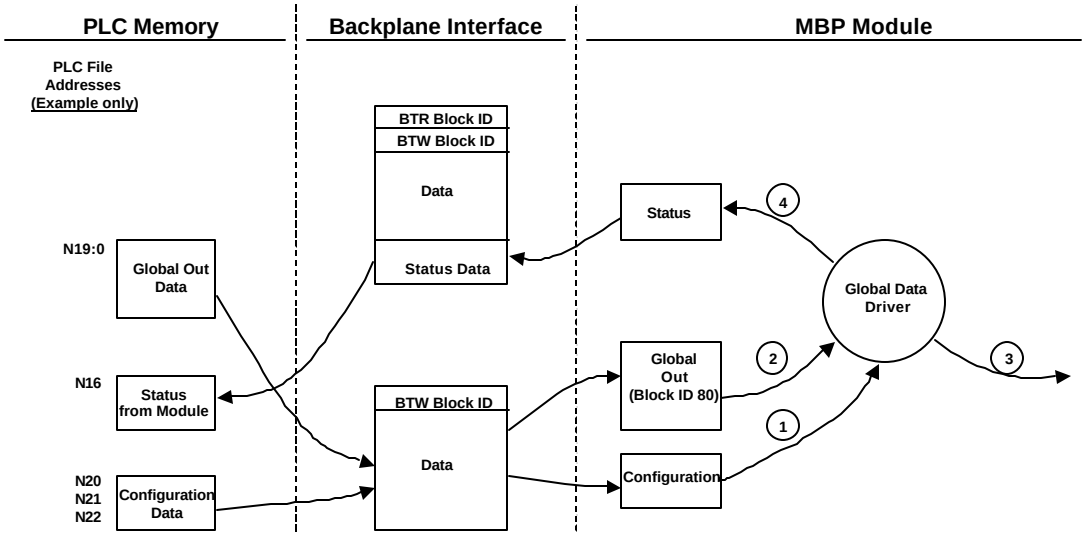
Step	Description
1	The Global In driver read configuration data from the PLC. This data includes the Device Definition File (Section 4) which includes the node address data, the number of Global In words and where to put this data in the module's register space.
2	During the configuration process, the Input File Map is updated out of the configuration file. The Input File Map tells the MBP module which data registers in the module's register space to feed into the PLC via the Input File Data BTR Block ID 80
3	The Global In Driver monitors Global In data from other nodes on the network. If the data matches one of the node addresses in the Configuration file and is qualified in terms of length, etc. the data is accepted
4	Once the data is accepted, the data is transferred into the module's register space. The location of the data in the is determined by the user via configuration in the Device Definition File
5	As the data is read from the other nodes on the network into the module, an asynchronous process is moving data from the module into the PLC via the BTR Block ID 80. The values to be moved are user determined via configuration of the Input File Map. Up to 32 words of data can be transferred in this fashion.
6	Status is monitored for each device in the Device Definition File that is expected to return Global In data to the PLC. This status is updated on an on-going basis and is transferred to the PLC for processing via the BTR command while the BTR Block ID values are between 0 and 80

2.2.2 Global Data Out Mode

When the MBP module's Global Output capability is enabled, up to 32 words of data can be transferred onto the Modbus Plus network by the MBP module. This data, typically reserved for high speed data such as for control applications, is passed each time the MBP module receives the network token.

The number of words transferred to the Modbus Plus network is User determined through the Module Configuration Block, detailed later in Section 3.

The following flow chart and associated table detail the flow of data into and out of the module.



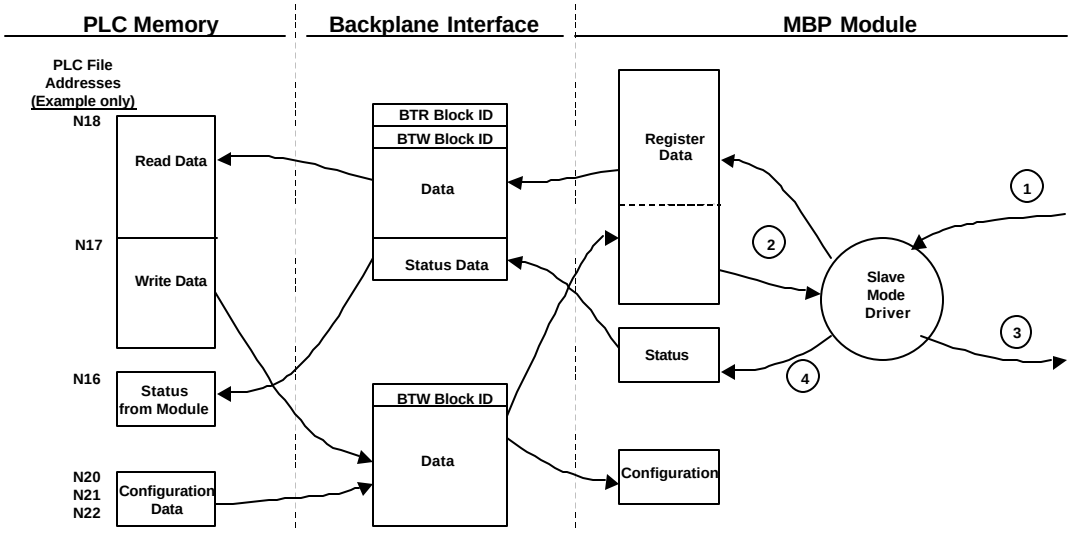
Step	Description
1	The Global Output driver reads configuration data from the PLC. This data consists of the number of words to be transmitted by the MBP module each time the module has the token. In addition, timing data on the update rate for the Global Out transmission is also obtained from the configuration data.
2	The Global Out data image is updated from the PLC Output File image. Based on the update rate configured by the user, the Global Out image in the Modbus Plus chipset will also be udpated
3	The Global Output driver in the Modbus Plus chipset will transmit the Global Out data each time the token is received by the module
4	The Global Output driver status is updated in the module.

2.2.3 Slave Driver Mode

The Slave Driver Mode allows the MBP module to respond to data read and write commands issued from other nodes on the Modbus Plus network. Two aspects of the module's operation must be kept in mind when considering using this mode:

1) The module supports MSTR Type 1 and Type 2 commands issued from a Modicon processor, or another device acting in a similar capacity
2) The module is a Modbus Plus Host type of node, therefore any device wishing to read or write data from the MBP module **must** be able to define a Data Slave Input Path in the Routing Path. The module supports all 8 Data Slave Input path, **but a Data Slave Path of 0 (zero) will cause the command to be rejected**

The following flow chart and associated table detail the flow of data into and out of the module.



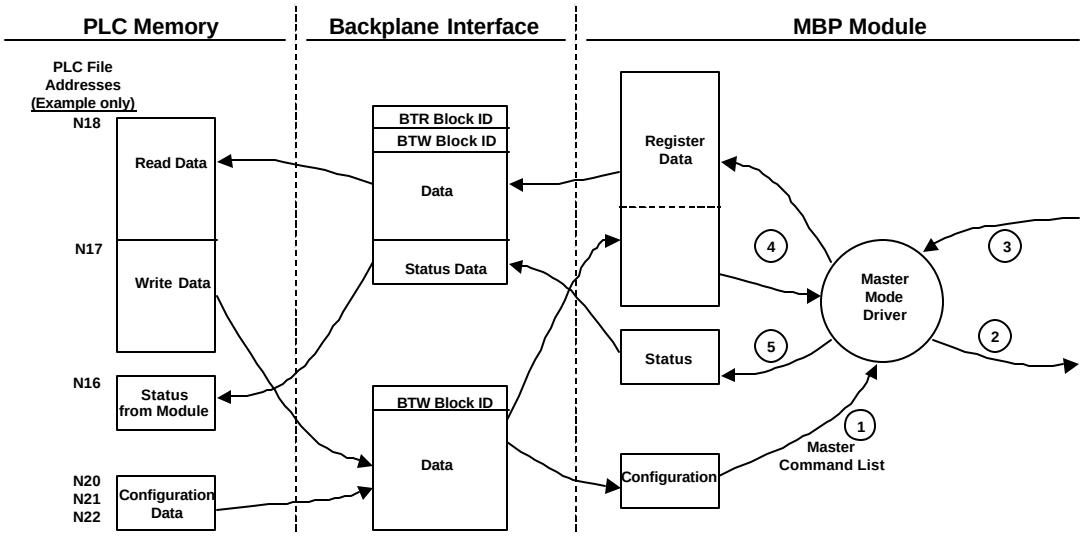
Step	Description
1	A Host device, such as a Modicon PLC or an MMI package issues a read or write command to the MBP module's node address. The Modbus Plus chipset qualifies the message before accepting it into the MBP module.
2	Once the MBP module accepts the command, the data is immediately transferred to or from the module. If the command is a Read command, the data is read out of the module's register space and appended to the response, and if the command is a Write command, the data is written directly into the module's register space
3	Once the data processing has been completed in Step 2, the response is issued to the originating node.
4	Several counters are available in the Status data block which allow a ladder logic program to determine the level of activity to the Slave Driver.

2.2.4 Master Driver Mode

In the Master Mode of operation, the MBP module is responsible for issuing read or write commands to other devices on the Modbus Plus network. These commands are User configured in the MBP module via the Master Command List. Command status is returned to the PLC on an individual command basis.

The MBP module emulates the MSTR Type 1 and Type 2 commands in terms of data read and write functionality.

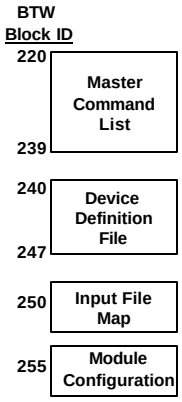
The following flow chart and associated table detail the flow of data into and out of the module.



Step	Description
1	The Master driver obtains configuration data from the PLC via the BTW transfer (Block ID 220 to 255). The configuration data obtained includes the number of commands, the Device Definition File, and the Master Command List. These values are used by the Master driver to determine the type of commands to issue to the other nodes on the Modbus Plus network (See Section 6 for Master Mode configuration)
2	Once configured, the Master driver begins transmitting read and/or write commands to the other nodes on the network. If writing data to another node, the data for the write command is obtained from the module to build the command
3	Presuming successful processing by the other nodes, responses are received into the Master driver for processing.
4	Data received from the other nodes on the network is passed into the module's register space, assuming a read command.
5	Status is returned to the PLC via the BTR command while the BTR Block ID is between 0 and 80 for each command in the Master Command List.

3 Module Configuration

In order for the MBP module to function in any of its possible modes, a minimum amount of configuration data must be transferred to the module. The table and diagram below provides an overview of the different types of configuration data that the module will require, depending on the operating modes to be supported.



BTW Block ID	Functional Modes Affected	Name	Description	Detailed In Section
255	Global In Global Out Slave Master	General Module Configuration	This section of the configuration data contains the generic module configuration data, and must be configured for the module to operate at all	3.1
250	Global In	Input File Map	If the module's Input File is to be used to transfer data from the modulel to the PLC, then this section of configuration data must be setup. This is detailed in a later section	6.2
240 to 247	Global In Master	Device Definition	If the module's Global Input or Master Mode functionality is to be used, then this section of configuration data must be setup. This is detailed in a later section	4.2
220 to 239	Master	Master Command List	If the module's Master Mode functionality is to be used, then the Master Command List must be setup. This is detailed in a later section.	8.2

3.1 General Module Configuration - Block ID 255

The Module Configuration Data contains the 'generic' configuration data for the MBP module. This section of configuration data must be setup by the User and transferred to the module in order for the module to function correctly.

IMPORTANT NOTE

The MBP module will not function correctly until the Module Configuration Data is received from the PLC with at least the Local Modbus Plus Node Address set to a valid value.

The MBP module must be configured at least once when the card is first powered up, and any time thereafter when the parameters must be changed.

Power Up

On power up, the module enters into a logical loop waiting to receive configuration data from the processor. While waiting, the module sets the second word of the BTR buffer (the BTW Block ID) to 255, telling the processor that the module must be configured before anything else will be done. The module will continuously perform block transfers until the communications configuration parameters block is received. Upon receipt, the module will begin execution of the command list if present, or begin looking for the command list from the processor.

Changing parameters during operation

Changing values in the configuration table can be done at any time. The module does not accept any of the changes until the 're-configuration' process is initiated. This can be accomplished in several ways, including:

1. Cycle power to the rack
2. Press the reset pushbutton on the module
3. Move 255 into BTW Block ID position (See example logic when B3/0 is set)

During this process, the 'CFG' LED will toggle, giving a visual indication that the module has received the configuration block.

Example Ladder Address	MBP Modbus Address	Value For Example Logic	Name	Description
N20:0	44211	0	Configuration Control (Not accessible via PLC)	The MBP module will monitor this word and when written into by a Modbus Plus host, controls if new configuration values are to be accepted into the module. This value is not accessible from the PLC and may only be written into from the module side through the Modbus Plus port. Normally this value will be used by the 3305-S/W configuration utility to configure the MBP module. The actions controlled by the word are bit mapped into the register as follows: **Bit** **Mask** **Description** 0 0x01 Reconfigure module using all config data from PLC 1 0x02 Store all configuration data from module in PLC (usually initiated by 3305-S/W utility) 2 0x04 Submit values in memory for testing. This does not store the values in the PLC (usually initiated by 3305-S/W utility)
N20:1	44212	2 (must	Modbus Plus Node Address	This value defines the Modbus Plus Node Address for the MBP module. A valid node address must be entered

		match dip switch settings)	(1 to 64)	for the module to operate, and the address must be unique on the network. Valid values are between 1 and 64, inclusive. Note that the value entered in the data table **must** match the value selected by the dip switches at the top of the module.
N20:2	44213	32	Global Output File Length (0 or 1 to 32)	This value defines the number of data words to transfer from the PLC Output Image to the Global Output data block transmitted from the MBP module onto the Modbus Plus network . Valid values are between 0 and 32, inclusive. Note that this value does not alter the need to configure the physical slot for 32 words of Output Data. The MBP module **must** be configured in its slot with 32 words for the processor to operate.

(Continued)

Example Ladder Address	MBP Modbus Address	Value For Example Logic	Name	Description
N20:3	44214	3 (every 4th BTW)	BTW Global Out Update Frequency (BTW Block ID 80 Update)	This value defines how many regular data Block Transfers (BTW Block ID 0 to 79) will occur between Global Output (BTW Block ID 80) transfers. The value is provided for performance optimization purposes. A value of 0 will default to a frequency of 5 (every 6th Block Transfer) if the Global Out File Length is greater than 0. Valid values in this field can range from 0 to 32767, but normal operating values will range from 1 to 5 transfers Example: A Frequency configuration value of 3 will configure the transfer of 1 Global Output block every 4th BTW transfer.
N20:4	44215	32	Input File Length (0 or 1 to 32)	This value defines the number of words to be transferred by the MBP module into the PLC Input File. Valid values range from 0 to 32 words, inclusive. Note that this value does not alter the need to configure the physical slot for 32 words of Input Data. The MBP module **must** be configured in its slot with 32 words for the processor to operate.
N20:5	44216	3 (every 4th BTR)	BTR Input File Update Frequency (BTR Block ID 80 Update)	This value defines how many regular data Block Transfers (BTR Block ID 0 to 79) will occur between Input File (BTR Block ID 80) transfers. The value is provided for performance optimization purposes. A value of 0 will default to a frequency of 5 (every 6th BTR transfer) if the Input File Length is greater than 0. Valid values in this field can range from 0 to 32767, but

				normal operating values will range from 1 to 5 transfers Example: A Frequency configuration value of 3 will configure the transfer of 1 Input File block (BTR Block ID 80) every 4th BTR transfer.
N20:6	44217	0 (1 sec)	Global In Update Timeout	This value defines the timeout period for receiving Global In Data from other nodes on the network. Once the timeout period has been exceeded, the Timeout Error will be returned in the Global In Update Status data block. A value of 0 will default to 1000 milliseconds (1 second). Valid values will range from 0 to 65535. Normally acceptable values will range from 50 to 5000 milliseconds. The low end of the range will depend on the number of nodes on the network. Note that using too small of a non-zero value will cause the Timeout Error to occur continuously.
N20:7 To N20:9	44218 - 44220	0	Spare	Not assigned at this time.

(Continued)

Example Ladder Address	MBP Modbus Address	Value For Example Logic	Name	Description
N20:10	44221	2	Number of Nodes Defined in the Device Definition File (See Section 4)	This value is for performance enhancement purposes. The Device Definition File will accept up to 32 entries (other devices on the network). In order to improve performance, if fewer units are defined, enter the actual number of nodes in the Device Definition File. Valid values range from 0 to 32, inclusive.
N20:11	44222	10	Number of Master Commands	This value defines the effective length of the Master Command List. The maximum length is 100 commands, but in order to improve performance, the actual number of commands should be entered. Valid values range from 0 to 100, inclusive.
N20:12	44223	2	Number of Master Data Paths Maximum	This value defines the number of Master Data Paths that will be made available to the MBP module's Master Mode driver by the Modbus Plus chipset. At this time, this value is for performance tuning purposes. Valid values range from 1 to 8. A 0 will default to 8. Note that this configuration parameter may be deleted in the future if minimum benefit is found during extended field use.
N20:13	44224	0 (1 sec)	Master Command Timeout Preset	This value defines the timeout for receiving a response to a command issued out of the Master Command List. Once the timeout period has been exceeded, the Timeout Error will be returned in the Master Command List Status

				registers. A value of 0 will default to 1000 milliseconds (1 second). Valid values will range from 0 to 65535. Normally acceptable values will range from 200 to 5000 milliseconds. The low end of the range will depend on the number of nodes on the network. Note that using too small of a non-zero value will cause the Timeout Error to occur continuously.
N20:14	44225	0 (Modbus Plus operates when PLC not in RUN)	Modbus Plus Action on PLC Not In Run	This value determines the failure mode of the Modbus Plus communication ports when the PLC is not running (i.e., either in PGM or in Fault). Valid values are 0 and 1, with the meanings as follows: **Value** **Description** 0 Modbus Plus port continues to operate when the PLC is not in RUN 1 Modbus Plus port shuts down when the PLC is not in RUN
N20:15 To N20:19	44226 - 44230	0	Spare	Not assigned at this time
N20:20	44231	0	Read Block ID Start	This value determines the starting BTR Block ID number that will be returned from the module. As an example, if the ladder logic needs to receive Blocks 2 through 5 from the module, the parameter should be configured with a '2' and the *Read Block Count* should be set to '4'. Valid values range from 0 to 79.

(Continued)

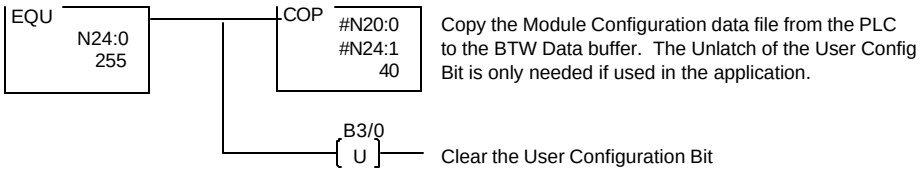
Example Ladder Address	MBP Module Address	Value For Example Logic	Name	Description
N20:21	44232	7	Read Block Cnt	This value represents the number of 50 word data blocks that are to be transferred from the MBP Module to the processor. The blocks returned from the module start with the value entered in the *Read Bock ID Start* parameter and increment from there. The maximum block count is 80. As an example, a value of 5 with a *Read Block ID Start* of 2 will return BTR Block ID data blocks: Read Block ID Start + 0 = 2 Read Block ID Start + 1 = 3 Read Block ID Start + 2 = 4 Read Block ID Start + 3 = 5 Read Block ID Start + 4 = 6 If a value greater than 80 is entered, the MBP module sets the value to 80
N20:22	44233	10	Write Block ID Start	This value determines the starting BTW Block ID that the module will generate. As an example, if the ladder logic needs to write into Blocks 4 and 5 to the module, this

				parameter should be set to '4' and the Write Block Count should be set to '2'. Valid values range from 0 to 79.
N20:23	44234	3	Write Block Cnt	This value represents the number of 50 word data blocks that are to be transferred from the processor to the MBP Module. The blocks written to the module start with the value entered in the *Write Bock ID Start* parameter and increment from there. The maximum block count is 80. As an example, if a value of 2 is entered with a *Write Block Start* value of 4, the MBP will generate: Write Block ID Start + 0 = 4 Write Block ID Start + 1 = 5 If a value greater than 80 is entered, the module will set the value to 80
N20:24 To N20:39	44235 - 44250		Spare	Not assigned at this time

3.2 Writing Configuration Data to the Module

In order to transfer the Module Configuration Data Block to the MBP module, a minimum amount of ladder logic must be entered in the PLC.

The logic required for the example provided with the module is as follows:

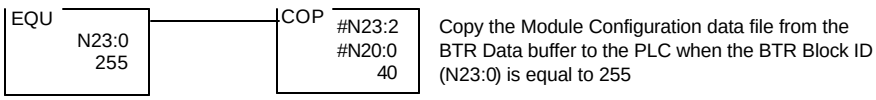


Note that this logic must be located within the BTW/BTR Enable interlock bits in order to function correctly. Please see example logic in Appendix E.

3.3 Reading Configuration Data from the Module

When an external utility is writing configuration data to the MBP module (such as the 3305-S/W Configuration Utility), the configuration data (all of it) must be saved in the PLC processor's memory for module initialization after reset or power fail. The MBP module does not use battery-backed memory to store the configuration values, therefore a valid configuration must be received from the PLC in order for the module to function properly.

The ladder logic required to back-up the configuration data for the example application provided with the module is as follows: (Only required is using 3305-SW utility)



Note that this logic must be located within the BTW/BTR Enable interlock bits in order to function correctly. Please see example logic in Appendix E.

4 Device Definition File – Global In and Master Modes

4.1 Overview

If the MBP module is going to be configured to operate in the Global In and/or Master Command modes, then the module's Device Definition File must be setup. The Device Definition File allows the user to configure specific operating parameters for each device on the Modbus Plus network. The parameters that are configured in the Device Definition File for each device are:

Routing Path: The Routing path is required by the MBP module and the Modbus Plus chipset to address specific nodes on the network. The routing path allows the module to support the addressing of nodes separated by Bridge Multiplexers, and to define Data Slave Input paths for devices requiring path specifications (i.e., other ModConnect Program devices)

Global Input Length: The Global Input Length defines how many words of Global Input data the module will be expecting from each of the network nodes

Global Input Data Storage location: The storage location tells the module where to place the Global Input data received from the network nodes into the module's memory. Valid locations are from 0 to 3999.

4.2 The Device Definition File – Block ID 240 to 247

The Device Definition File supports up to 32 nodes on the Modbus Plus network, with each node's entry in the File allocated 10 words. The total file size is then 320 words, broken down as follows:

Block ID Number	Example Ladder Addresses	Name	Description
General Overview			
240 to 247	N21:0 to N21:9 N21:10 to N21:19 N21:20 to N21:29 N21:30 to N21:39 N21:40 to N21:49 Etc. - - Not assigned in example	Device Def ID #0 Device Def ID #1 Device Def ID #2 Device Def ID #3 Device Def ID #4 - - - Device Def ID #30 Device Def ID #31	This data consists of 32 individual entries in the Device Definition File, with each entry consisting of 10 data words. Note that the Device ID numbers, which will be referenced by the Master Command List, begin at zero. This data is updated by the module only during the configuration process (i.e., initiated by writing a BTW Block ID 255 to the module).
Specific Block ID Functionality			
240	N21:0 to N21:9 N21:10 to N21:19 N21:20 to N21:29 N21:30 to N21:39	Device Def ID #0 Device Def ID #1 Device Def ID #2 Device Def ID #3	Each entry consists of 10 words, with the structure of each entry detailed in the next section.
241	N21:40 to N21:49 N21:50 to N21:59 N21:60 to N21:69 N21:70 to N21:79	Device Def ID #4 Device Def ID #5 Device Def ID #6 Device Def ID #7	
242	N21:80 to N21:89 N21:90 to N21:89 N21:100 to N21:109 N21:110 to N21:119	Device Def ID #8 Device Def ID #9 Device Def ID #10 Device Def ID #11	

243	N21:120 to N21:129 N21:130 to N21:139 N21:140 to N21:149 N21:150 to N21:159	Device Def ID #12 Device Def ID #13 Device Def ID #14 Device Def ID #15	
244	N21:160 to N21:169 N21:170 to N21:179 N21:180 to N21:189 N21:190 to N21:199	Device Def ID #16 Device Def ID #17 Device Def ID #18 Device Def ID #19	

(Continued)

Block ID Number	Example Ladder Addresses	Name	Description
245	N21:200 to N21:209	Device Def ID #20	
	N21:210 to N21:219	Device Def ID #21	
	N21:220 to N21:229	Device Def ID #22	
	N21:230 to N21:239	Device Def ID #23	
247	N21:240 to N21:249	Device Def ID #24	
	N21:250 to N21:259	Device Def ID #25	
	N21:260 to N21:269	Device Def ID #26	
	N21:270 to N21:279	Device Def ID #27	
248	N21:280 to N21:289	Device Def ID #28	
	N21:290 to N21:299	Device Def ID #29	
	N21:300 to N21:309	Device Def ID #30	
	N21:310 to N21:319	Device Def ID #31	

4.2.1 The Detailed Structure

The individual entries in the Device Definition File are structured as follows:

Offset in Structure	Example Ladder Addresses	Example Ladder Value	Name	Description
0	N21:0	6	Routing Address 1	These values determine the network route that a message will use to get from the MBP module to the node on the network. The values entered in these locations are entered directly in the Modbus Plus message. Note the following when entering addresses: Programmable Controllers: When addressing these devices, the last non-zero byte in the routing specifies the network node address. Example : 6 0 0 0 0 Address a PLC at Node Address 6 ModConnect Type Devices: When addressing these devices, including other MBP modules, the next-to-last non-zero value specifies the Node Address, while the last non-zero value specifies the Slave Data Path to use (1 – 8). A n incorrect value in the Slave Data Path will cause communications to fail. Example: 6 1 0 0 0 Address Node Address 6 through Slave Data Path 1
1	N21:1	0	Routing Address 2	
2	N21:2	0	Routing Address 3	
3	N21:3	0	Routing Address 4	
4	N21:4	0	Routing Address 5	
5	N21:5	0	Spare	Not assigned at this time
6	N21:6	32	Global In Length	The Global Input Length defines how many words of Global Input data the module will be expecting from each of the network nodes. If less data is returned, then an Error Code is returned to the PLC for the Node Address and the data is rejected.

				Conversely, if more data is returned, only the number of words requested are copied to the module's memory and no error is flagged (as of 12/97) Valid values range from 0 to 32. Note that a value of 0 tells the MBP module not to request Global Data from a node.

(Continued)

Offset in Structure	Example Ladder Addresses	Example Ladder Value	Name	Description
7	N21:7	0	Global In Storage Address	The storage location tells the module where to place the Global Input data received from the network nodes into the module's memory. Valid locations are from 0 to 3999.
8 9	N21:8 N21:9	0 0	Spare	

4.2.2 Entering the Values

When entering the values in the PLC data table, the structure will appear as follows in the data edit mode:

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Description**
N21:0	6	0	0	0	0	0	32	0	0	0	Device ID #0
N21:10	7	1	0	0	0	0	16	40	0	0	Device ID #1
N21:20	10	0	0	0	0	0	2	60	0	0	Device ID #2
N21:30	14	12	1	0	0	0	0	0	0	0	Device ID #3

Where:

Device ID #0: This entry addresses a Modicon PLC at Network Address #6. The Modicon PLC is expected to send 32 words of Global Data which will be placed in the module's memory beginning at address 0

Device ID #1: This entry is addressing a ModConnect type device at Network Address #7, and will utilize Data Slave Path #1. The node is expected to transmit 16 words of Global Data which will be saved in the module's memory beginning at address 40

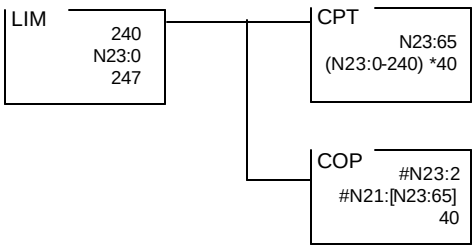
Device ID #2: This entry is addressing a Modicon PLC at Network #10. The Modicon PLC is expected to send 2 words of Global Data, which will be placed in the module's memory beginning at address 60

Device ID #3: This entry is addressing a ModConnect type device with a Node Address of 12 using a Slave Data Path of 1. The command is to be routed through a Bridge at Network Address 14. Note that Nodes routed through Bridges cannot transmit Global Data through the Bridge, therefore a Global In length of 0 must be specified.

4.3 PLC Ladder Logic Requirements

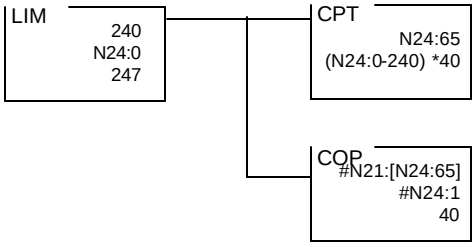
The Device Definition File is moved to/from the module in a similar fashion to the Module Configuration Data when the Block ID values are between 240 and 247, using standard BTW and BTR instructions.

Writing the Device Definition File from the PLC to the MBP module
(Only required is using 3305-SW utility)



Copy the Device Definition data file from the BTR Data buffer to the PLC when the BTR Block ID (N23:0) is between 240 and 247. The offset into the data file is calculated based on the Block ID value.

Reading The Device Definition File from the MBP module to the PLC



Copy the Device Definition data file from the PLC to the BTW Data buffer when the BTW Block ID (N24:0) is between 240 and 247

Please note the following:

1. Both of these rungs must be located within the BTW/BTR Enable interlock bits in order to function correctly. Please see example logic in Appendix E.
2. The Device Definition data file (N21 in example ladder) must be sized correctly when created (i.e., 40 words per Block ID to be processed)

5 Global Output Mode – BTW Block ID 80

If the MBP module's Global Output Mode is enabled (Global Output Length > 0), then the module will transmit a Global Out Data block every time it receives the Modbus Plus token. This data block (up to 32 words in length), maintained for the high speed transmission of data to the Modbus Plus network, is written from the PLC to the MBP module when the BTW Block ID value is 80.

5.1 Functional Overview

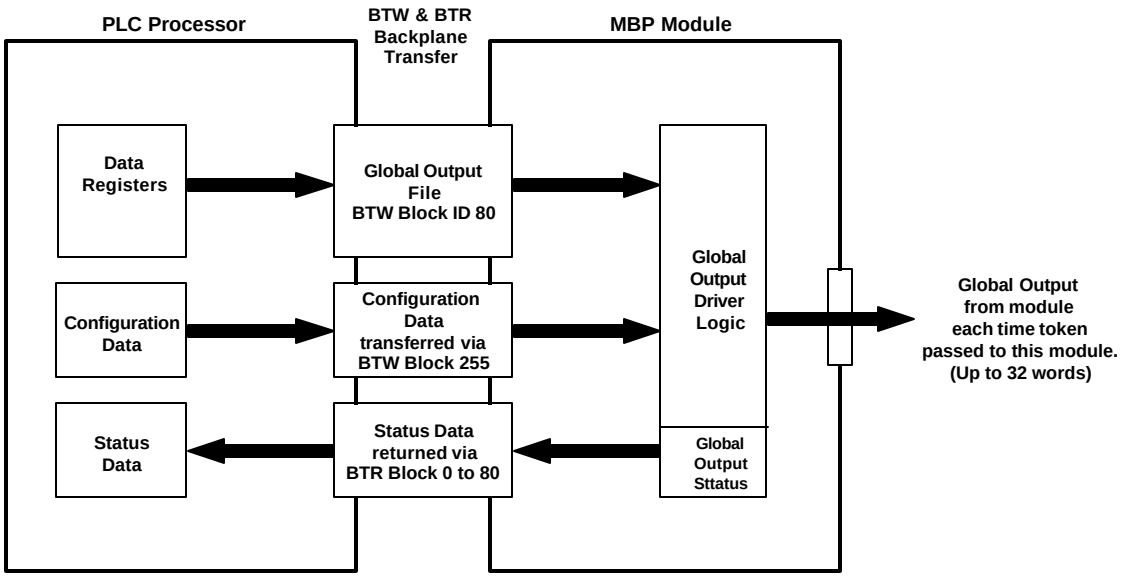
The MBP module can be easily configured to send Global Output Data onto the Modbus Plus network. The transfer and transmission of the Global Output Data is given a high priority level to assure a high level of performance. This priority can be attenuated by configuring some time delay on the update process, as described in the following discussion.

The following diagram depicts the processes involved in the transfer of the Global Output Data. These are as follows:

Data Transfer: Up to 32 data words can be transferred from the PLC through the BTW Data buffer when the Block ID is 80.

Configuration: Several configuration values must be entered by the User, including the number of Global Output Data words (0, 1 to 32) and the BTW Update Frequency

Status: Several status values returned to the PLC can be used to monitor the module



5.2 Configuration Requirements – MBP Module

In order to enable the Global Output operating mode to function properly, the following parameters must be configured in the module.

General Module Configuration Data Block – Section 3.1			
Parameter	**Function**	**Example Address**	**Example Value**
Global Output File Length	Defines the number of data words to transfer from the PLC Output image to the Modbus Plus Network whenever the Global Output data is transmitted. Note that this configuration value does not affect the	N20:2	32

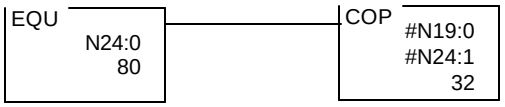
	physical configuration of the module – the MBP module **must** be configured in its slot with 32 words for the processor not to fault.		

(Continued)

Parameter	Function	Example Address	Example Value
BTW Global Ouput Update Frequency	This value defines how many regular data Block Transfers (BTW Block ID 0 to 79) will occur between Global Output (BTW Block ID 80) transfers. Example: A Frequency configuration value of 3 will configure the MBP module to transfer 1 Global Output block every 4 BTW transfers.	N20:3	3

5.3 PLC Ladder Logic Requirements

A minimum amount of ladder logic is required to transfer the data to the MBP module via the Global Output Block Transfer (BTW Block ID 80) The following rung can be modified as needed to gather the data from any location in the PLC data table.



Copy the data to be transmitted via the Global Output to the BTW Data Buffer when the BTW Block ID is 80

Note that this logic must be located within the BTW/BTR Enable interlock bits in order to function correctly. Please see example logic in Appendix E.

5.4 Monitoring Status

The MBP module returns two values which are useful for determining the operating status of the Global Output function. The Status values are returned to the PLC via the data transfer process from the MBP module (while BTR Block ID is between 0 and 80), at which point the ladder logic can monitor the values and react as required for the application. (See Section 9.1.2 for the ladder logic requirements associated with the Status Data).

Example Ladder Address	MBP Modbus Address	Module Register Address	Name	Description
N16:155	44156	4155	Global Output Status	This is a word value returning a value indicating the configuration and/or operating status of the Global Output Function. The valid values which may be returned are: **Value** **Hex** **Dec** **Description** 0x01 1 Updating – All OK 0x02 2 Not Assigned 0x04 4 Not Assigned 0x08 8 Global Update Timeout (Not transmitted in 500 ms) 0x10 16 Global Data Not Configured (Length in Config Block = 0) 0x20 32 Not Assigned 0x40 64 Invalid Global Data Length (Length > 32 words) 0x80 128 Not Assigned
N16:156	44157	4156	Global Output Update Counter	This is a 16 bit roll-over counter which increments from 0 to 0xFFFF (-32767 to

				32767). The counter increments each time a Global Output command has been successfully processed by the Modbus Plus chipset on the MBP module.

6 Global Input Mode and Input File Data – BTR Block ID 80

Two concepts are covered in this Section, the configuration of the Device Definition File to accept Global Data from other nodes, and the movement of data to the Input File via BTR Block ID 80 for high speed transfer across the PLC backplane.

6.1 Overview

Data is received from the MBP module through the BTR Transfer process. To provide a mechanism for the high speed transfer of data, a special BTR Block ID has been setup at Block ID 80.

BTR Block ID 80 (Input File Data)is intended for data that must be updated to the PLC on a very high speed basis, while the BTR Block ID 0 to 79 data transfers are used to access all data in the module at a lower priority. The relative priority of the Input File Data (BTR Block ID 80) update process can be adjusted by configuring the 'BTR Input File Update Frequency' parameter as described in the following discussion.

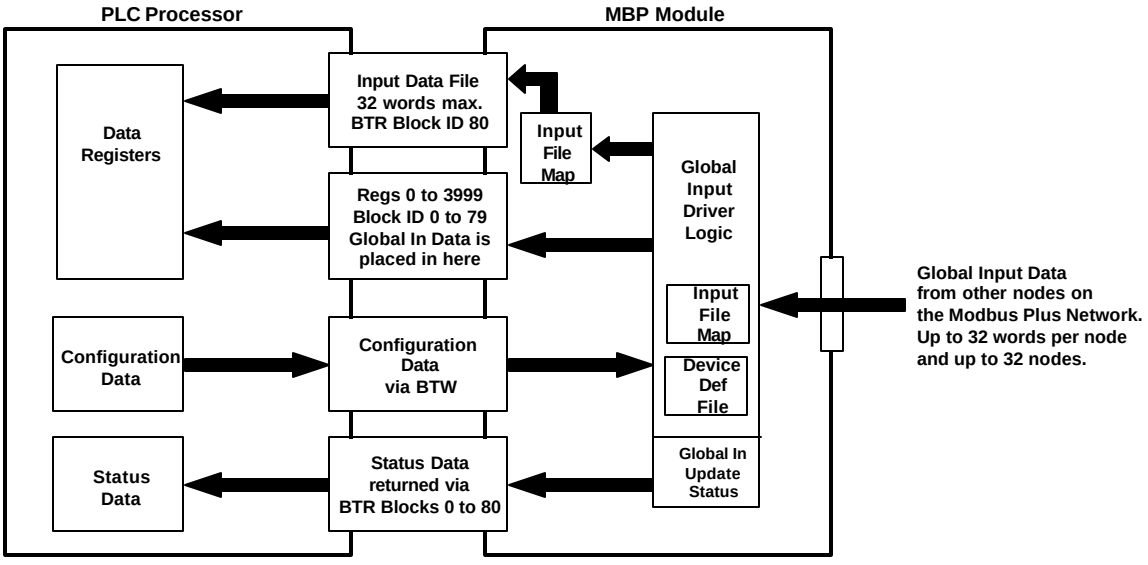
The following diagram depicts the processes involved in the transfer of the Global Input Data as well as the transfer of Input File Data. The following steps occur during this process:

Configuration: The Global Input driver logic receives several configuration values from the PLC which are key to making the process work. These include the Node Addresses of devices transmitting Global Data, the number of Global Data words expected from each node (both from the Device Definition File), and the Input File Length (Module Configuration Data).

BTR Block ID 0 to 79 Data Transfer: As the Global Input data is received from the Modbus Plus nodes, the data is transferred to the PLC via the BTR process.

Input File Data Transfer(BTR Block ID 80): Based on the 'BTR Input File Update Frequency' parameter, data is moved to the PLC via the BTR Block ID 80 transfer.

Status: Status data is returned for each node configured in the Device Definition File indicating the success or failure of the process



6.2 Configuration Requirements – MBP Module

In order for the module to successfully receive Global Input data from other nodes on the Modbus Plus network and transfer data to the Input Data File, several parameters must be configured. The following sections detail these configuration requirements.

6.2.1 General Module Configuration – Block ID 255

Several parameters in the General Module Configuration data block must be configured.

General Module Configuration Data Block – Section 3.1			
Parameter	**Function**	**Example Address**	**Example Value**
Input File Length	Defines the number of data words to transfer from the PLC Output image to the Modbus Plus Network whenever the Global Outpt data is transmitted.	N20:4	32
BTR Input File Update Frequency	This value defines the how many regular BTR transfers (BTR Block ID 0 to 79) will occur between Input Data File (BTR Block ID 80) transfers	N20:5	3
Global Input Timeout	This value defines the timeout period for receiving Global In Data each node on the network. Once the timeout period has been exceeded for a node, the Timeout Error will be returned in the Global In Update Status data block. Note that a value of zero defaults to 1 sec.	N20:6	0 (defaults to 1 sec.)

6.2.2 Device Definition File – Block ID 240 to 247

The Device Definition file contains configuration data important to the Global Input process. The parameters in this file tell the Global in driver how much Global Input Data to expect, from which nodes to expect it from, and where to store the resulting data.

Device Definition File – Section 4			
Parameter per Node	**Function**	**Example Address**	**Example Value**
Routing Adresses 1 – 5	These values determine the network route path that a message will use to get form the MBP module to the node on the network.	N21:0 N21:1 N21:2 N21:3 N21:4	6 0 0 0 0
Global In Length	This value defines how many words of Global In data the module should expect from each network node.	N21:6	32
Global In Storage Address	This value defines where the data received from the network nodes will be placed in the module	N21:7	0

6.2.3 Input File Map – Block ID 250

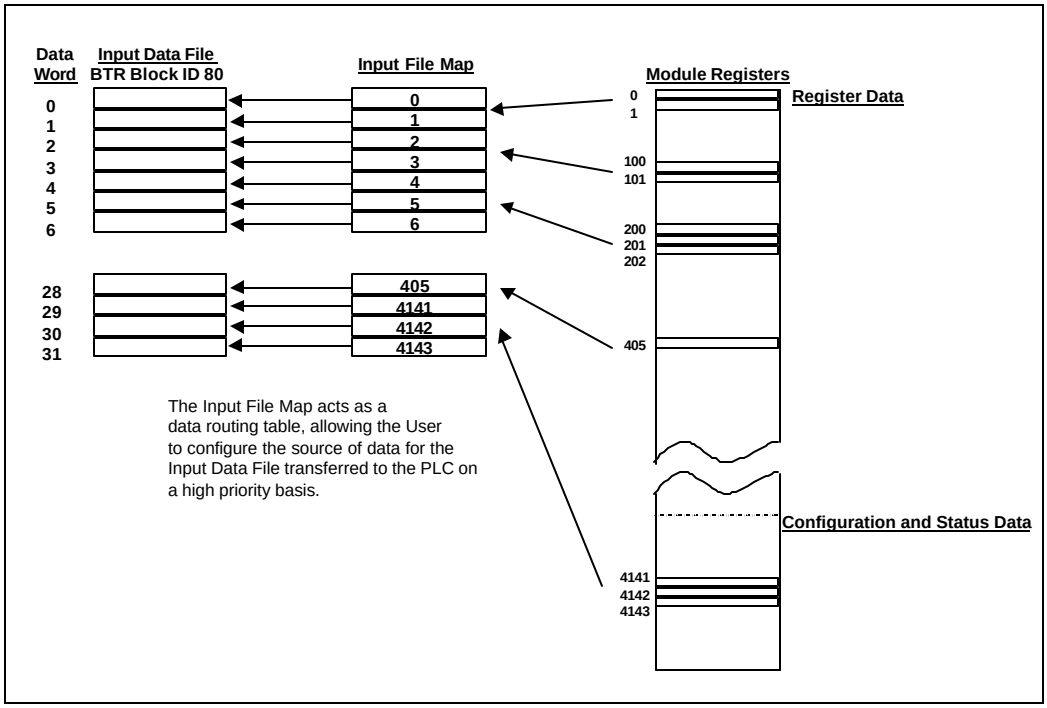
The Input File Map is a 32 word data block that selects values from registers 0 to 3999 in the module to transfer to the Input Data File (BTR Block ID 80). The Input File Map is copied to the MBP module during module configuration. The structure of this data block is as follows:

Example Ladder Address	MBP Modbus Address	Module Register Address	Example Value	Name	Description
N20:40	44251	4250	0	Input File Map – Word 0	The Input File Map contains the Source Register Addresses for the data locations in the module that will be routed from the MBP Data Registers (0 to 5609) into the Input Data File. Valid values in the Input File Map registers are between 0 to 3999 for Register Data and 4000 to 5609 for Module Configuration and Status data.
N20:41	44252	4251	1	Input File Map – Word 1	
N20:42	44253	4252	2	Input File Map – Word 2	
N20:43	44254	4253	3	Input File Map – Word 3	
N20:44	44255	4254	4	Input File Map – Word 4	
N20:45	44256	4255	5	Input File Map – Word 5	
N20:46	44257	4256	6	Input File Map – Word 6	
N20:47	44258	4257	7	Input File Map – Word 7	
N20:48	44259	4258	8	Input File Map – Word 8	

N20:49	44260	4259	9	Input File Map – Word 9	Configuration and Status data. The diagram in the following section depicts the flow of the data to the Input Data File (BTR Block ID 80).
N20:50	44261	4260	10	Input File Map – Word 10	
N20:51	44262	4261	40	Input File Map – Word 11	
N20:52	44263	4262	41	Input File Map – Word 12	
N20:53	44264	4263	42	Input File Map – Word 13	

(Continued)

Example Ladder Address	MBP Modbus Address	Module Register Address	Example Value	Name	Description
N20:54	44265	4264	43	Input File Map – Word 14	
N20:55	44266	4265	44	Input File Map – Word 15	
N20:56	44267	4266	45	Input File Map – Word 16	
N20:57	44268	4267	46	Input File Map – Word 17	
N20:58	44269	4268	47	Input File Map – Word 18	
N20:59	44270	4269	48	Input File Map – Word 19	
N20:60	44271	4270	49	Input File Map – Word 20	
N20:61	44272	4271	50	Input File Map – Word 21	
N20:62	44273	4272	80	Input File Map – Word 22	
N20:63	44274	4273	81	Input File Map – Word 23	
N20:64	44275	4274	82	Input File Map – Word 24	
N20:65	44276	4275	83	Input File Map – Word 25	
N20:66	44277	4276	84	Input File Map – Word 26	
N20:67	44278	4277	85	Input File Map – Word 27	
N20:68	44279	4278	86	Input File Map – Word 28	
N20:69	44280	4279	4141	Input File Map – Word 29	
N20:70	44281	4280	4142	Input File Map – Word 30	
N20:71	44282	4281	4143	Input File Map – Word 31	
N20:72 To N20:79	44283 to 44290	4282 to 4289		Unassigned	



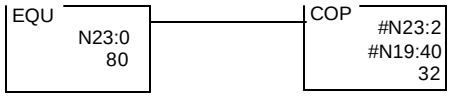
Input File data mapping: This diagram shows how the Input File Map is used to 'route' data values from the modules Register and Config/Status Data areas into the Input Data File.

6.3 PLC Ladder Logic Requirements

The Input Data File contains up to 32 words of register data (16 bit words) transferred from the MBP module to the PLC when the BTR Block ID is 80. The Input Data File register contents are determined by the User during configuration of the Input File Map.

6.3.1 Reading Input Data File – Block ID 80

The following rung can be modified as needed to distribute data coming in the Input File into the PLC Data Table:

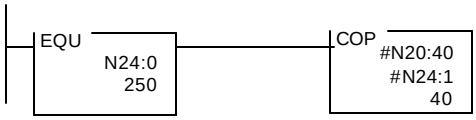


Copy the data from the BTR Data Buffer into the PLC memory when the BTR Block ID is equal to 80

6.3.2 Input File Map – Block ID 250

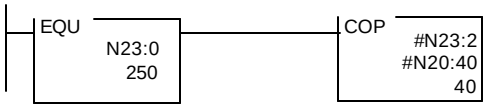
The following rung can be modified as needed to read and write the Input File Map:

Write Input File Map from PLC to MBP Module



Copy the Input File Map from the PLC to the MBP module via the BTW Data Buffer when the BTW Block ID is 250

Read Input File Map MBP Module into PLC Memory (Only required if using 3305-SW Utility)



Copy the Input File Map data from the BTR Data Buffer into the PLC memory when the BTR Block ID is equal to 250

Please note the following:

1. Both of these rungs must be located within the BTW/BTR Enable interlock bits in order to function correctly. Please see example logic in Appendix E.
2. The Input File Map data file (N20:40 to N20:79 in example ladder) must be sized correctly when created

6.4 Monitoring Status

The Global Input process generates several pieces of status data which may be useful to the ladder logic programmer. In both cases, the status values are returned to the PLC via the data transfer process from the MBP module (while BTR Block ID is between 0 and 80), at which point the ladder logic can monitor the values and react as required for the application. (See Section 9.1.2 for the ladder logic requirements associated with the Status Data).

6.4.1 Global Input Update Status

The Global Input Update Status data block returns the status for up to 32 active devices, as configured in the Device Definition File. The structure of this data block is as follows:

Example Ladder Address	MBP Modbus Addr	Module Register Addr	Description

N16:0	44001	4000	Global In Update Stat – Device ID #0
N16:1	44002	4001	Global In Update Stat – Device ID #1
N16:2	44003	4002	Global In Update Stat – Device ID #2
N16:3	44004	4003	Global In Update Stat – Device ID #3
N16:4	44005	4004	Global In Update Stat – Device ID #4
N16:5	44006	4005	Global In Update Stat – Device ID #5
N16:6	44007	4006	Global In Update Stat – Device ID #6
N16:7	44008	4007	Global In Update Stat – Device ID #7
N16:8	44009	4008	Global In Update Stat – Device ID #8
N16:9	44010	4009	Global In Update Stat - Device ID #9
N16:10	44011	4010	Global In Update Stat - Device ID #10

(Continued)

Example Ladder Address	MBP Modbus Addr	Module Register Addr	Description
N16:11	44012	4011	Global In Update Stat - Device ID #11
N16:12	44013	4012	Global In Update Stat - Device ID #12
N16:13	44014	4013	Global In Update Stat - Device ID #13
N16:14	44015	4014	Global In Update Stat - Device ID #14
N16:15	44016	4015	Global In Update Stat - Device ID #15
N16:16	44017	4016	Global In Update Stat - Device ID #16
N16:17	44018	4017	Global In Update Stat - Device ID #17
N16:18	44019	4018	Global In Update Stat - Device ID #18
N16:19	44020	4019	Global In Update Stat - Device ID #19
N16:20	44021	4020	Global In Update Stat - Device ID #20
N16:21	44022	4021	Global In Update Stat - Device ID #21
N16:22	44023	4022	Global In Update Stat - Device ID #22
N16:23	44024	4023	Global In Update Stat - Device ID #23
N16:24	44025	4024	Global In Update Stat - Device ID #24
N16:25	44026	4025	Global In Update Stat - Device ID #25
N16:26	44027	4026	Global In Update Stat - Device ID #26
N16:27	44028	4027	Global In Update Stat - Device ID #27
N16:28	44029	4028	Global In Update Stat - Device ID #28
N16:29	44030	4029	Global In Update Stat - Device ID #29
N16:30	44031	4030	Global In Update Stat - Device ID #30
N16:31	44032	4031	Global In Update Stat - Device ID #31
N16:32 To N16:39	44033 to 44040	4032 to 4039	Not Used

The valid status values returned for each device are:

Word Value Hex	Word Value Decimal	Description
0x01	1	Updating – All is OK.
0x02	2	Not Assigned
0x04	4	Not Assigned
0X08	8	Global Update Timeout No Global Data has been received from this node within the Global In Timeout period. Verify that the node is online, or that the Timeout period is sufficient for the application
0x10	16	Global Data Not Configured This Device Definition ID# does not have a Global In Length of 0 configured in the Device Definition File.
0x20	32	Not Assigned
0x40	64	Invalid Global Data Length The Global In command has completed successfully, but the MBP has detected less data from the node than requested. Note that under these conditions, all Global In data from the node is disregarded.
0x80	128	Not Assigned

6.4.2 Global Input Update Counters

The MBP module returns a block of counter values, which the PLC can use to determine if the module is operating as desired. These counters, one per Device in the Device Definition File, increment each time a Global In command is successfully completed. The counters are 16 bit rollover counters (0 to 0xffff). The following table shows the location of these values in the module and the relationship between the Device ID number and the Modbus address.

Example Ladder Address	MBP Modbus Addr	Module Register Addr	Description
N16:170	44171	4170	Global In Update Counter - Device ID #0
N16:171	44172	4171	Global In Update Counter - Device ID #1
N16:172	44173	4172	Global In Update Counter - Device ID #2
N16:173	44174	4173	Global In Update Counter - Device ID #3
N16:174	44175	4174	Global In Update Counter - Device ID #4
N16:175	44176	4175	Global In Update Counter - Device ID #5
N16:176	44177	4176	Global In Update Counter - Device ID #6
N16:177	44178	4177	Global In Update Counter - Device ID #7
N16:178	44179	4178	Global In Update Counter - Device ID #8
N16:179	44180	4179	Global In Update Counter - Device ID #9
N16:180	44181	4180	Global In Update Counter - Device ID #10
N16:181	44182	4181	Global In Update Counter - Device ID #11
N16:182	44183	4182	Global In Update Counter - Device ID #12
N16:183	44184	4183	Global In Update Counter - Device ID #13
N16:184	44185	4184	Global In Update Counter - Device ID #14
N16:185	44186	4185	Global In Update Counter - Device ID #15
N16:186	44187	4186	Global In Update Counter - Device ID #16
N16:187	44188	4187	Global In Update Counter - Device ID #17
N16:188	44189	4188	Global In Update Counter - Device ID #18
N16:189	44190	4189	Global In Update Counter - Device ID #19
N16:190	44191	4190	Global In Update Counter - Device ID #20
N16:191	44192	4191	Global In Update Counter - Device ID #21
N16:192	44193	4192	Global In Update Counter - Device ID #22
N16:193	44194	4193	Global In Update Counter - Device ID #23
N16:194	44195	4194	Global In Update Counter - Device ID #24
N16:195	44196	4195	Global In Update Counter - Device ID #25
N16:196	44197	4196	Global In Update Counter - Device ID #26
N16:197	44198	4197	Global In Update Counter - Device ID #27
N16:198	44199	4198	Global In Update Counter - Device ID #28
N16:199	44200	4199	Global In Update Counter - Device ID #29
N16:200	44201	4200	Global In Update Counter - Device ID #30
N16:201	44202	4201	Global In Update Counter - Device ID #31
N16:202 To N16:209	44203 to 44210	4202 to 4209	Not Used

7 Slave Operating Mode

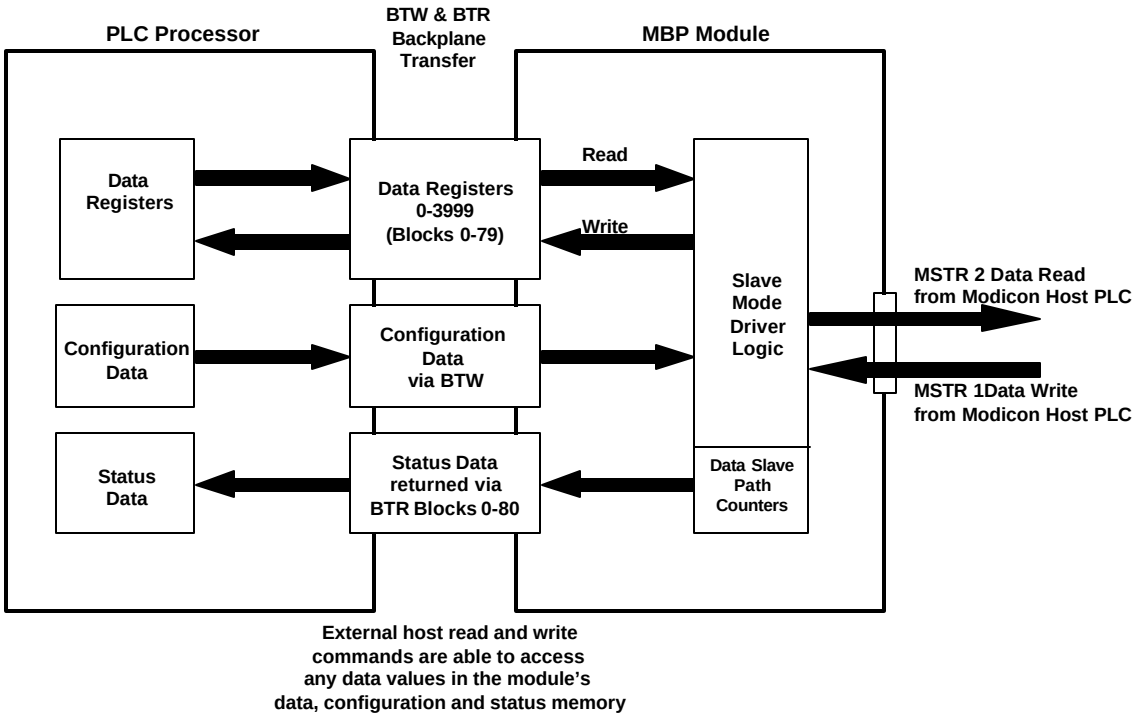
7.1 Functional Overview

Operating the 3300-MBP module in the Slave Mode requires the minimum amount of configuration and PLC ladder logic. The following diagram shows the flow of data between the PLC and the MBP module and the processes involved when operating in the Slave Mode. The processes are as follows:

Data Transfer: Data is transferred into and out of the module using standard BTW and BTR instructions. All Modbus Plus Read and Write requests(i.e., from other hosts) are serviced by the module out of the module's internal memory.

Configuration: The module must receive a configuration block from the PLC before the Modbus Plus driver will be enabled.

Status: Several status values are available in the Miscellaneous Status data which can be used to monitor the module's Slave mode operation



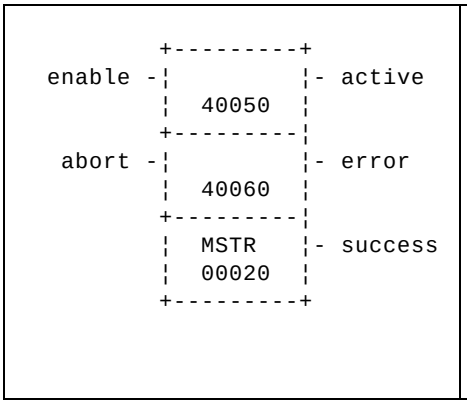
7.2 Configuration Requirements – MBP Module

There are no special MBP module configuration requirements to place the module in the Slave Operating Mode, beyond configuring the Module Configuration Block (BTW Block ID 255 – Section 3). When the MBP module is operating in the slave mode, some external device(s) is acting as a Master and reading data from (or writing to) the module.

7.3 Modicon Programming - MSTR 2 Data Read Command

In order for a Modicon PLC to read data from the MBP module, an MSTR Type 2 instruction must be entered in the Modicon's ladder program. This instruction initiates a Modbus Plus network transaction between the PLC and the MBP module. In the configuration of the command, the programmer can specifically choose the location and amount of data to be read from the MBP module and returned to the Modicon's memory.

The following diagram details an example configuration for a MSTR Type 2 command entered in a Modicon 984 style processor.



Contents of registers in the control block

40050 = 2	Read instruction
40051 = 0	Error code
40052 = 20	Length of the read
40053 = 50	slave register to read (MBP address 40051)
40054 = 6	Node address to retrieve data from
40055 = 1	Slave Input Path for routing
40056 = 0	Routing Address 3
40057 = 0	Routing Address 4
40058 = 0	Routing Address 5
40060	Destination address in the Modicon PLC for the data from the 3300-MBP

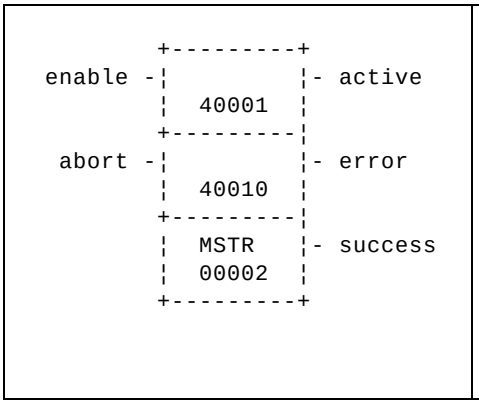
The MSTR 2 instruction shown above reads 20 words from the 3300-MBP beginning at address 40051(MBP Register 50) and places the data in the Modicon PLC beginning at address 40060.

Note that the Slave Input Path value must be entered in order for the command to execute successfully. Valid values are from 1 to 8.
Any other values will cause the command to fail

7.4 Modicon Programming – MSTR 1 Data Write Command

In order for a Modicon PLC to write data to the MBP module, an MSTR Type 1 instruction must be entered in the Modicon's ladder program. This instruction initiates a Modbus Plus network transaction between the PLC and the MBP module. In the configuration of the command, the programmer can specifically choose the destination address and the amount of data to be written to the MBP module from the Modicon's memory.

The following diagram details an example configuration for a MSTR Type 1 command entered in a Modicon 984 style processor.



Contents of registers in the control block

40001 = 1	Write instruction
40002 = 0	Error code
40003 = 30	Length of the write
40004 = 100	MBP Register to Write to (40101 in MBP)
40005 = 6	MBP Node address to write to
40006 = 1	Slave Input Path for routing
40007 = 0	Routing Address 3
40008 = 0	Routing Address 4
40009 = 0	Routing Address 5
40010	Source of the data in the Modicon PLC to send to the 3300-MBP

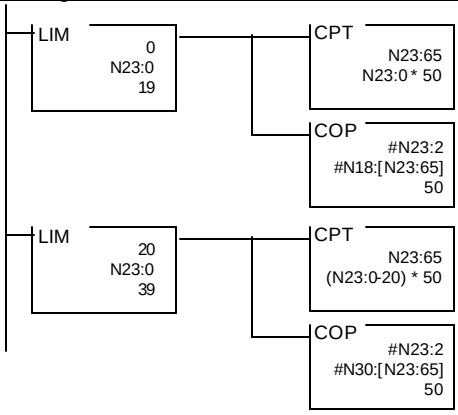
This instruction will write 30 words (from 40010-40039) in the PLC to the 3300-MBP data space beginning at Data Register address 40101(MBP Register 100).

Note that the Slave Input Path value must be entered in order for the command to execute successfully. Valid values are from 1 to 8.
Any other values will cause the command to fail

7.5 PLC Ladder Logic Requirements

Very little ladder logic is required to support the movement of Register Data between the PLC and the MBP module. The following rungs can be modified as needed to support the application.

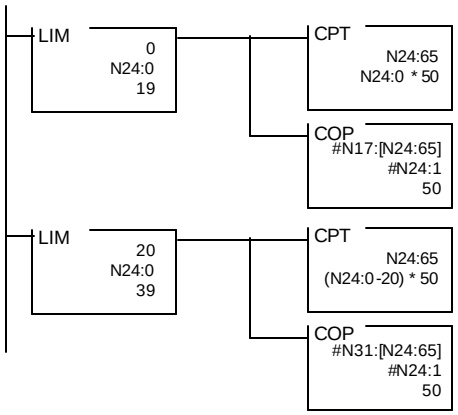
Reading Data from the MBP Module to PLC Memory



Copy register data from the BTR Data buffer to the PLC when the BTR Block ID (N23:0) is between 0 and 19 (up to 1000 words). The offset into the data file is calculated based on the Block ID value.

This second branch shows the logic needed to move registers 1000 to 1999 into the PLC. Two more branches must be created to copy the entire 4000 words from the MBP module to the PLC.

Writing Data from PLC Memory to the MBP module



Copy register data from the PLC to the BTW Data buffer to when the BTW Block ID (N24:0) is between 0 and 19 (up to 1000 words). The offset into the data file is calculated based on the Block ID value.

This second branch shows the logic needed to move registers 1000 to 1999 into the module. Two more branches must be created to copy the entire 4000 words from the PLC to the MBP module.

Please note the following:

1. Both of these rungs must be located within the BTW/BTR Enable interlock bits in order to function correctly. Please see example logic in Appendix E.
2. The PLC data files must be sized correctly when created (i.e, 50 words per Block ID to be processed)

7.6 Monitoring Status

The MBP module returns several counter values which are useful in determining the module's Slave mode operating status. These values are returned to the PLC via BTR Blocks 0 to 80. They are part of the Miscellaneous Module Status data block and are rollover byte counters split into a high and low byte. The following table shows the location of these values in the module's Modbus address space and in the PLC Data table for the example logic. See Section 9.1.2 for the lader logic required for the Status Data.

Example Ladder Address	MBP Modbus Address	Name	Description
N16:151	44152	Data Slave In Counters – Path 1 & 2	These byte counters (high and low byte split) increment every time a command is successfully processed by a Data
N16:152	44153	Data Slave In Counters – Path 3 & 4	
N16:153	44154	Data Slave In Counters – Path 5 & 6	

N16:154	44155	Data Slave In Counters – Path 7 & 8	Slave Input Path. Example N16:151 High Byte – Path 1 N16:151 Low Byte – Path 2

8 Master Operating Mode

In the Master Mode of operation, the MBP module is responsible for actively creating and executing commands to other nodes on the Modbus Plus link. The commands issued from the MBP module can read and write data values between the MPB module and the other nodes. These commands can be configured to operate continuously (See Section 8.2) or they can be controlled by ladder logic (See Event Commands in Section 8.3).

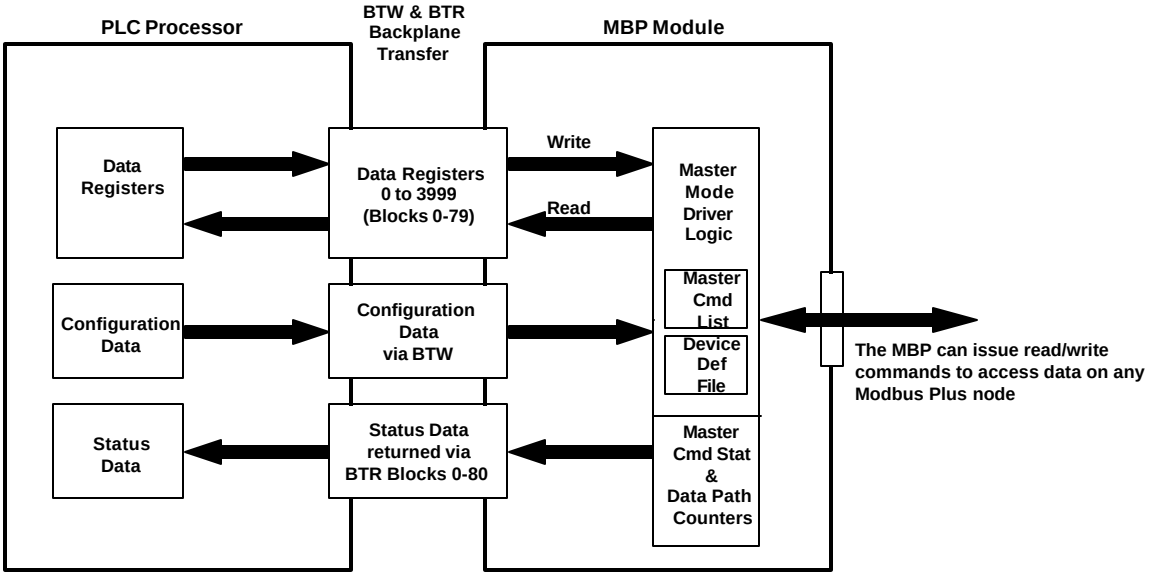
8.1 Functional Overview

Configuring the 3300-MBP module to operate in the Master Mode can be accomplished with some simple setup in the PLC ladder logic. Once the setup in the PLC data table is complete, this configuration information is moved to the MBP module using the BTW instruction. The following diagram shows the flow of data between the PLC and the MBP module, and the processes involved when operating in the Master Mode:

Data Transfer: Data read from other nodes, or to be written to other nodes, is transferred between the MBP and the PLC using standard BTW and BTR instructions.

Configuration: The module must receive valid Device Definition data (BTW Block ID 240 to 247) as well as Master Command List data(BTW Block ID 220 to 239) in order to operate properly in the Master mode.

Status: Several different status values are returned by the MBP module which can be used to monitor the Master driver operation.



8.2 Configuration Requirements – Continuous and Conditional Commands

In order for the MBP module to operate in the Master Mode (actively reading/writing data with other nodes on the network), several parameters must be configured in the PLC Data File. The following sections detail these configuration requirements:

8.2.1 Device Definition File – Block ID 240 to 247

An entry must be made in the Device Definition File for each node on the network that is to be addressed by the MBP module's Master Command List. The entry in the Device Definition File must consist of at least the Routing Path, including a valid Data Slave Input path if the device is not a Modicon PLC. See Section 4.2.1 for details on the Device Definition File.

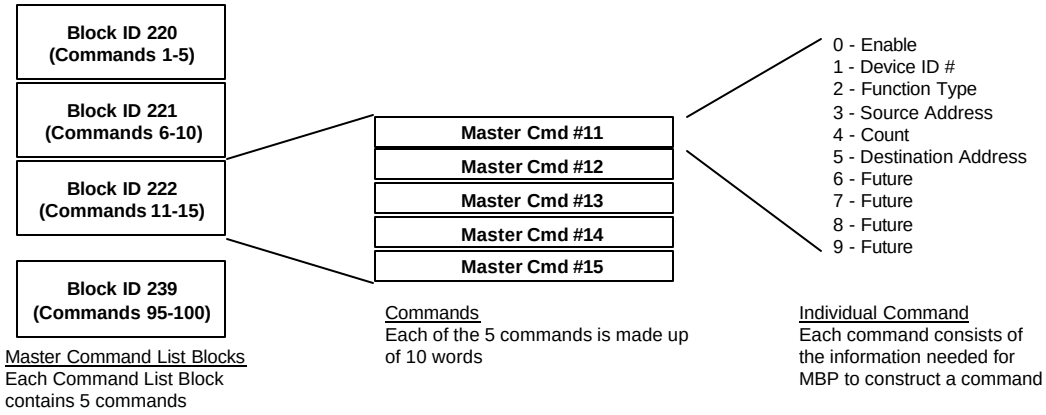
Device Definition File – Section 4.2.1			
Parameter per Node	**Function**	**Example Address**	**Example Value**
Routing Adresses 1 – 5	These values determine the network route path that a message will use to get from the MBP module to the node on the network. Remember to include the Data Slave Input Path if addressing a non-Modicon PLC node. See Section 4.2 for details	N21:0 N21:1 N21:2 N21:3 N21:4	6 0 0 0 0

8.2.2 Master Command List – Block ID 220 to 239

In order to function in the Master Mode, the MBP module's Master Command List must be setup. This list contains up to 100 individual entries, with each entry consuming 10 words of PLC data table space and consisting of the following:

- Device ID Number (for Routing Path from Device Definition File)
- Command Type – Read or Write up to 100 words per command
- Source and Destination Register Address – Determines where data will be placed and/or obtained
- Count – Select the number of words to be transferred – 1 to 100

The Master Command List is transferred to the MBP module only during the configuration process, and is not otherwise updated by the module. This means that any changes in the command list must specifically be downloaded to the module by initiating a BTW Block ID 255 (Set User Config Bit B3/0 in Example Logic).



The following table shows the PLC data file location of the Command List entries and relates this to the Block ID Numbers, using the the example ladder program addresses.

Block ID Number	Example Ladder Addresses	Name	Description
220	N22:0 to N22:9	Master Command #1	This data consists of up to 100 individual entries in the Master Command List, with each entry consisting of 10 data words. The structure of each entry is detailed in Section 8.2.3. Note that this data is only transferred to the PLC during the configuration process, initiated by a BTW Block ID 255.
	N22:10 to N22:19	Master Command #2	
	N22:20 to N22:29	Master Command #3	
	N22:30 to N22:39	Master Command #4	
	N22:40 to N22:49	Master Command #5	
221	N22:50 to N22:59	Master Command #6	
	N22:60 to N22:69	Master Command #7	
	N22:70 to N22:79	Master Command #8	
	N22:80 to N22:89	Master Command #9	
	N22:90 to N22:99	Master Command #10	
222	N22:100 to N22:109	Master Command #11	
	N22:110 to N22:119	Master Command #12	
	N22:120 to N22:129	Master Command #13	
	N22:130 to N22:139	Master Command #14	
	N22:140 to N22:149	Master Command #15	
223	N22:150 to N22:159	Master Command #16	
	N22:160 to N22:169	Master Command #17	
	N22:170 to N22:179	Master Command #18	
	N22:180 to N22:189	Master Command #19	
	N22:190 to N22:199	Master Command #20	
224	N22:200 to N22:209	Master Command #21	
	N22:210 to N22:219	Master Command #22	
	N22:220 to N22:229	Master Command #23	
	N22:230 to N22:239	Master Command #24	
	N22:240 to N22:249	Master Command #25	
225	N22:250 to N22:259	Master Command #26	
	N22:260 to N22:269	Master Command #27	
	N22:270 to N22:279	Master Command #28	
	N22:280 to N22:289	Master Command #29	
	N22:290 to N22:299	Master Command #30	
226	N22:300 to N22:309	Master Command #31	
	N22:310 to N22:319	Master Command #32	
	N22:320 to N22:329	Master Command #33	
	N22:330 to N22:339	Master Command #34	
	N22:340 to N22:349	Master Command #35	
227	N22:350 to N22:359	Master Command #36	
	N22:360 to N22:369	Master Command #37	
	N22:370 to N22:379	Master Command #38	
	N22:380 to N22:389	Master Command #39	
	N22:390 to N22:399	Master Command #40	
228	N22:400 to N22:409	Master Command #41	
	N22:410 to N22:419	Master Command #42	
	N22:420 to N22:429	Master Command #43	
	N22:430 to N22:439	Master Command #44	
	N22:440 to N22:449	Master Command #45	

229	N22:450 to N22:459	Master Command #46	
	N22:460 to N22:469	Master Command #47	
	N22:470 to N22:479	Master Command #48	
	N22:480 to N22:489	Master Command #49	
	N22:490 to N22:499	Master Command #50	
230	N22:500 to N22:509	Master Command #51	
	N22:510 to N22:519	Master Command #52	
	N22:520 to N22:529	Master Command #53	
	N22:530 to N22:539	Master Command #54	
	N22:540 to N22:549	Master Command #55	
231	N22:550 to N22:559	Master Command #56	
	N22:560 to N22:569	Master Command #57	
	N22:570 to N22:579	Master Command #58	
	N22:580 to N22:589	Master Command #59	
	N22:590 to N22:599	Master Command #60	

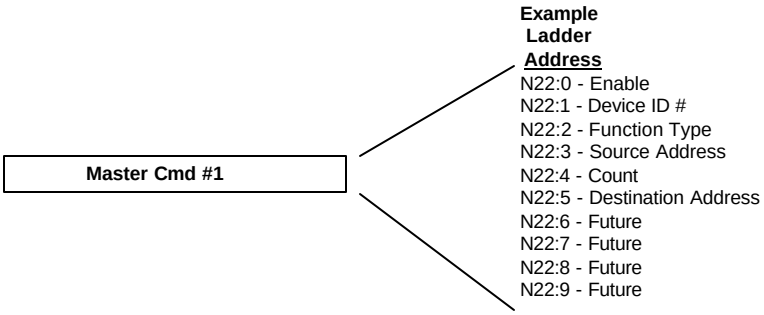
(Continued)

Block ID Number	Example Ladder Addresses	Name	Description
232	N22:600 to N22:609	Master Command #61	
	N22:610 to N22:619	Master Command #62	
	N22:620 to N22:629	Master Command #63	
	N22:630 to N22:639	Master Command #64	
	N22:640 to N22:649	Master Command #65	
233	N22:650 to N22:659	Master Command #66	
	N22:660 to N22:669	Master Command #67	
	N22:670 to N22:679	Master Command #68	
	N22:680 to N22:689	Master Command #69	
	N22:690 to N22:699	Master Command #70	
234	N22:700 to N22:709	Master Command #71	
	N22:710 to N22:719	Master Command #72	
	N22:720 to N22:729	Master Command #73	
	N22:730 to N22:739	Master Command #74	
	N22:740 to N22:749	Master Command #75	
235	N22:750 to N22:759	Master Command #76	
	N22:760 to N22:769	Master Command #77	
	N22:770 to N22:779	Master Command #78	
	N22:780 to N22:789	Master Command #79	
	N22:790 to N22:799	Master Command #80	
236	N22:800 to N22:809	Master Command #81	
	N22:810 to N22:819	Master Command #82	
	N22:820 to N22:829	Master Command #83	
	N22:830 to N22:839	Master Command #84	
	N22:840 to N22:849	Master Command #85	
237	N22:850 to N22:859	Master Command #86	
	N22:860 to N22:869	Master Command #87	
	N22:870 to N22:879	Master Command #88	
	N22:880 to N22:889	Master Command #89	
	N22:890 to N22:899	Master Command #90	
238	N22:900 to N22:909	Master Command #91	
	N22:910 to N22:919	Master Command #92	
	N22:920 to N22:929	Master Command #93	
	N22:930 to N22:939	Master Command #94	
	N22:940 to N22:949	Master Command #95	

239	N22:950 to N22:959 N22:960 to N22:969 N22:970 to N22:979 N22:980 to N22:989 N22:990 to N22:999	Master Command #96 Master Command #97 Master Command #98 Master Command #99 Master Command #100	

8.2.3 Master Command List – Detailed Structure

The individual entries in the Master Command List consists of 10 data words. The structure for the command entry is detailed in the table below, as well as the PLC Data Table addresses for Master Command #1 in the example ladder logic:



Offset In Structure	Example Ladder Addresses	Name	Description
0	N22:0	Command Enable	This value determines if the Master Driver will execute the command in the Command List, or if it will be disregarded. The following values are valid: **Value** — **Description** 0 — Disable Command 1 — Enable Continuous Cmd 5 — Enable Conditional Cmd Continuous commands will be executed every time the modules command list is scanned (i.e., as fast and as frequently as possible) Conditional commands will be executed every scan of the command list, but only if any of the contents to be written have changed from the last time the command was executed. If any one or more values have changed, the entire data block controlled by the command is written.
1	N22:1	Device Definition File ID	The Master Driver uses this value to reference the Device Definition File. The Master Driver obtains the Route Path data for the remote node from the Device Definition File. Valid values in this entry are as follows: **Value** — **Description** 0 — Device ID #0 1 — Device ID #1 - 99 — Device ID #99 100 — Device ID #100

2	N22:2	Function Type	This entry determines if the command to be executed will be a Read or a Write. Valid values are as follows: **1** **Write Command (fc 16)** The Write Command will transfer data from the MBP module to the remote node on the network using a function code 16. **2** **Read Command (fc 3)** The Read Command will transfer data from the remote node to the MBP module using a function code 3.
3	N22:3	Source Register Address	The value represents the register address for both read and write commands, from which data will be obtained. The distinction between the two command types is as follows: - When issuing a Read command, this value is the register location in the remote node where the command will begin getting data - When issuing a Write command, this value is the register location in the MBP module where the command will begin obtaining the data to be written to the remote node. If a Write command, valid values are between 0 and 3999. Modbus Addresses are converted into valid Source Register Address entries by subtracting 40001 from desired address. Example 40501 = Enter 500 in table
4	N22:4	Count	Represents the number of data words which the command will process. Valid values are between 1 and 100.
5	N22:5	Destination Register Address	The value represents the register address for both read and write commands, to which data will be written. The distinction between the two commands types is as follows: - When issuing a Read command, this value is the register location in the MBP module where the command will begin placing the data returned from the remote node - When issuing a Write command, this value is the register location in the remote node where the command will begin placing the data written from the MBP module. If a Read command, valid values are between 0 and 3999

			Modbus Addresses are converted into valid Source Register Address entries by subtracting 40001 from desired address. Example 40501 = Enter 500 in table
6-9	N22:6-9	Future	Not assigned at this time

8.2.4 Master Command List - Entering the Values

When entering the values in the PLC data table, the structure will appear as follows in the data edit mode:

	Enable	Device ID	Cmd Type	Src Addr	Cnt	Dest Addr	Not Used	Not Used	Not Used	Not Used	
	0	1	2	3	4	5	6	7	8	9	Description
N22:0	1	0	2	0	20	600	0	0	0	0	Master Cmd #1
N22:10	1	0	1	0	5	15	0	0	0	0	Master Cmd #2
N22:20	1	1	2	0	50	650	0	0	0	0	Master Cmd #3
N22:30	5	1	1	10	10	140	0	0	0	0	Master Cmd #4

Where:

Master Cmd #1: This entry issues is a Read Command (Function Code 3-Type 2) from the MBP module to a device on the network (MBP Device ID#0), reading 20 words from 40001 (Entered as address – 40001 = 0) and storing the data in the MBP at address 600

Master Cmd#2: This entry issues a Write Command (Function Code 16-Type 1) from the MBP module to Device ID #0, writing 5 words beginning from MBP address 0, and placing the data in the remote device beginning at 40016 (Register 15).

Master Cmd #3: This is a Read Command entry (Function Code 3-Type 2) where the MBP module issues a command to node Device ID#1, reading 50 words from 40001 in the remote node and storing the data in the MBP beginning at address 650

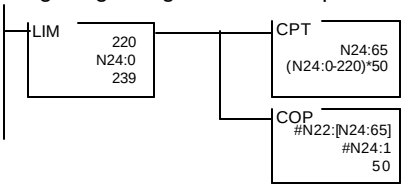
Master Cmd #4: This is a Write Command entry (Function Code 16-Type 1) where the MBP module writes 10 words of data from MBP address 10 to the node defined by Device ID#1 at 40141 (Register 140). This write command is Conditional and is executed only when a change in any of the 10 words to be written is detected.

8.2.5 PLC Ladder Logic Requirements

A minimum amount of ladder logic is required to move the Master Command List to the MBP module. Note that only commands to be used need to be written to the MBP module during configuration as the Master Command List is initialized to all zeros (0) on power up. The module will determine the number of Block Transfers (i.e, the number of Block ID 220-239 blocks) to transfer based on the 'Number of Master Commands' configuration value (N20:12 in example ladder program).

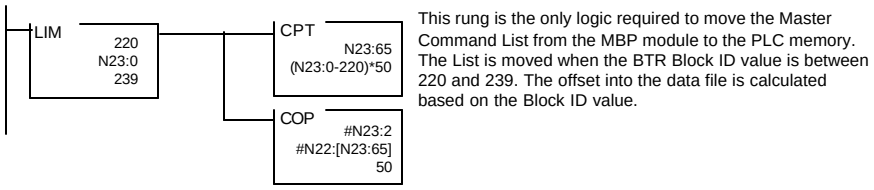
Writing the Master Command List to the MBP module

The following rung of logic will move up to 100 Master Command List entries to the module.



This rung is the only logic required to move the entire Master Command List from the PLC to the MBP module. The List is moved when the BTW Block ID (N24:0) is between 220 and 239. The offset into the data file is calculated based on the Block ID value.

Reading Master Command List from the MBP module(Only required if using 3305-SW utility)
The following rung of logic will read up to 100 Master Command List entries from the module and store them in the PLC.



Please note the following:

1. Both of these rungs must be located within the BTW/BTR Enable interlock bits in order to function correctly. Please see example logic in Appendix E.
2. The Master Command List data file (N22 in example ladder) must be sized correctly when created (i.e, 50 words per Block ID to be processed)

8.3 Configuration Requirements – Event Initiated Commands

The Master Driver generates several pieces of status data which may be useful to the ladder logic programmer in determining the success/failure of the Master Commands. These values are returned to the PLC via BTR Blocks 0 to 80. The following table shows the location of these values in the module's Modbus address space and in the PLC Data table for the example logic. See Section 9.1.2 for the ladder logic required for the Status Data.

8.3.1 Device Definition File – Block ID 240 to 247

An entry must be made in the Device Definition File for each node on the network that is to be addressed by the MBP module's Event Command List. The entry in the Device Definition File must consist of at least the Routing Path, including a valid Data Slave Input path if the device is not a Modicon PLC. See Section 4.2.1 for details on the Device Definition File.

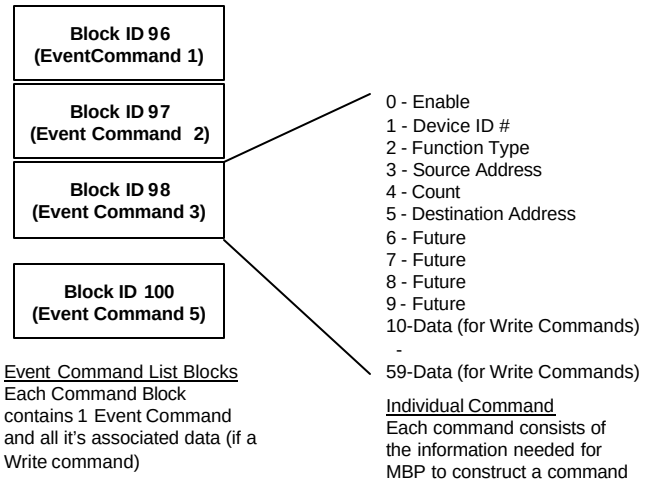
Device Definition File – Section 4.2.1			
Parameter per Node	**Function**	**Example Address**	**Example Value**
Routing Adresses 1 – 5	These values determine the network route path that a message will use to get from the MBP module to the node on the network. Remember to include the Data Slave Input Path if addressing a non-Modicon PLC node. See Section 4.2 for details	N21:0 N21:1 N21:2 N21:3 N21:4	6 0 0 0 0

8.3.2 Event Command List – Block ID 96 to 100

In order to function in the Master Mode, the MBP module's Master Command List must be setup. This list contains up to 100 individual entries, with each entry consuming 10 words of PLC data table space and consisting of the following:

- Device ID Number (for Routing Path from Device Definition File)
- Command Type – Read or Write up to 100 words per command
- Source and Destination Register Address – Determines where data will be placed and/or obtained
- Count – Select the number of words to be transferred – 1 to 100

The Master Command List is transferred to the MBP module only during the configuration process, and is not otherwise updated by the module. This means that any changes in the command list must specifically be downloaded to the module by initiating a BTW Block ID 255 (Set User Config Bit B3/0 in Example Logic).

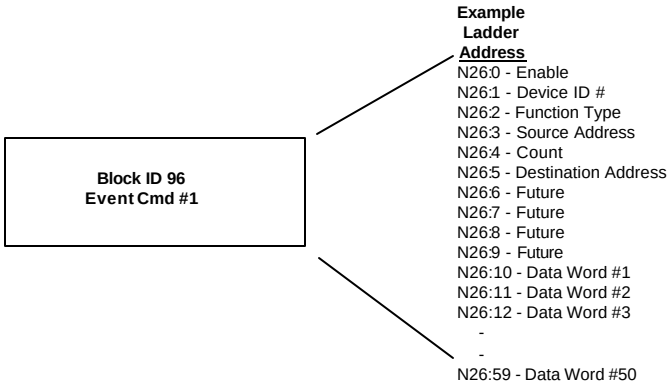


The following table shows the PLC data file location of the Command List entries and relates this to the Block ID Numbers, using the the example ladder program addresses.

Block ID Number	Example Ladder Addresses	Name	Description
96	N26:0 to N26:59	Event Command #1	This data consists of up to 5 entries in the Event Command List, with each entry consisting of 60 data words. The structure of each entry is detailed in Section 8.3.3. Note that this data can be transferred to the module at anytime under the ladder logic control.
97	N26:60 to N26:119	Event Command #2	
98	N26:120 to N26:179	Event Command #3	
99	N26:180 to N26:239	Event Command #4	
100	N26:240 to N26:299	Event Command #5	

8.3.3 Event Command – Detailed Structure

The individual entries in the Event Command consists of 60 data words. The structure for the command entry is shown below. For details as to the meaning of each entry in the table see the table in Section 8.2.3.



8.3.4 Event Command List - Entering the Values

When entering the values in the PLC data table, the structure will appear as follows in the data edit mode:

	Enable	Device ID	Cmd Type	Src Addr	Cnt	Dest Addr	Not Used	Not Used	Not Used	Not Used	
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Description**
N26:0	1	0	16	0	10	600	0	0	0	0	Event Cmd Setup
	Data	**Data**	**Data**	**Data**	**Data**	**Data**	**Data**	**Data**	**Data**	**Data**	
N26:10	1	2	3	4	5	6	7	8	9	10	Event Cmd Data
N26:20	0	0	0	0	0	0	0	0	0	0	Event Cmd Data
N26:30	0	0	0	0	0	0	0	0	0	0	Event Cmd Data
N26:40	0	0	0	0	0	0	0	0	0	0	Event Cmd Data
N26:50	0	0	0	0	0	0	0	0	0	0	Event Cmd Data

Where:

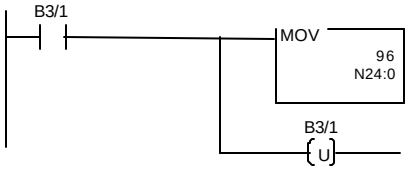
Event Cmd #1: This entry issues is a Write Command (Function Code 16-Type 1) from the MBP module to a device on the network (MBP Device ID#0), writing 10 words from the Event Cmd Block (words 10-19 or N26:10 to N26:19) to a Modbus device at register address 600

8.3.5 PLC Ladder Logic Requirements – Event Commands

A minimum amount of ladder logic is required to move the Event Command to the MBP module. Note that the Event Command only needs to be written to the module when ready for execution. The transfer to the module can be done at any time during the module's operation.

Setting up the Block ID Number

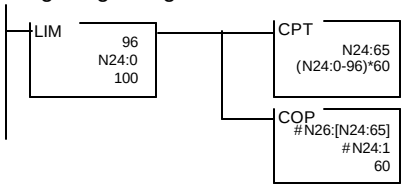
The following branches of logic can be added to the BTR rung, right above the MOV 255 instruction. The purpose of this logic is to move the Event Cmd Block ID values (96-100) to setup the BTW buffer correctly.



This branch of logic sets up the BTW Block ID value to transfer Event Command #1 from the PLC to the MBP module. Similar branches can be added for the remaining Event Commands.

Writing the Event Command to the MBP module

The following rung of logic will move the Event Command to the module.



This rung is the only logic required to move the Event Commands from the PLC to the MBP module. The List is moved when the BTW Block ID (N24:0) is between 96 and 100. The offset into the data file is calculated based on the Block ID value.

Please note the following:

1. Both of these rungs must be located within the BTW/BTR Enable interlock bits in order to function correctly. Please see example logic in Appendix E.
2. The Event Command data file (N26 in example ladder) must be sized correctly when created (i.e., 60 words per Block ID to be processed)

8.4 Monitoring Command Status

The Master Driver generates several pieces of status data which may be useful to the ladder logic programmer in determining the success/failure of the Master Commands. These values are returned to the PLC via BTR Blocks 0 to 80. The following table shows the location of these values in the module's Modbus address space and in the PLC Data table for the example logic. See Section 9.1.2 for the ladder logic required for the Status Data.

8.4.1 Master Command Status – Per Command

The MBP module monitors the status of the individual commands in the Master Command List and returns status data to the PLC.

Example Ladder Address	MBP Modbus Addr	Description
N16:40	44041	Master Command Status - #1
N16:41	44042	Master Command Status - #2
N16:42	44043	Master Command Status - #3
N16:43	44044	Master Command Status - #4
N16:44	44045	Master Command Status - #5
-	-	-
-	-	-
N16:135	44136	Master Command & Event Command Status - #96
N16:136	44137	Master Command & Event Command Status - #97
N16:137	44138	Master Command & Event Command Status - #98
N16:138	44139	Master Command & Event Command Status - #99
N16:139	44140	Master Command & Event Command Status - #100

The valid status values returned for each command are:

High Byte	Low Byte	Word Value Decimal	Description
0x00			
	0x01	1	This bit will toggle when command is being executed successfully. This value is zeroed in the module after each transfer to the PLC to assure that the displayed value is the most current value.
	0x08	8	Master Data Path Timeout error
	0x10	16	Command Not Configured
	0x20	32	Conditional Command - Data unchanged. This will toggle quickly to a 1 when command is executed (May not always see this in status)

(Continued)

High Byte	Low Byte	Word Value Decimal	Description
0x02			**Routing Errors**

	0x01	513	No response received – Is addressed unit online
	0x02	514	program access denied
	0x04	516	exception response received
	0x08	520	invalid node type in routing path
	0x10	528	Slave rejected the Modbus command. Check that a valid Input Path has been defined (1 – 8) if addressing a non-Modicon PLC device on the network
	0x20	544	initiated transaction forgotten by slave
	0x40	576	Unexpected Master Output Path Received
	0x80	640	unexpected response received
0x04			**Configuration Errors**
	0x01	769	Invalid Configuration for Command. Check the following: Device ID# > Max Number Nodes Cfg Count > 100 Count = 0 Node Address = 0
	0x02	770	Invalid Command Type 1 = Write 2 = Read All others are invalid
	0x04 to 0x80		Not assigned

8.4.2 Master Output Path Counters

The MBP module returns several counter values which are useful in determining the module's Master mode operating status. These values are returned to the PLC via BTR Blocks ID 0 to 80. They are part of the Miscellaneous Module Status data block and are rollover byte counters split into a high and low byte. Their purpose is to indicate the level of activity for each Master Ouput Path in the MBP module. The Modbus Plus chipset supports up to 8 Master Output Paths, with the number of supported paths being configured in the Module Configuration Block (See Section 3). See Section x.x for the ladder logic required for the Status Data.

Example Ladder Addres	MBP Modbus Address	Name	Description
N16:147	44148	Data Master Path Counters Path 1 & 2	These byte counters (high and low byte split) increment every time a command is successfully processed by a Master Output Path. Example N16:147 High Byte – Path 1 N16:147 Low Byte – Path 2
N16:148	44149	Data Master Path Counters Path 3 & 4	
N16:149	44150	Data Master Path Counters Path 5 & 6	
N16:150	44151	Data Master Path Counters Path 7 & 8	

9 Status Data & Hardware Diagnostics

The module provides diagnostic information in two forms; 1) Status Data values returned from the module to the data table in the PLC, and 2) LED Status indicators on the front of the module.

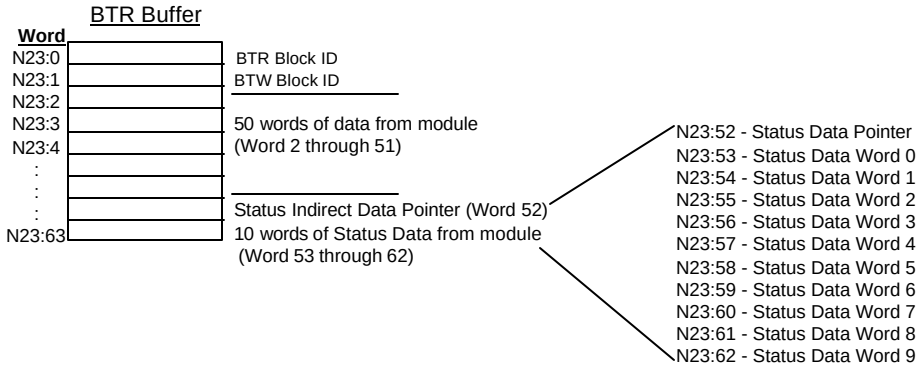
The following sections explain how to obtain the Status Data from the module and the meaning of the individual LEDs on the module.

9.1 Reading Status Data from the module

The MBP module returns a 210 word Status Data block that can be used to determine the module's operating status. This data block, detailed in Section 9.1.3, is 'paged' out of the module into the PLC via the BTR Buffer in 10 word blocks. This process is detailed in the following Section.

9.1.1 Status Data Transfer via BTR Buffer

A paging scheme has been implemented to transfer the Status Data out of the module. As shown in the following diagram, the tail end of the BTR Buffer has been reserved for 11 words associated with the transfer of the Status Data.



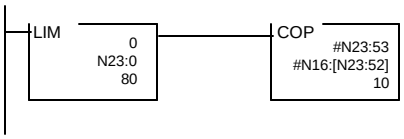
The first of these 11 words is a pointer which can be used in ladder logic to implement a single COP instruction using indirect addressing to move all 210 Status Data words into a PLC data file. With every new BTR instruction, the Status Data Pointer and the subsequent 10 words of data are updated. Therefore it will take 21 total block transfers to 'page' in the entire Status Data file.

The following diagram shows the relationship between the Status Data Pointer, the type of status data, and the PLC address for the example ladder program.

PLC Address (Example)	Status Data Pointer	
N16:0	0	Global In Update Status (See Section 6.4.1)
N16:10	10	
N16:20	20	
N16:30	30	
N16:40	40	Master Command List Status (See Section 8.4)
N16:50	50	
N16:60	60	
N16:70	70	
N16:80	80	
N16:90	90	
N16:100	100	
N16:110	110	
N16:120	120	
N16:130	130	
N16:140	140	Miscellaneous Module Status (See Section 9.2)
N16:150	150	
N16:160	160	
N16:170	170	Global In Update Counters (See Section 6.4.2)
N16:180	180	
N16:190	190	
N16:200	200	

9.1.2 PLC Ladder Logic Requirements

The following rung is an example of the ladder logic needed to transfer the Status Data file from the module to a PLC data file. This logic assumes that an entire file, beginning with address 0 has been reserved for the data (File N16 has been set aside for this purpose in the example ladder program).



This rung transfers the Status Data File from the BTR Buffer (i.e., from the MBP module) to the PLC memory. The Status Data is moved when the BTR Block ID value is between 0 and 80. The Status Data Pointer can be used to copy the data directly into a data file.

9.1.3 Status Data File Structure

The following table details the relationship between the Status Data Pointer, the PLC File Addresses, and the type of Status Data received from the module. The Status Data details are referenced to other sections of the manual where more details on the data values themselves can be obtained.

Status Data Pointer	Words	Example Addr Range	Descriptions	Block Size
0	0-9	N16:0 to N16:9	Global In Update Status	40
10	10-19	N16:10 to N16:19		
20	20-29	N16:20 to N16:29		
30	30-39	N16:30 to N16:39		
40	40-49	N16:40 to N16:49	Master Command Status	100
50	50-59	N16:50 to N16:59		
60	60-69	N16:60 to N16:69		
70	70-79	N16:70 to N16:79		
80	80-89	N16:80 to N16:89		
90	90-99	N16:90 to N16:99		
100	100-109	N16:100 to N16:109		
110	110-119	N16:110 to N16:119		
120	120-129	N16:120 to N16:129		
130	130-139	N16:130 to N16:139	Event Command Status also	

140	140-149	N16:140 to N16:149	Misc Module Status	30
150	150-159	N16:150 to N16:159		
160	160-169	N16:160 to N16:169		
170	170-179	N16:170 to N16:179	Global In Update Counters	40
180	180-189	N16:180 to N16:189		
190	190-199	N16:190 to N16:199		
200	200-209	N16:200 to N16:209		

9.2 Miscellaneous Module Status File

The Miscellaneous Module Status File contains an assortment of status data, ranging from Modbus Plus chipset status, to product revision information, and Global Output Update status. The values in these status registers are detailed in the following table.

Example Ladder Address File N16	MBP Modbus Address	Name	Description
N16:140	44141	Modbus Plus Crash Code	This register contains values returned from the Modbus Plus chipset. Normal Operation **Value** **Description** 0x00 Interface is operational Interface Crash Codes Interface crash codes indicate that an invalid command was sent to the Modbus Plus chipset by the MBP module. The MBP module will reset this error automatically. The error will continue to occur until the source of the offending command is identified and is rectified. **Value** **Description** 0x01 2 second interface timeout 0x02 Bad interface opcode 0x03 Interface Data error 0x04 Interface test error 0x05 Interface x-fer done error 0x06 Bad interface path 0x07 Bad transfer state 0x08 Bad transfer length 0x09 Global Data length error 0x0A Global Data address error 0x0B Global Data not present Fatal Crash Codes A fatal internal hardware or software error not caused by a mistake from the module has crashed the Modbus Plus chipset. In this case, the Modbus Plus connection is dropped immediately, and is not restored until after the module has completed the power up reset routine.

			Value **Description** 0x81 PROM checksum error 0x82 int-RAM data test error 0x83 ext-RAM data test error 0x84 ext-RAM address test error 0x85 bad confidence test index 0x86 ext-int0 event error 0x87 ext-int1 event error 0x88 dma-int0 event error 0x89 comm-int event error 0x8A xmit-no-good event error 0x8B no-resp timeout MAC State 0x8C no-resp timeout MAC idle 0x8D receive-ok MAC State 0x8E transmit-ok MAC State 0x8F no receive buffer free 0x90 bad input-transfer length 0x91 reserved rev-buf error 0x92 bad trans-control state 0x93 bad word request bit 0x94 node-queue overflow 0x95 bad data-queue error 0x96 empty data-path error 0x97 bad path search index 0x98 bad data-slave path Please contact the factory if one of these error conditions occurs and cannot easily be cleared by modifying the Module Configuration or the Master Command List.

(Continued)

Example Ladder Address File N16	MBP Modbus Address	Name	Description
N16:141	44142	Peer Status	This register provides status of the Modbus Plus chipset relating to the network communications: **Value** **Description** 0 Monitor Link Operation 32 Normal Link Operation 64 Never getting token 96 Sole station 128 Duplicate station
N16:142	44143	Token Pass Counter	This value increments each time the module gets the token on the Modbus Plus network
N16:143	44144	Token Rotation Time	This is the time period, in milliseconds, that the module is passed the token
N16:144	44145 – H	Communication Failed Error Counter	These rollover counters are returned from the Modbus Plus chipset, and indicate the occurrence and frequency of individual error conditions
	- L	Communication Retry Counter	
N16:145	44146 – H	No Response Received Error Counter	

	- L	Good Receive Packet Success Counter	
N16:146	44147 – H	Unexpected Path Error Counter	
	- L	Exception Response Received Error Counter	
N16:147	44148	Data Master Output Path Counters – Path 1 & 2	These registers, split between High and Low bytes, contain rollover counters which indicate successful activity on an individual Data Master Path. The Data Master paths are accessed by commands executed out of the Master Command List.
N16:148	44149	Path 3 & 4	
N16:149	44150	Path 5 & 6	
N16:150	44151	Path 7 & 8	
N16:151	44152	Data Slave Input Cntrs Path 1 & 2	These registers, split between High and Low bytes, contain rollover counters that indicate successful activity on an individual Data Slave Path basis. The Data Slave Paths are accessed by external devices issuing commands to the module's node address.
N16:152	44153	Path 3 & 4	
N16:153	44154	Path 5 & 6	
N16:154	44155	Path 7 & 8	
N16:155	44156	Global Out Update Status	This is a word value returning a value indicating the configuration and/or operating status of the Global Output Function. The valid values which may be returned are: **Value** **Hex** **Dec** **Description** 0x01 1 Updating – All OK 0x02 2 Not Assigned 0x04 4 Not Assigned 0x08 8 Global Update Timeout (Not transmitted in 500 ms) 0x10 16 Global Data Not Configured (Length in Config Block = 0) 0x20 32 Not Assigned 0x40 64 Invalid Global Data Length (Length > 32 words) 0x80 128 Not Assigned

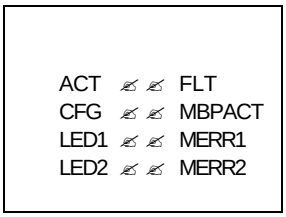
(Continued)

Example Ladder Address File N16	MBP Modbus Address	Name	Description
N16:156	44157	Global Out Update Counter	This is a 16 bit roll-over counter which increments from 0 to 0xFFFF (-32767 to 32767). The counter increments each time a Global Output command has been successfully processed by the Modbus Plus chipset on the MBP module.
N16:157 to N16:162	44158 to 44163	Not Assigned	Spare
N16:163 N16:164	44164 44165	Product ID – 'MB' and 'P2'	These registers contain the ASCII representation of the Product ID. 'MBP2' represents the 3300-MBP module
N16:165	44166	Revision Level of 3300-MBP Firmware	This register, when viewed in hex, contains the encoded representation of the module's firmware

		(0x0106 = 1.06)	release level. This value is useful during troubleshooting when discussing issues with the factory.
N16:166	44167	Batch Number for 3300-MBP Firmware (0x0006 = 6)	This register, when viewed in hex, contains the batch number for the 3300 firmware. This is a value that will also be useful during troubleshooting discussions with the factory.
N16:167	44168	MBP Update Processing Time	This is a timer value in milliseconds, which represents the main loop processing time in the module. This value may be useful during optimization of the module's operation when attempting to balance performance of the Modbus Plus network with that of the backplane transfer.
N16:168	44169	Global In Update Time	This is a millisecond timer that indicates the period in which the Global In data is being received.
N16:169	44170	Global Out Update Time	This is a millisecond timer that indicates the period in which the Global Out data is being sent out by the module.

9.3 LED Status Indicators

The LEDs will indicate the module's operating status:



ProSoft Module	Color	Status	Indication
ACT	Green	Blink (Fast)	Normal state : The module is operating normally and transferring data with the PLC
		On/Off	The module has not cleared the reset condition after power up. Make sure the processor is in the RUN mode.

(Continued)

ProSoft Module	Color	Status	Indication
CFG	Green	Off	Normal State: No configuration related activity is occurring at this time.
		Blink	This light blinks every time the PLC writes a 1 into the Module Configuration Control word.
		On	The light is on continuously whenever the module has not been configured after a power cycle, or when the PLC is not in run. Placing the PLC in run and setting a 1 into the Module Configuration Control word will clear the light.

LED1	Amber	On	Configuration Error: The module has detected an incorrect configuration value. Verify that all of the configuration values are within valid ranges. The most probable source of the error is the Node Address selected by the dip switches does not match the value in the configuration table (N20:1).
		Off	Normal State
LED2	Amber	On	Modbus Plus Communication Error
		Off	Normal State
FLT	Red	Off	Normal State : No system problems are detected during background diagnostics
		On	A system problem was detected during background diagnostics. Please see the next Section of this manual or contact the Factory for assistance
MBPACT Modbus Plus Status	Green	6 flashes per second	The 3300-MBP is working normally in that it is successfully receiving and passing the token. All nodes on the link should be flashing this pattern.
		1 flash per second	This node is off-line after just being powered up, or after exiting the four flashes per second mode. In this state, the node monitors the network and builds a table of active nodes and token-holding nodes. It remains in this state for five seconds, then attempts to go to its normal operating state.
		Two Flashes then OFF for two sec	The node is hearing the token being passed among other nodes, but is never receiving the token. Check the network for an open circuit or defective termination.
		Three Flashes then OFF for 1.7 sec	The node is not hearing any other nodes. It is periodically claiming the token but finding no other node to which to pass it. Check the network for an open circuit or defective termination.
		Four Flashes then OFF for 1.4 sec	The node has heard a valid message from another node that is using the same address as this node. The node remains in this state as long as it continues to hear the duplicate address. If the duplicate address is not heard for five seconds, the node then changes to the pattern of one flash every second.
MERR1 MERR2	Red	Off	Normal State : When the error LED is off and the related port is actively transferring data, there are no communication errors
		Blink	If the LED blinks momentarily, a message error has been detected on the cable path.
		On	If the LED is on steady, a hard fault has occurred either in the cable or in a node device connected to the cable. Also, the LED will be on steady if none of the commands in the Master Command list are successfully being completed. Redundant configuration If communication is lost on one cable path, the other path continues normally.

9.4 Clearing a Fault Condition

Typically, if the FAULT LED on the front of the module becomes illuminated, a hardware problem has been detected in the module. This condition will normally cause the PLC processor to also fault. To attempt to clear the condition:

1. Cycle power to the rack
2. Verify the configuration data being transferred to the MBP module from the PLC
3. Clear the fault condition in the PLC and place the PLC in the RUN mode

If the MBP module's FAULT LED does not turn off, contact the factory.

9.5 Troubleshooting

In order to assist in the troubleshooting of the module, the following tables have been put together to assist you. Please use the following to help in using the module, but if you have additional questions or problems please do not hesitate to contact us.

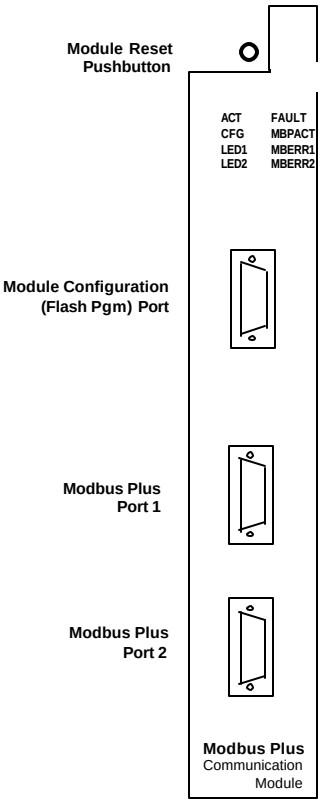
The entries in this section have been placed in the order in which the problems would most likely occur after powering up the module.

Problem Description	Steps to take
Processor Fault	Usually a processor fault with the MBP module indicates that there is an indirect address command that is attempting to write to a PLC data file which does not exist. To eliminate the problem, verify the sizes of the configuration and read/write data files which are being used in the ladder program. Invariably, it will be found that the logic is attempting to move data to/from a non-existent memory location
CFG LED is on continuously after power up	This is normally an indication that the MBP module is not being configured by the PLC: 1) Verify that the ladder logic in the PLC correctly moves data to the module and that the Module Configuration Control word is being set correctly 2) Verify that the ladder correctly clears the User Configuration Bit 3) Verify that the PLC is in the RUN mode

10 Cable Connections to the Module

The 3300-MBP has the following communication connections on the module:

1. Two (2) Modbus Plus communication ports (Redundant ports)
2. One (1) RS-232 Configuration port



10.1 Modbus Plus Communication Ports

The 3300-MBP module has two physical Modbus Plus connectors, each a DB-9 Male plug located on the front of the module. These ports operate as redundant Modbus Plus ports, allowing two separate physical networks (one logical network) to be routed through a facility.

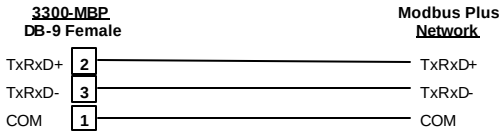
10.1.1 Connecting the cable to the connector

Modicon provides two different Modbus Plus connectors to ease installation. These connectors are as follows:

Modicon Part Number	**Description**
AS-MBKT-085	In-line Connector
AS-MBKT-185	Terminating Connector

The actual cable installation and the wiring of the cable to the connectors is fully documented in the Modicon publication *Modicon Modbus Plus Network Planning and Installation Guide – Pub No. GM-MBPL-001*.

In case the Modicon connectors are not available during installation, the following pin out applies to the DB-9 Modbus Plus port connections:



10.1.2 Plugging the connector into the module

There are two physical Modbus Plus ports on the 3300-MBP. The top port, labelled Port 1, should be used as the module's primary communication port in cases where only one physical network is being installed.

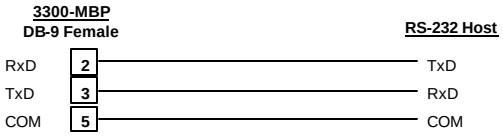
Note that the DB-9 ports on the 3300-MBP module have been carefully located to allow the front cover to be closed while the cable connectors are plugged in.

10.2 RS-232 Flash Program & Module Monitor Port

This port is physically a DB-9 Female connection and serves two purposes:

1) Allowing the module's firmware to be upgraded in the field
2) Provides a connection for the ProSoft 3305-S/W Configuration Utility

The Flash Upgrade procedure will be distributed with the HEX file, available on our ftp site as they become available.



A Support, Service and Warranty

Technical Support

ProSoft Technology survives on its ability to provide meaningful support to its customers. Should any questions or problems arise, please feel free to contact us at:

Factory/Technical Support
ProSoft Technology, Inc.
9801 Camino Media, Suite 105
Bakersfield, CA 93311
(661) 664-7208
(800) 326-7066
(661) 664-7233 (fax)
E-mail address: prosoft@prosoft-technology.com
Web Site: http://www.prosoft-technology.com

Before calling for support, please prepare yourself for the call. In order to provide the best and quickest support possible, we will most likely ask for the following information (you may wish to fax it to us prior to calling):

1. Product Version Number
2. System hierarchy
3. Module Configuration
4. LED Patterns

An after-hours answering system (on the Bakersfield number) allows pager access to one of our qualified technical and/or application support engineers at any time to answer the questions that are important to you.

Module Service and Repair

The MBP card is an electronic product, designed and manufactured to function under somewhat adverse conditions. As with any product, through age, misapplication, or any one of many possible problems, the card may require repair.

When purchased from ProSoft Technology, the module has a one-year parts and labor warranty according to the limits specified in the warranty. Replacement and/or returns should be directed to the distributor from whom the product was purchased. If you need to return the card for repair, it is first necessary to obtain an RMA number from ProSoft Technology. Please call the factory for this number and display the number prominently on the outside of the shipping carton used to return the card.

General Warranty Policy

ProSoft Technology, Inc. (Hereinafter referred to as ProSoft) warrants that the Product shall conform to and perform in accordance with published technical specifications and the accompanying written materials, and shall be free of defects in materials and workmanship, for the period of time herein indicated, such warranty period commencing upon receipt of the Product.

This warranty is limited to the repair and/or replacement, at ProSoft's election, of defective or non-conforming Product, and ProSoft shall not be responsible for the failure of the Product to perform specified functions, or any other non-conformance caused by or attributable to: (a) any misapplication of misuse of the Product; (b) failure of Customer to adhere to any of ProSoft's specifications or instructions; (c) neglect of, abuse of, or accident to, the Product; or (d) any associated or complementary equipment or software not furnished by ProSoft.

Limited warranty service may be obtained by delivering the Product to ProSoft and providing proof of purchase or receipt date. Customer agrees to insure the Product or assume the risk of loss or damage in transit, to prepay shipping charges to ProSoft, and to use the original shipping container or equivalent. Contact ProSoft Customer Service for further information.

Limitation of Liability

EXCEPT AS EXPRESSLY PROVIDED HEREIN, PROSOFT MAKES NO WARRANT OF ANY KIND, EXPRESSED OR IMPLIED, WITH RESPECT TO ANY EQUIPMENT, PARTS OR SERVICES PROVIDED PURSUANT TO THIS AGREEMENT, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANT ABILITY AND FITNESS FOR A PARTICULAR PURPOSE. NEITHER PROSOFT OR ITS DEALER SHALL BE LIABLE FOR ANY OTHER DAMAGES, INCLUDING BUT NOT LIMITED TO DIRECT, INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, WHETHER IN AN ACTION IN CONTRACT OR TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY), SUCH AS, BUT NOT LIMITED TO, LOSS OF ANTICIPATED PROFITS OR BENEFITS RESULTING FROM, OR ARISING OUT OF, OR IN CONNECTION WITH THE USE OR FURNISHING OF EQUIPMENT, PARTS OR SERVICES HEREUNDER OR THE PERFORMANCE, USE OR INABILITY TO USE THE SAME, EVEN IF PROSOFT OR ITS DEALER'S TOTAL LIABILITY EXCEED THE PRICE PAID FOR THE PRODUCT.

Where directed by State Law, some of the above exclusions or limitations may not be applicable in some states. This warranty provides specific legal rights; other rights that vary from state to state may also exist. This warranty shall not be applicable to the extent that any provisions of this warranty is prohibited by any Federal, State or Municipal Law that cannot be preempted.

Hardware Product Warranty Details

Warranty Period : ProSoft warranties hardware product for a period of one (1) year.
Warranty Procedure: Upon return of the hardware Product ProSoft will, at its option, repair or replace Product at no additional charge, freight prepaid, except as set forth below. Repair parts and replacement Product will be furnished on an exchange basis and will be either reconditioned or new. All replaced Product and parts become the property of ProSoft. If ProSoft determines that the Product is not under warranty, it will, at the Customer's option, repair the Product using current ProSoft standard rates for parts and labor, and return the Product freight collect.

B Dip Switch Settings

SW 1 to 6 : Modbus Plus Node Address

1	Address Bit 0	Value = 1
2	Address Bit 1	Value = 2
3	Address Bit 2	Value = 4
4	Address Bit 3	Value = 8
5	Address Bit 4	Value = 16
6	Address Bit 5	Value = 32

Example Addresses = 1 to 64

6	5	4	3	2	1	Address
on	on	on	on	on	on	1
on	on	on	on	on	off	2
on	on	on	on	off	on	3
on	on	on	on	off	off	4
on	on	on	off	on	on	5
on	on	on	off	on	off	6
on	on	on	off	off	on	7
on	on	on	off	off	off	8
on	on	off	on	on	on	9
on	on	off	on	on	off	10
on	on	off	on	off	on	11
on	on	off	on	off	off	12
on	on	off	off	on	on	13
on	on	off	off	on	off	14
on	on	off	off	off	on	15
on	on	off	off	off	off	16
on	off	on	on	on	on	17
on	off	on	on	on	off	18
on	off	on	on	off	on	19
on	off	on	on	off	off	20
on	off	on	off	on	on	21
on	off	on	off	on	off	22
on	off	on	off	off	on	23
on	off	on	off	off	off	24
on	off	off	on	on	on	25
on	off	off	on	on	off	26
on	off	off	on	off	on	27
on	off	off	on	off	off	28
on	off	off	off	on	on	29
on	on	off	off	on	off	30
on	off	off	off	off	on	31
on	off	off	off	off	off	32

6	5	4	3	2	1	Address
off	on	on	on	on	on	33
off	on	on	on	on	off	34
off	on	on	on	off	on	35
off	on	on	on	off	off	36
off	on	on	off	on	on	37
off	on	on	off	on	off	38
off	on	on	off	off	on	39
off	on	on	off	off	off	40
off	on	off	on	on	on	41
off	on	off	on	on	off	42
off	on	off	on	off	on	43
off	on	off	on	off	off	44
off	on	off	off	on	on	45
off	on	off	off	on	off	46
off	on	off	off	off	on	47
off	on	off	off	off	off	48
off	off	on	on	on	on	49
off	off	on	on	on	off	50
off	off	on	on	off	on	51
off	off	on	on	off	off	52
off	off	on	off	on	on	53
off	off	on	off	on	off	54
off	off	on	off	off	on	55
off	off	on	off	off	off	56
off	off	off	on	on	on	57
off	off	off	on	on	off	58
off	off	off	on	off	on	59
off	off	off	on	off	off	60
off	off	off	off	on	on	61
off	on	off	off	on	off	62
off	off	off	off	off	on	63
off	off	off	off	off	off	64

SW 8 : Module Run Mode

Off: Module Run Mode (Default Position)

On: Force Flash Program Mode
Only used in extreme cases when recommended by factory

C Memory Mapping and Object Definitions

General Read/Write Register Data – Block ID 0 to 79

PLC Access	Example Addr Range	Modbus Addr Range	Descriptions	Block Size
Write to Module Read From Module	N17:0 to N17:499 N18:0 To N18:499	40001 to 44000	Data Registers General purpose data for servicing Modbus Plus driver commands and Block Transfers to/from the PLC	4000 max.

Status Data from Module – Within Block ID 0 to 80

PLC Access	Example Addr Range	Modbus Addr Range	Descriptions	Block Size
R	N16:0 To N16:39	44001 to 44040	Global In Update Status	40
R	N16:40 to N16:39	44041 to 44140	Master Command Status	100
R	N16:140 To N16:169	44141 to 44170	Misc Module Status	30
R	N16:170 To N16:209	44171 to 44210	Global In Update Counters	40

Configuration Data – Block ID 220 to 255

PLC Access	Example Ladder Addr	Modbus Addr Range	Descriptions	Block Size
R/W	N20:0 To N20:39	44211 to 44250	Module Configuration Block Section 3	40
R/W	N20:40 To N20:79	44251 to 44290	Input File Map Section 6	40
R/W	N21	44291 to 44610	Device Definition File Section 4	320
R/W	N22	44611 to 45610	Master Command List Section 8	1000

Input and Output File Data

PLC Access	Example Ladder Addr	Modbus Addr Range	Descriptions	Block Size
	N19:0	45611	Global Out Image	40

Write	To N19:31	to 45650	32 actual data words max	
Read	N19:40 To N19:71	45651 to 45691	Global In Image 32 actual data words max	40

Global In Update Status

Up to 32 active devices may be referenced for Global Input Data. The Global In Update Status for these devices, configured through the Device Definition File configuration space, is returned in this data block.

Example Ladder Address N16	MBP Modbus Addr	Description
File N16		
0	44001	Global In Update Stat - Device ID #0
1	44002	Global In Update Stat - Device ID #1
2	44003	Global In Update Stat - Device ID #2
3	44004	Global In Update Stat - Device ID #3
4	44005	Global In Update Stat - Device ID #4
5	44006	Global In Update Stat - Device ID #5
6	44007	Global In Update Stat - Device ID #6
7	44008	Global In Update Stat - Device ID #7
8	44009	Global In Update Stat - Device ID #8
9	44010	Global In Update Stat - Device ID #9
10	44011	Global In Update Stat - Device ID #10
11	44012	Global In Update Stat - Device ID #11
12	44013	Global In Update Stat - Device ID #12
13	44014	Global In Update Stat - Device ID #13
14	44015	Global In Update Stat - Device ID #14
15	44016	Global In Update Stat - Device ID #15
16	44017	Global In Update Stat - Device ID #16
17	44018	Global In Update Stat - Device ID #17
18	44019	Global In Update Stat - Device ID #18
19	44020	Global In Update Stat - Device ID #19
20	44021	Global In Update Stat - Device ID #20
21	44022	Global In Update Stat - Device ID #21
22	44023	Global In Update Stat - Device ID #22
23	44024	Global In Update Stat - Device ID #23
24	44025	Global In Update Stat - Device ID #24
25	44026	Global In Update Stat - Device ID #25
26	44027	Global In Update Stat - Device ID #26
27	44028	Global In Update Stat - Device ID #27
28	44029	Global In Update Stat - Device ID #28
29	44030	Global In Update Stat - Device ID #29
30	44031	Global In Update Stat - Device ID #30
31	44032	Global In Update Stat - Device ID #31
32 to 39	44033 to 44040	Not Used

The valid status values returned for each device are:

Value		
Hex	**Dec**	**Description**
0x01	1	Updating – All OK
0x02	2	Not Assigned

0x04	4	Not Assigned
0x08	8	Global Update Timeout
0x10	16	Global Data Not Configured
0x20	32	Not Assigned
0x40	64	Invalid Global Data Length
0x80	128	Not Assigned

Master Command Status

Up to 100 active commands may be configured in the MBP module. The individual command status data is returned in this data block.

Example Ladder Address File N16	MBP Modbus Addr	Description
40	44041	Master Command Status - #1
41	44042	Master Command Status - #2
42	44043	Master Command Status - #3
43	44044	Master Command Status - #4
44	44045	Master Command Status - #5
45	44046	Master Command Status - #6
-	-	-
-	-	-
135	44136	Master Command/Event Command Status - #96
136	44137	Master Command/Event Command Status - #97
137	44138	Master Command/Event Command Status - #98
138	44139	Master Command/Event Command Status - #99
139	44140	Master Command/Event Command Status - #100

The valid status values returned for each command are:

High Byte	Low Byte	Word Value Decimal	Description
0x00			
	0x01	1	This bit will toggle when command is being executed successfully. When a '1', the module will zero out the value after each transfer to PLC to assure that the displayed status is current.
	0x08	8	Master Data Path Timeout error
	0x10	16	Command Not Configured
	0x20	32	Conditional Command - Data unchanged. This will toggle quickly to a 1 when command is executed (May not always see this in status)
0x02			**Routing Errors**
	0x01	513	No response received – Is addressed unit online
	0x02	514	Program access denied

	0x04	516	Exception response received
	0x08	520	invalid node type in routing path
	0x10	528	Slave rejected the Modbus command. Check that a valid Input Path has been defined (1 – 8) if addressing a non-Modicon PLC device on the network
	0x20	544	Initiated transaction forgotten by slave
	0x40	576	Unexpected Master Output Path Received
	0x80	640	Unexpected response received
0x04			**Configuration Errors**
	0x01	769	Invalid Configuration for Command
	0x02	770	Invalid Command Type 1 or 16 = Write 2 or 3 = Read All others are invalid
	0x04 to 0x80		Not assigned

Miscellaneous Module Status

A 30 word block of data has been set aside to return 'miscellaneous' status data from the module to the PLC processor. This data includes network diagnostics returned from the Modbus Plus chipset as well as Product Revision data.

Example Ladder Address File N16	MBP Modbus Address	Description
140	44141	MBP Error Status
141	44142	Peer Status
142	44143	Token Pass Counter
143	44144	Token Rotation Time
144	44145 – H	Communication Failed Error Counter
	- L	Communication Retry Counter
145	44146 – H	No Response Received Error Counter
	- L	Good Receive Packet Success Counter
146	44147 – H	Unexpected Path Error Counter
	- L	Exception Response Received Error Counter
147	44148	Data Master Output Path Counters – Path 1 & 2
148	44149	Data Master Output Path Counters – Path 3 & 4
149	44150	Data Master Output Path Counters – Path 5 & 6
150	44151	Data Master Output Path Counters – Path 7 & 8
151	44152	Data Slave Input Counters - Path 1 & 2
152	44153	Data Slave Input Counters - Path 3 & 4
153	44154	Data Slave Input Counters - Path 5 & 6
154	44155	Data Slave Input Counters - Path 7 & 8
155	44156	Global Out Update Status
156	44157	Global Out Update Counter
157 to 162	44158 to 44163	Not Assigned
163 164	44164 44165	Product ID – 'MB' and 'P '
165	44166	Revision Level of 3300-MBP Firmware (0x0100 = 1.00)

166	44167	Batch Number for 3300-MBP Firmware(0x0001 = 1)
167	44168	Timer Counter - MBP Update Processing Time
168	44169	Timer Counter - Global In Update Time
169	44170	Timer Counter - Global Out Update Time

Global In Update Counters

Up to 32 active devices may be referenced for Global Input Data. The Global In Update Counters for these devices are returned in a data block. The counters are 16 bit rollover counters.

Example Ladder Address	MBP Modbus Addr	Description
File N16		
170	44171	Global In Update Counter - Device ID #0
171	44172	Global In Update Counter - Device ID #1
172	44173	Global In Update Counter - Device ID #2
173	44174	Global In Update Counter - Device ID #3
174	44175	Global In Update Counter - Device ID #4
175	44176	Global In Update Counter - Device ID #5
176	44177	Global In Update Counter - Device ID #6
177	44178	Global In Update Counter - Device ID #7
178	44179	Global In Update Counter - Device ID #8
179	44180	Global In Update Counter - Device ID #9
180	44181	Global In Update Counter - Device ID #10
181	44182	Global In Update Counter - Device ID #11
182	44183	Global In Update Counter - Device ID #12
183	44184	Global In Update Counter - Device ID #13
184	44185	Global In Update Counter - Device ID #14
185	44186	Global In Update Counter - Device ID #15
186	44187	Global In Update Counter - Device ID #16
187	44188	Global In Update Counter - Device ID #17
188	44189	Global In Update Counter - Device ID #18
189	44190	Global In Update Counter - Device ID #19
190	44191	Global In Update Counter - Device ID #20
191	44192	Global In Update Counter - Device ID #21
192	44193	Global In Update Counter - Device ID #22
193	44194	Global In Update Counter - Device ID #23
194	44195	Global In Update Counter - Device ID #24
195	44196	Global In Update Counter - Device ID #25
196	44197	Global In Update Counter - Device ID #26
197	44198	Global In Update Counter - Device ID #27
198	44199	Global In Update Counter - Device ID #28
199	44200	Global In Update Counter - Device ID #29
200	44201	Global In Update Counter - Device ID #30
201	44202	Global In Update Counter - Device ID #31
202 to 209	44203 to 44210	Not Used

D Product Revision History

Revision 1.3 2/5/98
Initial release of product
Revision 1.4 3/27/98
Modified TIC logic to correctly account for PLC not in RUN
Revision 1.5 5/13/98
Added Modbus Slave driver to Comm port for 3305-SW access
Revision 1.6 6/6/98
Added Event Initiated Command support
Added support for FC 3/16 configuration (not just 1 & 2)
Zero out Master Command Status after update PLC data table
Revision 1.7 8/18/98
Move the module signature so that MBP Config Utility can go online w/o valid configuration
Revision 1.8 10/14/98
Add support for Function Code 6 to slave driver
Revision 1.9 11/23/98
Add support for Function Code 5 to slave driver
Revision 1.10 01/5/99
Add support for Function Code 1,2, and 4 to slave driver
Revision 1.11 02/11/99
Fixed event command read handling of destination address. Was always grabbing zero for destination
Revision 1.12 07/02/99
Add Conditional Write Command support to Function Code 16 in Master driver

E Example PLC Ladder Logic

The following ladder logic provides an example for the ladder logic necessary to integrate the 3300-MBP module into an PLC application. This logic can be incorporated directly as is, or if desired, modified as needed for the application.

Data File Usage

The data file layout in this example program is as follows:

N16	MBP Module Status Data
N17	MBP Module – Write Data to module
N18	MBP Module – Read Data from module
N19	Global Out and Input File Data
N20	Module Configuration and Input File Map
N21	Device Definition File
N22	Master Command List
N23	BTR Data File
N24	BTW Data File
BT25	BT Control File
N26	Event Initiated Commands

Rung Overview

There are three rungs in the example logic:

Rung 0: Read Data from Module

This rung is used to read Register Data and Status Data from module. This rung also is responsible for setting up the BTW Block ID number, and processing a user initiated module configuration.

Rung 1: Read Configuration Data from Module

This rung is only required if using the 3305-SW Configuration Software Utility. If not using this utility, the rung can be deleted.

Rung 2: Write Data to Module

This rung transfers all Configuration and Register Data from the PLC to the module.