KHD2-IVI-AB1

ALLEN-BRADLEY REMOTE I/O NODE ADAPTER FOR PEPPERL + FUCHS INDUCTIVE IDENTIFICATION SYSTEM IDENT-I System-V

USER MANUAL

1999

PEPPERL+FUCHS

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IMPORTANT FIRMWARE VERSION INFORMATION

All new KHD2-IVI-AB1s have a new 5.10 version of software installed.

Version 5.10 has the “First Bit” convention removed from the Block Transfer functions. This means that the “First Bit” (MSB) of each word does not have to be toggled for each BTW, which, in most cases will reduce the ladder size and debug time. The only disadvantage is that the responses to the BTW’s don’t echo the state of the first bits, thus eliminating a good feedback mechanism.

We discovered an incompatability between the prior -AB1 and the most recent IVI interface versions. If you issue a “Version” command the -AB1 will hang. The software team in Germany changed the length of the version response by shortening it. The -AB1 expects a certain length string, and by the time it gets all but the last character, most of the error check has been satisfied. The -AB1 waits for the last version character, thus “hanging”. The new version can handle variable length version responses now.

The new -AB1s easily replace the old ones. Old ladder logic that toggles first bits will work just fine with the new version because the “First Bits” (MSBs) are now “Don’t Care” bits. Discrete I/O transfers must still use the “First Bit” convention to protect against bad data.

Contents

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NOTE: During the course of this document, the KHD2-IVI-AB1 will be referred to as the -AB1 to enhance the flow of the information by associating a short name with the interface.

1) Any command component or data that actually goes to, or comes from, the PLC will be designated in **<BOLD><CAPITALIZED><ARIAL FONT>**

2) Names of commands, components, operating modes will be designated in CAPITALIZED TIMES NEW ROMAN FONT.

3) Normal text will be in normal Times New Roman font (What you are now reading)

4) Critical information will be in ***Italicized bold serif 'd Times New Roman font***

5) The three hyphens found in many of the bit locations in the word tables represent “don't care” conditions.

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A. Overview

The KHD2-IVI-AB1 is an interface module designed to permit P+F Inductive ID Systems to communicate directly with the Allen-Bradley Remote I/O network and thus communicate more directly with the host PLC. The KHD2-IVI-AB1 interface essentially emulates a remote I/O rack. The node addressing, data transfer and physical connection to the RIO network is performed in a manner similar to that of a remote rack of I/O. This configuration eliminates the need for special cabling, special programmable modules for the PLC, programming of a new communication protocol, serial communication/ASCII string handling, network gateways or any other third party integration solutions, all of which add to the equipment, programming, wiring, debugging and maintenance costs of building a system.

The KHD2-IVI-AB1 interface has been developed in conjunction with Allen-Bradley. P+F has licensed the proprietary RIO node adapter chipsets from Allen-Bradley. By using A-B's chipsets, P+F can guarantee compatability with A-B RIO applications. Allen-Bradley engineers have also supported P+F's design process to further insure the correct implementation of the A-B RIO chipsets in the KHD2-IVI-AB1 interface.

B. Features

- The KHD2-IVI-AB1 interface can administrate either the read-only (fixed-code) or the read/write ID modes of the P+F ID system.
- There are essentially eight commands which can be issued by the PLC to the attached ID systems, mini mizing command set complexity or the need for a thorough working knowlege of the complete P+F ID command set.
- The KHD2-IVI-AB1 can be configured to a "one-quarter", "one-half" or "full" rack of PLC I/O memory depending upon available I/O memory and desired functionality.
- The KHD2-IVI-AB1 can communicate via "Block Transfer" or "Discrete I/O" (Discrete I/O can be used in half and full rack configurations, but not in quarter rack configuration).
- Error condition message can be passed back to the PLC for equipment status information.
- 24 VDC power supply.
- Compact housing designed similar to the ID system interface housing mounting compatibility.

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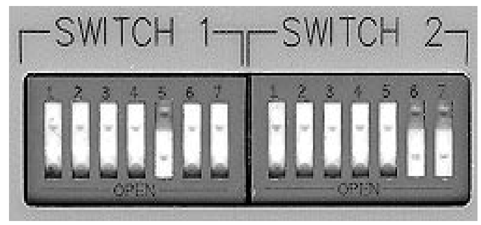
Setting up the -AB1 Configuration

The -AB1* interface communicates with the IVI-KHA6-4HRX (AC powered version) and the IVI-KHD2-4HRX (DC powered version) read/write ID system interfaces or the IRI-KHA6-4.RX (AC powered version) and the IRI-KHD2-4.RX (DC powered version) read-only ID system interfaces via RS-232C serial communication. The baud rate is fixed at 19,200. There are two 7-position DIP-switches (SW1,SW2) in the -AB1 interface that must be set before the interface is powered-up. The DIP-switches can exist in several forms such as slide or rocker types. Switches are ON or "1" or CLOSED when the slider is up or the upper portion of the rocker is depressed, and switches are OFF or "0" or OPEN when the slider is down or the lower portion of the rocker is depressed. In the illustration to the right, three of the switches are ON and the rest are OFF. (These are the rocker type)

The definition of the DIP-switches is as follows:



SWITCH 1:

S1: ID system mode
- 0 - Read Only ID system.
- 1 - Read/Write ID system.

S2, S3: Data rate of Allen-Bradley RIO link.
- 00 - 57.6 kbits/sec.
- 01 - 115.2 kbits/sec.
- 10, 11 - 230.4 kbits/sec.

S4, S5: Rack size of Allen-Bradley RIO link.
- 00 - Quarter rack.
- 01 - Half rack.
- 10, 11 - Full rack.

S6, S7: Start quarter (group) of Allen-Bradley RIO link.
- 00 - First. (I/O group 0)
- 01 - Second. (I/O group 2)
- 10 - Third. (I/O group 4)
- 11 - Fourth. (I/O group 6)

SWITCH 2:

S1: Last rack. (This only tells the RIO scanner that this is the last address to scan. This does not switch-in a terminating resistor. The resistor is added to the outside of the -AB1.)

S2-S7: Rack address of Allen-Bradley RIO link.
(e.g. if S2-S7 are set as 010011, then the address is 19decimal, or 23octal).

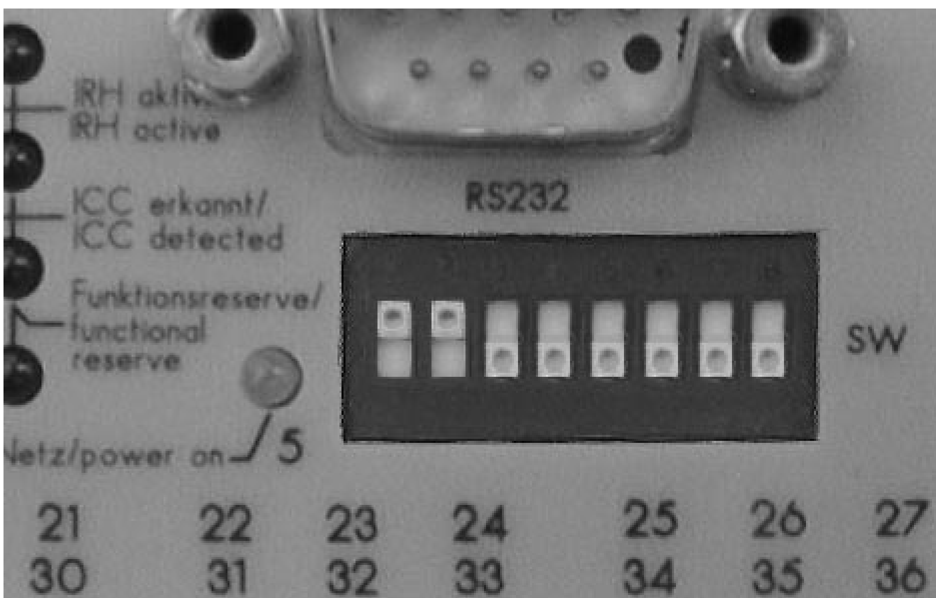
CAUTION: A RIO address setting like 001100 can be confused between decimal 12 and octal 14. Treat this as decimal 12. If you prefer to work with octal (like the PLC's I/O is layed out) just split S2-S7 into 2 groups of three. Our previous example, 001100, when split, becomes very easy to determine the octal value: (001 , 100) = (1 , 4) = 14octal.

*NOTE: During the course of this document, the KHD2-IVI-AB1 will be referred to as the -AB1 to enhance the flow of the information by associating a short name with the interface.

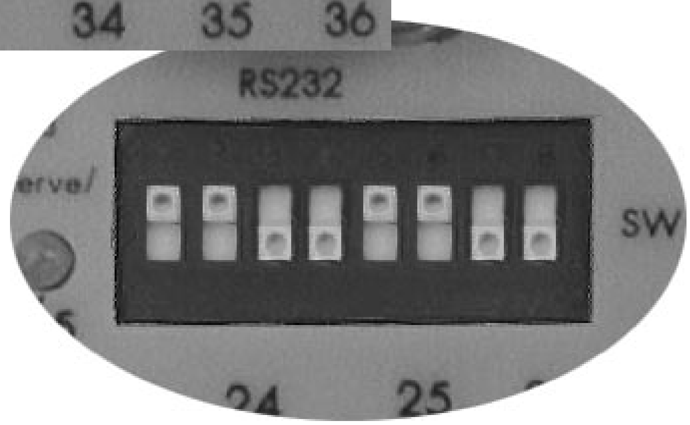
Connecting the -AB1 to the ID interface (either IVI-...-4HRX or IRI-...-4.RX)

The -AB1 comes with a 6" RS-232 connector which is to be attached to the 9-pin D-sub connectors on the IVI/IRI and the -AB1. The IVI/IRI DIP-switches must be set for 19,200 baud (sw 1 and 2 are ON or "1". The IVI can be set to be read/write or read-only. If read/write is desired set switches 5 and 6 to ON or "1". Actually, a very nice pattern exists for the IVI DIP-switches in read/write mode: ON, ON, OFF, OFF, ON, ON, OFF, OFF. For IVI to do read-only, turn switches 5 and 6 OFF. This is also the pattern for the IRI (dedicated read-only). This DIP-switch pattern is: ON, ON, all the rest OFF. Remember to set IRI/IVI DIP-switches with the power off to avoid locking up the firmware.
(see pages 68-69 for more IVI/IRI info or consult the individual component's user's manual which is included on the accompanying disk in PDF file format.)

The DIP-switches in the following image are set as (from left to right) ON, ON, OFF, OFF, OFF, OFF, OFF, OFF. This is the setting for read-only operation of the ID system interface.



The DIP-switches in the image to the right are set as (from left to right) ON, ON, OFF, OFF, ON, ON, OFF, OFF. This is the setting for read/write operation of the IVI read/write ID system interface.



Connecting the -AB1 to the RIO network

Connect the Remote I/O network cable (Belden "Blue Hose") to the -AB1 in the following order:

Network Connections:

Clear to terminal 10
Shield to terminal 11
Blue to terminal 12

21-27 VDC Power :

"+" to terminal 7
"-" to terminal 8.

A. The Three Steps to Getting the -AB1 Online

1)Connect the -AB1 to the ID system interface with the RS-232 jumper cable after the -AB1 and the ID system interface have been configured (see pp. 5 and 6). When the ID interface is correctly connected to the -AB1 and powered, the 4 green LED's on the ID interface should blink in a repeating sequence (1, 2, 3, 4 very quickly then about a 1 second pause) ***without*** the RIO link connected. In fact, this check should be made before connecting the RIO wiring. This then is a good indicator for correct communication between ID and -AB1. It doesn't matter if read heads are connected or not at this time.

2)Connect the RIO network cable (Blue Hose) to the -AB1 and configure the RIO nodes in the PLC to include the rack, size and start group of the -AB1(see p9 for -AB1 RIO wiring). Sometimes auto-config works and sometimes it doesn't. The new node can be added manually. Remember not to confuse octal and decimal when choosing the rack address (the best bet is to just look at the binary pattern of the address DIP-switches, then you can group them by 3's to get OCTAL or by 4's to get HEX).

3)Send a sample command to verify complete communication. P+F recommends a Discrete I/O command sent from the monitor/force I/O image table screens in the programming software's online mode. (The "read code carrier" for read-only or "read data carrier" for read/write command with the "continuous response" bit set) By continuously polling a read head, a continuous read command will give an excellent visual indication (via a yellow/orange LED on both the read head and the ID interface) that the command went. Then the input image can be monitored and you can actually see the status and data bits changing as you put and remove tags (ICC's or IDC's) from in front of the read head. (read about the "First Bit" convention on pp12-13, the Discrete I/O Command Mechanism on pg11, and the DIO image table example on pp14-15).

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B. Brief explanation of Discrete I/O transfers from A-B PLC to -AB1

The mechanism for creating DIO (Discrete I/O) transfers to the KHD2-IVI-AB1 is the same mechanism used to transfer on/off bits to a remote rack of outputs. The output image table location in the PLC that corresponds to the destination rack is set with the appropriate bit pattern which then is transferred out to the remote rack. On every scan of the remote I/O network master, the contents of the output image table for each configured rack is transferred to its respective racks. Each remote rack has an input image table which receives the appropriate image (bit pattern) from the PLC. Each remote rack also has an output image table. On every scan, the contents of the remote rack's output image table is transferred to the PLC's input image table and placed in the area corresponding to that particular rack. This is the mechanism for transferring discrete data back-and-forth from PLC to remote rack. To summarize, each complete RIO Discrete I/O scan consists of an image table update to-and-from each configured rack on the network.

The -AB1 (KHD2-IVI-AB1) also has an input and output image table used to transfer data. The big difference is that the ID system uses several words of contiguous data to get its message across. The RIO scan is not synchronized with the PLC scan and there is no guarantee (as per Allen-Bradley) that the PLC won't take its "snapshot" of the image table right in the middle of the RIO scanner's update of any given rack's image. This then presents the possibility of the PLC acquiring a split of old and new data. To prevent this, P+F has implemented a convention using the First Bits (MSB's) of each word in the image table. In order for a command to be accepted as valid by an AB1, all the first bits of all 3****** or 7****** *useable* words (depending on whether 1/2 or full rack is configured) must be either all 1's or all 0's.

*****NOTE**:* Even though a 1/2 rack has 4 words total and a full rack has 8 words total, this really means 3 or 7 words because the first word (WORD 0) is reserved for Block Transfers and should always be all 0's.

C. The 'FIRST BIT' Convention

The PLC scan and the RIO scan are not synchronized to each other and a slight chance exists for a rewrite of part of the input image table by the RIO before the PLC has had a chance to remove the entire block of related data To verify command/response data accuracy between the -AB1 and the PLC, a procedure using the First Bit (most significant bit, bit15(decimal), or bit17 (octal)) of all transmitted words is used. The integrity of the groups of data is maintained by changing all of the First Bits of the command words to their opposite state each time another command is issued. After power-up or **RESET**, the first bits are all initialized to 0 (zero). Remember that the very first word (WORD 0) in the output image table must be zeroed out at startup and always remain zeroed, including the first bit.

The very first command issued after the power-up or **RESET** must have the First Bits set to 1 (one). The next command is sent with the First Bits set back to 0, the next with First Bits to 1, the next to 0, and so on. A correct response will echo back the "command-first-bits" value in its own First Bits of each word of response. Then the PLC will know that the entire set of response words came from the same response to the issued command. If the first bits don't all agree, then the PLC will know that a remnant of an old response hasn't been overwritten yet or that a newer response has partially overwritten the desired response.

In the case where the -AB1 is configured to a "full" or "half" rack, both DIO and Block Transfers can be used. Both types of commands can be intermixed in a command sequence. Just be sure that each succesive command of the same type has its first bits changed even though there may be commands of the other type in between.

EXAMPLE:

COMMAND	FIRST BIT(S)
power-up	0
DIO version	**1**
BTW version	1
BTW read	0
BTW read	1
BTW read	0
DIO read	**0**

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D. Implementing the 'FIRST BIT' Convention

After power-up, the first command that the -AB1 will accept is the one that has all 1's as first bits. The PLC's output image table is presented to the -AB1 every RIO scan, but until all First Bits are 1's, the -AB1 will ignore the update. So, to prepare a command the first time, set the First Bit (msb, bit15(decimal), or bit 17(octal)) of the first useable word (actually the second word, word 1) to 0. As long as this bit is 0 the -AB1 will ignore the images presented by the RIO scanner (remember it is looking for all 1's the first time). This will allow you to load up the output image table with the correct -AB1 command without accidentally sending out unwanted information, because you weren't ready to send it yet. Set all the other 2 or 6 words' First Bits to 1 and prepare the command. When everything is all set up correctly except for the First Bit of the second word (word 1), flip the First Bit of the second word to 1 and the -AB1 will accept the command on the very next RIO scan.

For the second command to the -AB1, leave the First Bit of the second word as 1. Change all of the other First Bits to 0 and set up the rest of the command. When you are ready to send it, flip the First Bit of the second word to 0. All the First Bits are now 0's and the -AB1 will accept the command on the very next scan. To send the third command. leave the First Bit of the second word 0 and set up the command with all of the other First Bits as 1's. When everything is set up, flip the First Bit to 1 and the command will be accepted. The sequence of commands just alternates First Bits between 1's and 0's starting with 1's at power-up or after a reset. The First Bits of the returned information echo the First Bits of the command. Look at the Discrete I/O commands to see how the output image table should be set up. We recommend the toggling of the second word's first bit last so that there is no doubt that the rest of the image table is correct and ready to go. If you flipped all of the first bits before setting up the command, then whatever is there will go out. This would either re-send the previous command or would result in an "unknown command" error if the image table were partially changed.

E. Simple Example of Discrete I/O Transfers

(the following Address/Data tables were created from data from the actual ONLINE PROGRAMMING | MONITOR DATA | I:xxx and O:xxx image tables set for binary). Let's assume that an -AB1 is set up as 1/2 rack, starting group 0 (1st quarter) at address 3. If we initially clear the output AND input image table , we would see the following pattern when viewing the output image table:

Address	17 <-------- Data ---------> 0			
O:030	0000	0000	0000	0000
O:031	0000	0000	0000	0000
O:032	0000	0000	0000	0000
O:033	0000	0000	0000	0000

(Don't put a tag in front of the read head yet....)

We will send a continuous read command to a read/write system. We will use read head #1 to read the first word (IDC address 0) from the tag. If you consult the "Discrete I/O Command Quick Reference Chart" on pg46, you will see that the command word is: F022 or 7022 (x111 0000 0010 0010 where x is the First Bit which toggles its value). The start address on the tag is specified in O:032. In our example it is 0 so we can leave O:032 as it is. The length of 1 is implied for a "half rack" (The length value (1 through 6) goes into O:033 for "full rack" implementations). So, the first thing to do to the cleared image is to enter the command into O:031.

Address	17 <-------- Data ---------> 0			
O:030	0000	0000	0000	0000
O:031	0111	0000	0010	0010
O:032	0000	0000	0000	0000
O:033	0000	0000	0000	0000

Then toggle the First Bit (the msb or bit 17(octal)) of each word except for the first [useable] word (O:031). As long as the First Bit of word O:031 hasn't been toggled, the -AB1 will ignore every scan. At this point, our command is all ready to go, just waiting for the First Bit of word O:031 to be changed to a one. (REMEMBER: All bits of O:030 must always remain 0).

Address	17 <-------- Data ---------> 0			
O:030	0000	0000	0000	0000
O:031	0111	0000	0010	0010
O:032	1000	0000	0000	0000
O:033	1000	0000	0000	0000

NOTE: If you have a Read-Only system, you can also perform this exercise by using the READ CODE CARRIER command. Just replace the "0010" in C3-C0 with "0000" and don't worry about setting start address and length bits. The status bits work the same way for read/write and read-only read commands. Of course the data will be somewhat different, but the concept is the same.

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E. Simple Example of Discrete I/O Transfers

(Still don't have a tag in front of the read head at this point)

Finally, toggle the First Bit of word O:031 to a value of one. At this point all of the First Bits are 1's and the -AB1 accepts the command on the next scan. The -AB1 will now be strobing read head #1. The -AB1 will also ignore all RIO scans until all 3 of the First Bits are toggled back to 0.

Address	17 <--------	Data	---------> 0	
O:030	0000	0000	0000	0000
O:031	1111	0000	0010	0010
O:032	1000	0000	0000	0000
O:033	1000	0000	0000	0000

Clear the input image table before sending any commands.

Address	17 <--------	Data	---------> 0	
I:030	0000	0000	0000	0000
I:031	0000	0000	0000	0000
I:032	0000	0000	0000	0000
I:033	0000	0000	0000	0000

After sending the continuous-read-word-0 command you will see the following activity in the corresponding input image table: Bit 7 of STATUS 1 (status word is I:031) is "1", telling us that no tag has been read since the command was issued. Bit 0 of STATUS 1 is "1", which indicates that read head #1 is active. I:032 is still all 0's because no data has been read into the buffer yet. You should see the three "First Bits" rapidly toggling between 1 and 0. The rapid toggling occurs because every scan of the RIO updates the input image with "First Bits" toggled from their previous state.

Address	17 <--------	Data	---------> 0	
I:030	0000	0000	0000	0000
I:031	1000	0000	1000	0001
I:032	1000	0000	0000	0000
I:033	1000	0000	0000	0000

For example, assume that "YO" is the data in the first data word (word 0) on the data carrier (tag). Hopefully, the tag still has not been placed in front of the read head. Now if you put the tag in front of the read head, bit 7 of STATUS is turned off because something has been read. However, bit 4 is now on indicating there is a tag being read and the tag is in front of the read head. The data in word I:032 is x101 1001 0100 1111 (59 4F hex or "YO" ASCII). If the tag is removed, bit 4 turns off, but the data stays in the -AB1's buffer until over-written by the next read.

Address	17 <--------	Data	---------> 0	
I:030	0000	0000	0000	0000
I:031	1000	0000	0001	0001
I:032	1101	1001	0100	1111
I:033	1000	0000	0000	0000

F. Tips, Hints and Facts

1)The KHD2-IVI-AB1 interface (-AB1) is able to work in Discrete I/O or Block Transfer modes. In Discrete I/O, the first word of the discrete output image and the first word of the discrete input image are not to be used. They are reserved for Block Transfer so that the interface can work in both Discrete I/O and Block Transfer modes. The best thing to do is to initially zero the WORD 0's of each defined rack in the input ***AND*** output image tables and leave them zeroed forever.
NOTE: In a "quarter rack" size, the interface only supports Block Transfers, not Discrete I/O. The 2 words of I/O in a "quarter rack" just aren't big enough to pass all of the necessary status and data via DIO. Block Transfers are serial packets of up to 64 words unrelated to rack size and the DIO image tables.

2)Clear the PLC's image table (I and O) before powering (or at least before commanding) the -AB1.

3)After "power-up", the -AB1 interface does a self-test which includes the microprocessor, internal RAM, external RAM, NodeAdapter Chip RAM, RS-232C serial communication, and the attached readhead(s). A hardware watchdog is provided which will reset the -AB1 interface if the interface has lost communication with the PLC for more than 1.2 seconds.

4)If the ID system is not communicating correctly with the -AB1, the -AB1 will not permit itself to be recognized by the RIO scanner as an active node (rack). If this is the case, first double check the DIP switch settings on the -AB1 and the ID system controller. Then if that doesn't work, test the ID system by itself on a PC. If PC test software is needed, contact your P+F supplier and ask for the ID test software called "IDENT". It will be provided free of charge. Anyone who has Windows can use terminal or hyper-terminal to the read-only ID system . If windows is not available, then any modem or comms software with a terminal emulator can also talk to the read-only ID system. For a read/write system, the IDENT software is recommended because a checksum must be calculated.

5)When using IDC-1K data carriers (type D4) make sure you have specified the ID interface: IVI-KHD2-4**H**RX or IVI-KHA6-4**H**RX. This interface defaults to IDC type D4 on power-up. If you still have older 256bit data carriers (type D1) make sure you have specified the ID interface: IVI-KHD2-4**.**RX or IVI-KHA6-4**.**RX.

6)The bit that is referred to as the "First Bit" in this manual is the MSB (or bit 15 decimal, bit 17 octal or leftmost bit in the PLC word). Many people call bit 0 (LSB) the first bit. Please pardon the confusion.

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F. Tips, Hints and Facts
Timing Issues

7)When issuing a command to make the ID system read or write, please keep the following concept in mind: A positive confirmation that the command has been delivered to the desired slave node (ie. -AB1) does not mean that the slave node is ready with a response to that command on the very next scan. Many people have made the mistake of sending a BTR for data upload immediately upon the setting of the Block Transfer BTW Done Bit. The ID system needs at least 20ms just to read a fixed code carrier. To write 16 words takes over 600ms on an IDC_1K tag. The ID system must be given enough time to get its ID'ing finished before sending the next command, or BTR errors and time outs, etc. will occur.

For example: Using Block Transfer and a read/write ID system, I send a BTW to write some data. Then on the BTW done bit I send a BTW to read. On that done bit I send a BTR to upload the data I read from the previous BTW. It seems logical until we realize that before the -AB1 could get the write going, that command was interrupted by the BTW read. The BTW read is interrupted by the BTR and the question arises: "What data is the BTR returning from the read that never happened from a tag that was never written?" It should suffice to say that the data will not be correct.

The same mistake can be made using DIO. It is no problem to reload the output image with a new command and flip all the first bits in one scan which would result in a new command every ~3 or so milliseconds. Please follow the timing guidelines on pages 70-72 for proper amounts of time to wait for various commands to be executed. During the actual integration most times can be fine tuned down somewhat to minimize cycle times.

A. Command Introduction

The P+F inductive ID system interface has its own set of commands and functions. The -AB1 interface also has its own unique set of commands and functions (described in the following sections) . The -AB1 commands are the only ones available to the PLC via the RIO network. Once an -AB1 command has been issued by the PLC, the -AB1 then creates the appropriate conversation with the ID system and readies the information for return to the PLC. The diversity of ID system commands has been trimmed down to only a few that are really necessary (and adaptable) to the RIO environment.

B. Command Overview

There are essentially nine -AB1 commands that can be issued by the PLC in either Discrete I/O (DIO) format or Block Transfer (BT) format. Several of the commands have several data handling options (modes) that can be selected for some flexibility in data retrieval by the PLC.
There are three different data handling modes as follows:

1 - **"CURRENT MODE"** - The PLC issues a command once, the -AB1 executes the command once, the ID system is activated once, and then data is collected by the -AB1 once and placed in the node adapter's I/O image for the next DIO scan to pick up. If using Block Transfer, the PLC can then request the data reply from the -AB1 with a BTR (Block Transfer Read) one time.

2 - **"MOST RECENT MODE"** - The PLC sends the command to the -AB1 which then activates the ID system. The ID system is continuously operated by the -AB1 always responding with the 'most recent" code to the -AB1. To retrieve this data with DIO, the PLC must issue the same command each time an update is required. To retrieve the data via BT, issue a BTR any time a data update is needed. (the BTW to start the reading only has to be issued once).

3 - **"CONTINUOUS MODE"** - After this command is issued by the PLC, the -AB1 activates the ID system continuously and continuously updates the PLC's input image table with each scan via Discrete I/O. This mode cannot be used in Block Transfers because the PLC always has to send a BTR (Block Transfer Read) each time a data update is performed. For Block Transfers then, this really just re-defines the "Most Recent" mode.
The nine commands are as follows:

1 - **"READ CODE CARRIER"** - This command reads a fixed-code (read-only) code carrier. In DIO ONLY ONE read head is activated and the reply contains the code for the specified head. In BT any combination of up to four read heads may be activated and the reply contains the codes for all of the active heads. This command can be performed in CURRENT, MOST RECENT and for DIO only, CONTINUOUS modes.

2 - **"B.A.R. CODE CARRIER" -** This command activates all read heads (up to four total) connected to the ID system and continuously reads for both DIO and BTs. This command is performed only in MOST RECENT mode for both BTs and DIO. For BTs the B.A.R., command only has to be issued once. From then on BTRs are issued for data updates.
NOTE: The first time the BAR command is sent, the -AB1 activates the ID system, but provides no codes. Therefore, the data in the input image table is just leftover from a previous operation and is invalid. The command has to be issued the second time to retrieve the code from the first command. Like other MOST RECENT mode commands when using DIO, sending the B.A.R. command the second time responds with the data from the previous B.A.R. command.

3 - **"READ DATA CARRIER" -** This command works like the "READ CODE CARRIER" command with the addition of a data carrier starting word address and a data word length to specify the location and range of data requested from the data carrier. In DIO, ONLY ONE read head is activated and the reply contains the code for the specified head. In BT, any combination of up to four read heads may be activated and the reply contains the codes for all of the active heads. This command can be performed in CURRENT, MOST RECENT and for DIO only, CONTINUOUS modes.
NOTE: For DIO configured as 1/2 rack, only one data word (2 bytes or characters from the data carrier) can be read per command, and for a full rack configuration, 6 words (12 bytes or characters from the data carrier) can be read per command. For BT, the -AB1 will respond with up to 15 words of data (plus the status word)for each read head with 4 read heads connected and 16 words of data (plus the status word) for each read head with 3 or less read heads connected (due to the 64 word Block Transfer limit).

4 - **"B.A.R. DATA CARRIER" -** This command works like the "BAR CODE CARRIER" command with the addition of a data carrier starting word address and a data word length to specify the location and range of data requested from the data carrier. This command activates all read heads (up to four total) connected to the ID system and continuously reads for both DIO and BT's. This command is performed only in MOST RECENT mode for both BT's and DIO. For BT's the B.A.R. command only has to be issued once. From then on BTR's are issued for data updates. When using DIO, the reply contains the code from one read head only and each consecutive BAR command receives the code from the next read head in the order that the actual reads were made.
NOTE: The first time the BAR command is sent, the -AB1 activates the ID system but provides no codes. Therefore, the data in the input image table is just leftover from a previous operation and is invalid. The command has to be issued the second time to retrieve the code from the first command. Like other MOST RECENT mode commands when using DIO, sending the B.A.R. command the second time responds with the data from the previous B.A.R. command.
NOTE: For DIO configured as 1/2 rack, only one data word (2 bytes or characters from the data carrier) can be read per command, and for a full rack configuration, 6 words (12 bytes or characters from the data carrier) can be read per command.

5 - **"WRITE DATA CARRIER"** - This command writes data of a certain specified word length at a certain starting word address on a read/write data carrier. Only one read head may be specified and this function is performed only once with either DIO or BT. (This would be CURRENT mode.)
NOTE: For DIO configured as 1/2 rack, only one data word (2 bytes or characters from the data carrier) can be written per command, and for a full rack configuration, 4 words (8 bytes or characters from the data carrier) can be written per command.
NOTE: For both DIO and BT, the first bit of each data word is not allowed to be used, regardless of the overall size of the data. This means that the value of the high byte of each and every data word MAY NOT EXCEED 7F. The low byte has no restrictions (value can be anything from 00-FF). Keep this in mind, especially when sending ASCII characters.

6 - **"DATA CARRIER RESET"** - This command resets a data carrier one time from one specific read head in either DIO or BT. (Archaic command for 256bit legacy systems)
NOTE: If using IDC-1K read/write data carriers (tags), this command is not needed because 1K tags don't need resetting, only the types D1 and D3 can be reset. (see "SET DATA CARRIER TYPE" command description immediately following for a more detailed explanation of which tags are which type.

7 - **"SET DATA CARRIER TYPE"** - This command sets the interface (IVI) protocol to match the various different types of read/write data carriers (tags) that P+F has (or had). The 256bit (or 32 byte, or 16 word) tag is type D1. The IMC series (256kbit and 64kbit, battery-backed RAM) tags are type D3. The 1kbit (128 byte or 64 word) tag is type D4.

8 - **"VERSION/STATUS"** - This command returns the version numbers of the ID system and -AB1 interface softwares, status indicating which read heads are connected, and internal -AB1 hardware status. This command responds once in either DIO or BT. The best time to retrieve the status information is immediately after a "power-up" or a RESET, after which, the status bytes are filled with code reading status information.

9 - **"RESET"** - This command does a hardware reset of the -AB1 including a self-test. This command is executed once in either DIO or BT and there is no reply.
NOTE: WAIT 1.5 SECONDS AFTER A RESET COMMAND TO ISSUE THE NEXT COMMAND.

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The following three special commands handle data a page at a time. A page is a 32 byte (or 16 word) memory page in the data carrier's memory. The IDC-1k (type D4) has 4 pages and the IMC-40-64k and IMC-40-256k (type D3) have 256 and 1024 pages respectively. Only the page address needs to be specified since the length is implied. These commands can only be used with Block Transfer because the data size is much too large for the DIO rack I/O size.

NOTE: The IDC-1K can only be read with page commands. It cannot be written.

NOTE: When using the IMC (type D3) tags, immediately after power-up or a reset, the ID system must be changed into type D3 mode via the "SET DATA CARRIER TYPE" command since the IVI interfaces do not have a type D3 start-up setting.

1 - **"PAGE READ"** - This command works like the "READ CODE CARRIER" command with the addition of a data carrier starting page address to specify the location on the tag from which to read data. Any combination of three read heads can be activated (due to the 64 word BT limit) and the reply contains the codes for all active read heads. This command can be performed in CURRENT or MOST RECENT modes.

2 - **"PAGE B.A.R. DATA CARRIER" -** This command works like the "BAR CODE CARRIER" command with the addition of a data carrier starting page address specify the location of data requested from the data carrier. This command activates all read heads (up to 4 total) connected to the ID system and continuously reads for BT's. This command is performed only in MOST RECENT mode.

3 - **"PAGE WRITE"** - ***Only for IMC series data carriers.*** This command writes a page of data at a certain starting page address on a read/write data carrier. Only one read head may be specified and this function is performed only once with BT only. (This would be CURRENT mode.)

NOTE: The first bit (MSB) of each data word is not allowed to be used, regardless of the overall size of the data because we need it for the FIRST BIT convention. This means that the value of the high byte of each and every data word MAY NOT EXCEED 7F. The low byte has no restrictions (value can be anything from 00-FF). Keep this in mind, especially when sending ASCII characters.

Introduction

When using Block Transfer, the user can select any rack size and appropriate starting quarter (if applicable). If the chosen rack size is larger than a quarter rack, Discrete I/O can also be used. After the -AB1 command is issued via BTW (Block Transfer Write command in the PLC), a BTR (Block Transfer Read command in the PLC) is used to request a response from the -AB1 interface. It is important for the user to set the requested data length of BTR to zero or an exact length (see command description). If the data length is set to 0, the -AB1 interface decides the correct data length of the BTR for various -AB1 commands. In some -AB1 commands, the user selects the read heads. If the user selects a read head which does not exist in the I.D system, the -AB1 interface replies with a head error to the PLC. The -AB1 interface also replies with error information when any other error occurs (see **STATUS1** and **STATUS0**).

Every BTW command begins with the control word. In fact, several of the commands consist of only the control word.

Control Word Format:

Word 0	1st	1	1	1	H_4	H_3	H_2	H_1	C_3	C_2	C_1	C_0	---	---	---	M_0

1st: - This is the First Bit (MSB or bit15 (decimal) or bit17 (octal)).

H_4, H_3, H_2, H_1 : - Read head select (H_1 is head #1 etc.).
1 - The head is selected.
0 - The head is not selected.

C_3, C_2, C_1, C_0: - Command bits unique for each command.

M_0: - Mode bit.
0 - CURRENT MODE.
1 - MOST RECENT MODE.

(see page18 for further descriptions of the CURRENT and MOST RECENT modes)

First Word of Response

The first word of response is a status word. A "1" in any bit location of byte STATUS1 indicates the existence of that particular error. STATUS0 indicates active heads and "tag-read" status.

Word 0	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$

STATUS1:

Bit6: - Microprocessor internal RAM error.
Bit5: - External RAM error.
Bit4: - Node Adapter Chip RAM error.
Bit3: - The head specified in the command does not exist.
Bit2: - The command is not available (bad command).
Bit1: - RS-232C serial communication error.
Bit0: - (N/A).

STATUS0:

Bit7: - No tag is read by read head(s).
Bit6: - (N/A).
Bit5: - (N/A).
Bit4: - The tag read by the read head is still present in front of the read head.
Bit3: - Read head 4 is active.
Bit2: - Read head 3 is active.
Bit1: - Read head 2 is active.
Bit0: - Read head 1 is active.

NOTE: When the system is first initialized, Bit7 (of **STATUS0**) is 1 because no tag has been read yet. When using MOST RECENT MODE or a BAR command, once a tag is read, Bit7 will be set to 0 and stay 0 as long as the same command is still active. This is because whether the tag is still there or not, a tag has been read. At this point, Bit4 should be watched to indicate whether the received code is from a tag that is still there or from a tag that has since left the read area. Once a different command is issued for a different read head, the buffer is cleared and Bit7 is set to 1 again until a read is once again made for that read head.

In CURRENT MODE, Bit4 will be set to 1 for a good read and set to 0 for all other conditions. In the case of an ID system error, data **ID19-ID12** (see diagram on following page) are replaced by the actual ID system error code. Bit7 is not useful in current mode.

1. Read Code Carrier

This command reads code carrier(s) from the specified read head(s). User can select more than one read head in the command. A one-word -AB1 command is issued to the -AB1 interface with a BTW.

Command Format:

Word 0	1st	1	1	1	H_4	H_3	H_2	H_1	0	0	0	0	---	---	---	M_0

If the command is in current mode, the PLC only can request data with a BTR once. If the command is in most recent mode, the specified read heads continuously work, and the PLC can request data with a BTR as many times as desired, or even request data with a continuous BTR command. It takes three words of block transfer memory for the reply information of each read head. So the data length of a BTR is equal to 3 X (the number of specified read heads).

Reply:

Word 0	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
Word 1	1st	0	0	0	ID_{23}	ID_{22}	ID_{21}	ID_{20}	ID_{19}	ID_{18}	ID_{17}	ID_{16}	ID_{15}	ID_{14}	ID_{13}	ID_{12}
Word 2	1st	0	0	0	ID_{11}	ID_{10}	ID_9	ID_8	ID_7	ID_6	ID_5	ID_4	ID_3	ID_2	ID_1	ID_0
Word n	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(ID_{23}-ID_0) is a 24-bit data read from a code carrier. The read-only ID system retrieves (**ID_{23}-ID_0**) in hexadecimal form, however, (**ID_{15}-ID_0**) is retrieved in decimal form by the read/write ID system. For example, if (**ID_{23}-ID_0**) from the code carrier is 661C4A, the data read by a read-only I.D system is 661C4A, as compared to 667242 read by a read/write ID system. It is recommended to use the read-only ID system to read code carriers so that the returned data will be entirely in hexadecimal.

When using current mode, and any ID system error occurs, the bit4 of the **STATUS0** is cleared, (**ID_{23}-ID_{20}**) is set to 0, and (**ID_{19}-ID_{12}**) is replaced by an error code [see ID system user manual (PDF file on accompanying disk) or ID Error Codes on page 69].

2. BAR (Buffered Auto Read) Code Carrier

This command makes all of the read heads attached to the ID system active. All read heads read code carriers continuously.

Command Format:

Word 0	1st	1	1	1	---	---	---	---	0	0	0	1	---	---	---	---

With each BTR, the -AB1 interface then replies to the PLC with the code carrier data in the order in which codes were read by the ID system. The reply is a three-word package (as shown below). If the ID system has not found any tags, it sets bit7, clears bit4, and sets the existing read head bits in **STATUS0** as a reply to the PLC.

Reply:

Word 0	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
Word 1	1st	0	0	0	ID_{23}	ID_{22}	ID_{21}	ID_{20}	ID_{19}	ID_{18}	ID_{17}	ID_{16}	ID_{15}	ID_{14}	ID_{13}	ID_{12}
Word 2	1st	0	0	0	ID_{11}	ID_{10}	ID_9	ID_8	ID_7	ID_6	ID_5	ID_4	ID_3	ID_2	ID_1	ID_0

(ID_{23}-ID_0) is a 24-bit data read from a code carrier. The read-only ID system retrieves (**ID_{23}-ID_0**) in hexadecimal form, however, (**ID_{15}-ID_0**) is retrieved in decimal form by read/write ID system. For example, if (**ID_{23}-ID_0**) from the code carrier is 661C4A, the data read by a read-only ID system is 661C4A, as compared to 667242 read by a read/write ID system. It is recommended to use the read-only ID system to read code carriers so that the returned data will be entirely in hexadecimal.

3. Read Data Carrier

This command reads data carrier(s) from the specified read head(s).

Command Format:

Word 0	1st	1	1	1	H_4	H_3	H_2	H_1	0	0	1	0	---	---	---	M_0
Word 1	1st	---	---	---	---	---	---	---	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
Word 2	1st	---	---	---	---	---	---	---	L_7	L_6	L_5	L_4	L_3	L_2	L_1	L_0

The interface replies to the PLC with the data in words starting at **START ADDRESS(A_7-A_0)** (00-3F hex for IDC-1K or 00-0F hex for old IDC-256bit) and a word length of **LENGTH(L_7-L_0)** (01-10 hex depending on the start address and number of read heads used. This is a limitation of the -AB1.). The sum of **START ADDRESS(A_7-A_0)** and **LENGTH(L_7-L_0)** should be less than or equal to the maximum address value of the data carrier so that the memory address range will not be exceeded.

The -AB1 interface can reply with up to **15** words of data plus one word of status for each read head if all four read heads are specified in the -AB1 interface, and up to **16** words of data plus one status word if only three or less read heads are specified, only because the maximum BT size is 64 words.

Reply: (For just one head. The replies for additional heads also looks like this and the additional replies are added on at the end.)

Word 0	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
Word 1	1st	$D0_{14}$	$D0_{13}$	$D0_{12}$	$D0_{11}$	$D0_{10}$	$D0_9$	$D0_8$	$D0_7$	$D0_6$	$D0_5$	$D0_4$	$D0_3$	$D0_2$	$D0_1$	$D0_0$
Word 2	1st	$D1_{14}$	$D1_{13}$	$D1_{12}$	$D1_{11}$	$D1_{10}$	$D1_9$	$D1_8$	$D1_7$	$D1_6$	$D1_5$	$D1_4$	$D1_3$	$D1_2$	$D1_1$	$D1_0$
Word 3	1st	$D2_{14}$	$D2_{13}$	$D2_{12}$	$D2_{11}$	$D2_{10}$	$D2_9$	$D2_8$	$D2_7$	$D2_6$	$D2_5$	$D2_4$	$D2_3$	$D2_2$	$D2_1$	$D2_0$
Word 4	1st	$D3_{14}$	$D3_{13}$	$D3_{12}$	$D3_{11}$	$D3_{10}$	$D3_9$	$D3_8$	$D3_7$	$D3_6$	$D3_5$	$D3_4$	$D3_3$	$D3_2$	$D3_1$	$D3_0$
Word n	...	...	...(data length up to 16 words D0-D15)...												...	...

All data words are 15-bit data. When an ID system error occurs, the bit4 of the **STATUS0($S0_4$)** is cleared and the low byte of **DATA0($D0_7$-$D0_0$)** is replaced with an error code [see ID system user manual (PDF file on accompanying disk) or ID Error Codes on page 69] and all of the other data is zero.

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This command is similar to the "BAR Code Carrier" command except the code carrier is replaced by a data carrier (read or write tag). For each BTR, the PLC receives the data from the data carriers through the read heads in the order in which new tags are read.

Command Format:

Word 0	1st	1	1	1	---	---	---	---	0	0	1	1	---	---	---	---
Word 1	1st	---	---	---	---	---	---	---	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
Word 2	1st	---	---	---	---	---	---	---	L_7	L_6	L_5	L_4	L_3	L_2	L_1	L_0

The interface replies to the PLC with the data in words starting at **START ADDRESS(A_7-A_0)** (00-3F hex for IDC-1K or 00-0F hex for old IDC-256bit) and a word length of **LENGTH(L_7-L_0)** (01-10 hex depending on the start address and number of read heads used. This is a limitation of the -AB1.). The sum of **START ADDRESS** and **LENGTH** should be less than or equal to the maximum address value of the data carrier so that the memory address range will not be exceeded.

The -AB1 interface can reply with up to **16** words of data plus one word of status for each read head.

Reply:

Word 0	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
Word 1	1st	$D0_{14}$	$D0_{13}$	$D0_{12}$	$D0_{11}$	$D0_{10}$	$D0_9$	$D0_8$	$D0_7$	$D0_6$	$D0_5$	$D0_4$	$D0_3$	$D0_2$	$D0_1$	$D0_0$
Word 2	1st	$D1_{14}$	$D1_{13}$	$D1_{12}$	$D1_{11}$	$D1_{10}$	$D1_9$	$D1_8$	$D1_7$	$D1_6$	$D1_5$	$D1_4$	$D1_3$	$D1_2$	$D1_1$	$D1_0$
Word 3	1st	$D2_{14}$	$D2_{13}$	$D2_{12}$	$D2_{11}$	$D2_{10}$	$D2_9$	$D2_8$	$D2_7$	$D2_6$	$D2_5$	$D2_4$	$D2_3$	$D2_2$	$D2_1$	$D2_0$
Word 4	1st	$D3_{14}$	$D3_{13}$	$D3_{12}$	$D3_{11}$	$D3_{10}$	$D3_9$	$D3_8$	$D3_7$	$D3_6$	$D3_5$	$D3_4$	$D3_3$	$D3_2$	$D3_1$	$D3_0$
Word n	...	...	...(data length up to 16 words D0-D15)...												...	...

All data words are 15-bit data. When an ID system error occurs, the bit4 of the **STATUS0($S0_4$)** is cleared and the low byte of **DATA0($D0_7$-$D0_0$)** is replaced with an error code [see ID system user manual (PDF file on accompanying disk) or ID Error Codes on p69] and all of the other data is zero.

5. Write Data Carrier

This command writes words of data starting at **START ADDRESS (A_7-A_0)** with the length of **LENGTH (L_7-L_0)** into the data carrier. Only one read head is specified in the command.

Command Format:

Select only one of the **H** bits (**H_1, H_2, H_3,** or **H_4**) to set to 1 and leave the rest 0.

Word 0	1st	1	1	1	H_4	H_3	H_2	H_1	0	1	0	0	---	---	---	---
Word 1	1st	---	---	---	---	---	---	---	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
Word 2	1st	---	---	---	---	---	---	---	L_7	L_6	L_5	L_4	L_3	L_2	L_1	L_0
Word 3	1st	$D0_{14}$	$D0_{13}$	$D0_{12}$	$D0_{11}$	$D0_{10}$	$D0_9$	$D0_8$	$D0_7$	$D0_6$	$D0_5$	$D0_4$	$D0_3$	$D0_2$	$D0_1$	$D0_0$
Word 4	1st	$D1_{14}$	$D1_{13}$	$D1_{12}$	$D1_{11}$	$D1_{10}$	$D1_9$	$D1_8$	$D1_7$	$D1_6$	$D1_5$	$D1_4$	$D1_3$	$D1_2$	$D1_1$	$D1_0$
Word 5	1st	$D2_{14}$	$D2_{13}$	$D2_{12}$	$D2_{11}$	$D2_{10}$	$D2_9$	$D2_8$	$D2_7$	$D2_6$	$D2_5$	$D2_4$	$D2_3$	$D2_2$	$D2_1$	$D2_0$
Word n	...	...	...(data length up to 16 words D0-D15)...												...	...

The length of written data is up to 16 words which depends on **START ADDRESS** (00-3F hex) and **LENGTH** (01-10 hex). If the content of **LENGTH** is zero, the -AB1 interface replies with an error (command is not available) to the PLC. The sum of **START ADDRESS** and **LENGTH** should be less than or equal to **40** hex (64 decimal) or the maximun address value of the data carrier will be exceeded.

Reply:

Word 0	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
Word 1	1st	0	0	0	0	0	0	0	E_7	E_6	E_5	E_4	E_3	E_2	E_1	E_0
Word 2	1st	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

If the bits in **ERROR** are zeros in the reply, writing was successful.

ERROR(E_7-E_0): **00** - successful
0D - unsuccessful

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This command is used to check the version of the ID system and that of the -AB1 interface. The reply to the PLC also includes which read heads are attached to the ID system.

Command Format:

Word 0	1st	1	1	1	---	---	---	---	1	1	1	0	---	---	---	---

Reply:

Word 0	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
Word 1	1st	$V0_{14}$	$V0_{13}$	$V0_{12}$	$V0_{11}$	$V0_{10}$	$V0_9$	$V0_8$	$V0_7$	$V0_6$	$V0_5$	$V0_4$	$V0_3$	$V0_2$	$V0_1$	$V0_0$
Word 2	1st	$V1_{14}$	$V1_{13}$	$V1_{12}$	$V1_{11}$	$V1_{10}$	$V1_9$	$V1_8$	$V1_7$	$V1_6$	$V1_5$	$V1_4$	$V1_3$	$V1_2$	$V1_1$	$V1_0$

VERSION 0 (**$V0_{14}$-$V0_0$**) is the version of the ID system interface.
VERSION 1 (**$V1_{14}$-$V1_0$**) is the version of the -AB1.

7. Reset

This command resets the -AB1 interface.

Command Format:

Word 0	1st	1	1	1	---	---	---	---	1	1	1	1	---	---	---	---

(No reply)

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8. Set Data Carrier Type

This command sets the data carrier type in the read/write system ID interface. The IDC-1K is type D4, the IDC-256bit is type D1, and the IMC's (256kbit and 64kbit battery backed RAM) are type D3. The IVI-KH__-4HRX ID system interface starts in type D4 (IDC-1K) at power-up. If the bits in **ERROR (E_7-E_0)** are zeros, the type set was successful.

Command Format:

Word 0	1st	1	1	1	---	---	---	---	1	1	0	1	T_3	T_2	T_1	T_0

Reply:

Word 0	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
Word 1	1st	0	0	0	ID_{23}	ID_{22}	ID_{21}	ID_{20}	ID_{19}	ID_{18}	ID_{17}	ID_{16}	ID_{15}	ID_{14}	ID_{13}	ID_{12}
Word 2	1st	0	0	0	ID_{11}	ID_{10}	ID_9	ID_8	ID_7	ID_6	ID_5	ID_4	ID_3	ID_2	ID_1	ID_0

ERROR(E_7-E_0): **00** - successful
0D - unsuccessful

.

9. Data Carrier Reset (*for IDC-256bit only*)

This command resets the data carrier from a ***single*** read head. If the bits in **ERROR** (E_7-E_0) in the reply are zeros, the reset was successful. Before this command is executed, a data carrier must be in front of the read head.

Command Format:

Select only one of the **H** bits (H_1, H_2, H_3, or H_4) to set to 1 and leave the rest 0.

Word 0	1st	1	1	1	H_4	H_3	H_2	H_1	0	1	0	1	---	---	---	---

Reply:

Word 0	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
Word 1	1st	0	0	0	0	0	0	0	E_7	E_6	E_5	E_4	E_3	E_2	E_1	E_0
Word 2	1st	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

If the bits in **ERROR** are zeros in the reply, writing was successful.

ERROR(E_7-E_0): **00** - successful
0D - unsuccessful

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10. Page Read Data Carrier (*for type D3 data carriers IMC-40-64K or 256K*)

This command reads a page (16 words) from type D3 data carriers, from up to three specified read heads. Only three heads can be used because the response per read head is 17 words and the max BT size is 64 words. The page address is specified by three hexadecimal digits: **A2, A1** and **A0**. The address is offset, meaning that the first page is page **000** and the eighth page would be **007**.

Command Format:

Word 0	1st	1	1	1	H_4	H_3	H_2	H_1	0	1	1	0	---	---	---	M_0
Word 1	1st	---	---	---	$A2_3$	$A2_2$	$A2_1$	$A2_0$	$A1_3$	$A1_2$	$A1_1$	$A1_0$	$A0_3$	$A0_2$	$A0_1$	$A0_0$

Reply:

Word 0	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
Word 1	1st	$D0_{14}$	$D0_{13}$	$D0_{12}$	$D0_{11}$	$D0_{10}$	$D0_9$	$D0_8$	$D0_7$	$D0_6$	$D0_5$	$D0_4$	$D0_3$	$D0_2$	$D0_1$	$D0_0$
Word 2	1st	$D1_{14}$	$D1_{13}$	$D1_{12}$	$D1_{11}$	$D1_{10}$	$D1_9$	$D1_8$	$D1_7$	$D1_6$	$D1_5$	$D1_4$	$D1_3$	$D1_2$	$D1_1$	$D1_0$
Word 3	1st	$D2_{14}$	$D2_{13}$	$D2_{12}$	$D2_{11}$	$D2_{10}$	$D2_9$	$D2_8$	$D2_7$	$D2_6$	$D2_5$	$D2_4$	$D2_3$	$D2_2$	$D2_1$	$D2_0$
Word 4	1st	$D3_{14}$	$D3_{13}$	$D3_{12}$	$D3_{11}$	$D3_{10}$	$D3_9$	$D3_8$	$D3_7$	$D3_6$	$D3_5$	$D3_4$	$D3_3$	$D3_2$	$D3_1$	$D3_0$
...	...	...	...(data length 16 words D0-D15) ...												...	...
Word 16	1st	$D15_{14}$	$D15_{13}$	$D15_{12}$	$D15_{11}$	$D15_{10}$	$D15_9$	$D15_8$	$D15_7$	$D15_6$	$D15_5$	$D15_4$	$D15_3$	$D15_2$	$D15_1$	$D15_0$

All data words are 15-bit data. When an ID system error occurs, the bit4 of the **STATUS0($S0_4$)** is cleared and the low byte of **DATA0($D0_7$-$D0_0$)** is replaced with an error code [see ID system user manual (PDF file on accompanying disk) or ID Error Codes on p69] and all of the other data is zero.

11. Page Write Data Carrier (*for type D3 data carriers IMC-40-64K or 256K*)

This command writes a page (16 words) to type D3 data carriers. The page address is specified by 3 hex digits: **A2, A1** and **A0**. The address is offset, meaning that the first page is page **000** and the eighth page would be **007**.

Command Format:

Word 0	1st	1	1	1	H_4	H_3	H_2	H_1	1	0	0	0	---	---	---	---
Word 1	1st	---	---	---	$A2_3$	$A2_2$	$A2_1$	$A2_0$	$A1_3$	$A1_2$	$A1_1$	$A1_0$	$A0_3$	$A0_2$	$A0_1$	$A0_0$
Word 2	1st	$D0_{14}$	$D0_{13}$	$D0_{12}$	$D0_{11}$	$D0_{10}$	$D0_9$	$D0_8$	$D0_7$	$D0_6$	$D0_5$	$D0_4$	$D0_3$	$D0_2$	$D0_1$	$D0_0$
Word 3	1st	$D1_{14}$	$D1_{13}$	$D1_{12}$	$D1_{11}$	$D1_{10}$	$D1_9$	$D1_8$	$D1_7$	$D1_6$	$D1_5$	$D1_4$	$D1_3$	$D1_2$	$D1_1$	$D1_0$
Word 4	1st	$D2_{14}$	$D2_{13}$	$D2_{12}$	$D2_{11}$	$D2_{10}$	$D2_9$	$D2_8$	$D2_7$	$D2_6$	$D2_5$	$D2_4$	$D2_3$	$D2_2$	$D2_1$	$D2_0$
...	...	...	...(data length 16 words D0-D15) ...												...	...
Word 17	1st	$D15_{14}$	$D15_{13}$	$D15_{12}$	$D15_{11}$	$D15_{10}$	$D15_9$	$D15_8$	$D15_7$	$D15_6$	$D15_5$	$D15_4$	$D15_3$	$D15_2$	$D15_1$	$D15_0$

Reply:

Word 0	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
Word 1	1st	0	0	0	0	0	0	0	E_7	E_6	E_5	E_4	E_3	E_2	E_1	E_0
Word 2	1st	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

ERROR(E_7-E_0): **00** - successful
0D - bad

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Block Transfer Command Quick Reference Chart

Control Word Format:

Word 0	1st	1	1	1	H_4	H_3	H_2	H_1	C_3	C_2	C_1	C_0	---	---	---	M_0

1st: - This is the first bit (MSB or bit15 hex or bit17 octal).

H_4, H_3, H_2, H_1 : - Read head select (**H_1** is head #1 etc.).
 1 - The head is selected.
 0 - The head is not selected.

C_3, C_2, C_1, C_0: - Command bits unique for each command.

M_0: - Mode bit.
 0 - CURRENT MODE.
 1 - MOST RECENT MODE.

(see page18 for further descriptions of the CURRENT and MOST RECENT modes)

Command Code:

	C_3	C_2	C_1	C_0	---	---	---	---
READ CODE CARRIER	0	0	0	0	---	---	---	M_0
B.A.R. CODE CARRIER	0	0	0	1	---	---	---	---
READ DATA CARRIER	0	0	1	0	---	---	---	M_0
B.A.R. DATA CARRIER	0	0	1	1	---	---	---	---
WRITE DATA CARRIER[1]	0	1	0	0	---	---	---	---
VERSION	1	1	1	0	---	---	---	---
RESET -AB1	1	1	1	1	---	---	---	---
SET DATA CARRIER TYPE[1]	1	1	0	1	---	T_2	T_1	T_0
RESET DATA CARRIER[1]	0	1	0	1	---	---	---	---
PAGE READ DATA CARRIER[2]	0	1	1	0	---	---	---	M_0
PAGE B.A.R. DATA CARRIER[2]	0	1	1	1	---	---	---	---
PAGE WRITE DATA CARRIER[2]	1	0	0	0	---	---	---	---

Possible start quarters (group) when using DIO "1/2 half rack": first quarter (group 0), second quarter (group 2) or third quarter (group 4). Be sure not to overlap remote rack assignments. When using a "full rack" configuration, the only choice is the first quarter (group 0).

Control Word Format:

Word 1																
Word 1	1st	1	1	1	0	0	0	0	C_3	C_2	C_1	C_0	H_1	H_0	M_1	M_0

C_3,C_2,C_1,C_0: -.Command number.
H_1,H_0: - Head number.
00 - Head1.
01 - Head2.
10 - Head3.
11 - Head4.
M_1,M_0: - Mode.
00 - Current mode.
01 - Most recent mode.
1x - Continuous mode.

The First Word of Response is a status word. A "1" in any bit location of byte **STATUS1($S1_6$-$S1_0$)** indicates the existence of that particular error. **STATUS0($S0_7$-$S0_0$)** indicates active heads and "tag-read" status. ***Remember: Word 0 must always remain zeroed out.***

Word 1	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$

STATUS1:

$S1_6$ (Bit6): - Microprocessor internal RAM error
$S1_5$ (Bit5): - External RAM error
$S1_4$ (Bit4): - Node Adapter Chip RAM error
$S1_3$ (Bit3): - The head specified in the command does not exist.
$S1_2$ (Bit2): - The command is not available.
$S1_1$ (Bit1): - RS-232C serial communication error
$S1_0$ (Bit0): - (N/A).

STATUS0:

$S0_7$ (Bit7): - No tag is read by read head(s).
$S0_6$ (Bit6): - (N/A).
$S0_5$ (Bit5): - (N/A).
$S0_4$ (Bit4): - The tag read by the read head is still present in front of the read head.
$S0_3$ (Bit3): - The read head 4 is active.
$S0_2$ (Bit2): - The read head 3 is active.
$S0_1$ (Bit1): - The read head 2 is active.
$S0_0$ (Bit0): - The read head 1 is active.

1. Read Code Carrier

This command reads a code carrier from a single read head.

Command Format:

Rack	Word																
Half Rack (Words 0–3) / Full Rack (Words 0–7)	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Word 1	1st	1	1	1	0	0	0	0	0	0	0	0	H_1	H_0	M_1	M_0
	Word 2	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 3	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 4	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 5	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 6	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 7	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Reply:

Rack	Word																
Half Rack (Words 0–3) / Full Rack (Words 0–7)	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Word 1	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
	Word 2	1st	0	0	0	ID_{23}	ID_{22}	ID_{21}	ID_{20}	ID_{19}	ID_{18}	ID_{17}	ID_{16}	ID_{15}	ID_{14}	ID_{13}	ID_{12}
	Word 3	1st	0	0	0	ID_{11}	ID_{10}	ID_9	ID_8	ID_7	ID_6	ID_5	ID_4	ID_3	ID_2	ID_1	ID_0
	Word 4	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 5	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 6	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 7	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

(ID_{23}-ID_0) is a 24-bit data read from a code carrier. The read-only ID system retrieves (**ID_{23}-ID_0**) in hexadecimal form, however, (**ID_{15}-ID_0**) is retrieved in decimal form by the read/write ID system. For example, if (**ID_{23}-ID_0**) from the code carrier is 661C4A, the data read by a read-only ID system is 661C4A, as compared to 667242 read by a read/write ID system. It is recommended to use the read-only ID system to read code carriers so that the returned data will be entirely in hexadecimal.

When using current mode, and any ID system error occurs, the bit4 of the **STATUS0** is cleared, (**ID_{23}-ID_{20}**) is set to 0, and (**ID_{19}-ID_{12}**) is replaced by an error code [see ID system user manual (PDF file on accompanying disk) or ID Error Codes on page 69].

2. BAR Code Carrier

This command makes all of the read heads attached to the ID system active. Then with each change of the four First Bits, the interface replies to the PLC with the data of the code carriers in the order in which they were read by ID system. If the ID system has not found any tags, it sets bit7, clears bit4 and sets the existing read head bits in **STATUS0** as a reply to the PLC.

Command Format:

Half Rack Half Rac	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Word 1	1st	1	1	1	0	0	0	0	0	0	0	1	---	---	---	---
	Word 2	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 3	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Full Rack Full Rack	Word 4	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 5	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 6	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 7	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Reply:

Half Rack	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Word 1	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
	Word 2	1st	0	0	0	ID_{23}	ID_{22}	ID_{21}	ID_{20}	ID_{19}	ID_{18}	ID_{17}	ID_{16}	ID_{15}	ID_{14}	ID_{13}	ID_{12}
	Word 3	1st	0	0	0	ID_{11}	ID_{10}	ID_9	ID_8	ID_7	ID_6	ID_5	ID_4	ID_3	ID_2	ID_1	ID_0
Full Rack	Word 4	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 5	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 6	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 7	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

(ID_{23}-ID_0) is a 24-bit data read from a code carrier. The read-only ID system retrieves (**ID_{23}-ID_0**) in hexadecimal form, however, (**ID_{15}-ID_0**) is retrieved in decimal form by the read/write ID system. For example, if (**ID_{23}-ID_0**) from the code carrier is 661C4A, the data read by a read-only ID system is 661C4A, as compared to 667242 read by a read/write ID system. It is recommended to use the read-only ID system to read code carriers so that the returned data will be entirely in hexadecimal.

When using current mode, and any ID system error occurs, the bit4 of the **STATUS0** is cleared, (**ID_{23}-ID_{20}**) is set to 0, and (**ID_{19}-ID_{12}**) is replaced by an error code [see ID system user manual (PDF file on accompanying disk) or ID Error Codes on page 69].

3. Read Data Carrier

This command reads one word (2 bytes) of data when using “Half Rack” addressing and up to 6 words with a **LENGTH** of 1-6 when using “Full Rack” addressing, starting at **START ADDRESS** (00-3F hex for IDC-1K), on the data carrier.

Command Format:

	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Half Rack	Word 1	1st	1	1	1	0	0	0	0	0	0	1	0	H_1	H_0	M_1	M_0
Half Rack	Word 2	1st	---	---	---	---	---	---	---	A_7	A_6	A_5	A_4	A_3	A2	A_1	A_0
Half Rack	Word 3	1st	---	---	---	---	---	---	---	L_7	L_6	L_5	L_4	L_3	L_2	L_1	L_0
Full Rack	Word 4	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Full Rack	Word 5	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Full Rack	Word 6	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Full Rack	Word 7	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Reply:

	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Half Rack	Word 1	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
Half Rack	Word 2	1st	$D0_{14}$	$D0_{13}$	$D0_{12}$	$D0_{11}$	$D0_{10}$	$D0_9$	$D0_8$	$D0_7$	$D0_6$	$D0_5$	$D0_4$	$D0_3$	$D0_2$	$D0_1$	$D0_0$
Half Rack	Word 3	1st	$D1_{14}$	$D1_{13}$	$D1_{12}$	$D1_{11}$	$D1_{10}$	$D1_9$	$D1_8$	$D1_7$	$D1_6$	$D1_5$	$D1_4$	$D1_3$	$D1_2$	$D1_1$	$D1_0$
Full Rack	Word 4	1st	$D2_{14}$	$D2_{13}$	$D2_{12}$	$D2_{11}$	$D2_{10}$	$D2_9$	$D2_8$	$D2_7$	$D2_6$	$D2_5$	$D2_4$	$D2_3$	$D2_2$	$D2_1$	$D2_0$
Full Rack	Word 5	1st	$D3_{14}$	$D3_{13}$	$D3_{12}$	$D3_{11}$	$D3_{10}$	$D3_9$	$D3_8$	$D3_7$	$D3_6$	$D3_5$	$D3_4$	$D3_3$	$D3_2$	$D3_1$	$D3_0$
Full Rack	Word 6	1st	$D4_{14}$	$D4_{13}$	$D4_{12}$	$D4_{11}$	$D4_{10}$	$D4_9$	$D4_8$	$D4_7$	$D4_6$	$D4_5$	$D4_4$	$D4_3$	$D4_2$	$D4_1$	$D4_0$
Full Rack	Word 7	1st	$D5_{14}$	$D5_{13}$	$D5_{12}$	$D5_{11}$	$D5_{10}$	$D5_9$	$D5_8$	$D5_7$	$D5_6$	$D5_5$	$D5_4$	$D5_3$	$D5_2$	$D5_1$	$D5_0$

DATA0 (..through **DATA5** for full rack) is a 15-bit data. When using current mode and an I.D system error occurs, the bit4 of the **STATUS0** is cleared, the low byte of **DATA0** is replaced with an error code (see I.D system user manual (PDF file on accompanying disk) or ID Error Codes on p69) and all of the other data is zero.

4. BAR Data Carrier

This command makes all of the read heads attached to the ID system active. Then with each change of the First Bits, the interface replies to the PLC with the data from the data carriers in the order in which they were read by ID system. If the ID system has not found any tags, it sets bit7, clears bit4 and sets the existing read head bits in **STATUS0** as a reply to PLC.
This command reads one word (2 bytes) of data when using "Half Rack" addressing and up to 6 words with a **LENGTH** of 1-6 when using "Full Rack" addressing, starting at **START ADDRESS** (00-3F hex for IDC-1K), on the data carrier.

Command Format:

Half Rack	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Word 1	1st	1	1	1	0	0	0	0	0	0	1	1	---	---	---	---
	Word 2	1st	---	---	---	---	---	---	---	A_7	A_6	A_5	A_4	A_3	A2	A_1	A_0
	Word 3	1st	---	---	---	---	---	---	---	L_7	L_6	L_5	L_4	L_3	L_2	L_1	L_0
Full Rack	Word 4	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 5	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 6	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 7	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Reply:

Half Rack	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Word 1	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
	Word 2	1st	$D0_{14}$	$D0_{13}$	$D0_{12}$	$D0_{11}$	$D0_{10}$	$D0_9$	$D0_8$	$D0_7$	$D0_6$	$D0_5$	$D0_4$	$D0_3$	$D0_2$	$D0_1$	$D0_0$
	Word 3	1st	$D1_{14}$	$D1_{13}$	$D1_{12}$	$D1_{11}$	$D1_{10}$	$D1_9$	$D1_8$	$D1_7$	$D1_6$	$D1_5$	$D1_4$	$D1_3$	$D1_2$	$D1_1$	$D1_0$
Full Rack	Word 4	1st	$D2_{14}$	$D2_{13}$	$D2_{12}$	$D2_{11}$	$D2_{10}$	$D2_9$	$D2_8$	$D2_7$	$D2_6$	$D2_5$	$D2_4$	$D2_3$	$D2_2$	$D2_1$	$D2_0$
	Word 5	1st	$D3_{14}$	$D3_{13}$	$D3_{12}$	$D3_{11}$	$D3_{10}$	$D3_9$	$D3_8$	$D3_7$	$D3_6$	$D3_5$	$D3_4$	$D3_3$	$D3_2$	$D3_1$	$D3_0$
	Word 6	1st	$D4_{14}$	$D4_{13}$	$D4_{12}$	$D4_{11}$	$D4_{10}$	$D4_9$	$D4_8$	$D4_7$	$D4_6$	$D4_5$	$D4_4$	$D4_3$	$D4_2$	$D4_1$	$D4_0$
	Word 7	1st	$D5_{14}$	$D5_{13}$	$D5_{12}$	$D5_{11}$	$D5_{10}$	$D5_9$	$D5_8$	$D5_7$	$D5_6$	$D5_5$	$D5_4$	$D5_3$	$D5_2$	$D5_1$	$D5_0$

DATA0 (..through **DATA5** for full rack) is a 15-bit data. When using current mode and an ID system error occurs, the bit4 of the **STATUS0** is cleared, the low byte of **DATA0** is replaced with an error code [see ID system user manual (PDF file on accompanying disk) or ID Error Codes on p69] and all of the other data is zero.

5. Write Data Carrier

This command writes a word (2 bytes) of data, starting at **START ADDRESS** (00-0F hex), into the data carrier.
This command writes one word (2 bytes) of data when using “Half Rack” addressing and up to 6 words with a **LENGTH** of 1-6 when using “Full Rack” addressing, starting at **START ADDRESS** (00-3F hexadecimal for IDC-1K), on the data carrier.

Command Format:

Half Rack	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Word 1	1st	1	1	1	0	0	0	0	0	1	0	0	H_1	H_0	---	---
	Word 2	1st	---	---	---	---	---	---	---	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
	Word 3	1st	---	---	---	---	---	---	---	L_7	L_6	L_5	L_4	L_3	L_2	L_1	L_0
Full Rack	Word 4	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 5	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 6	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 7	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Reply:

Half Rack	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Word 1	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
	Word 2	1st	0	0	0	0	0	0	0	E_7	E_6	E_5	E_4	E_3	E_2	E_1	E_0
	Word 3	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Full Rack	Word 4	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 5	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 6	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 7	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

If the bits in **ERROR** are zeros in the reply, writing was successful.

ERROR(E_7-E_0): **00** - successful
0D - unsuccessful

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6. Data Carrier Reset

This command resets the data carrier from a single read head. If the bits in **ERROR** in the reply are zeros, the reset was successful. Before this command is executed, a data carrier must be in front of the read head.

Command Format:

	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Half Rack	Word 1	1st	1	1	1	0	0	0	0	0	1	0	1	H_1	H_0	---	---
	Word 2	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 3	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 4	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Full Rack	Word 5	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 6	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 7	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Reply:

	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Half Rack	Word 1	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
	Word 2	1st	0	0	0	0	0	0	0	E_7	E_6	E_5	E_4	E_3	E_2	E_1	E_0
	Word 3	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 4	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Full Rack	Word 5	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 6	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Word 7	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

7. Version

This command is used to check the version of the ID system and that of the -AB1 interface. It also replies to the PLC regarding which read heads are connected to the ID system.

Command Format:

Half Rack / Full Rack	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Half Rack / Full Rack	Word 1	1st	1	1	1	0	0	0	0	1	1	1	0	---	---	---	---
Half Rack / Full Rack	Word 2	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Half Rack / Full Rack	Word 3	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Full Rack	Word 4	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Full Rack	Word 5	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Full Rack	Word 6	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Full Rack	Word 7	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Reply:

Half Rack / Full Rack	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Half Rack / Full Rack	Word 1	1st	$S1_6$	$S1_5$	$S1_4$	$S1_3$	$S1_2$	$S1_1$	$S1_0$	$S0_7$	$S0_6$	$S0_5$	$S0_4$	$S0_3$	$S0_2$	$S0_1$	$S0_0$
Half Rack / Full Rack	Word 2	1st	$V0_{14}$	$V0_{13}$	$V0_{12}$	$V0_{11}$	$V0_{10}$	$V0_9$	$V0_8$	$V0_7$	$V0_6$	$V0_5$	$V0_4$	$V0_3$	$V0_2$	$V0_1$	$V0_0$
Half Rack / Full Rack	Word 3	1st	$V1_{14}$	$V1_{13}$	$V1_{12}$	$V1_{11}$	$V1_{10}$	$V1_9$	$V1_8$	$V1_7$	$V1_6$	$V1_5$	$V1_4$	$V1_3$	$V1_2$	$V1_1$	$V1_0$
Full Rack	Word 4	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Full Rack	Word 5	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Full Rack	Word 6	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Full Rack	Word 7	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Ver0 is the version of the ID system.
Ver1 is the version of the -AB1 interface.

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This command resets the -AB1 interface. Reset should not be issued immediately after power-up or a previous reset.

Command Format:

Full	Half Rack	Word 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Word 1	1st	1	1	1	0	0	0	0	1	1	1	1	---	---	---	---
		Word 2	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		Word 3	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		Word 4	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		Word 5	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		Word 6	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		Word 7	1st	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Discrete I/O Command Quick Reference Chart

Control Word Format:

Word 1	1st	1	1	1	0	0	0	0	C_3	C_2	C_1	C_0	H_1	H_0	M_1	M_0

M1, M0:
- **00 - current**
- **01 - most recent**
- **1x - continuous most recent**

H1, H0:
- **00 - head #1**
- **01 - head #2**
- **10 - head #3**
- **11 - head #4**

Command Code:

	C3	C2	C1	C0				
READ CODE CARRIER	0	0	0	0	H_1	H_0	M_1	M_0
B.A.R. CODE CARRIER	0	0	0	1	---	---	---	---
READ DATA CARRIER	0	0	1	0	H_1	H_0	M_1	M_0
B.A.R. DATA CARRIER	0	0	1	1	---	---	---	---
WRITE DATA CARRIER[1]	0	1	0	0	H_1	H_0	---	---
SET DATA CARRIER TYPE[1]	1	1	0	1	---	T_2	T_1	T_0
VERSION	1	1	1	0	---	---	---	---
RESET INTERFACE	1	1	1	1	---	---	---	---
RESET DATA CARRIER[1][2]	0	1	0	1	H_1	H_0	---	---

[1] ONLY FOR READ/WRITE ID SYSTEM
[2] ONLY FOR 2KBIT OR 256BIT DATA CARRIERS

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PLC 5/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE

GOAL: Write and read three words of data to an inductive data carrier (read/write tag) using Block Transfers.

LAYOUT: We will use Rack #3, Group #4, Module 0, quarter rack size.
We will put the write command (to be sent via block transfer write) into N20:0, N20:1, N20:2, N20:3, N20:4 and N20:5. (see page 28 for a detailed explanation of the WRITE DATA CARRIER block transfer command)
We will put the read command (also to be sent via block transfer write) into N30:0, N30:1, and N30:2. (see page 26 for a detailed explanation of the READ DATA CARRIER block transfer command)

ON STARTUP: Move needed values into the appropriate N-files.

Move........

F140 (hex) into N20:0 (1st bit = 1, write, head #1)
8000 (hex) into N20:1 (1st bit = 1, start address on IDC = 0)
8003 (hex) into N20:2 (1st bit = 1, length of 3 words)
F0A5(hex) into N20:3 (1st bit = 1, data is 70A5 or x111000010100101 in binary)
F0A5(hex) into N20:4 (1st bit = 1, data is 70A5 or x111000010100101 in binary)
F0A5(hex) into N20:5 (1st bit = 1, data is 70A5 or x111000010100101 in binary)
(data words are just arbitrary values that suited my fancy. The FIRST BIT is “x” because it may change and therefore really can’t be used for valid data)

7221 (hex) into N30:0 (1st bit = 0, read from head #2, read words, most recent mode)
0000 (hex) into N30:1 (1st bit = 0, start address on IDC = 0)
0003 (hex) into N30:2 (1st bit = 0, length = 3 words)

CONTINUOUS PROCESS (the part of the ladder program that gets scanned continuously after the one-time startup functions are completed)

Notice that the size of the BTW(block transfer write) will be six words for the WRITE DATA command starting at N20:0.
The READ DATA command will be a 3 word BTW starting at N30:0.

PSEUDO-LADDER........

1) Do the BTW to write the data. The BTW command should look something like: Rack #3, Group #4, Mod #0, Control N20:10, Data N20:0, Length 6.
NOTE: I have chosen arbitrary addresses and values to set-up this demo. There is no reason other appropriate addresses and values can’t be used (ie. if your PLC has 7 racks of I/O, you can use rack #6).

2) On the BTW-Done bit use it to start a 600msec (minimum) timer: TON, T4:1, Base .01, Preset 60, Accum 0.
NOTE: This timer gives the ID system a chance to write the data to the IDC (read/write tag) before moving on. (see point #7 of section F of the OPERATION section of this manual on page 17 for further

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PLC 5/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE

3) Use the T4:1 timer's done bit to trigger the sending of a BTR to see the status of our write attempt. BTR's reflect back the BTW's the First Bit state, and on multiple BTR's the -AB1 will alternate First Bits in the responses so they are able to be distinguished from one another. The BTR should look something like: BTR, Rack #3, Group #4, Module #0, Control N40:10, Data File N40:0, Length = 0. We set Length = 0 so that the -AB1 can decide what size the response to the BTR will be. We should expect 3 words in our BTR response: Status, error, and error2.

4) Once the BTR is finished we can then send out the BTW which will read the tag from head #2.
NOTE: Observe the "First Bit" convention. (for more details on the first bit convention see pages 12-13) This is the second BTW since startup or RESET and therefore it must have its first bits = 0. The tag-write is first (1st bits = 1) and the tag-read is second (1st bits = 0) and then the scan repeats. You could also mask move in the first bits depending on your specific situation. Just remember ***ALL*** words in the BTW must have their First Bits set.
The BTW should look something like: BTW, Rack #3, Group #4, Module #0, Control N30:10, Data N30:0, Length = 3, Continuous = no.

5) On the BTW done bit, run a 100msec (minimum) timer (T4:2, Base = .01, Preset = 10, Accum = 0) to give the ID system time to read the three words. Notice that the ID system does not need as much time to do a read as compared to the write time.

6) On the timer's done bit, send the BTR to retrieve the data. (BTR, Rack #3, Group #4, Module #0,Control N50:10, Data N50:0, Length = 0). Four words should show up in N50:3, 4, 5, and 6, one status word and the 3 data words.

Go to Step One to repeat the scan.

Some additional application notes:
Use timers to slow down the scan time or force wait times for purposes of clarity in these examples. The efficient programmer usually has a host of other processes and done bits that take certain amounts of time and can be used in place of the wasteful timers. For example, a pallet pulls in to a trimming station to get some flash trimmed off of a part. As the pallet comes into the station it gets its ID read. At the same time, the pallet already in the station is getting its trim which takes 1 second. You could BTW a read command for your pallet when the trim process is started on the other pallet. Then when the trim process finishes 1 second later, BTR the -AB1 for the read response. The trim process is sort of a built-in timer which has to be there anyway.

PLC 5/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE

```
Word version

<---- Rung 2:0 ---->
|  S:1                                                 +MOV---------------+  |
+--] [------------------------------------------------++MOVE              ++-+
|    15                                               ||Source      -32768|| |
|                                                     ||                  || |
|                                                     ||Destination  N20:1|| |
|        ***NOTES for RUNG 2:0                        ||            -32768|| |
|           MOVE the 3 word command to write to       |+------------------+| |
|           the tag into N20:0, 1, and 2.             |+MOV---------------+| |
|           MOVE 3 words of data into N20:3, 4 and 5. ++MOVE              ++ |
|           Our command will write 3 words of data    ||Source      -32767|| |
|           to the tag starting at address 0(zero).   ||                  || |
|           I sort of cheated by setting all of these ||Destination  N20:2|| |
|           first bits to 1 because I know this will  ||            -32767|| |
|           always be the first or third BTW and it   |+------------------+| |
|           will always have first bits of 1.         |+MOV---------------+| |
|           This command uses read head #1.           ++MOVE              ++ |
|                                                     ||Source       -3931|| |
|                                                     ||                  || |
|                                                     ||Destination  N20:3|| |
|                                                     ||             -3931|| |
|                                                     |+------------------+| |
|                                                     |+MOV---------------+| |
|                                                     ++MOVE              ++ |
|                                                     ||Source       -3931|| |
|                                                     ||                  || |
|                                                     ||Destination  N20:4|| |
|                                                     ||             -3931|| |
|                                                     |+------------------+| |
|                                                     |+MOV---------------+| |
|                                                     ++MOVE              ++ |
|                                                     ||Source       -3931|| |
|                                                     ||                  || |
|                                                     ||Destination  N20:5|| |
|                                                     ||             -3931|| |
|                                                     |+------------------+| |
|                                                     |+MOV---------------+| |
|                                                     ++MOVE              ++ |
|                                                      |Source       -3776|  |
|                                                      |                  |  |
|                                                      |Destination  N20:0|  |
|                                                      |             -3776|  |
|                                                      +------------------+  |
<---- Rung 2:1 ---->
|  S:1                                                 +MOV---------------+  |
+--] [------------------------------------------------++MOVE              ++-+
|    15                                               ||Source       29217|| |
|                                                     ||                  || |
|                                                     ||Destination  N30:0|| |
|       ***NOTES on RUNG 2:1                          ||             29217|| |
|          MOVE the 3 word command to read 3 words    |+------------------+| |
|          from the tag into N30:0, 1, and 2.         |+MOV---------------+| |
|          This command will use read head #2 and     ++MOVE              ++ |
|          read 3 words starting at address 0(zero).  ||Source           0|| |
|          I also sort of cheated on the first bits   ||                  || |
|          again knowing that this will always be     ||Destination  N30:1|| |
|          the second or fourth BTW and that the      ||                 0|| |
|          first bits will always be 0.  In a normal  |+------------------+| |
|          application situation the state of the     |+MOV---------------+| |
|          first bits cannot be predicted.  To deal   ++MOVE              ++ |
|          with this, MVM (1000 0000 0000 0000 mask)   |Source           3|  |
|          a word with bit15 a 1 or 0 to all command   |                  |  |
|          words, or BTD(PLC5) a toggle bit into bit15 |Destination  N30:2|  |
|          of all command words.                       |                 3|  |
|                                                      +------------------+  |
```

PLC 5/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE

```
<---- Rung 2:2 ---->
|  S:1          ***NOTE:  Latch a bit to start the whole sequence.        B3  |
+--] [--------------------------------------------------------------------(L)--+
|    15                                                                    48 |
<---- Rung 2:3 ---->
|    B3                                        +BTW--------------------+      |
+-+-] [-+--------------------------------------+BLOCK TRANSFER WRITE   +-(EN)-+
| |   48|                                      |Rack                 03|      |
| | T4:3|     ***NOTE for RUNG 2:3             |Group                 4+-(DN) |
| +-] [-+        Here is the BTW to write 3    |Module                0|      |
|     DN         words of data to the ID tag.  |Control block    N20:10+-(ER) |
|                Notice the BTW length is 6:   |Data file         N20:0|      |
|                3 words of header and 3 words |Length                6|      |
|                of data.                      |Continuous            N|      |
|                                              +-----------------------+      |
<---- Rung 2:4 ---->
| N20:10                                                                 B3   |
+--] [-------------------------------------------+--------------------(U)-+-+
|    13                                           |                        48| |
|                                                 |+TON---------------+    | |
|       ***NOTES for RUNG 2:4                     ++TIMER ON DELAY    +-(EN)+ |
|          Here is a big fat 2 sec timer just to   |Timer         T4:0|       |
|          really slow things down.                |Time base     0.01+-(DN)  |
|          REMEMBER: JUST BECAUSE THE BTW DONE BIT |Preset         200|       |
|           IS SET IT DOES NOT MEAN THAT THE ID    |Accum          200|       |
|           SYSTEM IS FINISHED WITH ITS ID'ING.    +------------------+       |
|           YOU MUST WAIT FOR THE ID SYSTEM TO FINISH BEFORE SENDING A BTR
|           TO GET THE STATUS OR DATA FROM THE BTW YOU JUST SENT.  FOR A WRITE
|           TRY 500-600ms AND FOR A READ TRY 100-200ms. YOU MAY HAVE TO ADJUST
|           THESE VALUES ON A PER-APPLICATION BASIS.
|              The timer is activated by the BTW "(DN)" bit.
|
<---- Rung 2:5 ---->
|  T4:0                                        +BTR--------------------+      |
+--] [-----------------------------------------+BLOCK TRANSFER READ    +-(EN)-+
|    DN                                        |Rack                 03|      |
|       ***NOTE for RUNG 2:5                   |Group                 4+-(DN) |
|          Here is the BTR that is sent to     |Module                0|      |
|          determine the status of the "tag    |Control block    N11:10+-(ER) |
|          write" that we just sent in the     |Data file         N11:0|      |
|          previous BTW. It is triggered by    |Length                0|      |
|          T4:0's "(DN)" bit.                  |Continuous            N|      |
|                                              +-----------------------+      |
|
<---- Rung 2:6 ---->
|
| N11:10                                            +TON---------------+      |
+--] [----------------------------------------------+TIMER ON DELAY    +-(EN)-+
|    13                                             |Timer         T4:1|      |
|       ***NOTE for RUNG 2:6                        |Time base     0.01+-(DN) |
|          On the BTR "(DN)" bit start this 2 sec   |Preset         200|      |
|          timer.                                   |Accum          200|      |
|                                                   +------------------+      |
|
<---- Rung 2:7 ---->
|
|  T4:1                                        +BTW--------------------+      |
+--] [-----------------------------------------+BLOCK TRANSFER WRITE   +-(EN)-+
|    DN                                        |Rack                 03|      |
|       ***NOTE for RUNG 2:7                   |Group                 4+-(DN) |
|          Send BTW to read 3 words from the   |Module                0|      |
|          tag when triggered by the timer 4:1 |Control block    N30:10+-(ER) |
|          "(DN)" bit.                         |Data file         N30:0|      |
|                                              |Length                3|      |
|                                              |Continuous            N|      |
|                                              +-----------------------+      |
|
```

PLC 5/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE

```
<---- Rung 2:8 ---->
|
| N30:10                                           +TON---------------+      |
+--] [---------------------------------------------+TIMER ON DELAY    +-(EN)-+
|    13                                            |Timer         T4:2|      |
|       ***NOTE for RUNG 2:8                       |Time base     0.01+-(DN) |
|          Use BTW "(DN)" bit to start timer.      |Preset         200|      |
|                                                  |Accum          200|      |
|                                                  +------------------+      |
<---- Rung 2:9 ---->
|
         |
|  T4:2                                       +BTR---------------------+      |
+--] [----------------------------------------+BLOCK TRANSFER READ     +-(EN)-+
|    DN                                       |Rack                  03|      |
|       ***NOTE for RUNG 2:9                  |Group                  4+-(DN) |
|          Use timer T4:2's "(DN)" bit        |Module                 0|      |
|          to start the BTR which will        |Control block    N12:10+-(ER) |
|          retrieve the data read from        |Data file         N12:0|      |
|          the tag by the BTW.                |Length                 0|      |
|                                             |Continuous             N|      |
|                                             +-----------------------+      |
<---- Rung 2:10 ---->
|                                                                           |
| N12:10                                           +TON---------------+      |
+--] [---------------------------------------------+TIMER ON DELAY    +-(EN)-+
|    13                                            |Timer         T4:3|      |
|       ***NOTE for RUNG 2:10                      |Time base     0.01+-(DN) |
|          Use BTR "(DN)" bit to start the 4th     |Preset         500|      |
|          timer. This timer's "(DN)" bit will     |Accum          167|      |
|          trigger the first BTW which repeats the +------------------+      |
|          whole sequence....                                               |
+---------------------------------[END OF FILE]-----------------------------------+
```


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PLC 5/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE

SLC 500/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE

Comment before we start this SLC example: The creation of Block Transfers on the SLC is more involved than with the PLC 5. With the PLC 5, you just fill in the blanks in the BTW or BTR command boxes that use just one rung of ladder. The SLC has to have the block transfer processed through the "M" files (like some external, data-generating, third-party gadgets are interfaced.). Be sure you understand the SLC/BT technique before diving into this example, even though this is an extremely simple example. If you are at all a little shaky on it, you should read through the SLC-RIO scanner manual where they explain what is what because this example is based largely on the scanner manual examples.

What this demo will do: This demo performs 4 BT operations in a repeating sequence. Four timers, each three seconds in duration put a pause between each BT so that the eye can follow the demo. These can be removed or altered. The 4 BT operations are representative of typical ID system operations:
1) BTW a command to the ID system along with some data. The ID system is commanded to take the 4 data words and write them sequentially to the tag starting at address zero.

2) BTR for a response to the BTW 1). This will give us status from the ID system regarding the success of the tag write(not the BTW write) or the status of the ID system error if the tag write failed.

3) BTW a command to the ID system telling it to read four words from a tag at head #2.

4) BTR for the data from the prior read command.

On the following page is a set of helpful tips regarding the SLC-SN module used with P+F ID via BT's.

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Hints on Communicating Between P+F ID and A-B's S/N module

Graciously submitted by W. Ted Evans University of Toledo faculty

1 - Each P+F read or write requires an Allen-Bradley write followed by a read. For the P+F read, using a BTW, send 3 words and expect a BTR of the length of the returning data plus one for status. [on all BTR's the length can be set as zero and let the -AB1 spec the length as an option]. For the P+F write use a BTW, send 3 words plus data and expect a 2 word BTR as a response to the BTW.

2 - Use the BTW and BTR pseudo commands explained in A-B's S/N module manual. Care must be taken not to allow the BTW or BTR to restart. This means that on the scan that the done bit comes on, suppress the enable bit. The programs from the S/N manual can almost be lifted straight out with this one exception. When the done bit comes on, stop the present BTW and move on to the BTR. When the BTR's done bit comes on, disable the BTR and exit the routine.

3 - The BTW and BTR can use the same 100 word block. For instance, use M0:e.1xx for the entire -AB1 communications [In the example here, I used a separate M0:e.x00 file set for each of my 4 BT's for clarity]

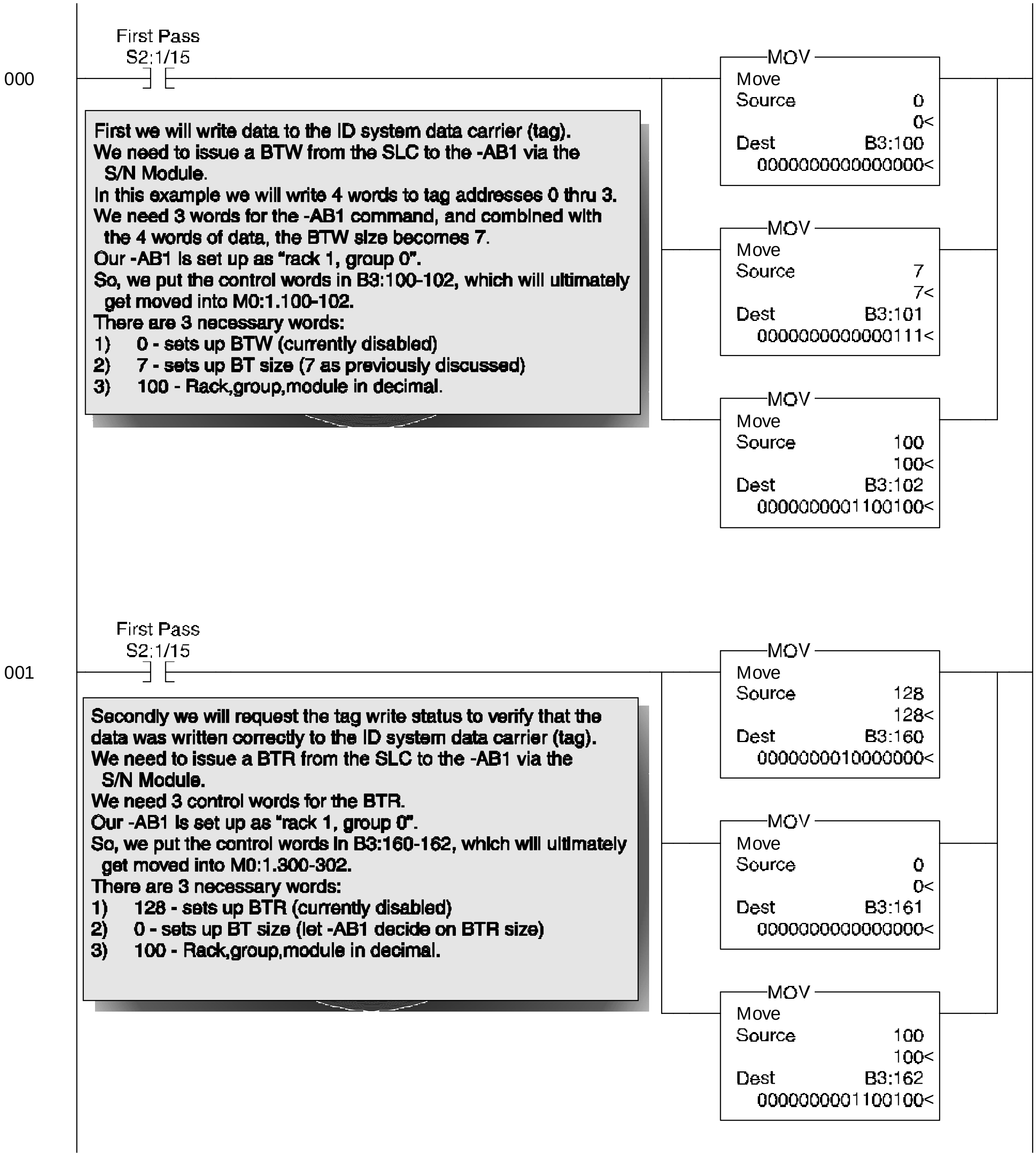
4 - When writing, do not forget the toggle bit. It is important to first turn it on, then off, then on again with each suceeding write of the BTW. The trick is not in the routine that writes the toggle, but in the program calling it. For instance, if seal circuits are used, do not allow the seal circuit to turn off and re-initiate a P+F read or write while one is already in progress. This problem can be accented by bouncy proximity or limit switches.

5 - Monitor all the feedback bits of Status 1 and Status 0 words and analyze them before using the data. If the read head is not active, repeat the process of reading or writing again (up to five times). Many times, the first attempt is not successful so try again. It is better to retry a couple of times rather than using timers followed by a solitary read or write.

6 - All data entered into the M0:e.100 - 102 words are in HEX except the logical address (word 102) which is in decimal.

7 - If three read heads are used for the -AB1, then 16 words can be accessed per readhead [51 words total size]. If all four heads are connected then the biggest size is 15 words [60 words of data and one word of status = 61].

SLC 500/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE



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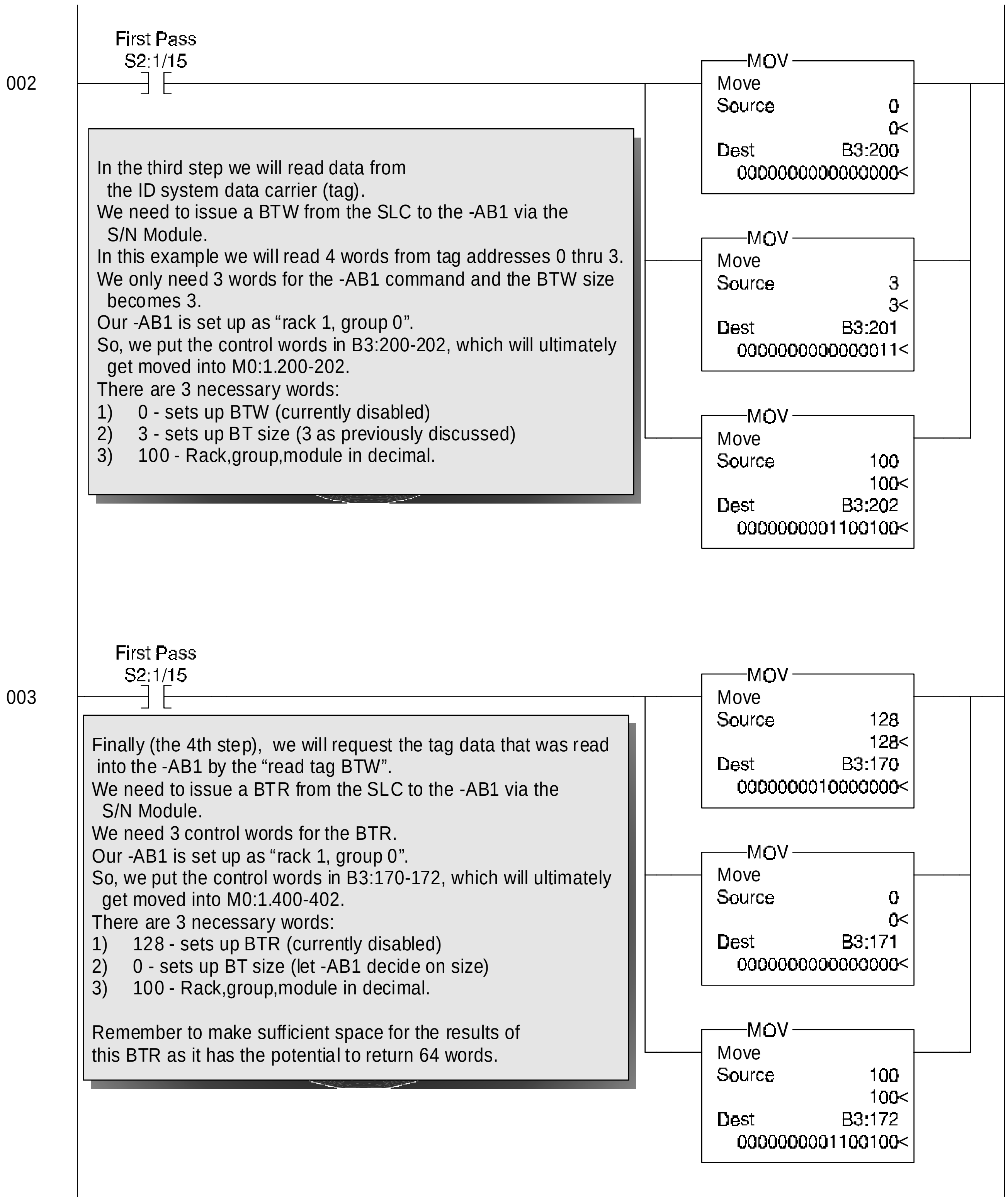
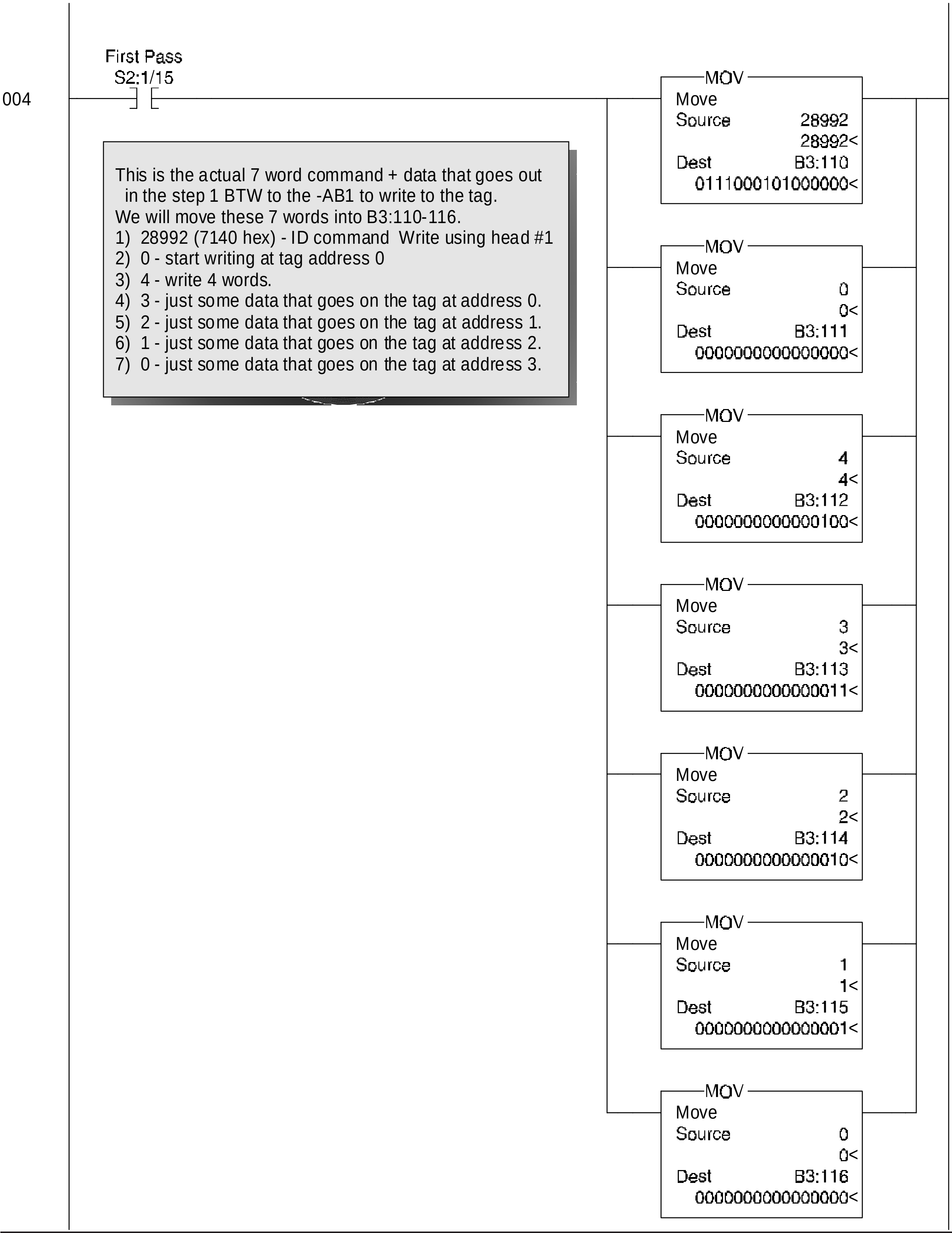
SLC 500/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE



SLC 500/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE



This is the actual 7 word command + data that goes out in the step 1 BTW to the -AB1 to write to the tag.
We will move these 7 words into B3:110-116.

1) 28992 (7140 hex) - ID command Write using head #1
2) 0 - start writing at tag address 0
3) 4 - write 4 words.
4) 3 - just some data that goes on the tag at address 0.
5) 2 - just some data that goes on the tag at address 1.
6) 1 - just some data that goes on the tag at address 2.
7) 0 - just some data that goes on the tag at address 3.

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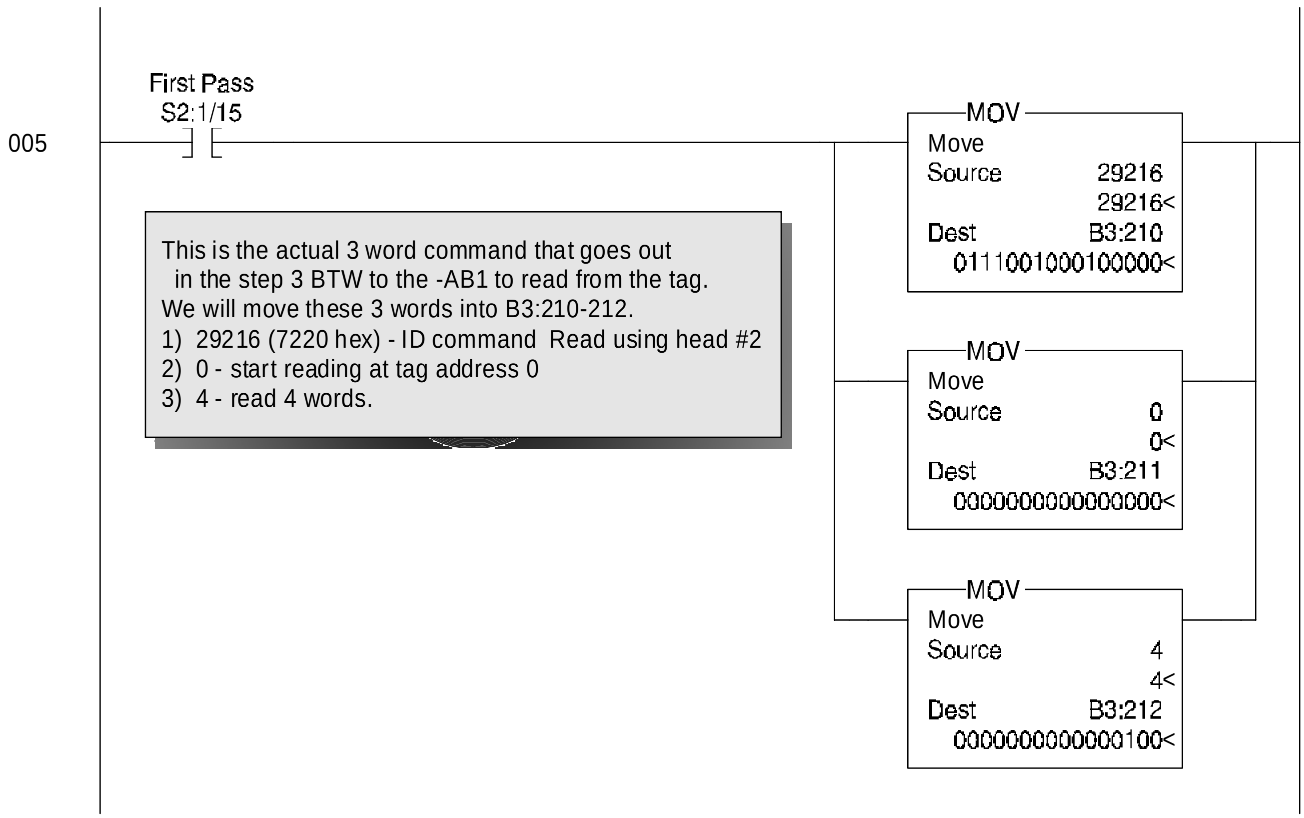
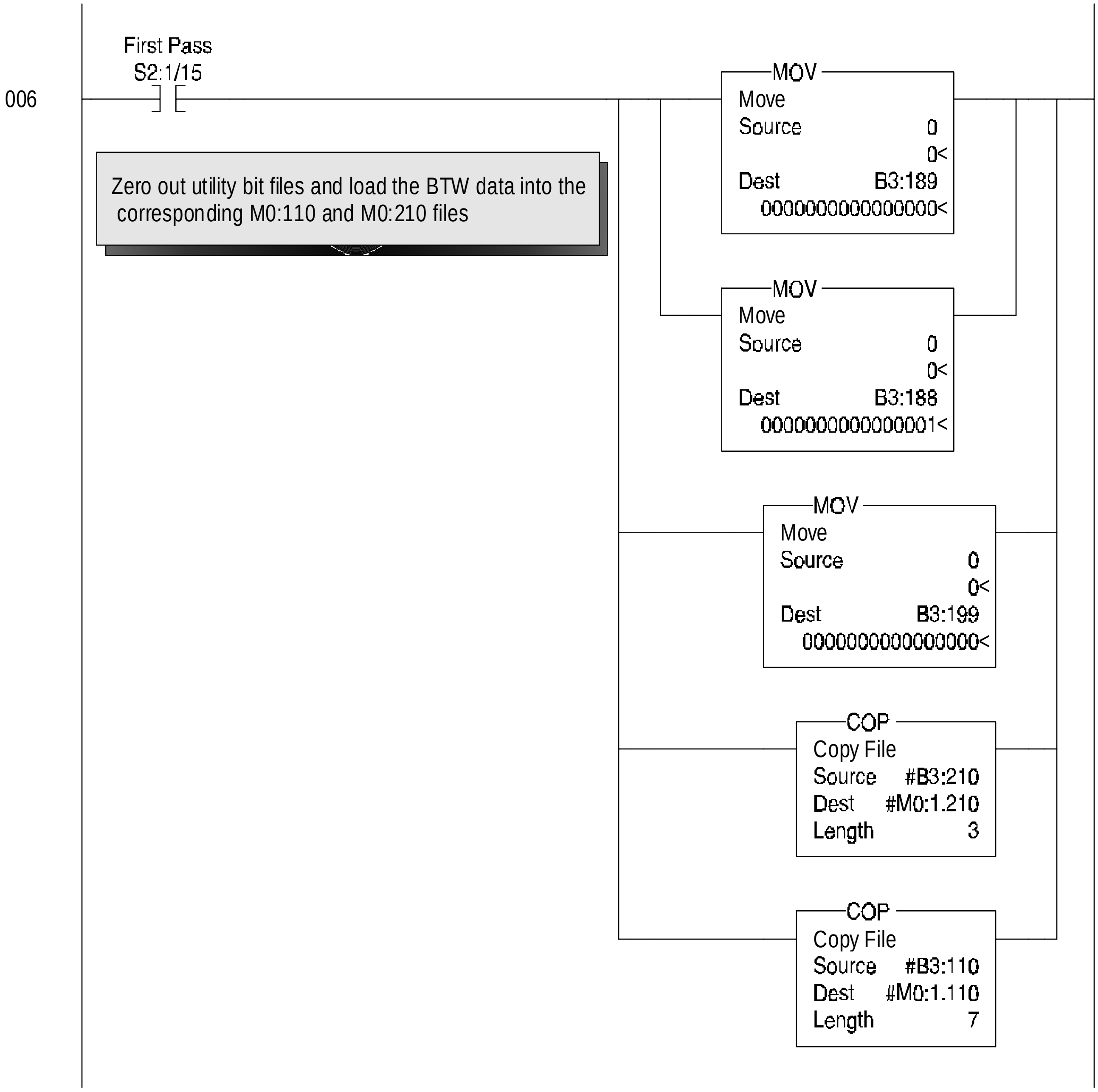
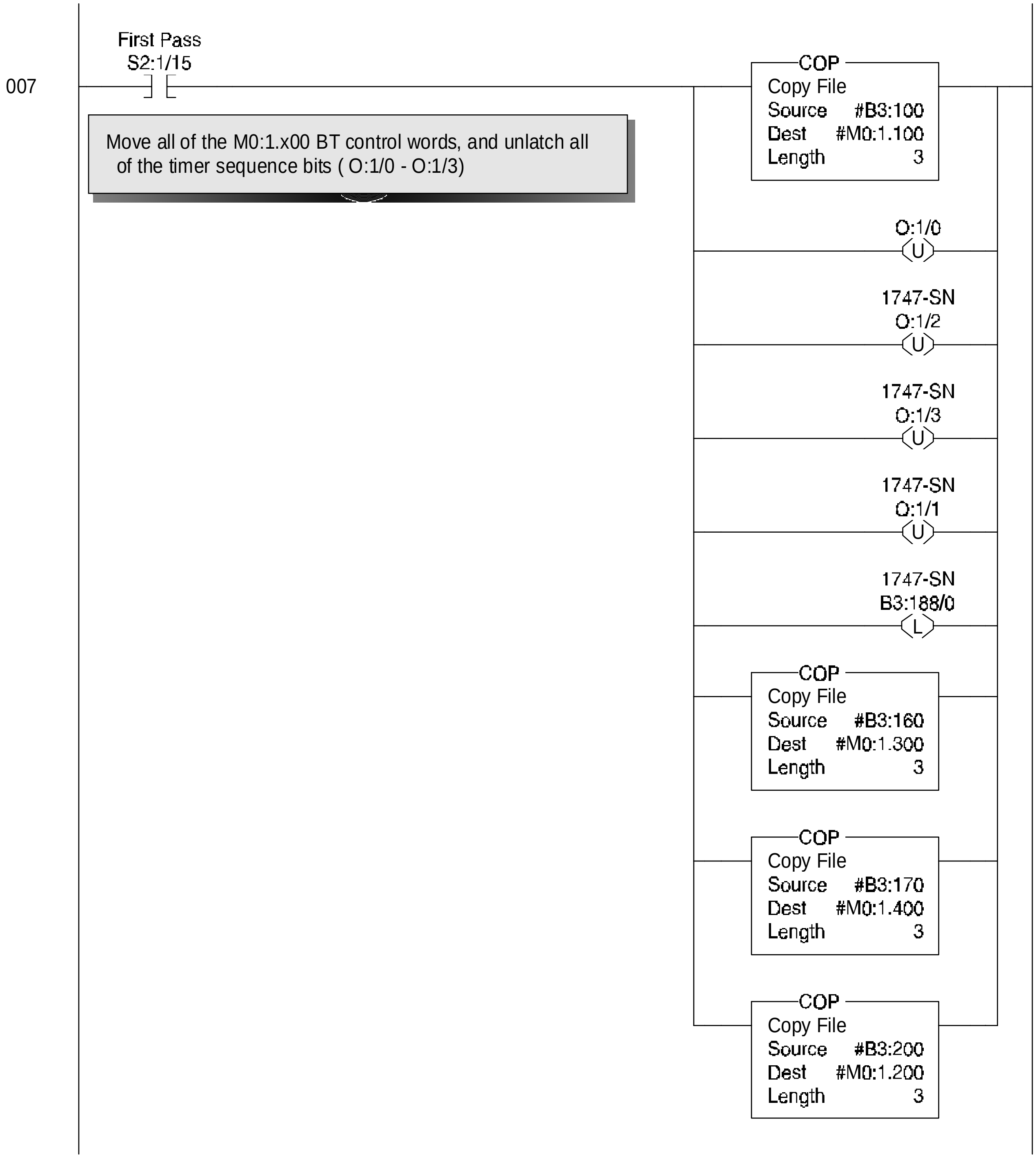
SLC 500/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE



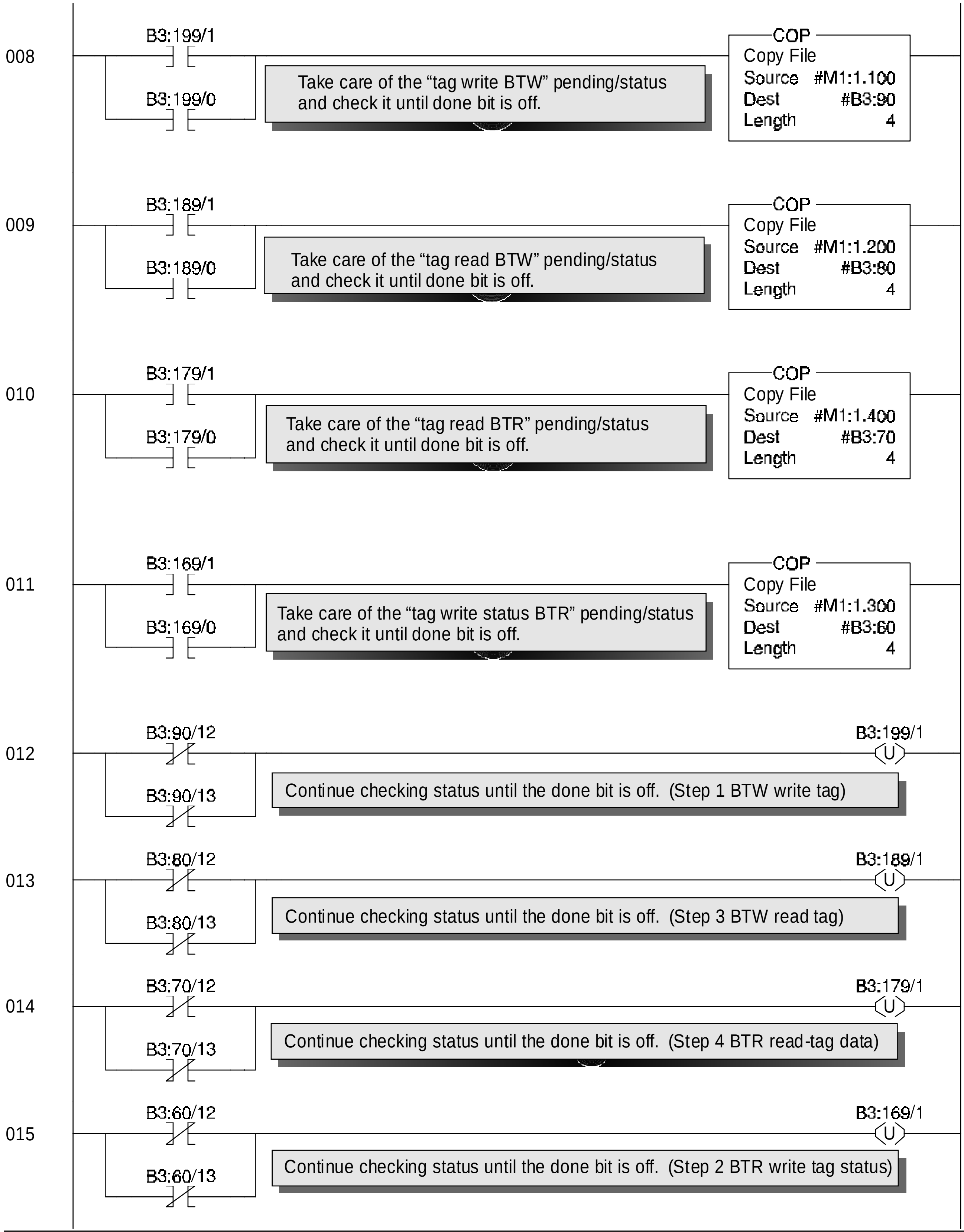
SLC 500/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE



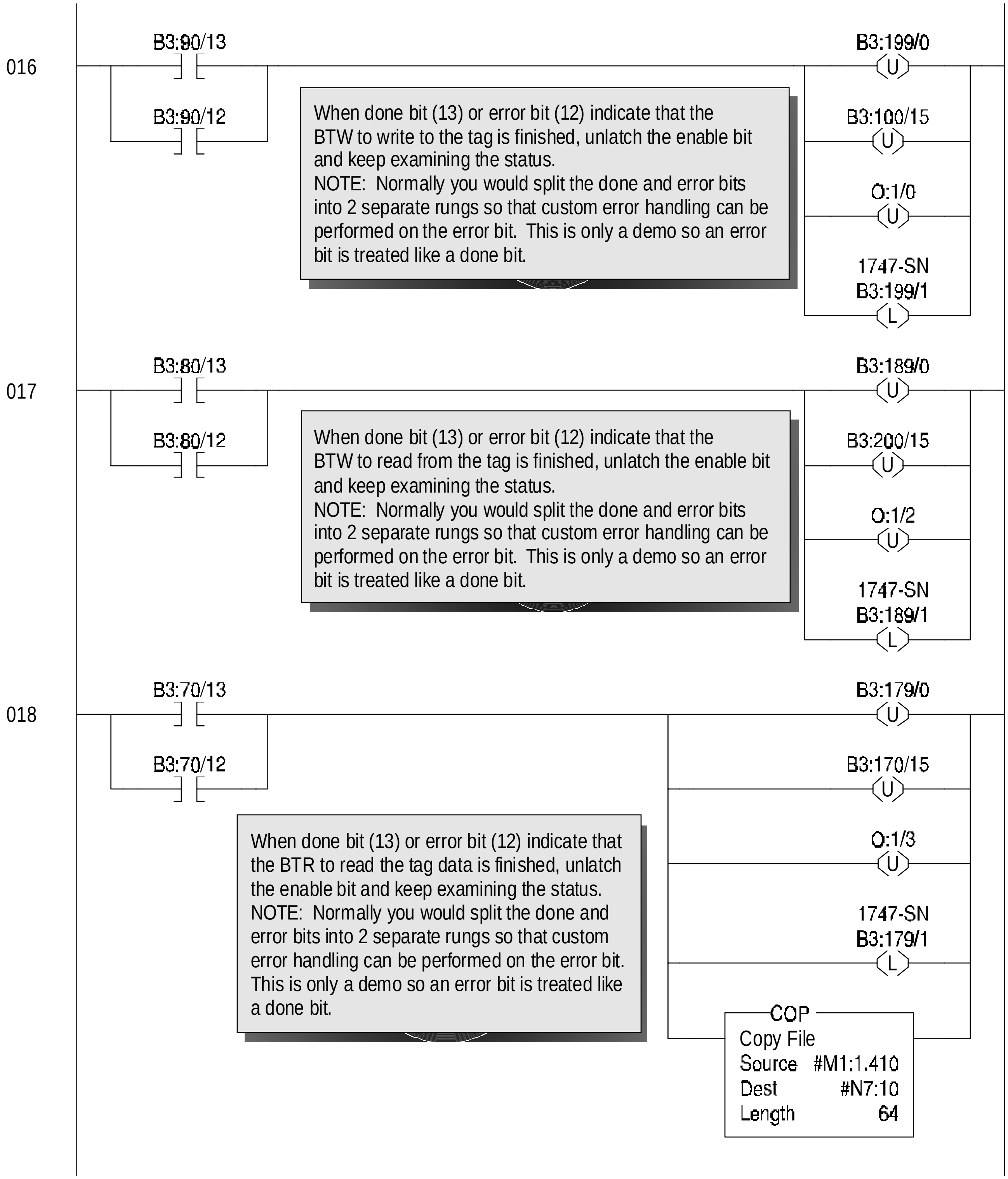
SLC 500/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE



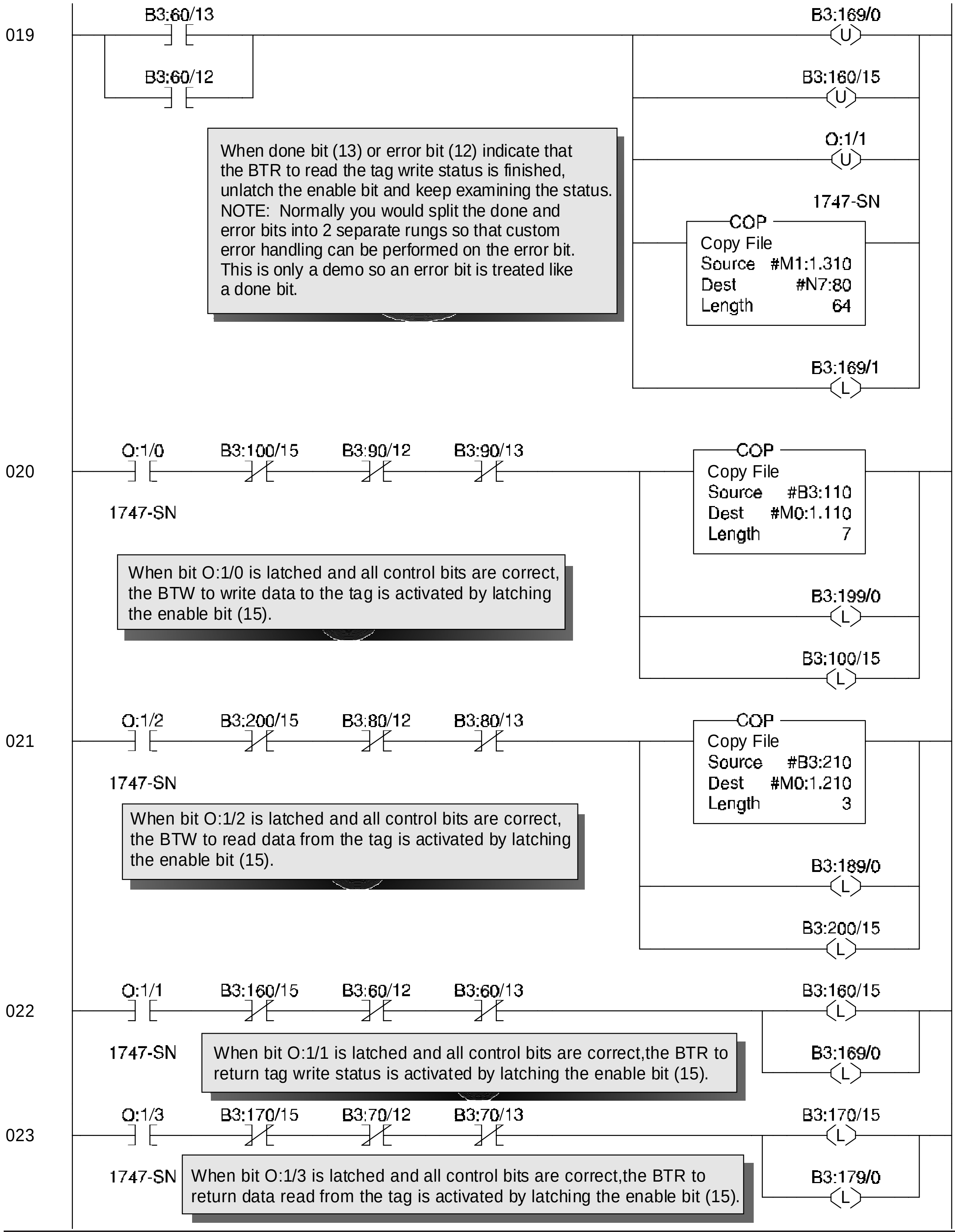
SLC 500/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE



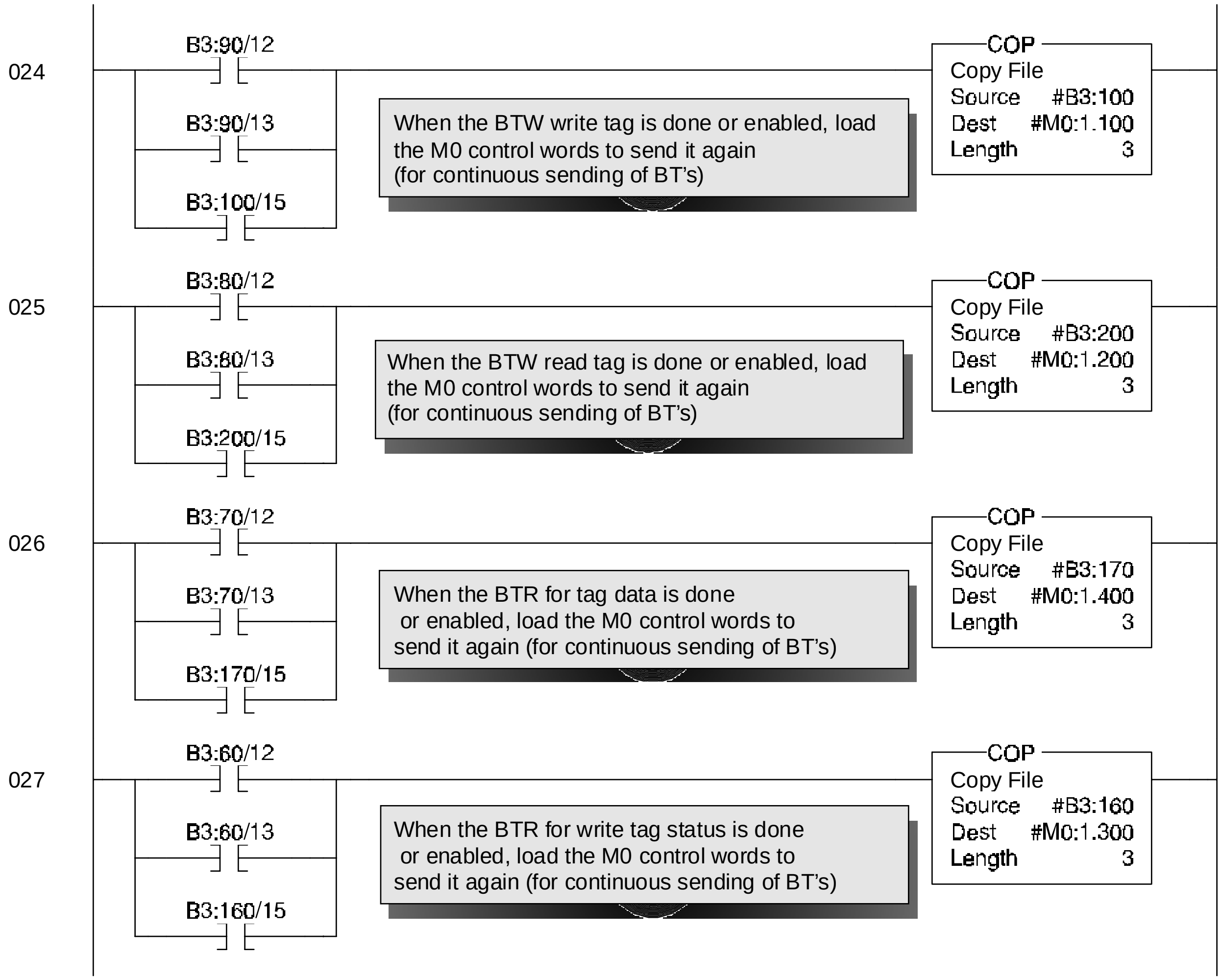
SLC 500/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE



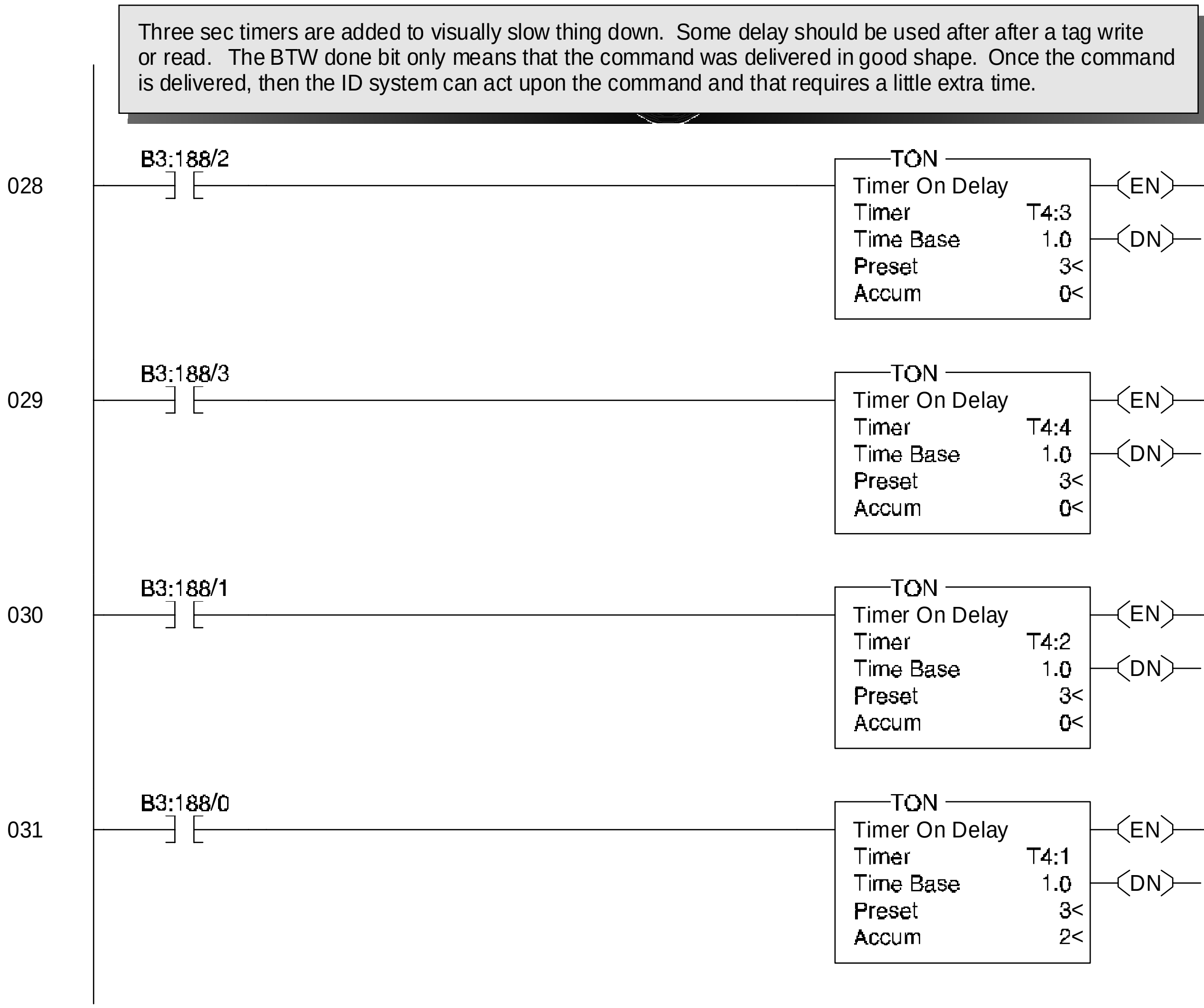
SLC 500/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE



SLC 500/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE



SLC 500/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE



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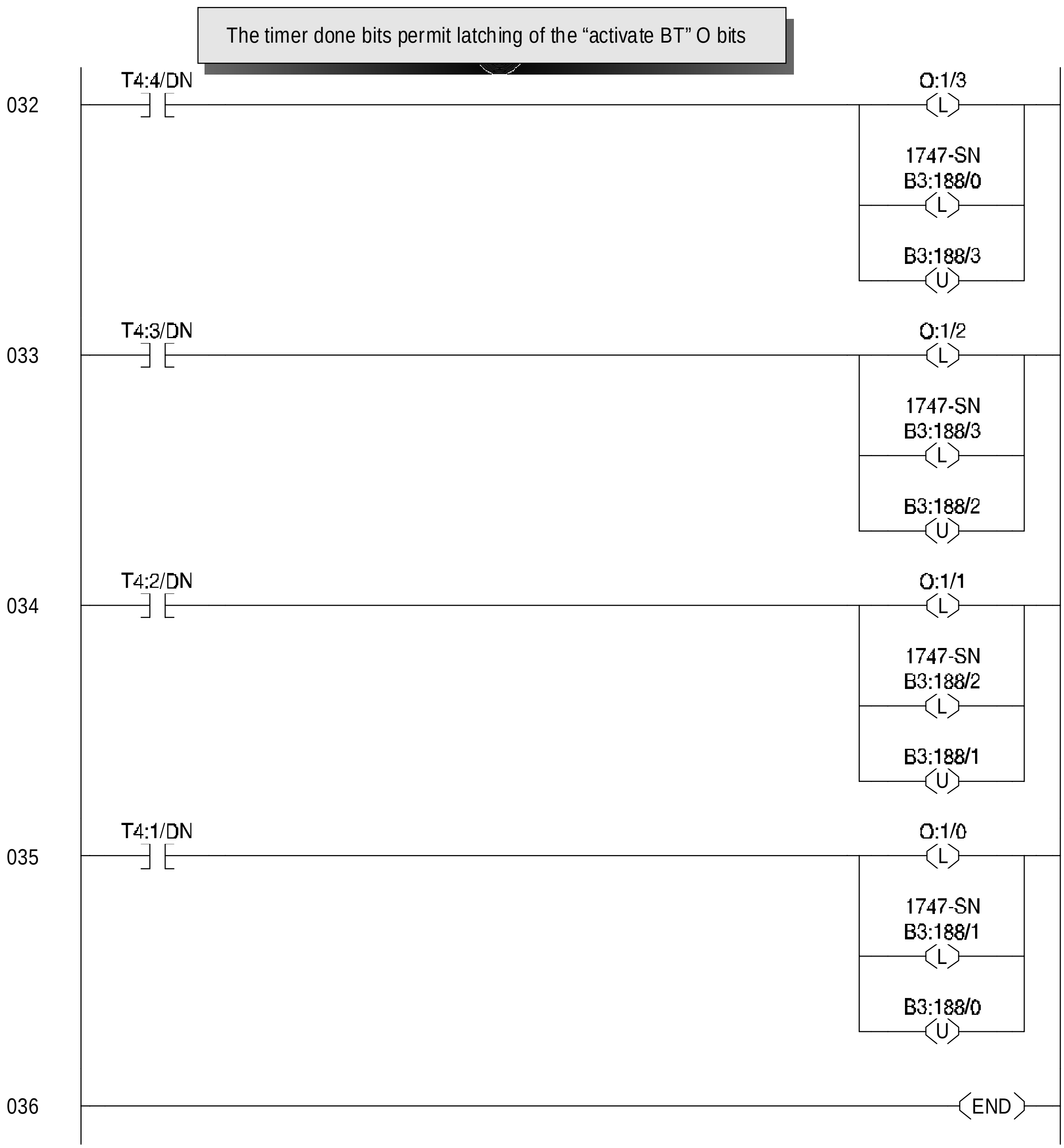
SLC 500/ -AB1 PROGRAMMING BLOCK TRANSFER EXAMPLE



NOTE: Please see appropriate IVI- or IRI- User Manual for complete ID interface operating information. (IVI and IRI User manuals are available as PDF files on the companion disk)

ID System tips and information:

❖ IVI- is read/write and IRI- is read only.
❖ IVI-KHA6-4HRX and IRI-KHA6-4.RX are 90-255V AC powered units.
❖ IVI-KHD2-4HRX and IRI-KHD2-4.RX are 18-32V DC powered units.

❖ Only set DIP switches with the power off.

❖ Set the interface for 19,200 Baud (DIP SW1-on, SW2-on, SW3-off).

❖ When connecting read head wires, connect them to the interface in the following order: 1-1(10,19,28), 2-2(11,20,29), 4-3(12,21,30), and 3-4(13,22,31). It‘s easier to connect 3 to 3 and 4 to 4, but it won't work.

❖ When the interface is correctly configured and connected to the -AB1, the -AB1 will scan through the read heads on the ID interface by itself. This can be useful for verifying that part of the communication link. (Recall step #1 of 3 for getting -AB1 online page10.)

❖ For separate operation or testing of the ID system, both a DOS based (Ident) and a Windows based (Winident) utility have been provided on the accompanying disk.

Read Only ID Interface Error Codes:

M1 - Hardware fault in interface, watch dog reset.
M2 - Memory fault in interface after RAM test.
M3 - Memory fault in interface after ROM test.
M4 - The received command not understood.
M5 - Parity error in serial comms or checksum error.
M6 - Binary mode not permitted in current data format.
M7 - The addressed read head not connected or not functioning properly.
M8 - No code/data carrier present or data transmission not possible.
M9 - Read head not responsive.

Read/Write ID Interface Error Codes:

00 - No error (used as confirmation that the intended event occurred correctly)
01 - The received command not understood.
02 - The addressed read head not connected or not functioning properly.
03 - No code/data carrier present or data transmission not possible.
04 - Write error.
05 - EEPROM fault.
06 - Check sum error (serial comms).
07 - RAM fault.
08 - Check sum or parity error (data carrier).
09 - Address of, or size of data beyond range of carrier.
0A - Read/Write head is unresponsive
0B - Watchdog reset.
0C - Echo fault in inductive data transfer.
0D - This function not allowed with the selected data carrier type.
0E - The read/write head not suited to this ID interface.
0F - ID interface synchronization error.
10 - Low battery in battery operated data carriers only.

These times are a measure of the time interval from when the -AB1 receives the -AB1 command from the A-B RIO scanner, to when the -AB1 completes the update of the output image table in the RIO node adapter chip. During this time, the -AB1 interprets the -AB1 command into an ID system command, sends the command to the ID system, captures the reply from the ID system,and updates the output image on the RIO chip.These times remain independent of the RIO scan times, RIO data formats or RIO baud rates which vary for each PLC application. (All times are in milliseconds)

The rule of thumb is: read 1- 16 words in 105ms

Read/Write System Performing Reads			
# of Read Heads	# of Code Carriers	# of Data Carriers	Time (millisec)
1	1	---	24
1	0	---	9
1	---	1 (16 words)	105
1	---	1 (1 word)	45
1	---	1 (2 words)	57
1	---	1 (3 words)	70
1	---	1 (4 words)	105
1	---	0	12

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These times are a measure of the time interval from when the -AB1 receives the -AB1 command from the A-B RIO scanner, to when the -AB1 completes the update of the output image table in the RIO node adapter chip. During this time, the -AB1 interprets the -AB1 command into an ID system command, sends the command to the ID system, captures the reply from the ID system,and updates the output image on the RIO chip.These times remain independent of the RIO scan times, RIO data formats or RIO baud rates which vary for each PLC application. (All times are in milliseconds)

The rule of thumb is: 100ms for all overhead plus 35ms per word --> 5words = 5*35 + 100 =275.

Read/Write System Performing Writes			
# of Read Heads	# of Data Carriers	# of Data Words	Time (millisec)
1	1	1	135
1	1	2	170
1	1	3	205
1	1	4	240
1	1	5	275
1	1	8	380
1	1	16	660

These times are a measure of the time interval from when the -AB1 receives the -AB1 command from the A-B RIO scanner, to when the -AB1 completes the update of the output image table in the RIO node adapter chip. During this time, the -AB1 interprets the -AB1 command into an ID system command, sends the command to the ID system, captures the reply from the ID system,and updates the output image on the RIO chip.These times remain independent of the RIO scan times, RIO data formats or RIO baud rates which vary for each PLC application. (All times are in milliseconds)

The rule of thumb is : 20ms per Code Carrier read

Read-Only System Performing Reads			
# of Read Heads	# of Code Carriers	# of Data Carriers	Time (millisec)
1	0	---	8
1	1	---	20
1	---	1	65
4	4	---	78
4	3	---	67
4	2	---	55
4	1	---	44
4	0	---	32

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Power Supply:	
Working Voltage	21-27 VDC
Power Requirement	Max. 2.0 VA
Serial Interface:	
RS-232 Cable Length	Max. 50 feet
RIO Link	Max. 10,000 feet @ 57.6 Kbps Max. 5,000 feet @ 115.2 Kbps Max. 2,500 feet @ 230.4 Kbps
Environmental Conditions:	
Working Temperature	0-70ºC
Storage Temperature	-25ºC-85ºC
Moisture	Max. 90% relative humidity
Mechanical:	
Construction	Terminal Housing 40mm
Mounting	Snap fitting onto standard rail (DIN 46277) or by screw tabs.
Housing Material	Makralon 6485
Flammability Class	UL94
Method of Connection	Self-opening instrument terminals, max. conductor csa 2 x 2.5mm^2. Built-in 9-pin D-sub connector

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