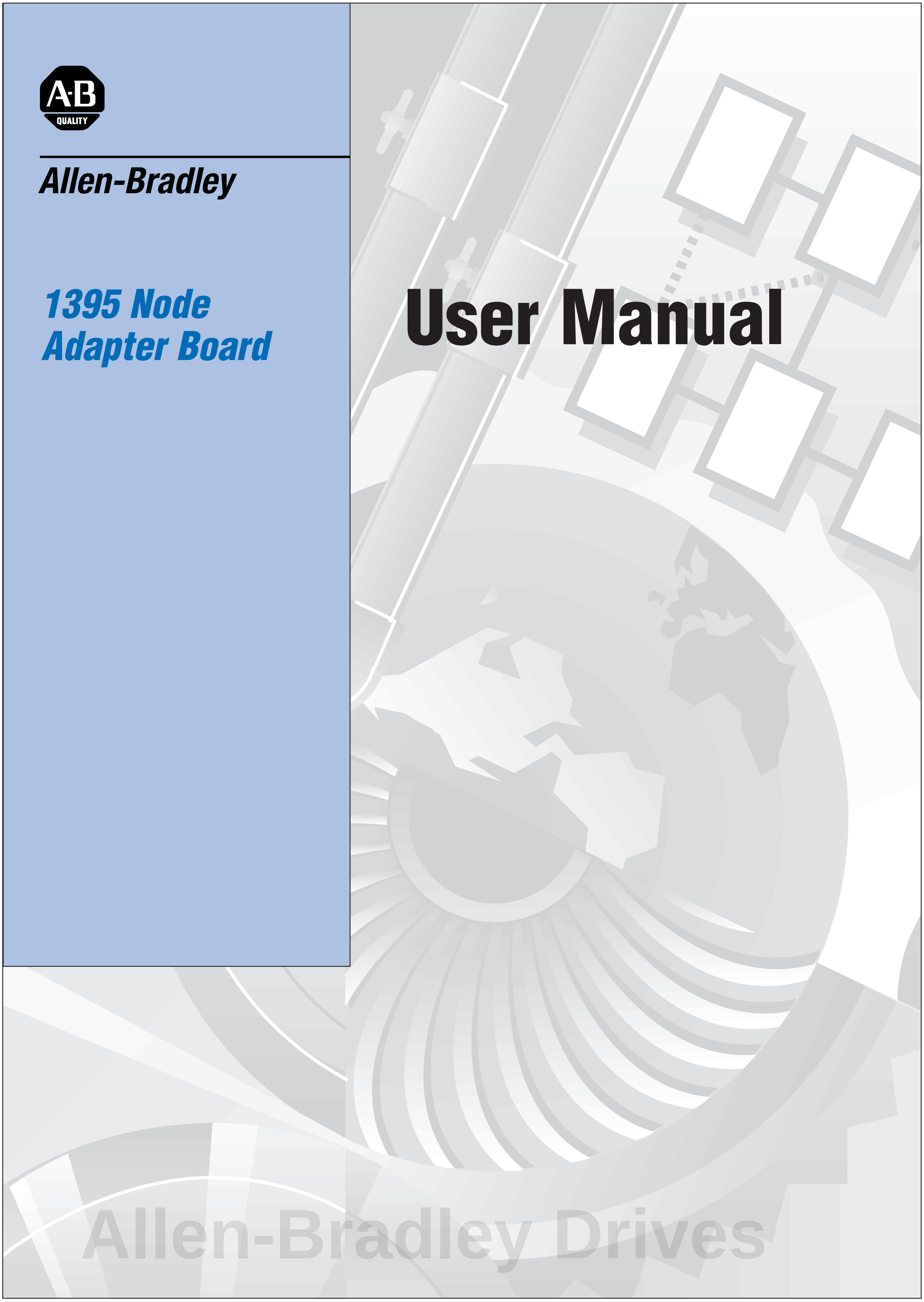
Allen-Bradley

1395 Node Adapter Board

User Manual



Before You Begin

Chapter 1

Introduction and Product Description

Chapter 2

Functional Description

Chapter 3

Chapter 1

Before You Begin

Objective

This manual contains the information necessary to perform the following functions on the Bulletin 1395 Node Adapter Board:

- ❏ Install and Set-up the Node Adapter board
- ❏ Configure the Drive for control by a PLC Controller
- ❏ Maintain and Troubleshoot the board

Audience

This manual is intended for use by expert personnel familiar with the functions of solid state drive equipment. You must be thoroughly familiar with the Bulletin 1395 and its hardware before attempting to setup or troubleshoot a Node Adapter Board.

To make efficient use of this Adapter Board you must be able to operate and program an Allen-Bradley PLC controller. If you cannot, refer to the appropriate programming and operations manual for your PLC controller and obtain training from the support division before attempting to setup and program the Node Adapter board.

Vocabulary

In this manual we also refer to the Node Adapter board as simply the “Adapter”.

The Remote Input/Output interface is referred to as the “RIO”.

The Programmable Logic Controller is referred to as a “PLC®”.

A Block Transfer Read operation is referred to as a BTR and a Block Transfer Write as a BTW.

Node Adapter Compatibility & Features

The Node Adapter board provides a sophisticated interface between external devices and the Main Control Board. This adapter has the following features:

- ❏ Capable of being configured as an Allen-Bradley Remote I/O (RIO) interface.
- ❏ Compatible with Allen-Bradley PLC3™ or PLC5™ family

Safety Precautions

The following types of precautionary statements will be found in this manual.

⚠ **ATTENTION:** Identifies particular areas of concern for correct board, processor or drive operation, or; tells you where machinery may be damaged or economic loss can occur if procedures are not followed properly, or; tells you where people may be hurt if procedures are not followed properly.

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Manual Organization

Table 1.A provides a brief overview of topics covered in this manual and their location within the book.

Table 1.A
Manual Organization

Chapter	Title	Topics
2	Introduction and Product Description	Board Identification, Hardware Content, Hardware requirements for Interfacing.
3	Configuration & Interfaces	Configuring the Drive for the Node board and interfacing the Drive with a PLC controller.
4	Installation	Unpacking & Inspection, mounting, wiring, switch settings etc.
5	Start-Up	Configuring the Drive.
6	Troubleshooting & Maintenance	Fault Diagnostics.
7	Periodic Maintenance	Preventative Maintenance & Inspections

Specifications

Electrical:
Board power provided by Drive (+5V)

Environmental:

Ambient Operating Temperature	0° to 60°C (32° to 140°F)
Storage Temperature	–40° to +85°C (–40° to +185°F)
Relative Humidity	5% to 95% non-condensing
Altitude:	3,300 feet (1,000 Meters)
Firmware Version	3.xx

Communications
Allen-Bradley Remote I/O (RIO)
Baud Rates: 57.5 KB/ 115KB
Rack Configurations: $^{1}/_{2}$ to Full

General Precautions

In addition to the precautions listed throughout this manual, the following statements which are general to the system must be read and understood.

ATTENTION: This drive may contain ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference A-B publication 8000-4.5.2, *Guarding Against Electrostatic Damage* or any other applicable ESD Protection Handbook.

ATTENTION: Severe injury or death can result from electrical shock, burn, or unintended actuation of controlled equipment. Hazardous voltages may exist in the cabinet even with the circuit breaker in the off position. Recommended practice is to disconnect and lock out control equipment from power sources and discharge stored energy in capacitors, if present. If it is necessary to work in the vicinity of energized equipment, the safety related work practices of NFPA 70E, Electrical Safety Requirements for Employee Workplaces, must be followed. DO NOT work alone on energized equipment!

ATTENTION: Potentially fatal voltages may result from improper usage of oscilloscope and other test equipment. The oscilloscope chassis may be at a potentially fatal voltage if not properly grounded. If an oscilloscope is used to measure high voltage waveforms, use only a dual channel oscilloscope in the differential mode with X 100 probes. It is recommended that the oscilloscope be used in the A minus B Quasi-differential mode with the oscilloscope chassis correctly grounded to an earth ground. Refer to equipment safety instructions for all test equipment before using with the 1395.

ATTENTION: The CMOS devices used on the control circuit boards can be destroyed or damaged by static charges. If personnel will be working near static sensitive devices, they must be appropriately grounded.

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Chapter 2

Introduction and Product Description

Chapter Objective

This chapter contains a description of the major hardware components of the Node Adapter board. It is not intended to be an all encompassing technical description of each hardware component. This chapter provides information to aid service personnel in:

❏ Identifing the Node Adapter board.

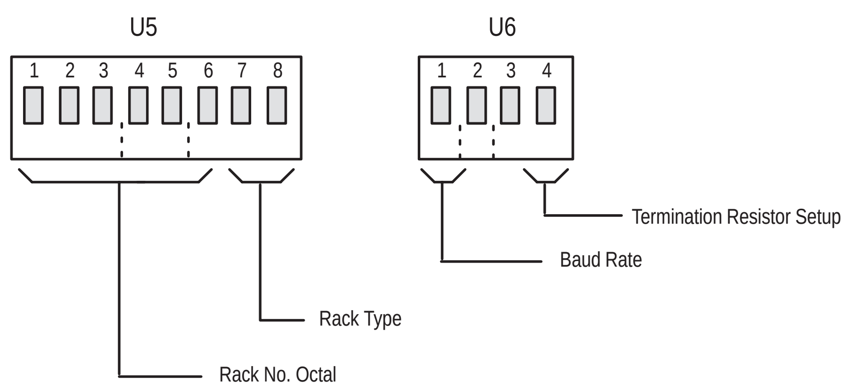
❏ Understanding the hardware content of the board.

❏ Understanding the hardware requirements necessary to interface the Node Adapter board with external devices.

General Board Description

The Node Adapter Board (Figure 2.3) contains a smaller surface mounted board. This smaller board contains the hardware which performs the Node Adapter functions related to communication with a PLC Controller and allows for discrete type PLC Controller I/O and block transfer. Additional hardware on the board allows selection of the baud rate, the rack number and also provide an interface to the Bulletin 1395 Main Control Board.

DIP switches U5 and U6 on the Node Adapter are used to select communication type, baud rate, and rack address in octal.



Switches SW1 through SW5 on U5 determine the rack address in Octal, while switches SW7 and SW8 determine the rack type.

Switch SW1 on U6 determines the baud rate of the communication between the PLC Controller and the Node Adapter Board. Switch SW4 on U6 determines whether a terminating resistor is used. Switches SW2 and SW3 are not used. Refer to the Installation chapter for switch settings.

Board Configuration

The Node Adapter Board causes the Bulletin 1395 Drive to appear as a remote I/O rack to the PLC Controller. Data transfer between the PLC Controller and Drive (at the PLC level) is the same as if the PLC Controller were transferring data to a remote I/O rack. The rack structure consists of two specific types : full or half rack. A full rack is defined as an 8 group rack, while a half rack is defined as a 4 group rack. Each group, whether in a full or half rack configuration contains 16 input and 16 output bits, which are mapped directly into the PLC Controller I/O image table (refer to Chapter 3 for a description of data transfer). Refer to Figure 2.1 and Figure 2.2 for further information on the full and half rack configurations.

Figure 2.1
Full Rack Configuration

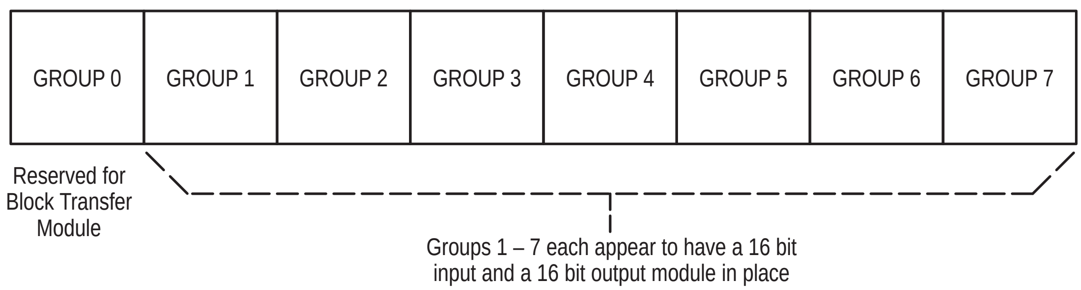
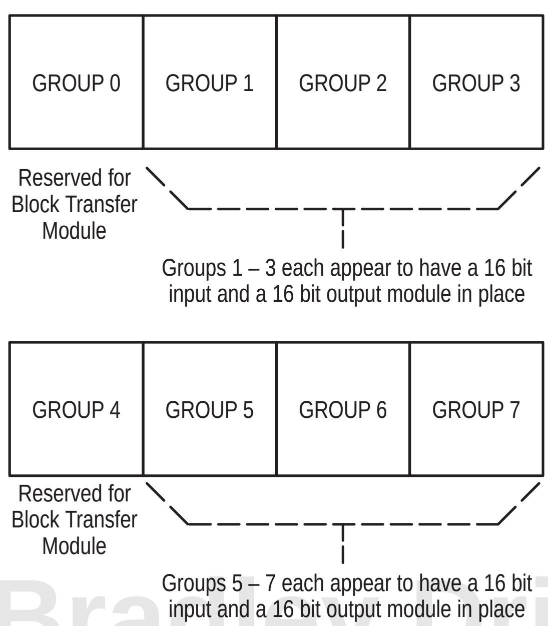


Figure 2.2
Half Rack Configuration



LED Indicators

The Node Adapter board contains two LED indicators. The red Processor Fault LED will illuminate only when a processor malfunction on the Node Adapter Board has occurred. The green “OK” LED indicates the communication status between the Node Adapter Board and the PLC Controller (Refer to Table 2.A).

Table 2.A
LED Indicator Status for Green “OK” indicator

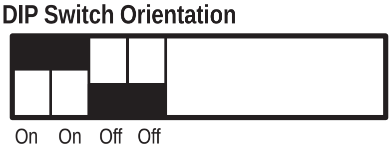
LED	State	Function
OK	LED Green	Normal PLC Communications
	LED Off	No communication to PLC Controller
	LED Blinking Green	PLC is in Reset/Program/Test Mode

DIP Switch Orientation

DIP Switch orientation (Figure 2.3) on the Node Adapter board is as follows:

CLOSED = “ON” = “1”
OPEN= “OFF” = “0”

Figure 2.3
DIP Switch Orientation



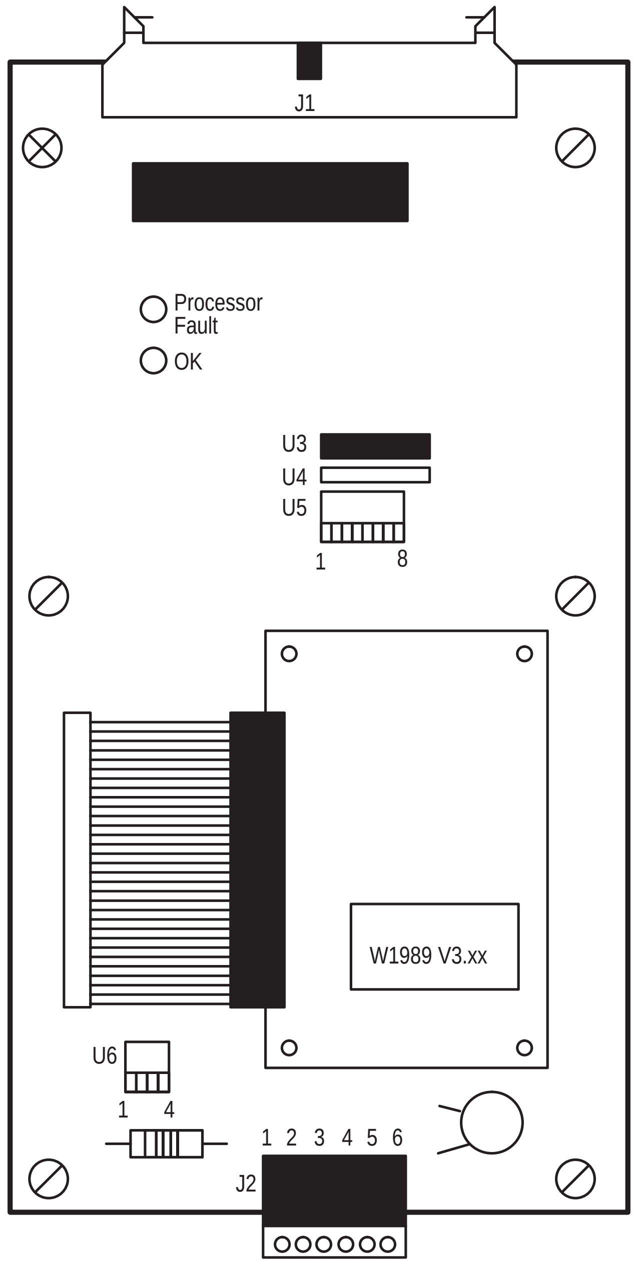
Firmware Location

The Node Adapter Board contains firmware version 3.xx (the “xx” designator may vary but does not effect information in this manual). Figure 2.4 shows the physical location of the firmware chip on the small surface mount board.

Board Location

The standard mounting position for the Node Adapter board is Port B of the Drive (Right Hand). If required, the Adapter can be mounted in Port A. Note that each port uses different parameters to store Adapter setup and configuration information.

Figure 2.4
Node Adapter Board Components



Chapter 3

Functional Description

Introduction

Chapter 3 contains a general description of the functionality of the Bulletin 1395 Node Adapter Board. This description is intended to provide sufficient background information to support other procedures in this manual and enable the reader to:

- Configure the Drive for use with the Node Adapter Board.
- Interface the Drive with a PLC Controller.

This chapter is not intended to be an all encompassing technical description of the Node Adapter Board.

Terminology

A brief description of terms and concepts covered in this chapter are:

Configuration – The process of linking Sink to Source parameters.

Fast Parameter – Fast parameters are all parameters whose values are updated every 1.0 millisecond. Fast parameters are used for real time data input and output of the drive. Fast parameters are NOT backed up in non-volatile memory.

Interface – The hardware and associated software required to transfer information and/or control signals from one device to another.

Microbus – Hardware and associated software designed by Allen-Bradley for exchange of digital information at the microprocessor level. The Microbus is used for the transfer of information between the Node Adapter Board and the Main Control Board.

Port – Main Control Board hardware which connects the Node Adapter Board to the Microbus. There are two ports available on the Main Control Board.

Parameter – Memory location used to store drive data. Each parameter is given a number called the parameter number which may be specified in decimal or hexadecimal. When the number is specified in hexadecimal, a letter “H” will appear after the parameter number.

Parameter Table – A table of entries for configuration and setup parameters used in the drive.

Source – Fast parameter used as a source of data.

Sink – Fast parameter used to receive data input.

General

The Node Adapter Board does not scale or manipulate data that is transferred between the drive and PLC Controller. As a result, there are no scaling parameters associated with the Node Adapter in the drive. If data in the PLC Controller is manipulated in units other than drive units, the data must first be converted to drive units before being sent to the drive. All scaling of data must be performed in the PLC Controller program. To allow data to be input to the drive control after entering through the Node Adapter, linking of the source and sink parameters must be setup and stored in the drive. Refer to Chapter 3 of the Bulletin 1395 Installation and Maintenance Manual for a description of configuration.

Discrete PLC Controller I/O Data Transfer

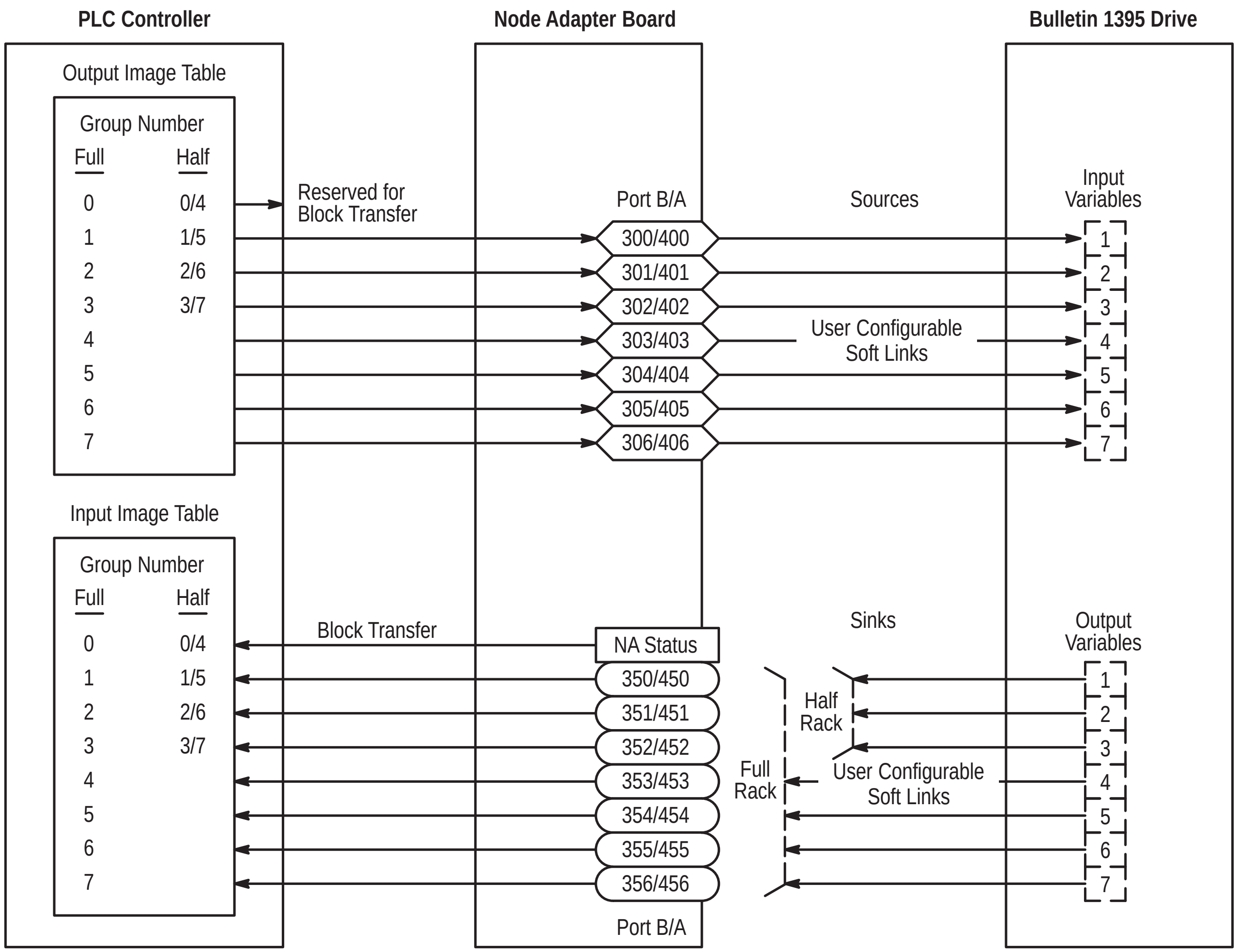
The selected rack size (determined by U5, switches SW7 & SW8) and Adapter Board Port (A or B) determine which port parameters in the drive are used for transfer of data between the PLC Controller and drive. The first group number associated with every rack number is reserved for the block transfer function. The remainder of the group numbers (1–7 for full racks, 1–3 or 5–7 for half racks) are used for the transfer of discrete type PLC Controller data. Each group number reserves a single 16 bit word in both the input and output image table of the PLC. All 16 bits of each 16 bit word are directly linked to a source or sink parameter in the drive through the Node Adapter Board as shown in Figure 3.1.

The parameters associated with each group number are predefined and depend on which adapter port the Node Adapter Board is connected to. For example, if the Node Adapter Board is connected to Port B, parameter 300 will contain the 16 bit word associated with group 1 of the PLC Controller output image table. In other words, the 16 bits of parameter 300 are mapped directly from the 16 output bits associated with group 1 in the PLC output image table.

The data type of the 16 bit word associated with each of the groups is determined by the drive configuration. For example, if parameter 300 is linked to a bit coded parameter such as Logic Cmd 1 (Parameter 150), then the bits associated with group 1 in the output image table of the PLC Controller are mapped directly into Parameter 150. Therefore, these bits are associated with the logic control of the drive and the PLC Controller program must treat them as such. Likewise, if Parameter 303, which is associated with group 4 of the output image table is linked to the Velocity Ref Whole (Parameter 154), then the data being sent to the 16 bits associated with group 4 of the output image table must be in the form of a 16 bit integer word. This is because Parameter 154 is a 16 bit integer word.

Data required by the drive on a continuously updated basis is sent (to the drive) using the method of data transfer described above. The rate of data transfer is determined by the standard conventions for determining the I/O update interval of the I/O scanner for the particular PLC Controller used.

Figure 3.1
Node Adapter Configuration Variables



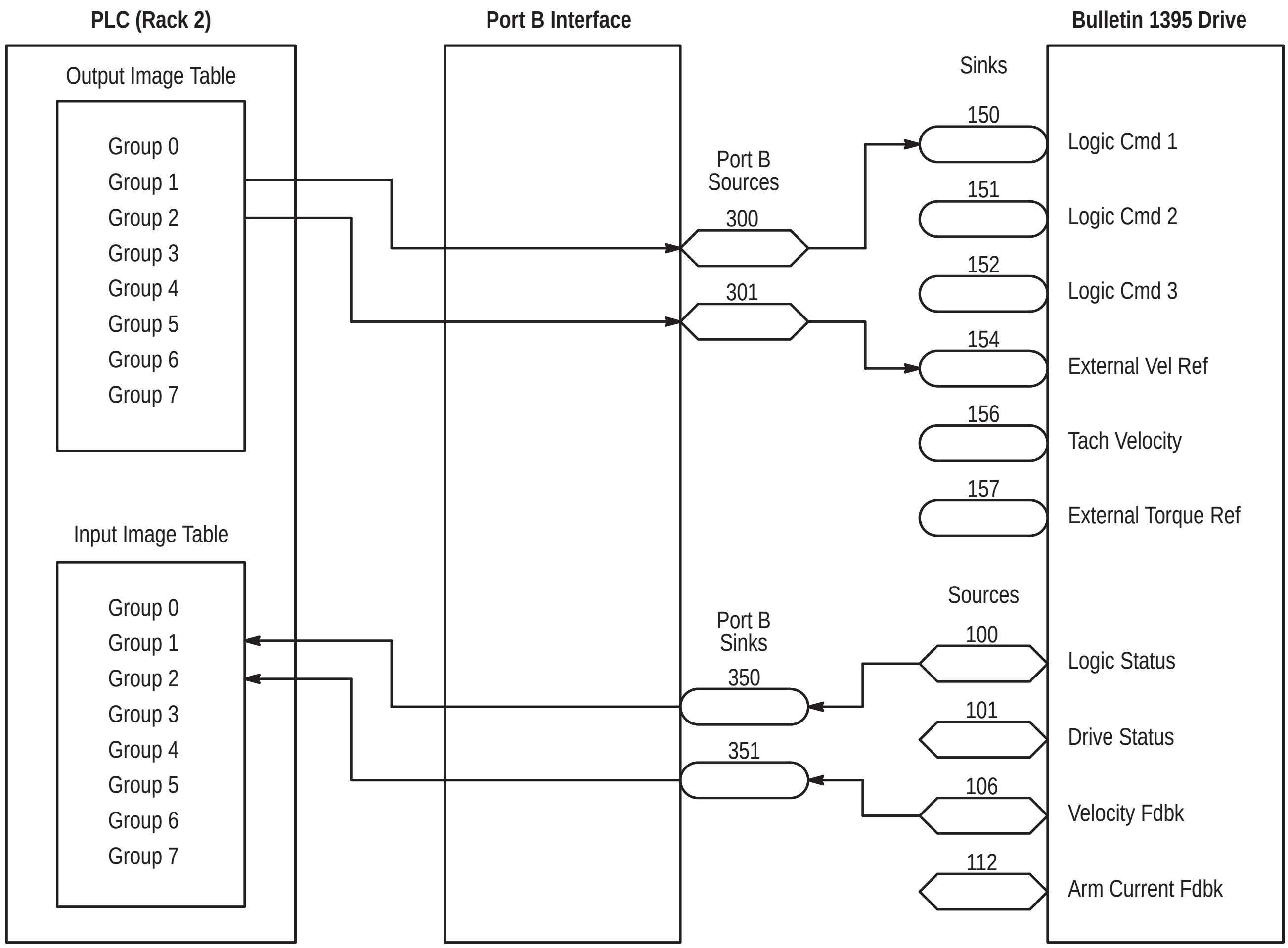
Discrete PLC Controller I/O Example

Figure 3.2 illustrates an application where the Node Adapter Board has been setup for a full rack (numbered rack 2) and the 16 bit words for group 1 and 2 are being used by the PLC Controller program for data transfer with the drive. In this example, the drive has been configured so that the data coming into source parameter 300 is sent to Logic Cmd 1 (Parameter 150). Information sent to the drive using the 16 bit output word for group 1 of rack 2 must therefore be a 16 bit logic word where the bits are defined by the description of Parameter 150.

Similarly, the External Velocity Ref (Parameter 154) has been linked to source Parameter 301. The 16 bit output word for group 2 of rack 2 must be a 16 bit signed integer whose value corresponds to the allowable values in drive units for Parameter 154.

Information from the drive consists of Logic Status (Parameter 100) and Velocity Fdbk (Parameter 106). Based on the links shown in Figure 3.2, the 16 bit input word for group 1, rack 2 in the PLC Controller is a 16 bit logic status word. The bits in this 16 bit word are defined by the description for Parameter 100. In addition, the 16 bit input for group 2, rack 2 in the PLC Controller is a 16 bit signed integer whose value corresponds to the allowable values in drive units for Parameter 106.

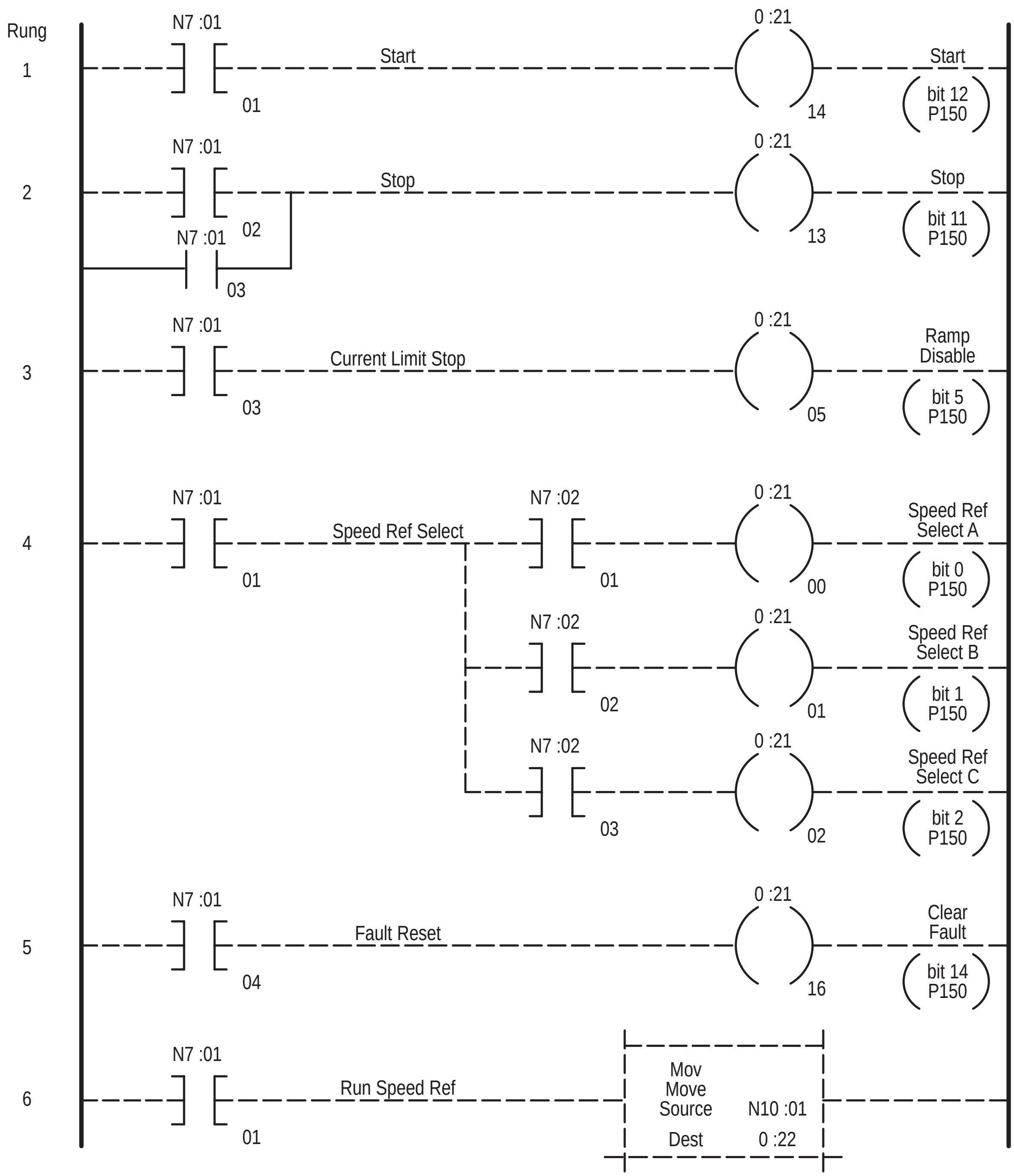
Figure 3.2
Discrete PLC Controller I/O Example



If the data transferred between the drive and PLC Controller will be manipulated (in the PLC Controller) in units other than drive units, the PLC Controller program must scale the information. The scaled information must be based on the drive units definitions for the parameters in the drive. The External Vel Ref (Parameter 154) is in drive units where 4096 is defined as base speed. If the PLC Controller program is written in terms of feet per minute (FPM), then FPM must be converted to drive units before being sent to the drive.

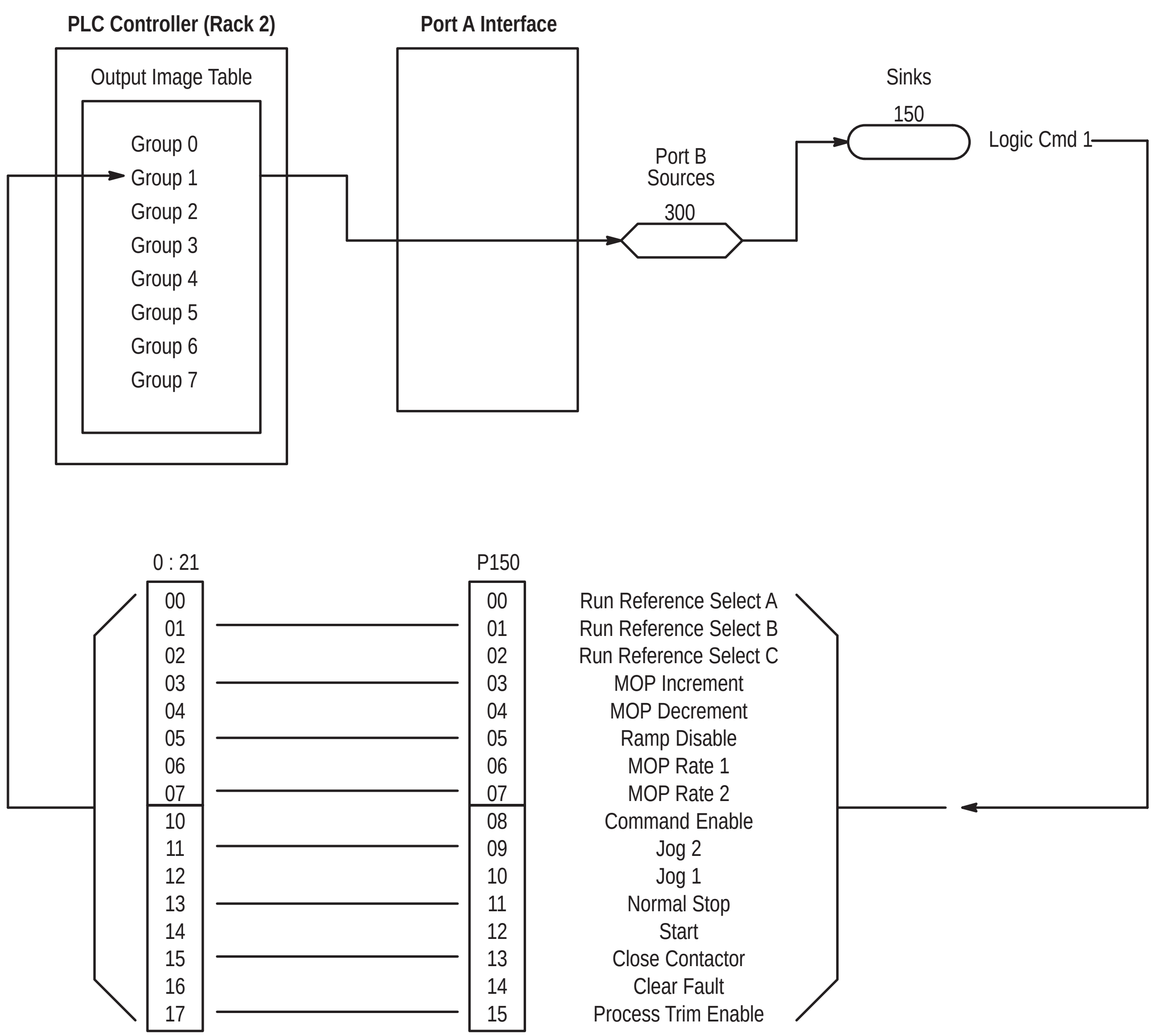
Figure 3.3 provides an example PLC Controller program which could be used to control the drive. Based on the configuration shown in Figure 3.2, the PLC Controller program will be transferring information to Parameter 150 and 154 in the drive. Integer file N7 in the PLC is being used for drive logic control and integer file N10 word 01 is used to store the drive speed reference. To control the logic operation of the drive, the PLC program must control the bits in the output image table which correspond to the desired operation. Because Parameter 300 has been linked to Parameter 150 (Figure 3.2), and Parameter 300 is associated with group 1 in the output image table, the PLC Controller program will be controlling bits in word 0:21.

Figure 3.3
Example PLC Controller Discrete I/O Program



Due to the fact that bit numbering in the PLC Controller is done in Octal, as opposed to decimal numbering in the drive Parameter 150, it is necessary to relate the output image table bits to the controlled bits in Parameter 150. Figure 3.4 shows the correlation between the output image table bits and the drive Parameter 150 bits. As a result of this relationship, if it is desired to set the start bit in Parameter 150 (bit 12 decimal), than bit 021/14 must be set as shown in the first rung of Figure 3.3. Control of other logic bits is illustrated in Figure 3.3.

Figure 3.4
Discrete PLC Controller I/O Example



The first 3 bits of the Logic Command word (Parameter 150 in this example), are used to determine which speed reference will be used by the drive. If the normal run speed reference input to Parameter 154 is to be used, all three bits must be 0. If a preset speed or the MOP function will be used, bits 0–2 are set accordingly (refer to the Bulletin 1395 Installation and Maintenance manual for a complete description of the Logic Command bits). In this example, the first three bits of word 2 of integer file N7 are used to determine the speed reference used by the drive as shown on rung 4 in Figure 3.3.

If the normal run speed reference is selected, the PLC Controller must send a 16 bit word to External Vel Ref (Parameter 154) in the drive. Because the speed reference is a complete 16 bit word, the PLC Controller must send the data as a complete word rather than as individual bits as was the case for logic command bits. In this example, word 1 of integer file N10 is used to store the speed reference for the drive. The MOV block in rung 6 of Figure 3.3 transfers the 16 bit word of N10:01 to word 2 of the output image table. Because word 2 of the output image table is sent to Parameter 301, which in turn is linked to Parameter 154 (Figure 3.2), the 16 bit word N10:01 is the speed reference input to the drive Parameter 154.

Information transferred back to the PLC Controller from the drive is handled much as it was in the previous example, with the exception that data is transferred from the input image table of the PLC Controller to the working data files in the PLC Controller program. Again, note that bit coded words such as Logic Status (Parameter 100), are bit numbered in octal in the PLC Controller, while the drive is in decimal.

Block Transfer

In addition to using the I/O image table to transfer data to the drive on a continuously updated basis, there are some conditions where data must be transferred on an occasional basis only or in large blocks of data. To perform this, the Node Adapter Board allows for use of the PLC Controller block transfer function. The block transfer function does not directly use any of the discrete I/O slots in the rack. However, the Node Adapter Board requires the use of several bits in the PLC Controller input image table to transfer a Node Adapter status byte. The status information must be updated at the same rate as the standard I/O, therefore, the Node Adapter Board reserves the first group in the rack for the Node Adapter status byte (see Figure 3.1). The PLC Controller does not send status information to the Node Adapter Board for the block transfer. As a result, the 16 bits associated with the first group in the PLC Controller output image table are not used.

Message Structure

Figure 3.5 illustrates the Data File message structure required by the block transfer (BTW) function in the PLC Controller. The BTR Data File Message does not have to be set up. It will reflect back data depending on the BTW function. The message is segmented into 16 bit words. The first four words (header) must be present. The data portion of the message is only required if the function being executed requires data. Each of the words in the message are broken into two 8 bit bytes. The following paragraphs provide a description of the message words.

Words 1 and 2 – used for internal PLC Controller communication functions. Words 1 and 2 are transparent to the block transfer function and are always 0.

Word 3 – contains two code numbers which determine the function to be performed by the Node Adapter Board upon receipt of the message from the PLC Controller. Table 3.A summarizes the valid command codes which may appear in the two bytes of Word 3. Note that the Class and Element codes are reversed. This word is set by the PLC Controller before the message is sent using the block transfer function. This word is not changed by the Node Adapter Board, therefore, the board returns the same data in this word when replying to the PLC Controller.

Figure 3.5
Block Transfer Write Message Header Structure

	High Byte	*Low Byte*	Section
Word 1	0	0	**Message Header**
Word 2	0	0	**Message Header**
Word 3	Element	Class	**Message Header**
Word 4	Status	Length	**Message Header**
Word 5	Data		**Data (Optional)**
Word 6	Data		**Data (Optional)**
Word 7	Data		**Data (Optional)**
	● ●		

Word 4 (high byte) – contains a 8 bit block transfer status byte (Table 3.B) which is a code number returned from the Node Adapter Board as a response to the block transfer function. This byte is not used by the PLC Controller when sending data to the Node Adapter Board and therefore is set to 0 when performing a block transfer write in the PLC Controller program.

Word 4 (low byte) – is the total length of the message in bytes including the number of bytes required for the data portion of the message. This byte must be calculated in the PLC Controller program and added to the message before being sent to the Node Adapter Board.

The board calculates the message length before returning a reply to the PLC Controller.

Depending on the action requested by the block transfer function, the message length contained in this byte may or may not be the same when returned from the Node Adapter Board.

Table 3.A
Block Transfer Message Word 3 – Code Definitions

Class	Element (HEX)	Word 3 (Decimal)
01 EE Memory Request	01 Recall	257
	02 Store	513
	03 Initialize	769
02 Read Request	02 Variable/Parameter Value	514
	03 Variable/Parameter Full (value, min, max dec, text)	770
	04 Read System Clock	1026
	06 Fault Code with Primary Fault Text	1538
03 Write Request	02 Parameter value	515
	04 Write System Clock	1027
	06 Reset Drive*	1539
	07 Clear Faults	1795
04 Configuration Request	01 Upload Configuration Table (#50–69)	260
	02 Upload Configuration Table (#150–169)	516
	03 Upload Configuration Table (#250–269)	772
	04 Upload Configuration Table (#350–369)	1028
	05 Upload Configuration Table (#450–469)	1284
	06 Download Configuration Table (#50–69)	1540
	07 Download Configuration Table (#150–169)	1796
	08 Download Configuration Table (#250–269)	2052
	09 Download Configuration Table (#350–369)	2308
	0A Download Configuration Table (#450–469)	2564
0E Trend Upload	01 Read Trend File	270

* No return response for BT

Table 3.B
Block Transfer Status Byte (Word 4, High Byte)

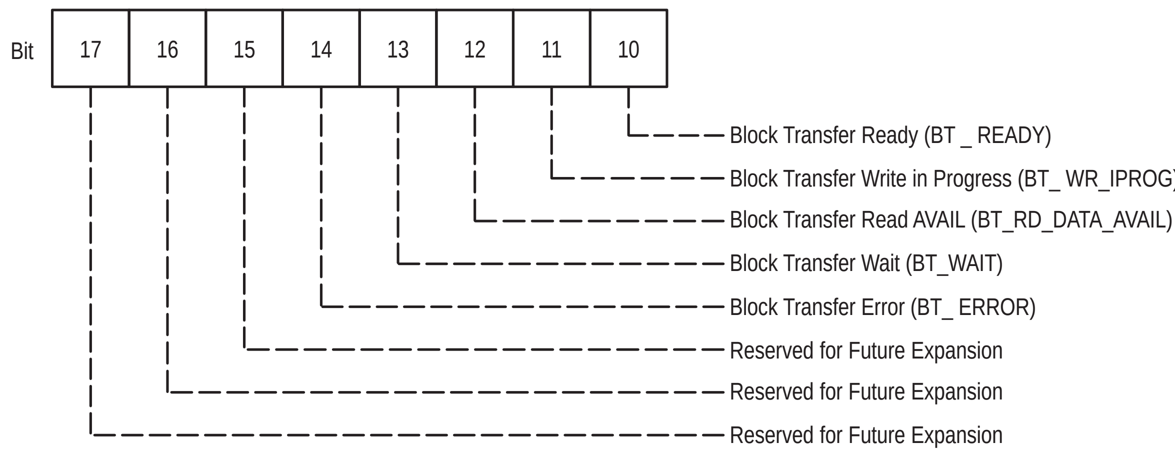
Decimal PLC / Octal	11 13	10 12	9 11	8 10	Description
	0	0	0	0	SUCCESSFUL
	0	0	0	1	MESSAGE I.D. ERROR
	0	0	1	0	ILLEGAL REQUEST
	0	0	1	1	NOT USED
	0	1	0	0	ILLEGAL PARAMETER
	0	1	0	1	ROUTE ERROR
	0	1	1	0	IGNORED BECAUSE OF MODE
	0	1	1	1	NOT USED
	1	0	0	0	OUT OF RANGE
	1	0	0	1	EXECUTION MALFUNCTION

Node Adapter Status Byte

The Node Adapter Status Byte is returned from the Node Adapter Board in addition to the Block Transfer Status Byte (Word 4, high byte). The Node Adapter Status Byte appears as the upper byte in the PLC Controller input image table of the first slot associated with the rack. This status byte indicates the condition of the Node Adapter Board itself and is not part of the standard block transfer blocks in the PLC Controller program.

Figure 3.6 details the information contained in this byte. Individual bits from this byte are used in the PLC Controller program to control the block transfer functions (refer to the block transfer examples).

Figure 3.6
Node Adapter Status Byte



BIT

10 **Block Transfer Ready** – Indicates that the drive and Node Adapter Board are communicating (via the Microbus) correctly. If the bit is set, the Bulletin 1395 is ready to process and receive block transfer requests.

IMPORTANT: Do Not attempt to send block transfers if this bit is not set. The drive will not respond to the request.

11 **Block Transfer In Progress** – Is set when a write block transfer to the Node Adapter Board is in progress. This bit remains set until the message has been received and placed in the queued message buffer of the drive.

IMPORTANT: Do Not attempt to initiate another block transfer when this bit is set. The drive will not respond to the request.

12 **Block Transfer Read Data Available** – Is set when the drive has data available which the PLC could read.

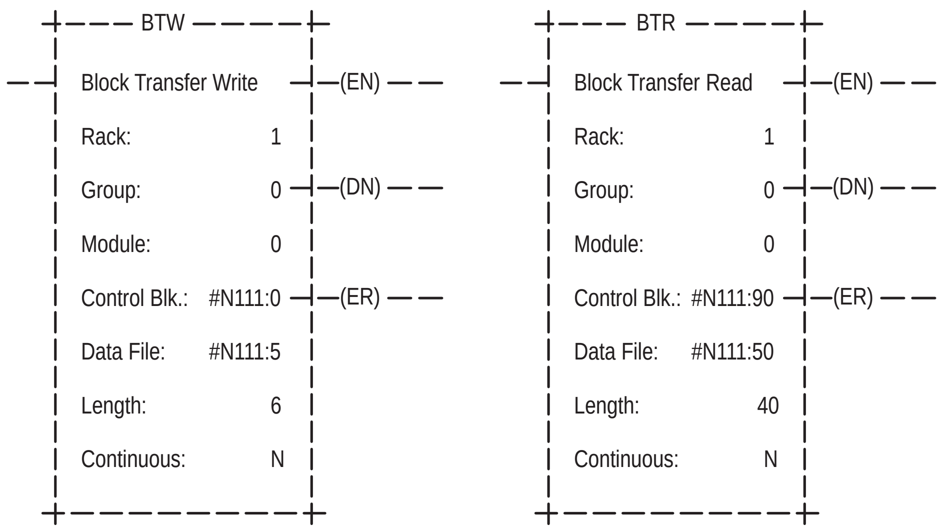
13 **Block Transfer Wait (Message Being Processed)** – Indicates that a message has been sent to the drive via the queued message mechanism and is awaiting a response. This bit is set at the completion of the write block transfer and is cleared at the reception of the response (start of the Read Block Transfer Request).

14 **Block Transfer Request Error** – When set, the Node Adapter Board has received an incorrect block transfer request from the PLC. This bit will be cleared when a correct block transfer has occurred.

Data Storage

In order to use the block transfer blocks in the PLC Controller program, it is necessary to reserve several words for data storage. Some of these words are required for internal use by the block transfer function and some contain the block transfer message information. In the PLC 5™, the BTW and BTR blocks require the use of two sets of words. Figure 3.7 illustrates the BTW and BTR blocks used for block transfer in the PLC 5™ along with example information associated with these blocks. A brief description of the information contained in these blocks specifically for the PLC 5™ follows. For more detailed information on the PLC 5™ and the PLC 3™ refer to the appropriate PLC Controller documentation.

Figure 3.7
PLC Controller Block Transfer Blocks



Rack – the rack number as set by the switch settings on the Node Adapter Board.

Group – the group number of the first group in the rack associated with the Node Adapter Board. In Figure 3.5, the rack has been setup as a full 8 group rack, therefore, the first group is 0. If half rack is selected the first group in the rack is 0 or 4.

Module – the module number associated with the block transfer in the associated slot. In all cases this will be 0.

Control Block – is a predefined set of words which contain bit information associated with the PLC Controller block transfer function. In the PLC 5, the control block requires 5 continuous words. In Figure 3.7, words N111:0 through N111:4 have been reserved for the bit array in the BTW block and words N111:90 through N111:94 have been reserved for the BTR block.

Data File – is the block transfer message illustrated in Figure 3.5 which contains both the header and the data portions of the message. The number of words required for the data file is dependent on the size of the message being sent. In Figure 3.7, N111:5 is the first word in the data file for the BTW block and N111:50 is the first word for the BTR block.

Length – specifies the length of the block transfer message in words. The BTR must always be set to 40.

IMPORTANT: The low byte of Word 4 in the message itself contains the length of the message in bytes. The length specified on the length line of the block transfer block is the same as specified in Word 4 of the message itself. The only difference is in units used to specify the length. In Figure 3.7, the length is 6 words for BTW (40 for BTR), which will appear as 12 bytes (80 bytes for BTR), in Word 4 low byte.

Continuous – specifies whether the block transfer block is to be executed on a continuous update or only when enabled. Normally, because of the nature of the data being transferred to the Drive using the block transfer function, this is set to N representing non-continuous execution.

PLC-5 Controller Block Transfer Rung Example

Figure 3.8 is used to sequence a block transfer operation between the PLC5 and the 1395. The node adapter status (I:010 for this example) and the block transfer Write/Read control bits are used to control the order of execution. The block transfer control bits are contained in the upper byte of the first word of the control block. When the rung is examined, it may seem that some of the bits are not needed. It is important to remember the block transfers are executed asynchronously to the program scan, so the bits are used to cover all possibilities. To start the block transfer operation, the enable bit (N7 : 3/1) must be set and communications between the PLC5 and the 1395 must be established. If the two are communicating, bit 10 (octal) will be set in the node adapter status word.

The first BTR instruction is used to discard erroneous data. This instruction is executed when a block transfer Read is available and the program has not executed a block transfer Write. This condition is detected by using the examine off instruction with both enable (15) and the done (13) bits of the BTW. This reasoning can be used because the block transfer instructions are normally executed in pairs with the BTW being the first. Therefore, if the drive has a read available before a write is done, the data may be discarded. If the first BTR is executed, the masked move on the next branch resets the upper byte of its control word. The byte is reset whether the BTR has faulted or has been completed successfully.

Three bits must be off to allow the execution of the BTW. The first, I : 10 / 11 is set when a block transfer Write to the Node Adapter board is in progress. The second (I : 010 / 12) is the Read available bit. The last is the block transfer wait (I : 010 / 13) bit. This bit indicates that a message has been sent to the drive and is awaiting a response.

Two branches are included for error handling. If I;10/14 is set, then the Node Adapter has received an incorrect blcok transfer request from the PLC. When this occurs, the BTW is re-enabled. The second branch handles the case where the BTW has not been completed within 8 seconds. The BTW will also be re-enabled when this happens.

There are two conditions that must be satisfied before the second BTR is executed. The block transfer Write done bit (N111: 0/13), and the read available bit (I:010/12) must be set. If the block transfer read is successful, the done bit (N111: 45/13) is set and the block transfer operation is complete.

Figure 3.8
Example PLC5/25 (Racks 1–7) Controller Block Transfer Rung

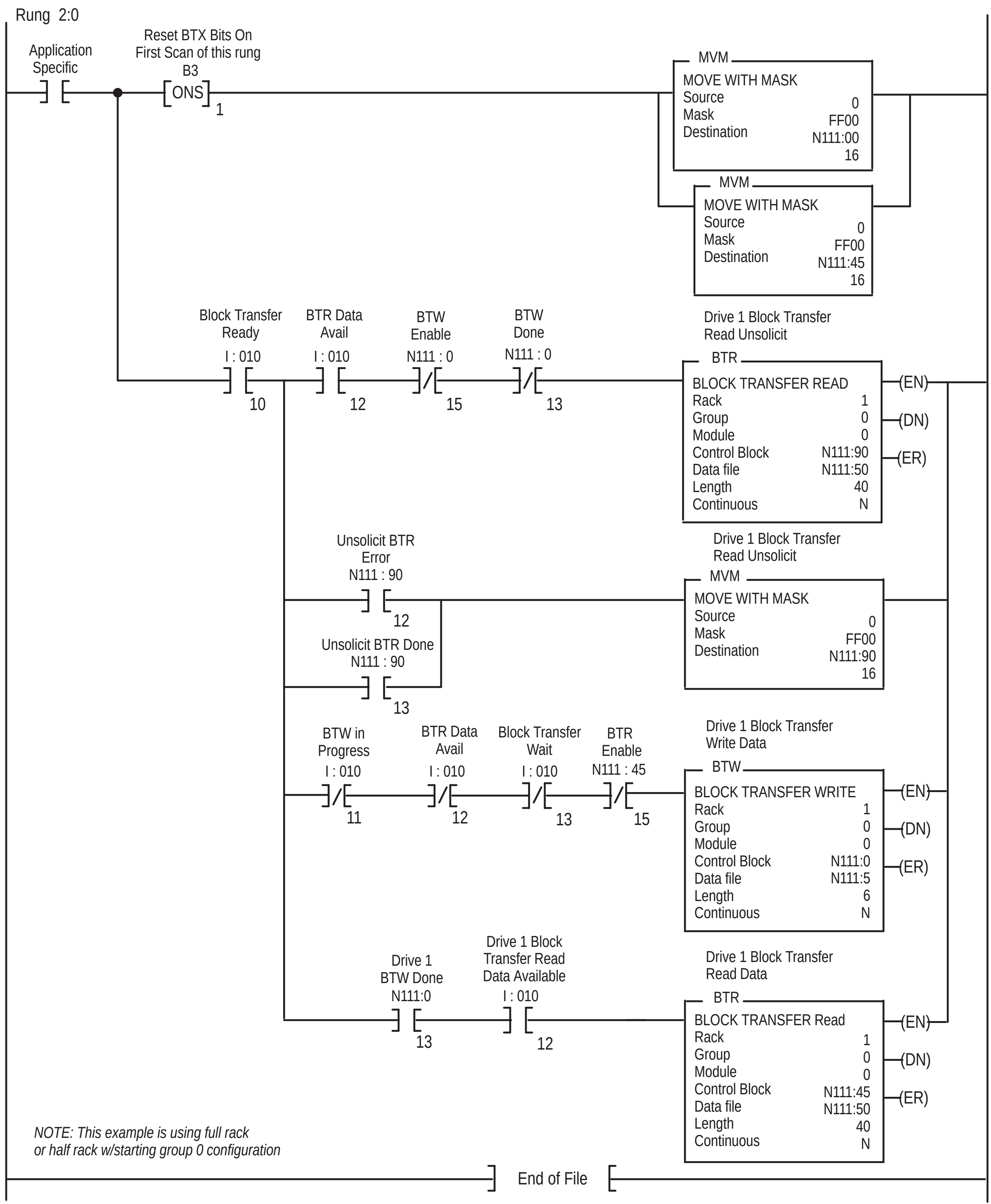
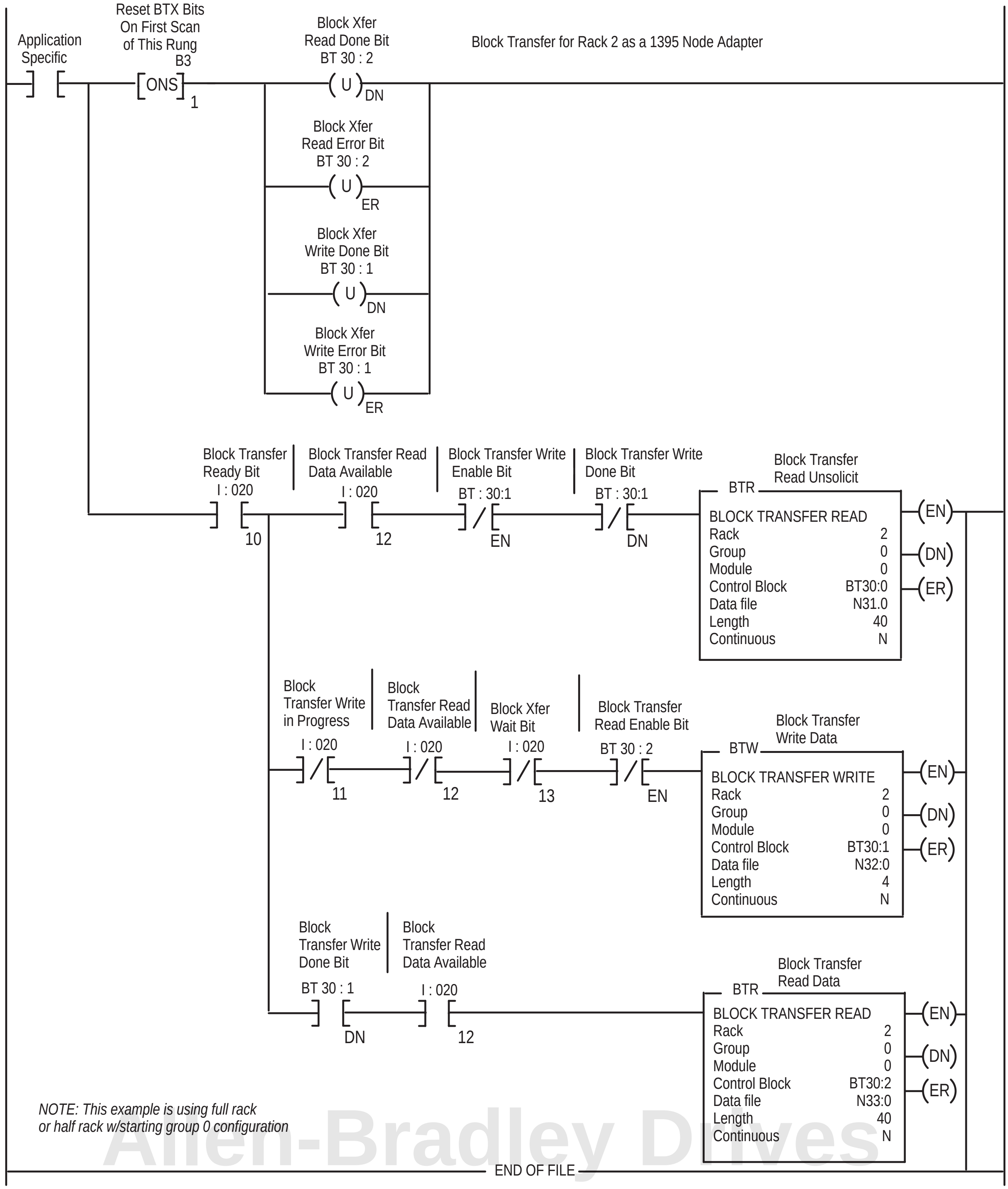
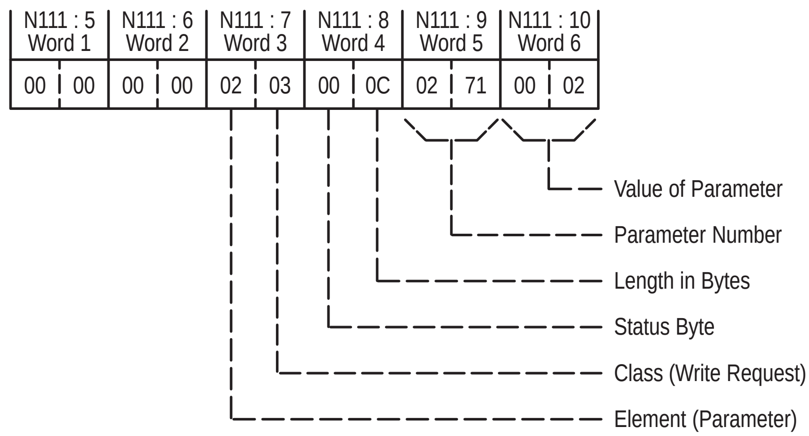


Figure 3.9
Example PLC5/40 Controller Block Transfer Rung



Only ONE parameter may be WRITTEN to or READ from the Drive via the Node Adapter.

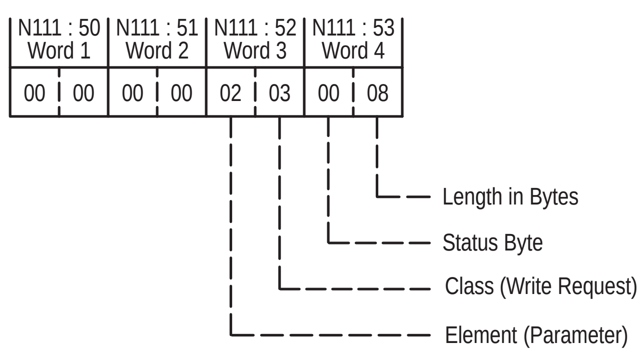
The BTW block has reserved 6 words starting at N111:5 for the block transfer message. To perform a Write request, the message words must be setup as shown below. Note: The data below is shown in hex.



All values shown for the message words are given in Hex. Parameter 625 (0271 Hex) is being sent the value 2 (0002 Hex).

The data returned to the PLC Controller in the BTR block will appear in a 40 word file starting as word N111:50. A data file length of 40 for the BTR is used to allow for internal status information.

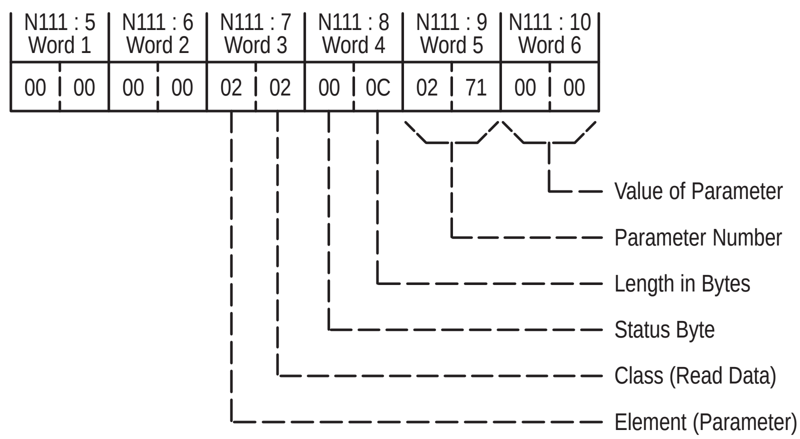
Because the BTW request was a Parameter Write, the Node Adapter will not return a data portion in the BTR message. Any data returned after the length defined in the BTW should be ignored, this is internal status information, and is not used. Information returned to the BTR block is as follows:



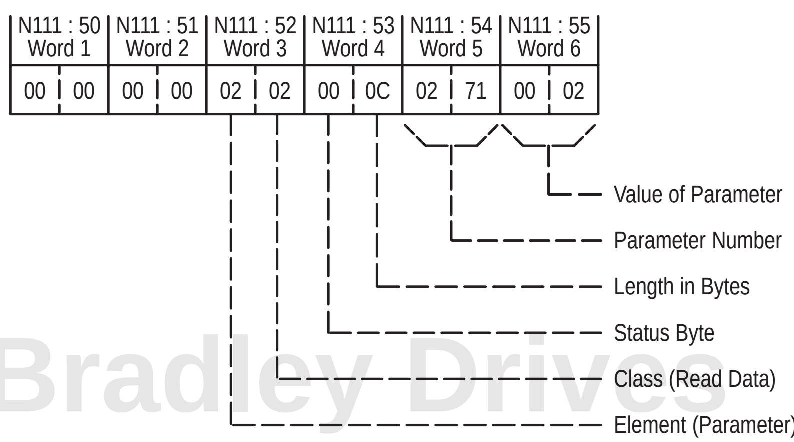
The message returned from the Node Adapter in this example is basically the same as the header portion of the message sent from the PLC Controller using the BTW block, except that the message length in Word 4 is different. The Class and Element in Word 3 are returned to the PLC Controller as they were received in the Node Adapter. If a block transfer error had occurred, then the ER bit in the BTR block would be set. This bit corresponds to bit 12 of the first word in the bit array, which in this example is N111:45/12 for the BTR block. In addition to the error bit, the high byte of Word 4 contains a status code, defined in Table 3.B. If there are no block transfer errors occurring, then the high byte of Word 4 is 0.

Block Transfer Read Data Available Example

A block transfer read data available request is performed using the same rung as for the write request. The only difference is in the data contained in the data file. Using the same parameter as in the block transfer write example, the data file will appear as shown below:



Once the message has been processed, the Node Adapter will return the requested data to the data file associated with the BTR block as shown below:



Message Formats

This section of the manual provides a detailed explanation of the messages that the Drive supports. These messages are used by the RIO block transfer interface to program Drive parameters, read parameter data, and control other Drive functions.

EE Memory Recall

This function takes the information stored in the Drive's EEPROM memory and places it in Drive memory.

IMPORTANT: All data that was stored in Drive memory prior to issuing the EE RECALL command will be erased when an EE RECALL takes place.

PLC Block Transfer Data –

BTW Instruction Length: 4
BTR Instruction Length: 40

BTW Message Structure –
Message Header Information:

Word 1: 0
Word 2: 0
Function Code, Word 3: 257
Write Message Length, Word 4: 8 bytes

BTW (SETUP)	WORD	BTR (RETURNED DATA)
0	1	0
0	2	0
257	3	257
8	4	See Note

NOTE: Word 4 of the BTR instruction is broken down into two bytes. The High byte contains the status bits per Table 3.B. The low byte contains the Drive message length in bytes.

Message Operation – The EE Memory Recall function instructs the Drive to replace the contents of Drive memory with the values that are stored in EEPROM. Any configuration links present in the Drive will also be replaced by those in EEPROM.

IMPORTANT: This message is ignored by the Drive when it is running (i.e. the contactor is picked up).

This BTW function requires the message header only. The status byte of the BTR will indicate the success or failure of the request.

EE Memory Store

This function takes the information in the Drive's memory and places it in the EEPROM. Any data in the EEPROM prior to issuing the EEPROM STORE command will be erased.

LC Block Transfer Data –

BTW Instruction Length: 4
BTR Instruction Length: 40

BTW Message Structure –
Message Header Information:

Word 1: 0
Word 2: 0
Function Code, Word 3: 513
Write Message Length, Word 4: 8 bytes

BTW (SETUP)	WORD	BTR (RETURNED DATA)
0	1	0
0	2	0
513	3	513
8	4	See Note

NOTE: Word 4 of the BTR instruction is broken down into two bytes. The High byte contains the status bits per table 3.B. The low byte contains the Drive message length in bytes.

Message Operation – The EE Memory Store function instructs the Drive to replace the contents of the Drive EEPROM with the values that are stored in Drive memory. Any configuration links present will also be replaced by those in memory. Depending on the Drive firmware version, this message may be ignored by the Drive when it is running (i.e. the contactor is picked up).

ATTENTION: When using the EE Memory Store function you must be certain that the values stored in Drive memory will not degrade Drive or System performance and will not cause a loss of either control or emergency stop functions.

This BTW function requires the message header only. The status byte in the BTR will indicate the success or failure of the request.

EE Memory Initialize

This function initializes the Drive's memory and EEPROM to a set of default values stored internally in the Drive.

IMPORTANT: Any data in Drive memory and EEPROM prior to issuing the EEPROM INITIALIZE command will be erased.

PLC Block Transfer Data –

BTW Instruction Length: 4
BTR Instruction Length: 40

BTW Message Structure –
Message Header Information:

Word 1: 0
Word 2: 0
Function Code, Word 3: 769
Write Message Length, Word 4: 8 bytes

BTW (SETUP)	WORD	BTR (RETURNED DATA)
0	1	0
0	2	0
769	3	769
8	4	See Note

NOTE: Word 3 of the BTR instruction is broken down into two bytes. The High byte contains the status bits per table 3.B. The low byte contains the Drive message length in bytes.

Message Operation – The EE Memory Recall function instructs the Drive to replace the contents of Drive memory with the values that are stored in EEPROM. Any configuration links present in the Drive will also be replaced by those in EEPROM. This message is ignored by the Drive when it is running (i.e. the contactor is picked up).

ATTENTION: When using the EE Memory Recall function you must be certain that the default values stored in the Drive will not degrade Drive or System performance and will not cause a loss of either control or emergency stop functions.

This BTW function requires the message header only. The status byte in the BTR will indicate the success or failure of the request.

Read Parameter Data

This function reads a parameter value from the Drive based on a parameter number provided by the PLC Program.

PLC Block Transfer Data –

BTW Instruction Length: 5
BTR Instruction Length: 40

Message Structure –

Message Header Information:

Word 1: 0
Word 2: 0
Function Code, Word 3: 514
Write Message Length, Word 4: 10 bytes

RIO (BTW) / RIO (BTR)

BTW (SETUP)	WORD	BTR (RETURNED DATA)
0	1	0
0	2	0
514	3	514
0	4	See Note
Parameter #	5	Parameter #
	6	Parameter Data

NOTE: Word 4 of the BTR instruction is broken down into two bytes. The High byte contains the status bits per table 3.B. The low byte contains the Drive message length in bytes.

Message Operation – The READ PARAMETER DATA function requests the Drive to provide a parameter data value for use in the PLC Controller. The value is returned in Drive units and may need to be scaled by the PLC Controller prior to being used in the Program.

Read Parameter Full (Value, Min, Max, Descriptor, Text)

This function reads the full parameter description from the Drive based on a parameter number provided by the PLC Program. The description includes the actual value, minimum value, maximum value, descriptor, and the parameter text.

PLC Block Transfer Data –

BTW Instruction Length: 5
BTR Instruction Length: 40

BTW Message Structure –
Message Header Information:

Word 1: 0
Word 2: 0
Function Code, Word 3: 770
Write Message Length, Word 4: 10 bytes

BTW (SET UP)	WORD	BTR RETURNED DATA)
0	1	0
0	2	0
770	3	770
10	4	See Note
Parameter #	5	Parameter #
	6	Parameter Data
		Minimum Value
		Maximum Value
		Descriptor
		Parameter Text
		•
		Parameter Text

NOTE: Word 4 of the BTR instruction is broken down into two bytes. The High byte contains the status bits per table 3.B. The low byte contains the Drive message length in bytes.

Message Operation – The READ PARAMETER FULL function requests the Drive to provide the full description of a parameter for use in the PLC Controller. This information includes the actual value, minimum value, maximum value, descriptor, and the parameter text.

Data Format:

Parameter Value – Drive units, may need to be scaled by the Controller prior to being used in the Program.

Maximum Value – Drive units, may need to be scaled by the PLC Controller prior to being used in the Program.

Minimum Value – Drive units, may need to be scaled by the PLC Controller prior to being used in the Program.

Descriptor – A numeric value used by Allen-Bradley program terminals to scale parameter data into the appropriate engineering units.

Parameter Text – The parameter text is provided in the following format. Each parameter text word contains two bytes in ASCII format, which represent the text displayed by the Drive's program terminals.

NOTE: Any parameter text that is returned comes back with each byte reversed.

Write Parameter Data

This function writes a parameter value to the Drive. The Drive can accept only one parameter at a time when using the RIO write mechanism.

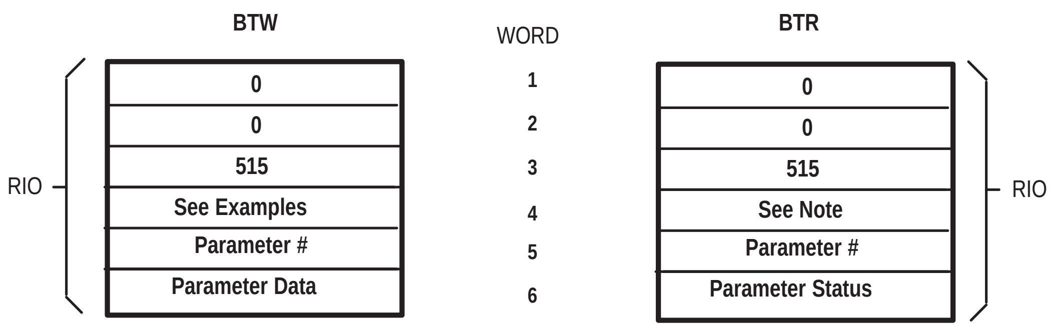
PLC Block Transfer Data –

BTW Instruction Length: 6
BTR Instruction Length: 40

BTW Message Structure –

Message Header Information:

Word 1: 0
Word 2: 0
Function Code, Word 3: 515
Write Message Length, Word 4: 12 Bytes



NOTE: Word 4 of the BTR instruction is broken down into two bytes. The High byte contains the status bits per table 3.B. The low byte contains the Drive message length in bytes.

Message Operation – The WRITE PARAMETER DATA function requests the Drive to change the value of the parameter specified in the message to the value contained in the message. The value must be sent to the Drive in Drive units and may need to be scaled by the PLC Controller prior to being sent. Only 1 parameter may be changed in a single block transfer.

Read System Clock

This function reads the system time from the Drive.

PLC Block Transfer Data –

BTW Instruction Length: 4
BTR Instruction Length: 40

BTW Message Structure –

Message Header Information:

Word 1: 0
Word 2: 0
Function Code, Word 3: 1026
Write Message Length, Word 4: 8 bytes

BTW (SETUP)	WORD	BTR (RETURNED DATA)
0	1	0
0	2	0
1026	3	1026
8	4	See Note
	5	Year
	6	Month (1 – 12)
	7	Day (1–31)
	8	Hour (0 – 24)
	9	Minute (0 – 59)
	10	Second (0 – 59)
	11	10’s of msec (0–100)

NOTE: Word 4 of the BTR instruction is broken down into two bytes. The High byte contains the status bits per table 3.B. The low byte contains the Drive message length in bytes.

Message Operation – The READ SYSTEM CLOCK function requests the Drive to provide it’s current time. The Drive stores time in the 24 hour format. The values returned are integer type and may be scaled by the PLC Controller prior to being used in the Program.

Write System Clock

This function writes the system time from the PLC Controller to the Drive.

PLC Block Transfer Data –

BTW Instruction Length: 10
BTR Instruction Length: 40

BTW Message Structure –

Message Header Information:

Word 1: 0
Word 2: 0
Function Code, Word 3: 1027
Write Message Length, Word 4: 20 bytes

BTW	WORD	BTR
0	1	0
0	2	0
1027	3	1027
20	4	See Note
Year	5	
Month (1 – 12)	6	
Day (1 – 31)	7	
Hour (0 – 23)	8	
Minute (0 – 59)	9	
Second (0 – 59)	10	

NOTE: Word 4 of the BTR instruction is broken down into two bytes. The High byte contains the status bits per table 3.B. The low byte contains the Drive message length in bytes.

Message Operation – The WRITE SYSTEM CLOCK function sets the time in the Drive from the PLC Controller. The Drive stores time in the 24 hour format. The values are integer type and may need to be scaled by the PLC Controller prior to being sent to the Drive.

Drive System Reset

This function causes the Drive to do a “warm boot restart”. Any data in Drive memory at the time the command is issued is erased and is not saved in EEPROM.

PLC Block Transfer Data –

BTW Instruction Length: 4

BTW Message Structure –

Message Header Information:

Word 1: 0
Word 2: 0
Function Code, Word 3: 1539
Write Message Length, Word 4: 8 bytes

BTW	WORD
0	1
0	2
1539	3
8	4

Message Operation – The DRIVE SYSTEM RESET function causes the Drive to reboot all processors. This is the same sequence that the Drive goes through when power is first applied.

IMPORTANT: Any parameter data or configuration links that were not stored in EEPROM prior to the Drive receiving this command will be erased.

This BTW function requires the message header only. Ignore any data returns.

Clear Faults

This function requests the Drive to clear any soft or warning faults that have occurred. It also clears the fault buffer. Hard faults cannot be cleared using the command.

PLC Block Transfer Data –

BTW Instruction Length: 4
BTR Instruction Length: 40

BTW Message Structure –

Message Header Information:

Word 1: 0
Word 2: 0
Function Code, Word 3: 1795
Write Message Length, Word 4: 8 bytes

BTW	WORD	BTR
0	1	0
0	2	0
1795	3	1795
8	4	8

NOTE: Word 4 of the BTR instruction is broken down into two bytes. The High byte contains the status bits per table 3.B. The low byte contains the Drive message length in bytes.

Message Operation – This function requests the Drive to clear any soft or warning faults that have occurred. It also clears the fault buffer. Hard faults cannot be cleared using this command.

IMPORTANT: If the Drive is running (i.e. the DC loop contactor is picked up), the CLEAR FAULTS command will be ignored.

This BTW function requires the message header only.

Upload Configuration Table

This function uploads the configuration table information from the Drive in blocks. Each block of configuration data has a separate function code.

PLC Block Transfer Data –

BTW Instruction Length: 4
BTR Instruction Length: 40

BTW Message Structure –

Message Header Information:

Word 1: 0
Word 2: 0
Function Code, Word 3: see table below
Write Message Length, Word 4: 8 bytes

Upload Function Codes

Parameter Numbers	Function Code
#50 – #69	260
#150 – #169	516
#250 – #269	772
#350 – #369	1028
#450 – #469	1284

BTW (SETUP)	WORD
0	1
0	2
See Table Above	3
8	4

The “x” designator is a position holder. It could represent parameter 150, 250, 350, etc. depending on which configuration table is being requested.

NOTE: Word 4 of the BTR instruction is broken down into two bytes. The High byte contains the status bits per Table 3.B. The low byte contains the Drive message length in bytes.

BTR
0
0
See Table
48
Parameter #(x50)
Parameter #(x51)
Parameter #(x52)
•
Parameter #(x69)

Message Operation – The UPLOAD CONFIGURATION TABLE function requests a listing of the Drive configuration links from the Drive for use in the PLC Controller. This command is broken down into five groups of tables. The drive will return a block of 24 words, 4 words of header information, and 20 words of data. The data returned will be the source parameter corresponding to the sink.

Download Configuration Table

This function downloads the configuration table information from the Drive in blocks. Each block of configuration data has a separate function code.

PLC Block Transfer Data –

BTW Instruction Length: 24
BTR Instruction Length: 40

Message Structure –

Message Header Information:

Word 1: 0
Word 2: 0
Function Code, Word 3: see table below
Write Message Length, Word 4: 48 bytes

Download Function Codes

Parameter Numbers	Function Code
#50 – #69	1540
#150 – #169	1796
#250 – #269	2052
#350 – #369	2308
#450 – #469	2564

BTW (SETUP)

0
0
See Table
48
Parameter #(x50)
Parameter #(x51)
Parameter #(x52)
•
Parameter #(x69)

The “x” designator is a position holder. It could represent parameter 150, 250, 350, etc. depending on which configuration table is being sent.

WORD	BTR
1	0
2	0
3	See Table
4	8

NOTE: Word 4 of the BTR instruction is broken down into two bytes. The High byte contains the status bits per Table 3.B. The low byte contains the Drive message length in bytes.

Message Operation – The DOWNLOAD CONFIGURATION TABLE function sends a listing of the desired Drive configuration links to the Drive. This command is broken down into five groups of tables. All 20 links of each group will be sent. The source parameter corresponding to each sink parameter must be defined in the data table. If no link is to be made to a sink parameter, a zero must be placed in the corresponding location of the data table.

IMPORTANT: Drive configuration links will not be changed by the Drive unless the following two conditions are met:

1. The Drive must not be running (i.e. the DC loop contactor must not be energized).
2. The Drive receives the fifth block (function code 2564) of links. The Configured Links command is contained in this block.

Read Trend Information

This function reads the trend information from the Drive. The Trend information is broken down into three separate blocks of data. Each block uses the same function code with the message specifing which block is to be read.

PLC Block Transfer Data –

BTW Instruction Length: 6
BTR Instruction Length: Refer to block information

Message Structure –
Message Header Information:

Word 1: 0
Word 2: 0
Function Code, Word 3: 270
Write Message Length, Word 4: 12 bytes

BTW	WORD	BTR
0	1	0
0	2	0
270	3	270
12	4	See Note
See Trend Number	5	See Block Definition
See Block Number	6	•

NOTE: Word 4 of the BTR instruction is broken down into two bytes. The High byte contains the status bits per Table 3.B. The low byte contains the Drive message length in bytes.

Trend Number – An integer number used to specify which trend buffer the Drive will provide data for:

Trend Buffer #1 – 1
Trend Buffer #2 – 2
Trend Buffer #3 – 3
Trend Buffer #4 – 4

Block Number – An integer number used to specify which block of trend data (from the above specified trend buffer) the Drive is to supply. The definition of each block is as follows:

Block #0 – 0, Trend setup parameters
Block #1 – 1, Trend data samples 0 through 33
Block #2 – 2, Trend data samples 34 through 66
Block #3 – 3, Trend data samples 67 through 99

Message Operation

The READ TREND FILE function is used by a PLC Controller to get information about the Drives trend buffers. This data includes both the setup information and the data samples for each buffer. The BTW message contents determine what data will be returned by the Drive. The following information shows what data will be returned by the Drive (in the BTR instruction) for the Block number specified.

Refer to the Drive instruction manual for detailed information on Trend buffer operation and use.

Block #0:

BTR Instruction Length: 19
MSG Size in Elements: 19

BTW
0
0
270
See Note
0
Trend Number
Operand X
Operand Y
Par # monitored
Operator Type
Sample Time
Post Samples
Year
Month (1 – 12)
Day (1 – 31)
Hour (0 – 23)
Second (0 – 59)
Millisecond (0 – 999)
Monitored Parameter Descriptor

Trend Number – The trend buffer number of the data being provided.

Operand X – One of the parameters used to define the trigger condition.

Operand Y – One of the parameters used to define the trigger condition.

Par # Monitored – The parameter that is being monitored by the selected Trend buffer.

Operator – The operator used to determine what condition(s) will cause a trigger to occur.

Val	Description
1	Greater Than (GT)
2	Less Than (LT)
3	Equal To (EQU)
4	Not Equal To (Not__EQU)
5	AND (AND)
6	Not AND (NAND)
7	OR (OR)
8	Not OR (NOR)

Sample Time – The rate at which the monitored parameter is sampled.

Post Samples – The number of samples taken after the trigger condition is detected.

Year – An integer value representing the year the trigger condition was detected.

Month (1 – 12) – An integer value representing the month the trigger condition was detected.

Day (1 – 31) – An integer value representing the day the trigger condition was detected.

Hour (0 – 23) – An integer value representing the hour the trigger condition was detected.

Second (0 – 59) – An integer value representing the second the trigger condition was detected.

Millisecond – An integer value representing the 10's of milliseconds in which the trigger condition was detected.

Monitored Parameter Descriptor – An integer value used by Allen-Bradley program terminals to display the proper units for the monitored parameter.

Block #1: This Block contains data samples 0 through 33 for the trend buffer specified in the BTW instruction.

BTR Instruction Length: 38 words
MSG Size in Elements: 38

BTR
0
0
270
See Note
1
Data Sample #1
Data Sample #2
•
Data Sample #33

Data Samples – The data samples are specified in Drive Units and may need to be scaled by the PLC Controller prior to being used in the Program.

Block #2: This Block contains data samples 34 through 66 for the trend buffer specified in the BTW instruction.

BTR Instruction Length: 38 words
MSG Size in Elements: 38

BTR
0
0
270
See Note
2
Data Sample #34
Data Sample #35
•
Data Sample #36

Data Samples – The data samples are specified in Drive Units and may need to be scaled by the PLC Controller prior to being used in the Program.

Block #3: This Block contains data samples 67 through 99 for the trend buffer specified in the BTW instruction.

BTR Instruction Length: 38 words

BTR
0
0
270
See Note
3
Data Sample #67
Data Sample #68
•
Data Sample #99

Data Samples – The data samples are specified in Drive Units and may need to be scaled by the PLC Controller prior to being used in the Program.

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Chapter 4

Installation

Introduction

This chapter is a detailed step-by-step procedure for the proper installation of the Bulletin 1395 Node Adapter Board. It also contains electrical and environmental specifications. Procedures performed in this chapter include:

- Verification of proper unpacking and inspection
- Verification of proper mounting
- Verification of proper wiring

Receiving

It is your responsibility to thoroughly inspect the equipment before accepting shipment from the freight company. You must take the responsibility for noting any damage. Do Not accept shipment before checking all items received against the purchase order, and noting any missing or damaged items on the freight bill.

If any concealed damage is found later during unpacking, it is your responsibility to notify the freight agent. Leave the shipping container intact and request that the freight agent make a visual inspection of the shipment.

Unpacking & Inspection

Remove all packing material from around the board, including the anti-static bag. The Node Adapter Board is a static sensitive device, and special precautions should be taken while handling the board. The circuit board can be damaged by Electrostatic Discharge. If personnel will make contact with an ESD sensitive component during installation, they must be grounded. Grounding should be accomplished with a wrist strap which is connected to an approved ground.

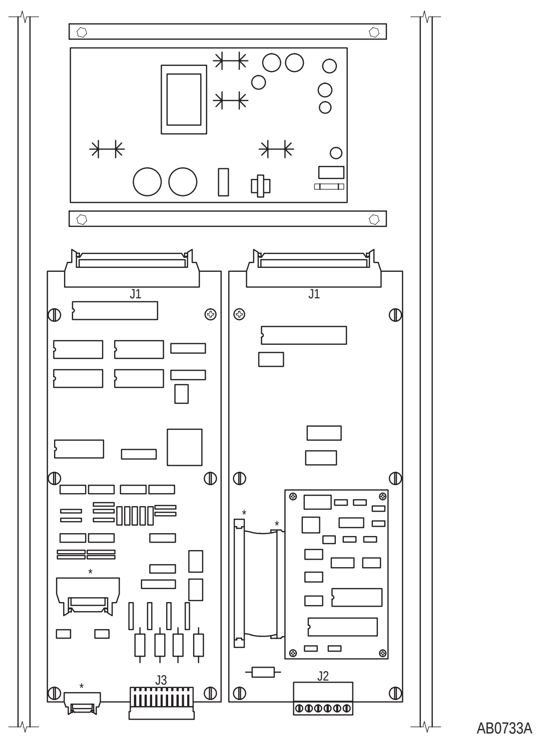
If the board will not be installed when it is unpacked, it should be stored in a clean dry place in the anti-static bag. The storage temperature must be between 0°C (32°F) and +60°C (140°F) with a maximum humidity of 95% non-condensing, to guard against damage to temperature sensitive components of the drive.

Mounting

The Node Adapter Board is mounted on the front of the the swing out panel. Two possible adapter board mounting positions are provided, depending on the port that the board will be connected. When looking at the mounting positions from the front, the right position corresponds to Port B and the left to Port A. The port used is dependent on the specific application of the drive.

After determining which port the Node Adapter Board will be connected to, mount the board, using the five (5) panel screws and one (1) phillips head screw supplied (Figure 4.1).

Figure 4.1
Configuration Overview



Connections

The 60 pin ribbon cable connector (J1) located on the Node Adapter Board (see Figure 4.1) provides a means of connecting the board to the Bulletin 1395 Main Control Board port connector (J6 or J7). The port connector used is determined by the port and the physical location of the Node Adapter Board. Main Control Board Connector J6 corresponds to Port B and J7 to Port A.

The Remote I/O cable from the PLC is connected directly to the Node Adapter Board at connector J2 (see Figure 4.2). If the PLC Controller is controlling only one drive, terminals 1–3 are used. If the PLC Controller is used to control several drives, terminals 1–3 are connected to the upstream drive (or PLC Controller if the drive is the first in the network) and terminals 4–6 are connected to the downstream drive. Refer to the following procedure and Figure 4.2 and Figure 4.3.

3. 1. Connect the 60 lead ribbon cable from J1 on the Node Adapter Board to the corresponding connector on the Main Control Board.

2. 3. Connect the PLC Controller communication cable to the drive as required by the application.

Figure 4.2
J2 Connections

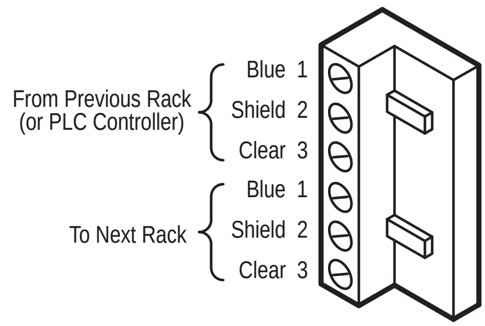
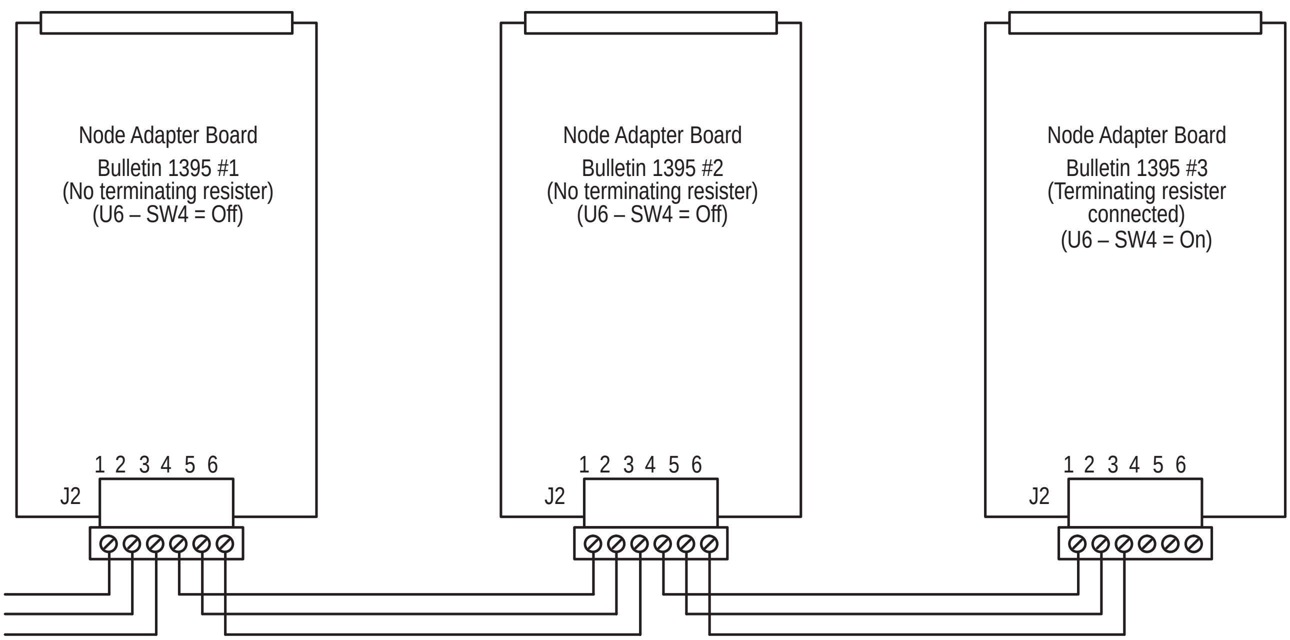


Figure 4.3
J2 Connections in a Multi-Drive System



ATTENTION: When breaking connections at Terminal J2 on any Node Adapter Board in a daisy chained system, communications will be interrupted to Nodes that are down line in the chain. Depending upon the application, a loss of control to devices connected to these nodes could cause hazardous system operation. To guard against personal injury, the system must be shut down, or local control maintained of critical devices connected to the daisy chain when making or breaking connections at J2 on any Node Adapter Board.

Switch Settings

The Node Adapter Board contains 2 DIP switches, U5 and U6 which perform several different setup functions. The first six positions of switch U5 determine the rack number (in octal) used by the PLC Controller corresponding to the drive. Any of the rack numbers listed in Table 4.A may be used. Each rack number may only be used once, therefore, in applications where several drives are connected to the same communications network (Figure 4.3) each drive must be associated with a different rack number. Switches SW7 and SW8 of U5 determine the rack configuration.

SW1 of U6 (Table 4.C) determines the communication baud rate between the PLC Controller and the Node Adapter Board. The baud rate is dependent on the specific PLC Controller hardware being used. Switch SW4 of U6 (Table 4.D) determines the termination resistor setup. In all cases, the last Node Adapter Board in the communication network must have the terminating resistor connected. In cases where only one board is used, the terminating resistor must be connected. If a daisy chain is used, only the last board in the chain will have the terminating resistor connected. All other boards in a daisy chain MUST have the resistor left NOT CONNECTED.

Refer to the following procedure and Tables 4.A through 4.D for proper switch settings.

4. 1. Determine the drive address and set the corresponding rack number using switches SW1 through SW6 (U5) and Table 4.A.

2. 3. Determine the required rack setup configuration and set switches SW7 and SW8 (U5) per Table 4.B.

4. 5. Determine the required baud rate and set switch SW1 (U6) per Table 4.C.

6. 7. Determine whether a terminating resistor is required and set switch SW4 (U6) appropriately using Table 4.D.

Table 4.A
Rack Address Switch Settings (U5)

Rack#	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6
00	ON	ON	ON	ON	ON	ON
01	ON	ON	ON	ON	ON	X
02	ON	ON	ON	ON	X	ON
03	ON	ON	ON	ON	X	X
04	ON	ON	ON	X	ON	ON
05	ON	ON	ON	X	ON	X
06	ON	ON	ON	X	X	ON
07	ON	ON	ON	X	X	X
10	ON	ON	X	ON	ON	ON
11	ON	ON	X	ON	ON	X
12	ON	ON	X	ON	X	ON
13	ON	ON	X	ON	X	X
14	ON	ON	X	X	ON	ON
15	ON	ON	X	X	ON	X
16	ON	ON	X	X	X	ON
17	ON	ON	X	X	X	X
20	ON	X	ON	ON	ON	ON
21	ON	X	ON	ON	ON	X
22	ON	X	ON	ON	X	ON
23	ON	X	ON	ON	X	X
24	ON	X	ON	X	ON	ON
25	ON	X	ON	X	ON	X
26	ON	X	ON	X	X	ON
27	ON	X	ON	X	X	X
30	ON	X	X	ON	ON	ON
31	ON	X	X	ON	ON	X
32	ON	X	X	ON	X	ON
33	ON	X	X	ON	X	X
34	ON	X	X	X	ON	ON
35	ON	X	X	X	ON	X
36	ON	X	X	X	X	ON
37	ON	X	X	X	X	X

(1) IMPORTANT: When using the PLC 5/15 or 5/25, the following series and software revisions are required as a minimum.

	Series	Revision
PLC 5/15	B	J
PLC 5/25	A	E

X = OFF or Open
ON = Closed

Table 4.B
Rack Setup Switch Settings (U5)

Description	SSW7	SW8
Full Rack Physical Rack Size = 3 Starting Quarter = 0 Last Rack = 1	X	X
Half Rack – Top (1) Physical Rack Size = 1 Starting Quarter = 2 Last Rack = 1	X	ON
Half Rack – Bottom, Last (1) Physical Rack Size = 1 Starting Quarter = 0 Last Rack = 1	ON	X
Half Rack – Bottom, Not Last Physical Rack Size = 1 Starting Quarter = 0 Last Rack = 0	ON	ON

(1) IMPORTANT: When using the PLC 5/15 or 5/25, the following series and software revisions are required as a minimum.

	Series	Revision
PLC 5/15	B	J
PLC 5/25	A	E

X = OFF or Open
ON = Closed

Table 4.C
Baud Rate Setting (U6)

Baud Rate	SW 1
57.6kbps	ON
115.2kbps	X

Table 4.D
Termination Resistor Setting (U6)

Resistor	SW 4
Connected	ON
Not Connected	X

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Chapter 5

Start-Up

Introduction

This chapter will provide basic procedures that are necessary to configure the drive control for Node Adapter Board use. Procedures that will be covered in this chapter include:

- Verification of proper installation and wiring.
- Verification of correct switch settings for the required application.
- Configuration of the drive control for use with a Node Adapter board.

Terminology

Configuration – The process of linking Sink to Source parameters.

Interface – The hardware and associated software required to transfer information and/or control signals from one device to another.

Parameter – Memory location used to store drive data.

Sink – Parameter used to receive data input.

Source – Parameter used as a source of data

Connection Verification

Before any attempt to configure the drive is made, the following connections and settings MUST be verified per Chapter 4.

- Check that the Node Adapter board is mounted in the proper location for the intended Port it will be connected to.
- Check that the 60 pin ribbon cable connector J1 is connected correctly for the location and port being used by the Node Adapter Board.
- Check that the setting of all Dip switches is correct for your application referring to Tables 4.A through 4.D in the Installation chapter.

WARNING: Failure to verify connections and switch settings before configuring the drive could result in personal injury and/or equipment damage.

Example Connection Configuration

The parameters used to configure the Node Adapter board are determined by which port of the Bulletin 1395 the Node Adapter is connected to. Figure 5.1 shows a sample configuration with the Node Adapter connected to Port A. Figure 5.2 shows an example of Port B configuration. A detailed functional description of drive configuration is contained in Chapter 3 of this manual. Note in particular that Port B must use 300 series parameters and Port A 400 series parameter numbers.

Figure 5.1
Configuration Example for Node Adapter Connected to Port A of Bulletin 1395

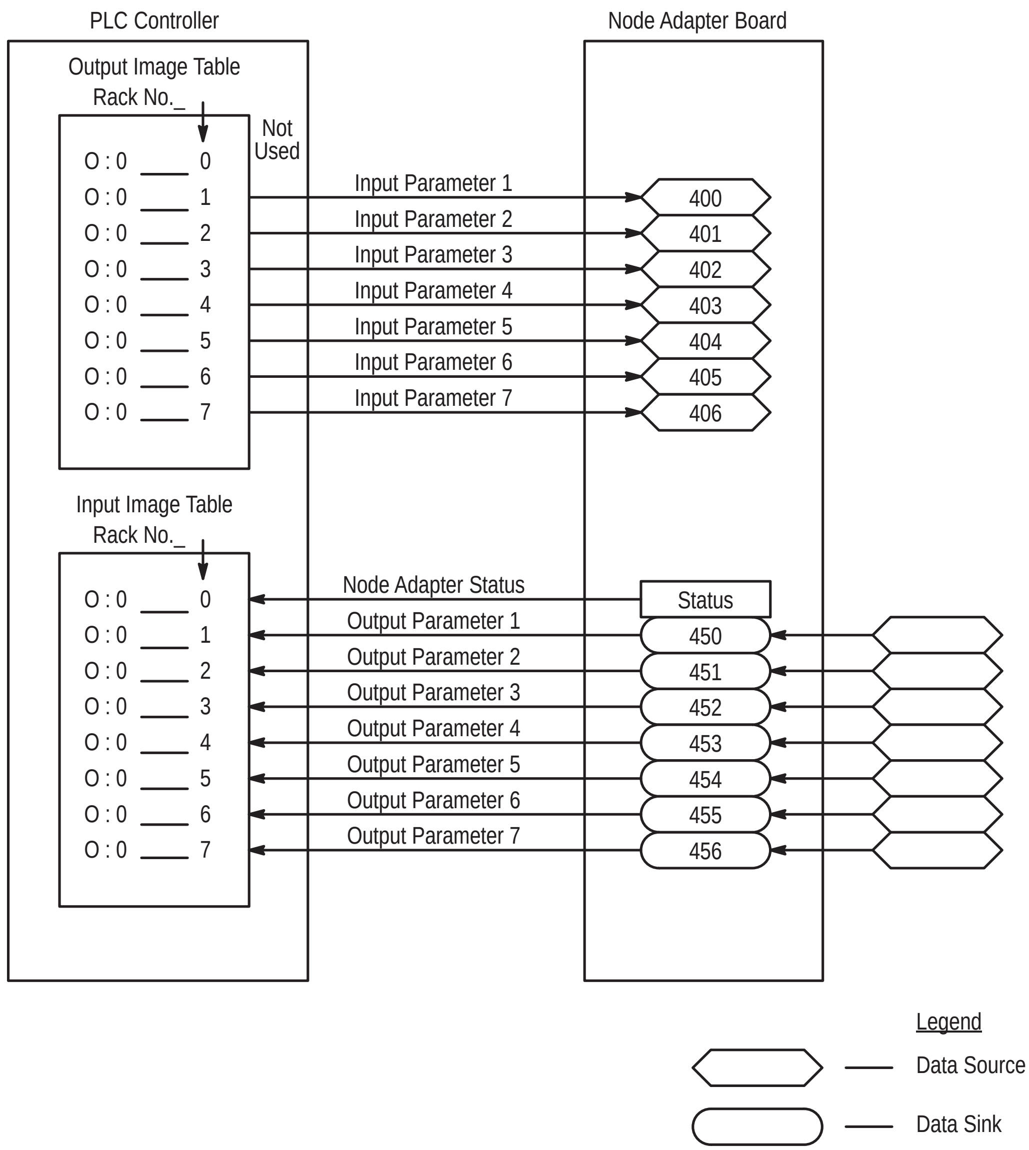
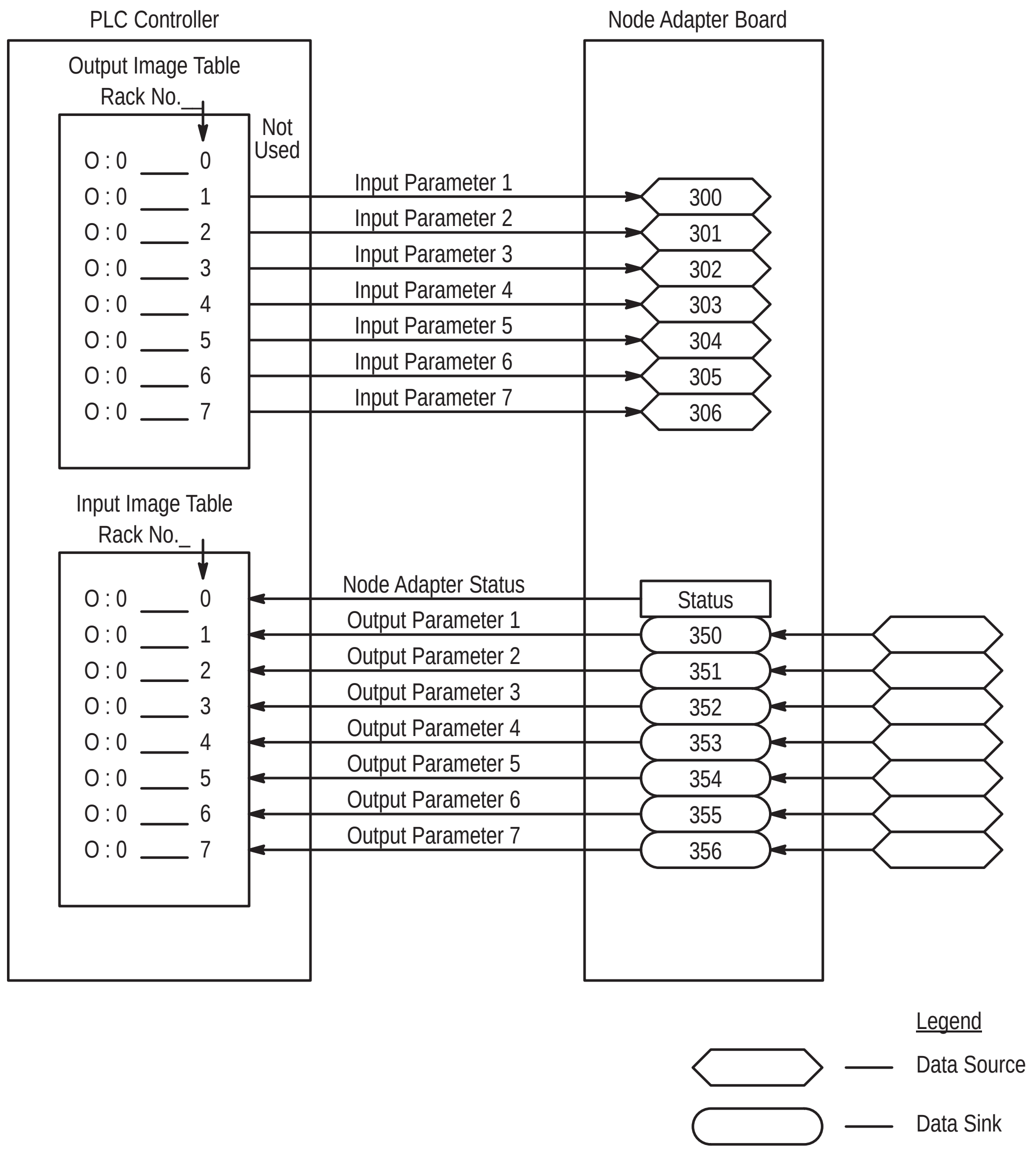


Figure 5.2
Configuration Example for Node Adapter Connected to Port B of Bulletin 1395



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Chapter 6

Troubleshooting and Maintenance

Introduction

This section describes the Node Adapter board fault diagnostics and how they are processed by the 1395 Drive.

All Adapter Boards provide initial fault handling based on conditions within their environment, and then signal the Bulletin 1395 which provides further disposition based on system requirements. Faults are divided into three categories:

Hard Faults

Hard Faults are non-recoverable. That is, the Bulletin 1395 must either be RESET or POWER-CYCLED in order to clear the fault condition. An Adapter Board transmit its fault to the Main Control Board through the dual-port RAM as explained in the Bulletin 1395 Instruction Manual. A Hard Fault in an adapter is designed to create an E-Coast Stop. The following examples are considered Hard Faults:

- Internal RAM
- External RAM
- Microbus RAM
- EPROM Checksum
- Watchdogs – which monitor internal states.

Soft Faults

Soft Faults occur when an Adapter Board detects a condition which may result in undesirable operation. The Adapter takes appropriate action within its domain to guard against further operation and signals the condition to the 1395 Drive. In addition, the fault may be cleared and normal operation resumed at the point the fault occurred. Examples of Soft Faults are:

- Microbus Handshake
- Bridge Overtemperature
- Serial Link Timeout

Warning Faults

These faults indicate error conditions which are generally transient in nature, but could result in unpredictable operation if allowed to persist. Examples of Warning Faults are:

- Overload Pending
- Excessive Armature Volts
- Serial Overrun

Certain fault conditions in the Bulletin 1395 can be configured in terms of their Soft or Warning Fault nature. That is, the user/operator may specify the action taken, either Soft Fault or Warning Fault (Report Only).

ATTENTION: Ignoring faults that have been configured as Report Only could damage certain components in the drive.

Examples of Soft/Warning Faults configurable by users are:

- Motor Overtemperature
- AC Line Out of Tolerance
- Heat Sink Overtemperature

Node Adapter Fault Messages

The fault messages available on the Discrete Adapter Board are:

- NA-01 – NODE ADAPTER – PROCESSOR OK
  Default state, no error exists.
- NA-02 through NA-05 – NOT USED
  Reserved for future use.
- NA-06 – HANDSHAKE TIMEOUT
  Communication malfunction between Node Adapter Board and Main Control Board. Replace Adapter Board, replace Main Control Board.
- NA-07 – NOT USED
  Reserved for future use.
- NA-08 – NO COMSOF
  Communication malfunction between Node Adapter Board and PLC Controller. Check wiring, PLC Controller, replace Adapter Board.
- NA-09 – ILLEGAL MODE SEQUENCE
  Incorrect mode detected. Replace Main Control Board, replace Node Adapter Board.
- NA-10 – NO INPUT IMAGE
  Communication malfunction between Node Adapter Board and PLC Controller. Check wiring, PLC Controller, replace Adapter Board.
- NA-11 – OUTPUT IMAGE LOST
  Communication malfunction between Node Adapter Board and PLC Controller. Check wiring, PLC Controller, replace Adapter Board.
- NA-12 – SIU BUFFER OVERFLOW
  Communication malfunction between Node Adapter Board and PLC Controller. Check wiring, PLC Controller, replace Adapter Board.
- NA-13 – PLC COMMAND ILLEGAL
  Communication malfunction between Node Adapter Board and PLC Controller. Check wiring, PLC Controller, replace Adapter Board.

- NA-14 – BLOCK TRANSFER TYPE
  Communication malfunction between Node Adapter Board and PLC Controller. Check wiring, PLC Controller, replace Adapter Board.
- NA-15 – BLOCK TRANSFER LENGTH
  Communication malfunction between Node Adapter Board and PLC Controller. Check wiring, PLC Controller, replace Adapter Board.
- NA-16 – NO COMM RECEIVED
  Communication malfunction between Node Adapter Board and PLC Controller. Check wiring, PLC Controller, replace Adapter Board.
- NA-17 – IDLE LINE LOST
  Communication malfunction between Node Adapter Board and PLC Controller. Check wiring, PLC Controller, replace Adapter Board.
- NA-18 – UNREQ BLOCK TRANSFER
  Communication malfunction between Node Adapter Board and PLC Controller. Check PLC Controller program, replace Adapter Board.
- NA-19 – COMM LOST STATE
  Communication malfunction between Node Adapter Board and PLC Controller. Check wiring, PLC Controller, replace Adapter Board.
- NA-20 – RESET/ PROGRAM/ TEST
  Communication malfunction between Node Adapter Board and PLC Controller. Check PLC Controller Mode Switch, replace Adapter Board.
- NA-21 through NA-23 – NOT USED
  Reserved for future use.
- NA-24 – IL RACK CONFIGURE
  Incorrect DIP switch settings on Adapter Board.
- NA-25 – IL BT REQUEST VALUE
  Internal error during handling of a block transfer.
- NA-26 through NA-99 – NOT USED
  Reserved for future use.

Adapter Troubleshooting

Each processor or Adapter Board provides its own set of sophisticated diagnostics which the user can examine to determine the exact nature of problems that may arise. Maintenance is done at the board level. Examining the diagnostic/fault messages available determines whether a board should be replaced. The malfunctioning board may be returned to Allen-Bradley for further disposition.

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Chapter 7

Periodic Maintenance

Preventive Maintenance

ATTENTION: Servicing energized industrial control equipment can be hazardous. Severe injury or death can result from electrical shock, burn, or unintended actuation of controlled equipment.

Recommended practice is to disconnect and lock out control equipment from power sources, and allow stored energy in capacitors to dissipate, if present. If it is necessary to work in the vicinity of energized equipment, the safety related work practices of NFPA 70E, Electrical Safety Requirements for Employee Workplaces, must be followed.

Periodic Inspection – Industrial control equipment should be inspected periodically. Inspection intervals should be based on environmental and operating conditions, and adjusted as indicated by experience. An initial inspection within 3 to 4 months after installation is suggested. Applicable parts of the following guidelines should be used:

Contamination – If inspection reveals that dust, dirt, moisture or other contamination has reached the control equipment, the cause must be eliminated. This could indicate an incorrect or ineffective enclosure, unsealed enclosure openings (conduit or other) or incorrect operating procedures. Dirty, wet or contaminated parts must be replaced unless they can be cleaned effectively by vacuuming or wiping.

Terminals – Loose connections can cause overheating that can lead to equipment malfunction or failure. Check the tightness of all terminals and bus bar connections and securely tighten any loose connections. Replace any parts or wiring damaged by overheating.

Solid-State Devices – Solid-state devices require little more than a periodic visual inspection. Printed circuit boards should be inspected to determine whether all ribbon cables are properly seated in their connectors. Board locking tabs should also be in place. Necessary replacements should be made only at the PC board or plug-in component level. Solvents should not be used on printed circuit boards. Where blowers are used, air filters if supplied should be cleaned or changed periodically depending on the specific environmental conditions encountered. For additional information see NEMA Standards Publication No. ICS 1.1-1984 entitled: “Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control.”

ATTENTION: Use of other than factory recommended test equipment for solid state controls may result in damage to the control or test equipment or unintended actuation of the controlled equipment.

Static Sensitive Items – While performing maintenance on the 1395 Drive and the Node Adapter Board, special precautions must be observed in handling or touching certain static sensitive components in the cabinet. All circuit cards and SCR's in the drive can be damaged by Electro-Static Discharge. If personnel will make contact with an ESD sensitive component during maintenance, they must be grounded. Grounding should be accomplished with a wrist strap which is connected to an approved ground.

Programming Terminal – The Programming Terminal controls are non-servicable items that should not be disassembled. If the display face becomes dirty, it should only be cleaned with a damp cloth. Cleaning solvents and detergents must not be used to clean the panel. Remote Programming Terminals should not be subjected to liquid or submerged for cleaning. Non-operable panels should be returned to the factory for replacement as a complete unit.

Tests and Records

Final Check Out – After maintenance or repair of industrial controls, always test the control system for proper functioning under controlled conditions that avoid hazards in the event of a control malfunction.

"Keep Good Maintenance Records" – This rule will be most helpful in locating possible intermittent problems by pointing to a particular area of recurring trouble within the overall system. Further, good maintenance records will help reduce major costly shutdowns by demanding the use of proper test equipment and an appropriate inventory of spare parts.For additional information See "NFPA 70B, Recommended Practice For Electrical Equipment Maintenance," published by the National Fire Protection Association.

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European Headquarters SA/NV, avenue Herrmann Debroux, 46, 1160 Brussels, Belgium, Tel: (32) 2 663 06 00, Fax: (32) 2 663 06 40
Asia Pacific Headquarters, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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