



ALLEN-BRADLEY
A Rockwell International Company

User's Manual

DC (5V) Multiplexer Input Module

(Cat. No. 1771-IS)

Price: \$25.00

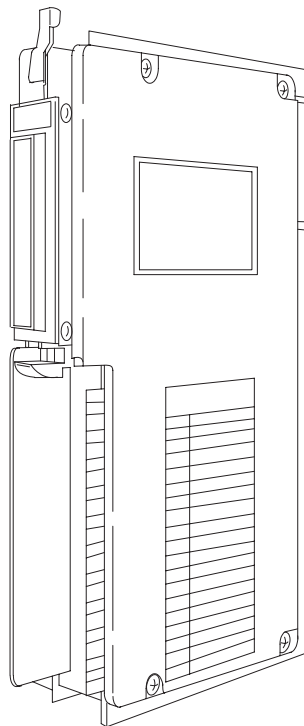
Introduction	1-1
General	1-1
Typical Applications	1-2
Module Preparation, Wiring and Installation	2-1
General	2-1
Switch Selection of Operating Modes	2-1
Wiring	2-4
Additional Considerations	2-10
Keying	2-11
Programming and Operation	3-1
General	3-1
Module Scan of Switch Contacts	3-1
Storage of Switch Contact Data	3-1
Block Transfer of Switch Data	3-14
Specifications	A-1

Introduction

General

The 1771-IS DC (5V) Multiplexer Input Module, Figure 1.1 reads the status of up to 72 hard contact switch devices through one I/O slot. This information is transferred to the PC processor by block transfer programming. The module can be used with any Allen-Bradley programmable controller that has block transfer capability, an expandable data table, and uses the 1771-I/O structure.

Figure 1.1
DC (5V) Multiplexer Input Module



17929

When thumbwheel switches are used with the module, user-selectable operating modes can be selected for convenient storage of 3-digit and 4-digit BCD thumbwheel data. An additional mode is provided that latches the input of momentary contact devices such as pushbutton or keyboard switches.

The module performs self diagnostics during its initial power-up sequence. If a memory failure is detected at any time, the fault LED on the front panel will illuminate and the module will not operate.

The module reads the status of switch contacts by enabling and reading a “bank” of 8 contacts at a time. This requires that the contacts be grouped and that diode decoupling be used to prevent the appearance of a “phantom” contact closure. Up to 9 banks of 8 contacts per bank can be handled by the module. Power to the switch banks is provided by the module.

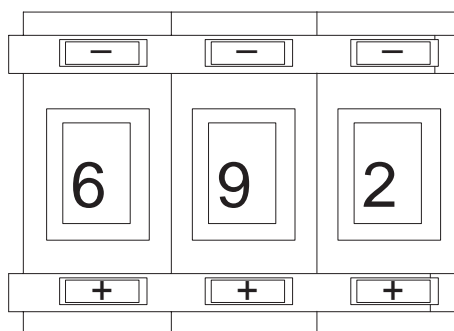
Contact scanning occurs until the module is interrupted by a read instruction from the PC processor. Contact status is stored in on-board RAM memory until the module outputs the contact status to the processor. Therefore switch scanning by the module is totally independent of I/O scanning by the processor. Module scanning is user-selectable at a normal or fast rate with contact de-bouncing.

Typical Applications

In many applications, it is necessary to set or change the preset values of timers or counters or the values of process variables. It is convenient to do this using BCD thumbwheel switches (Figure 1.2). Applications that require the use of multiple thumbwheel switches include, but are not limited, to the following:

- control of chemical processes
- production-part adjustments used in the automatic balancing of tires
- control of pallets in materials handling
- cycle time adjustments in production machines and processes

Figure 1.2
Typical 3-digit Thumbwheel Switch



17928

The DC (5V) Multiplexer Input Module saves I/O space and user program. It can handle the switch input from up to six 3-digit or four 4-digit BCD thumbwheel switches. It can also handle up to 72 discrete contact switches.



WARNING: Outputs of any output module may temporarily change operating state at power-up if placed in the same I/O chassis with a multiplexer module, cat. no. 1771-IS, earlier than hardware revision D, and a power supply (or processor with self-contained power supply) other than 1771-P1 or 1771-P2. To avoid damage to equipment and/or injury to personnel use only multiplexer modules, cat. no. 1771-IS, hardware revision D or later.

Important: Hardware revision D is designated by part no. XXXXXX-XX/D on the module nameplate. Earlier modules (cat. no 1771-ISC) do not have this part no./D designation.

Module Preparation, Wiring and Installation

General

The modes of operation must be set internally to suit the conditions under which the module will be used. In addition, switch contacts and decoupling diodes must be wired to the module.

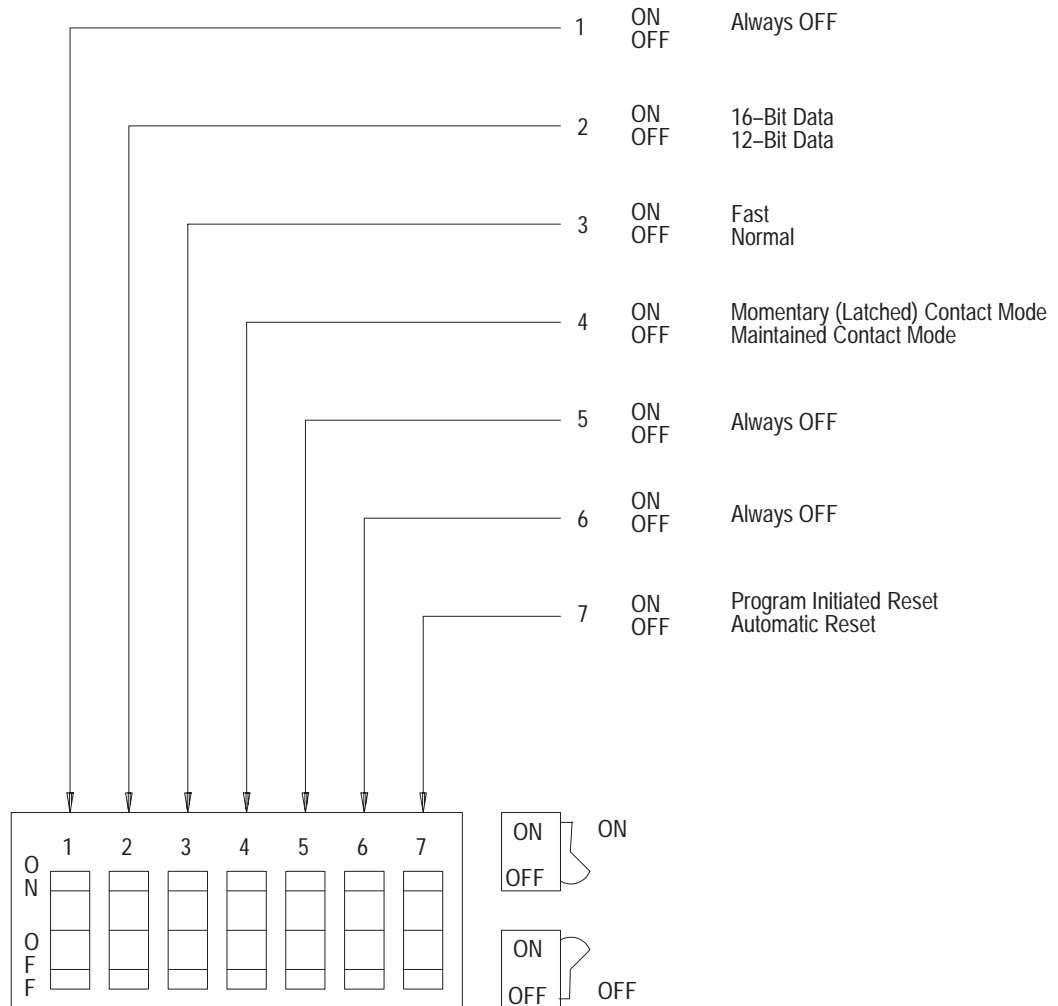
Switch Selection of Operating Modes

The module is capable of operating in a variety of modes depending on the kinds of switches connected to it, whether the module is placed in a local or remote I/O rack, and/or whether latched data in module memory will be reset automatically or by program logic after the transfer of data.

The mode selection switch is mounted near the lower rear corner of the printed circuit board under the left side cover of the module. It is accessible by removing the four slotted cover screws on the right side of the module.

The modes are selected by setting the mode selection switches ON or OFF according to the positions defined in Figure 2.1.

Figure 2.1
 Mode Selection Dip Switch



10362

Switch #1 - Always OFF.

Switch #2 - 16 Bit Storage/12 Bit Storage, Select 12-bit storage when using 3-digit BCD thumbwheel switches. Select 16-bit storage when using 4-digit BCD thumbwheel switches, discrete momentary contact switches, or discrete maintained contact switches. (ON for 16-bit storage, OFF for 12-bit storage.)

Switch #3 - Normal Scan/Fast Scan. The module scan is independent of the processor scan and is generally set at the normal (15.3 msec) position. The fast scan (5.1 msec) can be used when operating in either the

momentary (latched) contact mode or maintained contact mode. (ON for fast scan, OFF for normal scan.)

Switch #4 - Maintained Contact Mode/Momentary (latched) Contact Mode. Select the maintained contact mode when storing the status, ON or OFF, of maintained switch contacts. Their status is updated in every scan. Select the momentary (latched) contact mode when storing momentary OFF-ON switch contact transitions. Subsequent scans will not reset latched bits even if the corresponding switches are reopened. The transition is latched ON in module memory and must be reset after the latched data is transferred to the processor. [ON for momentary (latched) contacts, OFF for maintained contacts.] The position of SW #4 will also affect data byte storage. See the diagrams in chapter 3 for further detail.

Switch #5 - Always OFF.

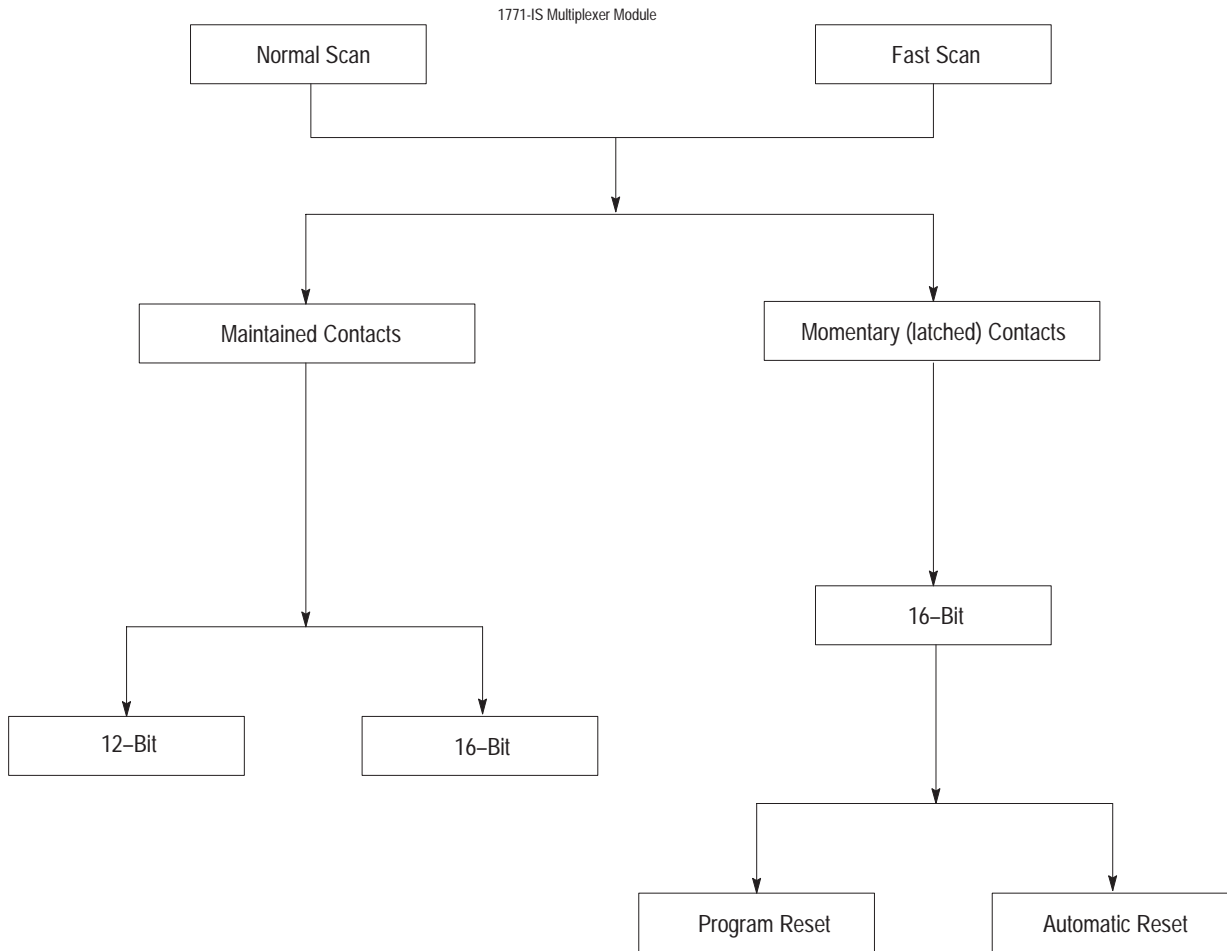
Switch # 6 - Always OFF.

Switch # 7 - Program Reset/Automatic Reset. Select program reset when momentary (latched) switch status data is to be reset by setting a bit in a user program instruction. Refer to section titled “Other Programming Considerations, PLC-2 Family and PLC-3.” Select automatic reset when momentary (latched) switch data is to be reset automatically. This switch is not functional when the module is operating in the maintained contact mode. (ON for program reset, OFF for automatic reset).

Important: When using momentary contact mode in remote applications, only the program reset mode should be selected. Use program reset to guard against loss of data during transfer to the processor. When using momentary contact mode in local I/O applications, either the program reset or automatic reset can be selected.

The allowable combinations of module operating modes are summarized in Figure 2.2.

Figure 2.2
Allowable Operating Modes



10363

Wiring

The wiring and programming of the module are dependent on each other. Switch assemblies should be wired according to the wiring schematics presented in this chapter. If wired differently, the transfer of data may not take place or may become scrambled.

Module Wiring

Connections to the module are made through a removable field wiring arm connector (cat. no. 1771-WF) which allows the module to be

removed or installed in the I/O rack without disconnecting the wiring.)
 The swingarm can be removed from the I/O rack at the pivot bar.

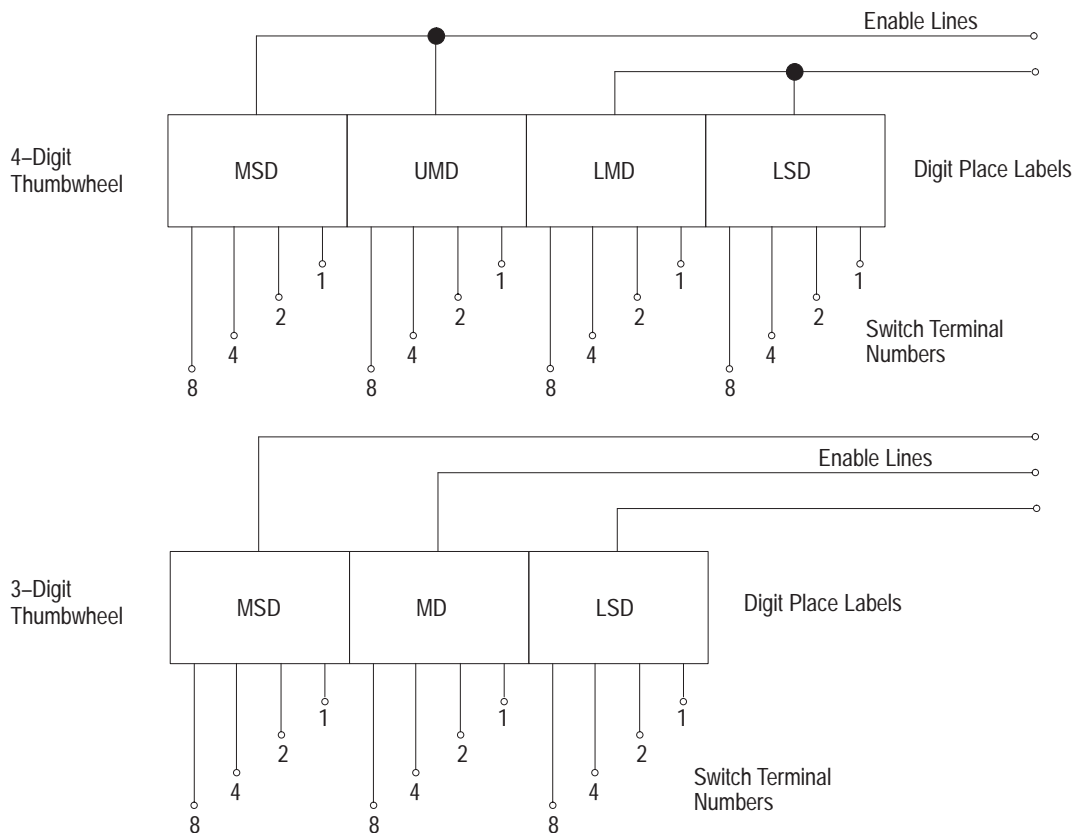
Thumbwheel Switch Wiring

Thumbwheel switch terminations are illustrated in Figure 2.3. Digit place labels refer to the position of each digit in a 3-digit or 4-digit thumbwheel switch as follows:

MSD and LSD - Most and Least Significant Digit; MD Middle Digit;
 UMD and LMD - Upper and Lower Middle Digit, respectively.

Thumbwheel switches are wired in parallel as shown in Figure 2.4 for 4-digit switches, and in Figure 2.5 for 3-digit switches. The four switch terminals numbered 8, 4, 2, 1 for each thumbwheel digit are wired respectively to field wiring arm terminals 2, 3, 4, 5 or 6, 7, 8, 9. Field wiring arm terminal 1 is not used.

Figure 2.3
Thumbwheel Terminations



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Figure 2.4
 Typical Point-to-point Wiring for Up to Four 4-digit Thumbwheel Switches (Maintained Switch Contact Mode)

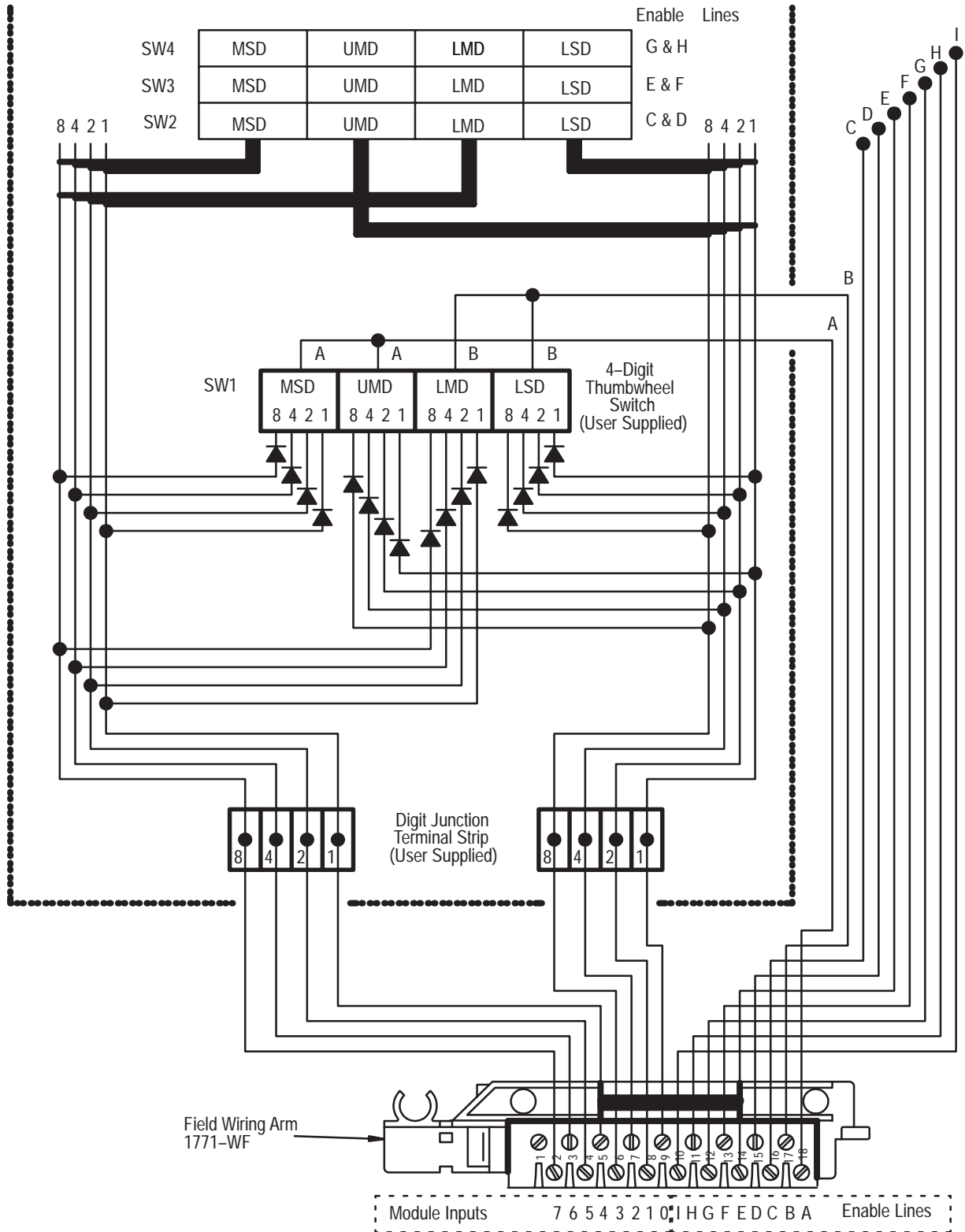
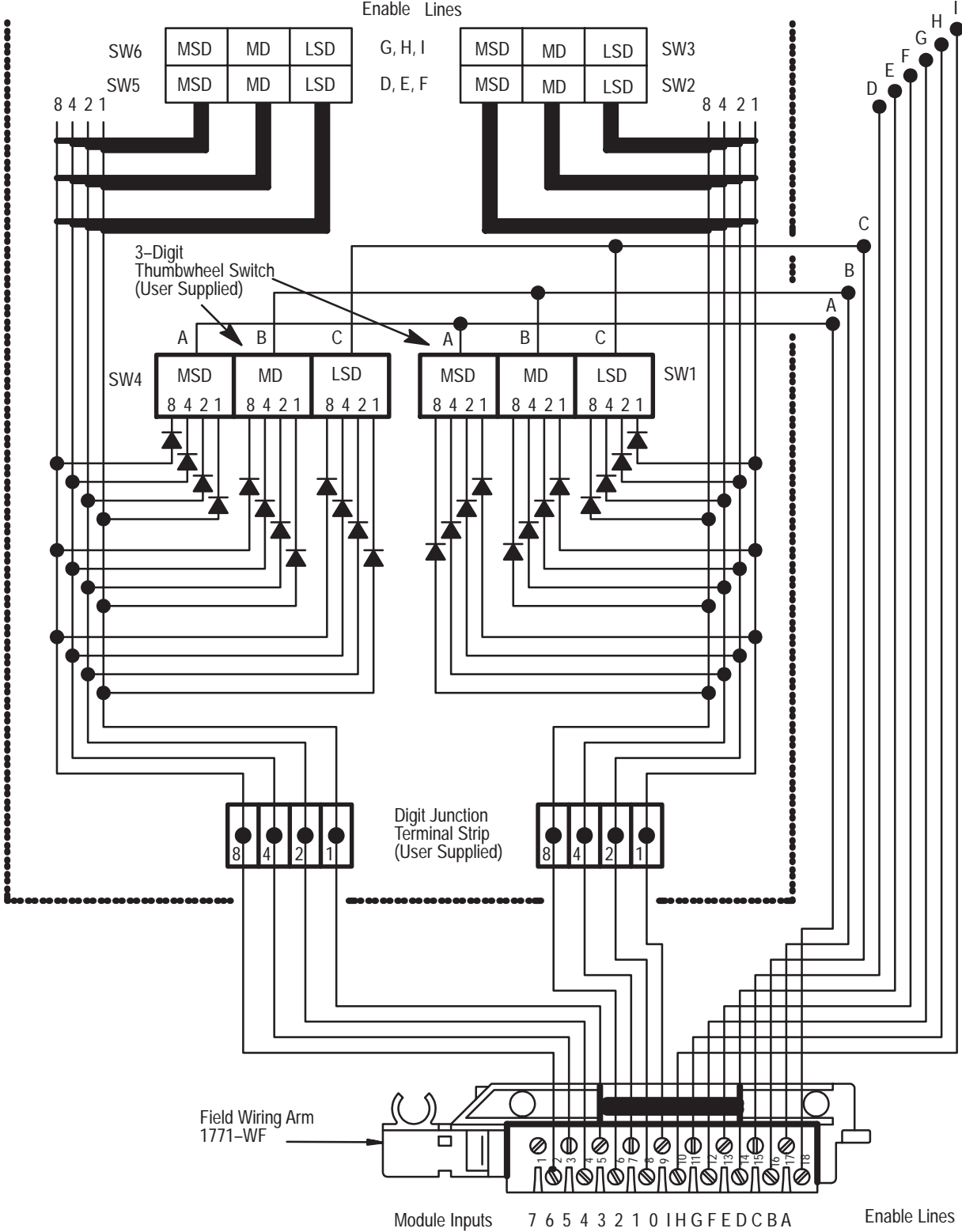


Figure 2.5
Typical Point-to-point Wiring for Up to Six 3-digit Thumbwheel Switches (Maintained Switch Contact Mode)



Important: The selection of the four field wiring arm terminals, either 2, 3, 4, 5 or 6, 7, 8, 9 is critical for correct transfer of switch status data.

The point-to-point wiring schematics show all electrical connections for the first of several parallel switch assemblies. The wiring of additional assemblies is shown conceptually (in the upper portion of each schematic). Switch lines 8, 4, 2, 1 are wired to each additional switch assembly using decoupling diodes identically to the first switch assembly. Enable line(s) for each additional switch assembly are specified in the conceptual part of the drawing.

The enable lines, A through I, are wired to field wiring arm terminals 18 through 10, respectively. Note that enable line A is connected to field wiring arm terminal 18, etc. It may be desirable to terminate thumbwheel switch lines 8, 4, 2, 1 at a terminal block on the switch panel. A single set of switch lines 8, 4, 2, 1 and enable lines should be contained in a shielded cable connecting the switch panel to the field wiring arm to minimize connections at the field wiring arm terminals.

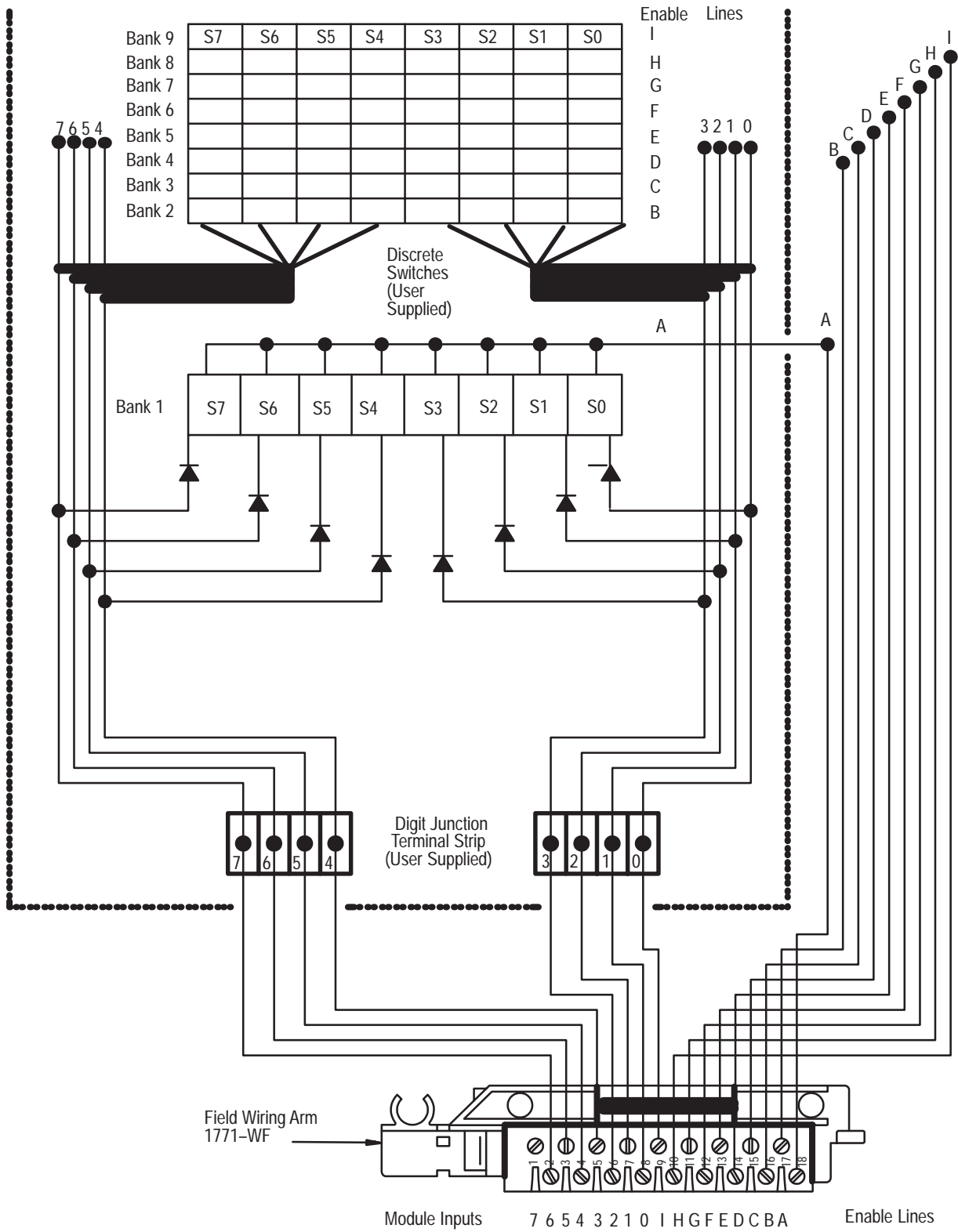
Observe the following practices when wiring thumbwheel switches:

- Bundle thumbwheel switch wiring separately from other wiring.
- Shielded cable is recommended.
- Ground the shielded cable only at the I/O rack. The shield must remain ungrounded at the other end.

Discrete Switch Bank Wiring

Up to 72 discrete contact switches can be wired to the module as shown in Figure 2.6. These switches can be momentary contact or maintained contact switches. Refer to section titled “Thumbwheel Switch Wiring” for wiring guidelines and practices.

Figure 2.6
Typical Point-to-point Wiring for up to 72 Discrete Contact Switches (Maintained Switch Contact Mode)



Diode Decoupling

Decoupling diodes prevent unwanted currents from circulating through the switch circuits and causing the false appearance of switch closures. Use decoupling diodes when the application calls for more than 8 switch contacts. Some thumbwheel switches have provision at the switch terminals for wiring the diodes. Otherwise, a separate terminal strip should be used for wiring a diode to each switch terminal. Be sure that all diodes are wired with the same polarity as shown in Figure 2.4, Figure 2.5 or Figure 2.6.

Additional Considerations

The following information will be helpful when selecting the cable and components, and when wiring the switches and decoupling diodes to the module.

Low - TRUE Logic

Module operation is based on a low = TRUE logic. Enable lines, A through I, ground the inputs connected to them through the switch contacts. This low = TRUE condition is interpreted as a logic “1” (or contact closed) by the module.

No External Power

The switches connected to the module are powered by the module enable lines. Any additional power source must NOT be used.



CAUTION: Damage to the module will result if any external power source is connected to the module field wiring arm terminals.

Switch Selection

Any contact closure switch than can successfully handle 8 to 14mA of current at 5V DC can be used. The minimum OFF resistance can be 10 K ohms. The maximum ON resistance can be 10 ohms including the cable resistance.



CAUTION: This module is not compatible with TTL switching. The external power source will damage the module.

When selecting BCD thumbwheel switches, be sure that they are equipped with decoupling diodes or that terminals are available on the thumbwheel switch so that the diodes can be wired directly to the switch assembly.

The diode polarity must be set for low = TRUE operation. Cathodes must be connected to the switch contacts and anodes to the module inputs (lines 8, 4, 2, 1).

When selection thumbwheel switches, be sure to select a BCD type. Decimal thumbwheel switches should be avoided because the 10 discrete connections for each digit would not be compatible with the 4 BCD coded input terminals for each digit on the module swingarm.

Diode Selection

Any diode can be used for diode decoupling that has a forward voltage drop of approximately 0.7 volts at 14 mA forward current. A 1N914 is a typical diode that can be used.

Cable Selection

The maximum cable capacitance can be .039 microfarad. The wire size can be 20 gauge or larger for cables shorter than 100 feet; and 18 gauge for up to 400 feet. The cable should be shielded and should not exceed 400 feet in length.

Keying

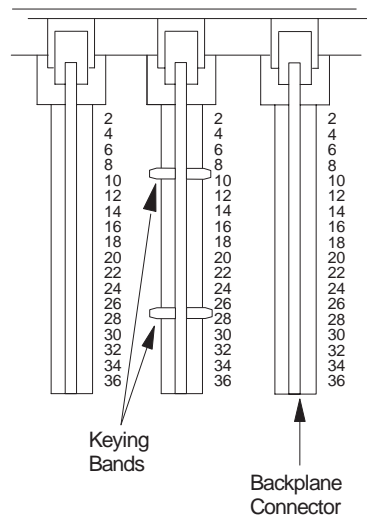
The backplane connector should be keyed to accept only this module after its position in the I/O rack has been determined. The module can be placed in any I/O slot except for the left-most slot. Th slot is reserved for the processor module in a single rack system or the I/O adapter module in a multi-rack system.

Plastic keying bands shipped with the I/O chassis should be used. The position of the keying bands on the upper backplane connector must correspond to the mating slots on the module connector.

Refer to Figure 2.7. Using needle-nose pliers, place the keying bands between these numbers on the backplane:

- Between 8 and 10
- Between 26 and 28

Figure 2.7
Keying Diagram



17871

The position of the keying bands can be changed if subsequent system design requires the module to be moved to a different location.

Programming and Operation

General

Switch status data is stored in the module, transferred to the data table upon request by block transfer instructions, then stored in a data table file until operated upon by user program instructions.

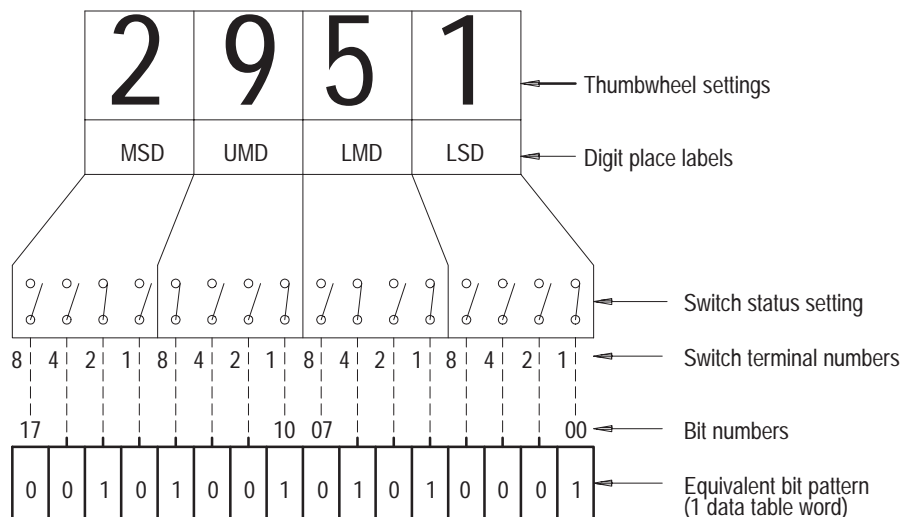
Module Scan of Switch Contacts

The user-selectable scan rates are 15.3 msec (normal) and 5.1 msec (fast). The nine enable lines, A through I, are sequentially and repeatedly enabled, one line at a time. The enable lines operate in a low = TRUE logic. Each enable line can enable a bank of 8 switches simultaneously. The module allows for contact debouncing before the module's microprocessor reads the status of the switch bank. Scanning is continuous unless interrupted by a user program instruction to transfer the status of the switch contacts to the data table. Scanning resumes at the same point where it was interrupted after the data is transferred.

Storage of Switch Contact Data

BCD thumbwheel switches convert selected decimal numbers to a switch status setting. Four switch contacts are required to encode each decimal digit of a thumbwheel switch in BCD. Switch status can be transferred to the processor data table and stored in word format by user program instructions (Figure 3.1).

Figure 3.1
Bit Pattern of a Thumbwheel Setting



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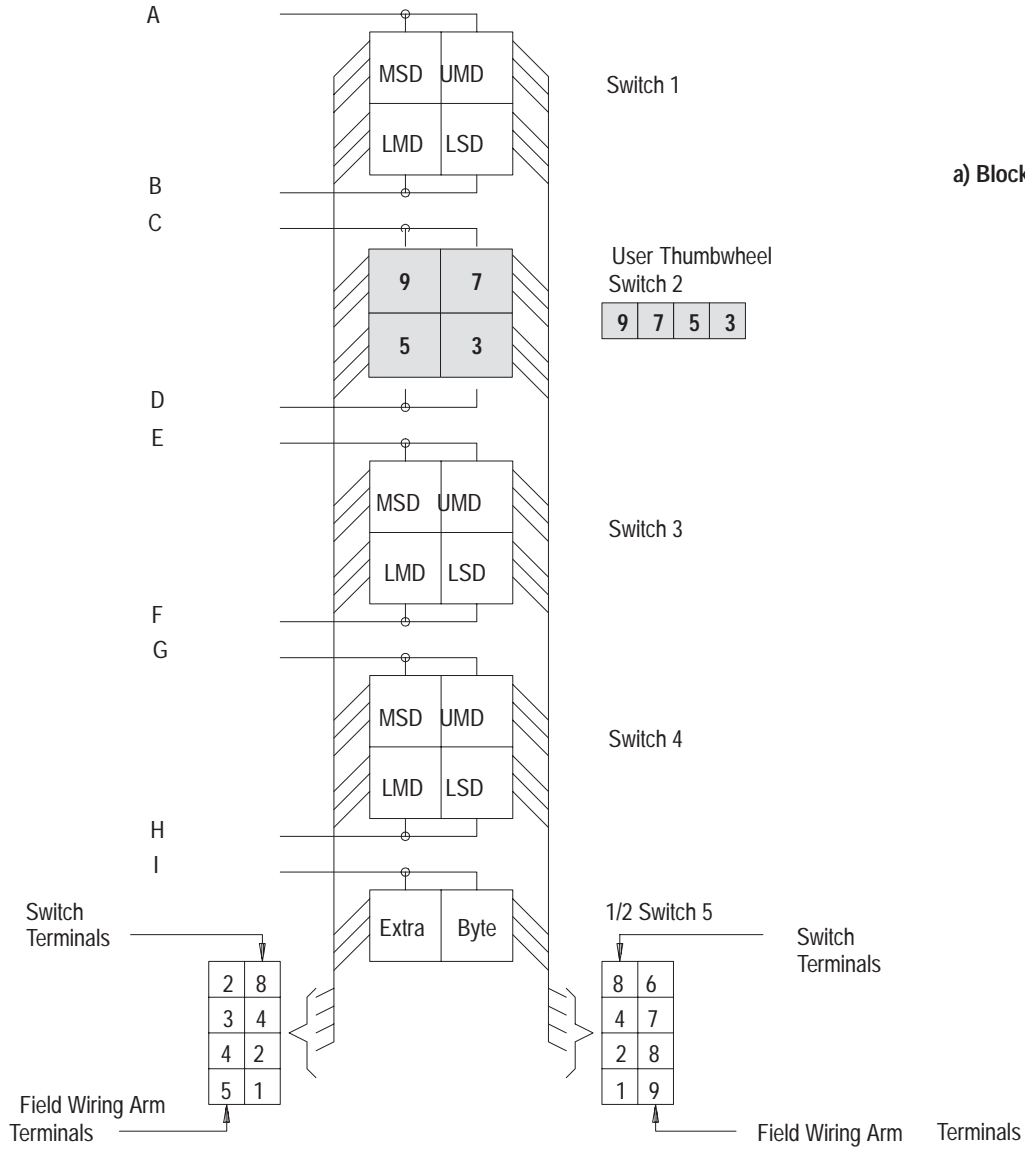
4-digit Thumbwheel Switch Data (16-bit storage)

Data is loaded into memory based on whether you have selected the maintained or momentary switch contact mode (SWITCH #4).

Maintained Contact Mode

When 4-digit BCD thumbwheel switches are wired according to the block diagram in Figure 3.2a, the switch settings will be stored automatically in the data table after a block transfer as shown in Figure 3.2b. The first word is reserved for diagnostic data. Each remaining word stores the four digits of the thumbwheel setting. The digits MSD, UMD, LMD and LSD have been loaded, respectively, from left to right, in the same order that they are normally read (left to right). For example, observe how the 4-digit switch setting 9753 of thumbwheel switch #2 is loaded into the data table.

Figure 3.2
4-digit Thumbwheel Switch Data Storage, Maintained Contact mode (SWITCH #4 OFF)



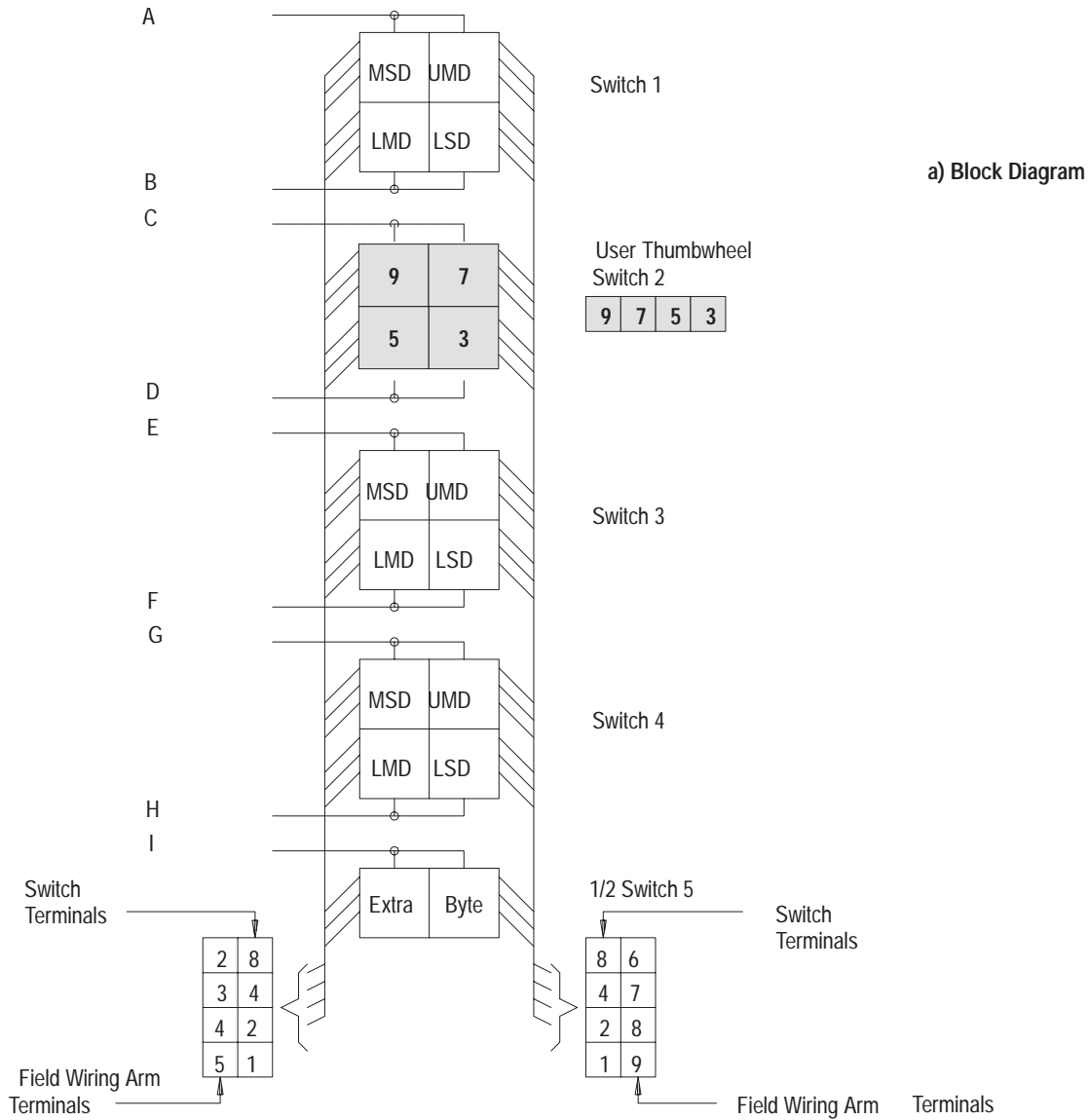
b) Data Table Map

Data Table Word	Switch Status Data				Switch Number
	17	10	07	00	
XX0	Diagnostics				-
1	MSD	UMD	LMD	LSD	1
2	9	7	5	3	2
3	MSD	UMD	LMD	LSD	3
4	MSD	UMD	LMD	LSD	4
5	-	-	Extra Byte		5

Momentary Contact Mode

When 4-digit BCD thumbwheel switches are wired according to the block diagram in Figure 3.3a, the switch settings will be stored automatically in the data table after a block transfer as shown in Figure 3.3b. The first word is reserved for diagnostic data. Each remaining word stores the 4 digits of the thumbwheel setting. The digits MSD, UMD, LMD and LSD have been loaded, respectively, from left to right, in the opposite byte order from which they normally read (left to right). For example, observe how the 4-digit switch setting 9753 of thumbwheel switch #2 is loaded into the data table.

Figure 3.3
4-digit Thumbwheel Switch Data Storage, Momentary Contact Mode (SWITCH #4 ON)



Data Table Word	Switch Status Data				Switch Number
17	10 07				00
XX0	Diagnostics				-
1	MSD	UMD	LMD	LSD	1
2	5	3	9	7	2
3	MSD	UMD	LMD	LSD	3
4	MSD	UMD	LMD	LSD	4
5	-	-	Extra Byte		5

b) Data Table Map

Important: The 16-bit data position (switch #2 ON) should be selected when 4-digit thumbwheel switches or discrete contact switches are used. Otherwise switch status data from these devices can become scrambled when transferred to the data table.

Discrete Contact Switch Data (16-Bit storage)

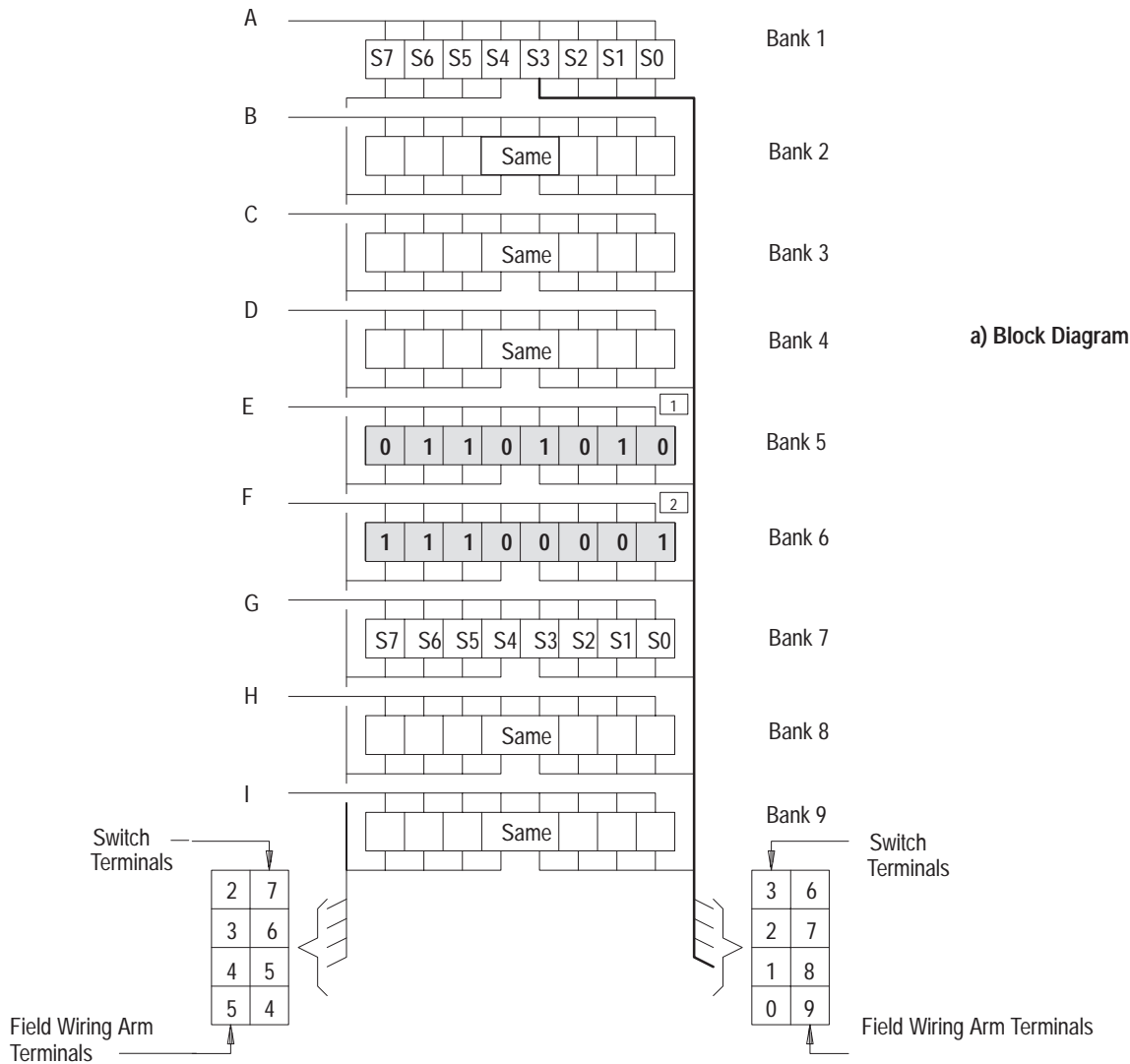
Data is loaded into memory on the basis of whether you have selected the maintained or momentary switch contact mode (switch #4).

Momentary Contact Mode

When up to 72 discrete contact switches are wired as switch banks, Figure 3.4a, the settings are stored automatically in the data table after a block transfer as shown in Figure 3.4b. The first word is reserved for diagnostic data. Each remaining word stores the status of two switch banks. The settings of a switch bank are represented by S7, S6, S5, S4, S3, S2, S1, S0.

Data of odd-numbered switch banks appears in the lower byte, and data of even-numbered switch banks appears in the upper byte, of their respective data table words. For example, observe how the ON/OFF settings of switch banks 5 and 6 are loaded into the data table in Figure 3.4b.

Figure 3.4
Discrete-Contact Switch Bank Data Storage (SW #4 ON (Momentary) Mode)



Data Table Word	Switch Status Data	
	17	10 07
XX0	Diagnostics	--
1	Bank 2	Bank 1
2	Bank 4	Bank 3
3	1110 0001 ²	0110 1010 ¹
4	Bank 8	Bank 7
5	-	Bank 9

b) Data Table Map

¹ 0110 1010 shows the settings, ON or OFF, of Switches S7, S6, S5, S4, S3, S2, S1, S0 of switch bank 5.

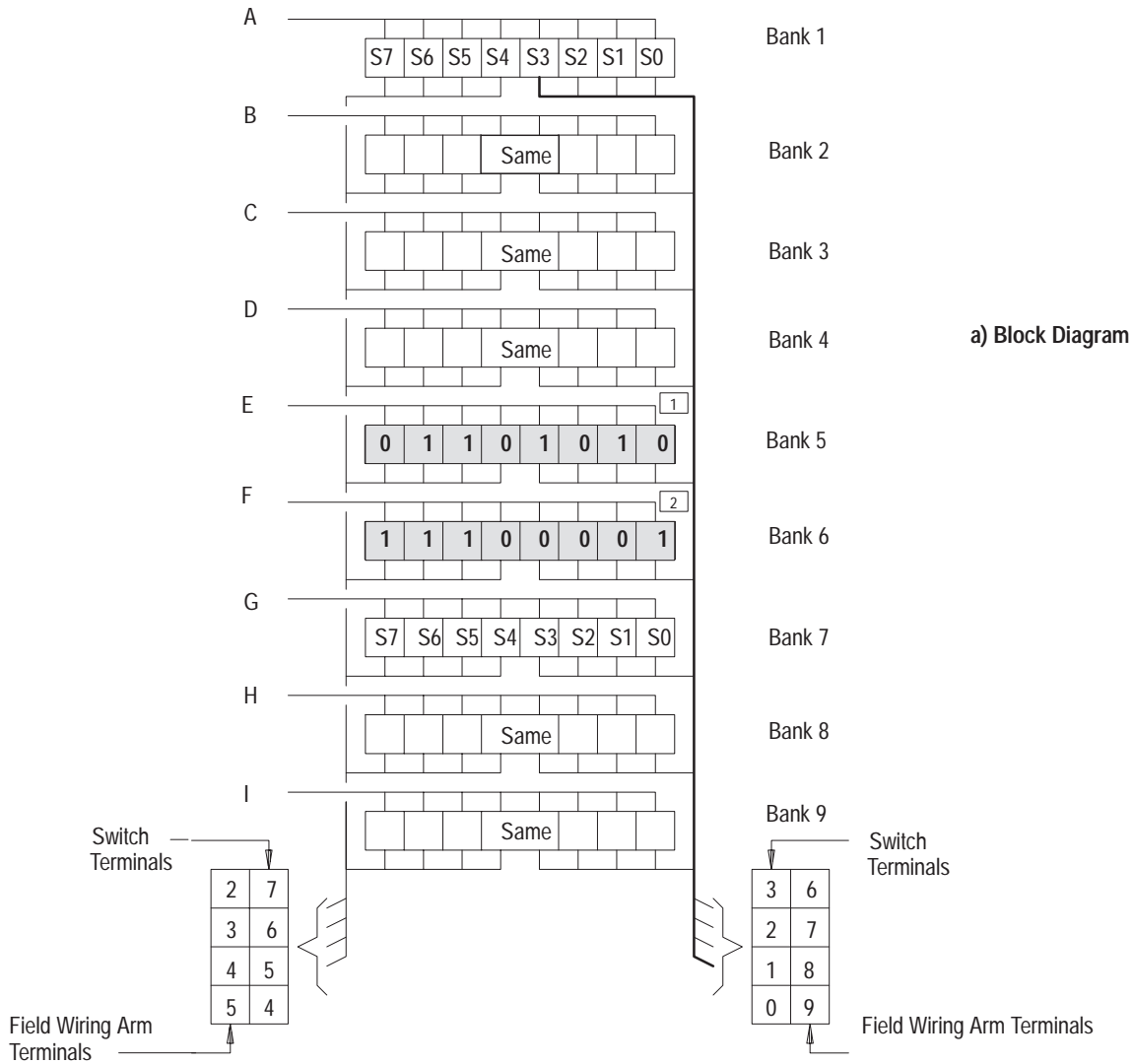
² 1110 0001 shows the settings, ON or OFF, of Switches S7, S6, S5, S4, S3, S2, S1, S0 of switch bank 6.

Maintained Control Mode

When up to 72 discrete contact switches are wired as switch banks, Figure 3.5a, the settings are stored automatically in the data table after a block transfer as shown in Figure 3.5b. The first word is reserved for diagnostic data. Each remaining word stores the status of two switch banks. The settings of a switch bank are represented by S7, S6, S5, S4, S3, S2, S1, S0.

Data of odd-numbered switch banks appears in the upper byte, and data of even-numbered switch banks appears in the lower byte of their respective data table words. For example, observe how the ON/OFF settings of switch banks 5 and 6 are loaded into the data table in Figure 3.5b.

Figure 3.5
Discrete-Contact Switch Bank Data Storage (SW #4 OFF (Maintained) (Mode)



b) Data Table Map

Data Table Word	Switch Status Data Bit Number	
	17	10 07
XX0	Diagnostics	--
1	Bank 2	Bank 1
2	Bank 4	Bank 3
3	0110 1010 ¹	1110 0001 ²
4	Bank 8	Bank 7
5	-	Bank 9

¹ 0110 1010 shows the settings, ON or OFF, of Switches S7, S6, S5, S4, S3, S2, S1, S0 of switch bank 5.

² 1110 0001 shows the settings, ON or OFF, of Switches S7, S6, S5, S4, S3, S2, S1, S0 of switch bank 6.

Important: When momentary switch contacts are used, the momentary (latched) contact position (switch #4, ON) should be selected. Otherwise, bits will be reset when the momentary contact switches open and data representing OFF-to-ON transitions can be lost.

The maintained contact position (switch #4 OFF) should be selected if the application calls for the use of up to 72 maintained contact switches.

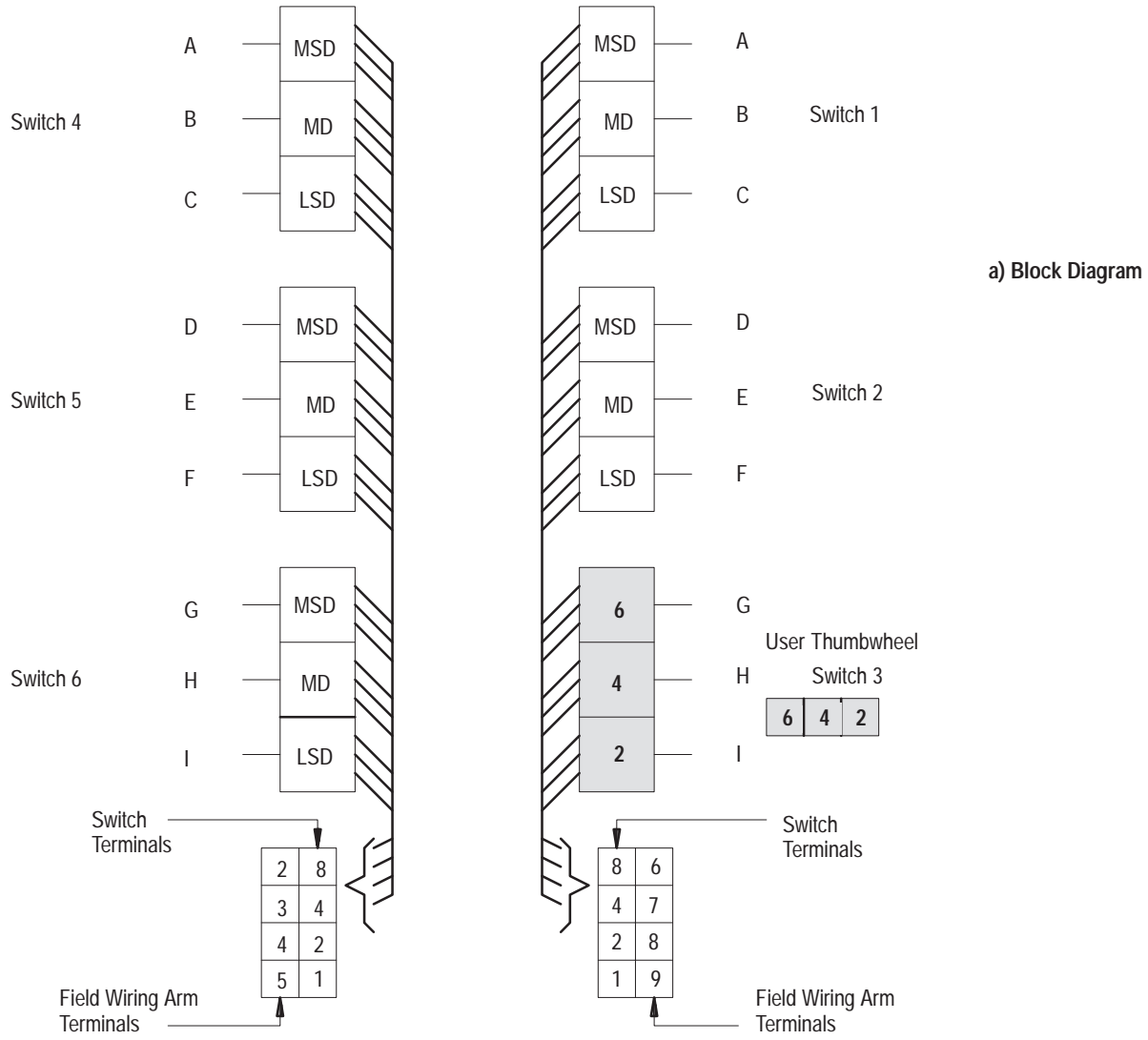
3-digit Thumbwheel Switch Data (12-bit storage)

Data is loaded into memory on the basis of whether you have selected the maintained or momentary switch contact mode (switch #4).

Maintained Contact Mode

When 3-digit BCD thumbwheel switches are wired according to the block diagram in Figure 3.6a, the switch settings are stored automatically in the data table after a block transfer as shown in Figure 3.6b. The first word is reserved for diagnostic data. Each remaining word stores the three digits of the thumbwheel setting. The digits MSD, MD and LSD have been loaded, respectively, from left to right, in bits 13-00 in the same order that they are normally read. For example, observe how the 3-digit switch setting 642 of switch #3 is loaded into the data table (Figure 3.6b).

Figure 3.6
3-digit Thumbwheel Switch Data Storage, Maintained Contact Mode (SWITCH #4 OFF)



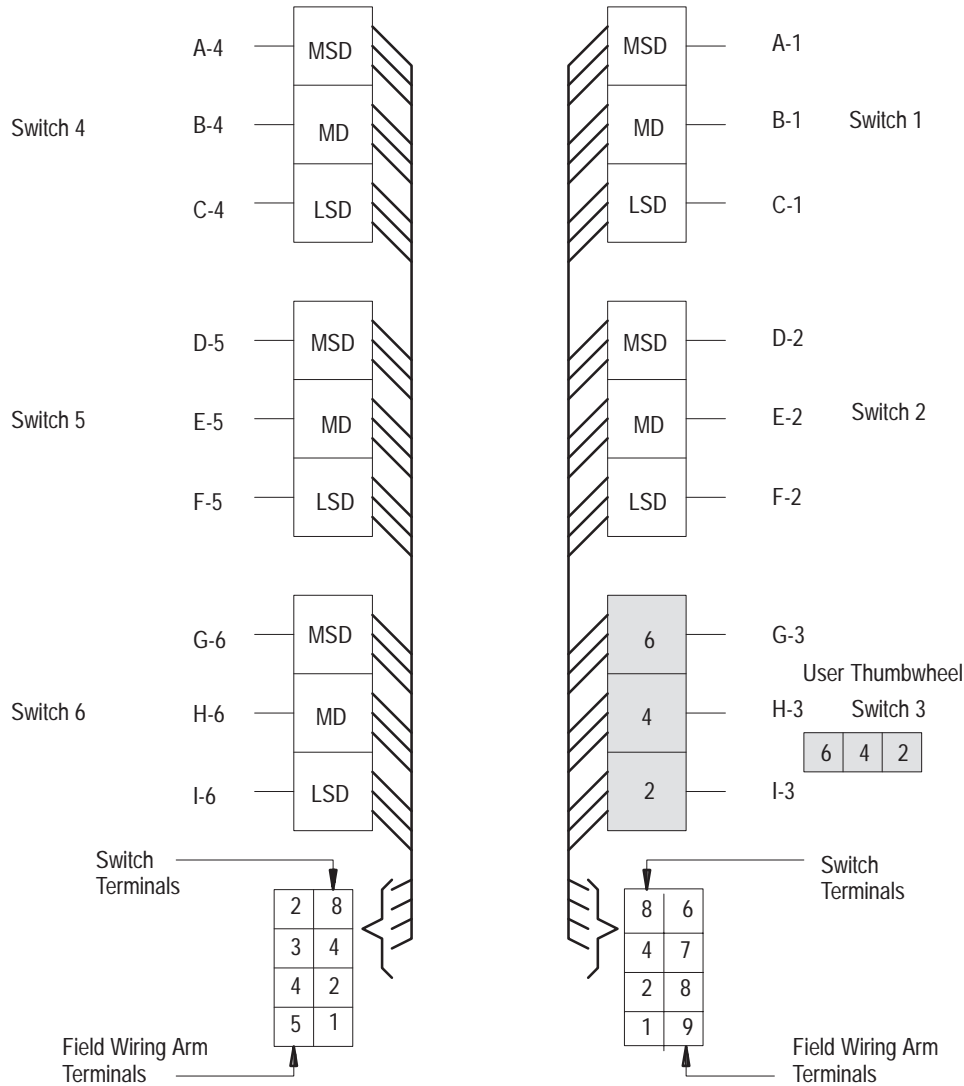
Data Table Word	Switch Status Data				Switch Number
	17	10 07		00	
XX0	Diagnostics		-	-	-
1	-	MSD	MD	LSD	1
2	-	MSD	MD	LSD	2
3	-	6	4	2	3
4	-	MSD	MD	LSD	4
5	-	MSD	MD	LSD	5
6	-	MSD	MD	LSD	6

b) Data Table Map

Momentary Contact Mode

When 3-digit BCD thumbwheel switches are wired according to the block diagram in Figure 3.7a, the switch settings are stored automatically in the data table after a block transfer, as shown in Figure 3.7b. The first word is reserved for diagnostic data. The remaining words store the three digits of the thumbwheel setting. The digits MSD, MD and LSD have been loaded in the order are shown in Figure 3.7. For example, observe how the 3-digit switch setting 642 of switch #3 is loaded into the data table (Figure 3.7b).

Figure 3.7
3-digit Thumbwheel Switch Data Storage, Momentary Contact Mode (SWITCH #4 ON)



Data Table Word	Switch Status Data			
	17	10	07	00
XX0	Diagnostics		-	-
1	B-4	B-1 ^{MD}	A-4	A-1 ^{MSD}
2	D-5	D-2	C-4	C-1 ^{LSD}
3	F-5	F-2	E-5	E-2
4	H-6	4 ^{MD}	G-6	6 ^{MSD}
5	-	-	I-6	2 ^{LSD}
6	-	-	-	-

b) Data Table Map

Important: The 12-bit data position (switch #2 OFF) should be selected when 3-digit thumbwheel switches are used. Otherwise switch status data from this device can become scrambled when transferred to the data table.

Block Transfer of Switch Data

Switch status data can be transferred to the PC processor data table by using block transfer instructions.

The Mini-PLC-2/15, PLC-2/30 and PLC-3 programmable controllers use block transfer instructions. The Mini-PLC-2 (1772-LN3 Processor) and PLC-2/20 use multiple GET instructions for programming block transfer.

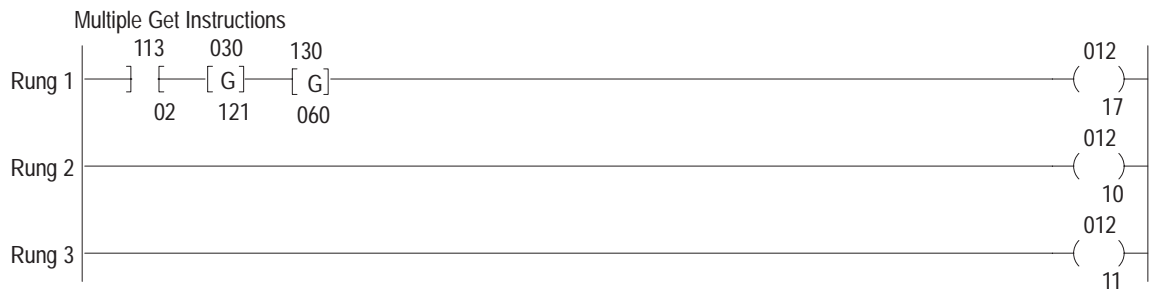
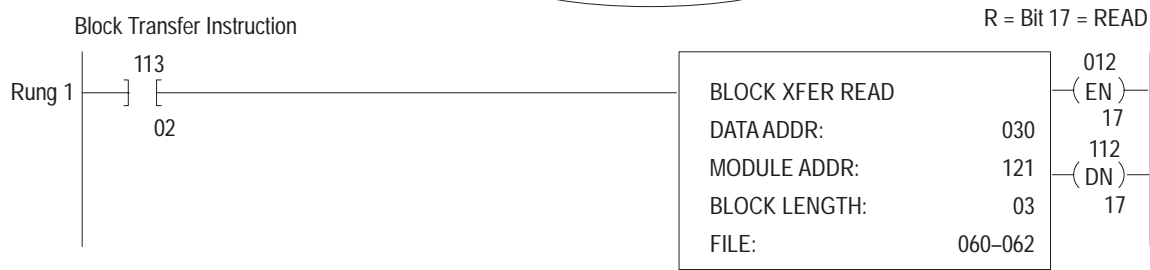
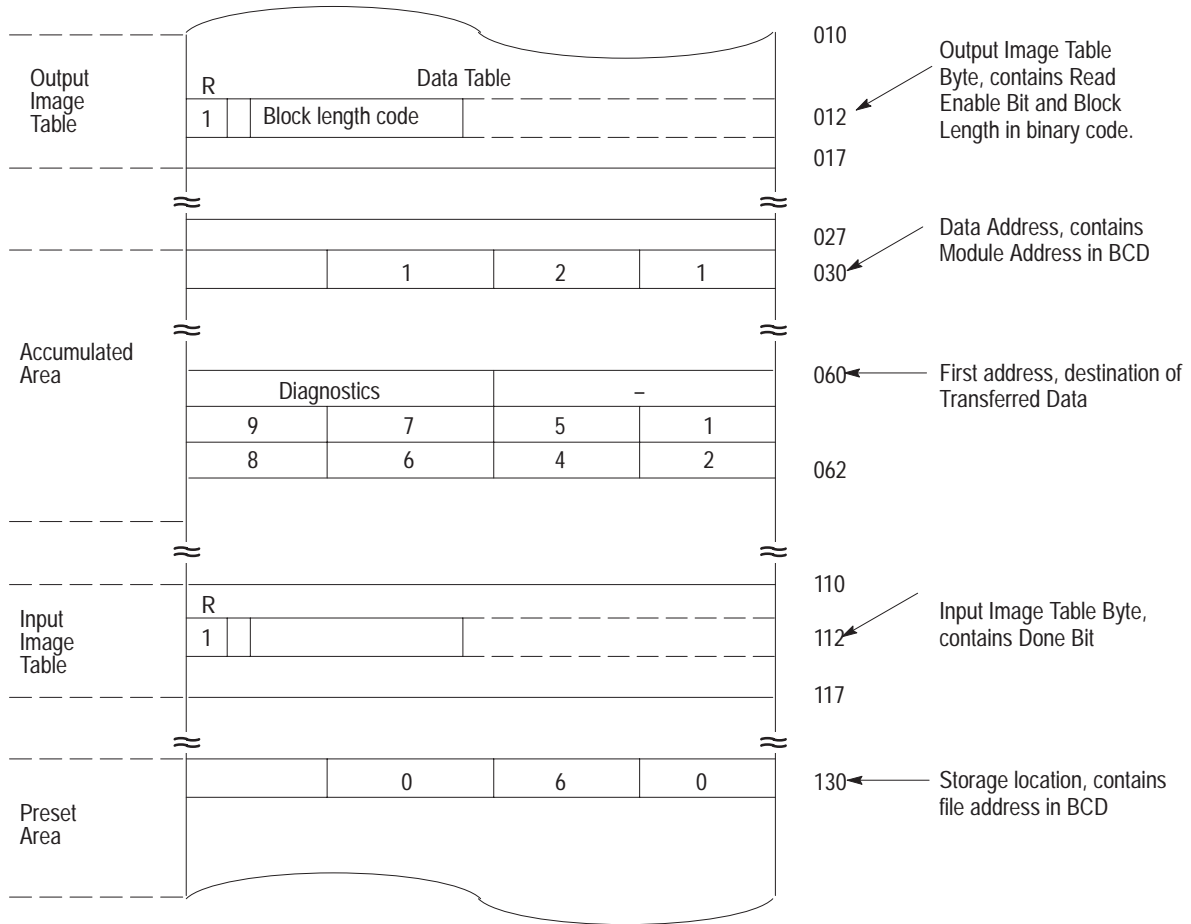
Block Transfer Programming, PLC-2 Family

The processor transfers switch status data from the module to the data table by a block transfer read operation. The following information must be specified in order to program block transfer, whether using block transfer instructions or multiple GET instructions. Values entered in parentheses correspond to the programming example in paragraph titled “Programming Example, PLC-2 Family” and Figure 3.8.

- a) block length: the number of words to be transferred can be 0-7 depending on the number of switch assemblies. (03)
- b) module address: rack, module group and slot number. (121)
- c) data address: contains the module address in binary coded decimal and is the first available address in the timer/counter accumulated area of the data table. (030)
- d) file address: defines the first of a group of words in the data table to receive the transferred data and is located 100₈ above the data address. (060)

For additional information on programming block transfer instructions, refer to paragraph titled “Programming Considerations, PLC-2 Family” and the Programming and Operations manual for the processor being used.

Figure 3.8
Example Block Transfer Programming, PLC-2 Family



Programming Example, PLC-2 Family

Two methods of programming are described: one using block transfer instructions, the other using multiple GET instructions. Refer to Figure 3.8. The data table mapping is the same for both.

For this example, 3 words of data are used to transfer the settings of two 4-digit thumbwheel switches. The settings are 9751 and 8642 for thumbwheel switch assembly 1 and 2, respectively. (The first word is reserved for diagnostic data.) The module is located in the upper slot of rack 1 module group 2. The module address is 121₈. If located in the lower slot, the module address would be 120₈ and output bits 10, 11, 12, 16 and 17 used in the example would become 00, 01, 02, 06 and 07, respectively.

Block Transfer Instructions

Rung 1 - When this rung is enabled, the switch status data in module memory is transferred to the data table. The 3 words specified by the block length will contain diagnostic data and the data of thumbwheel switch assemblies 1 and 2.

The block length is set to 1 plus the number of thumbwheel switch assemblies, or 1 plus the number of pairs of switch banks required by the application.

Multiple Get Instructions

Read the description for BLOCK TRANSFER INSTRUCTIONS first.

Rung 1 - This rung is used to identify the module (module address 121₈ in the first GET instruction) and the first address of the destination of the transferred data (word address 060₈ in the second GET instruction). The rung also sets the block transfer read bit (bit 17) in the module's output image table byte.

Rungs 2, 3 - These rungs set the number of words to be transferred by setting a binary bit pattern in the module's output image table byte. Bits 10 and 11 are set ON. the binary bit pattern 11 is equivalent to the number 3.

Programming Considerations, PLC-2 Family

The block transfer data address is the address that identifies the block transfer instruction. Care should be taken when assigning these addresses in the data table.

Date Address (PLC-2 Family)

The data address for a block transfer instruction should be the first available address in the timer/counter accumulated area of the data table. This address is 030₈ for the Mini-PLC-2 or -2/15. For the PLC -2/20 or -2/30, this address depends on the number of I/O racks connected to the processor module, i.e. address 020₈ for 1 I/O rack, 030₈ for 2 racks, etc. to 070₈ for 6 racks and 200₈ for 7 racks. When more than one block transfer module is used, the data addresses should be consecutive.

Data Address Boundary (PLC-2 Family)

A boundary word containing zeros should be entered in the data table following the last block transfer data address. When the processor sees the boundary word, it terminates the block transfer search routine so that subsequent data table values are not interpreted as the rack, module group and slot numbers associated with block transfer data addresses.

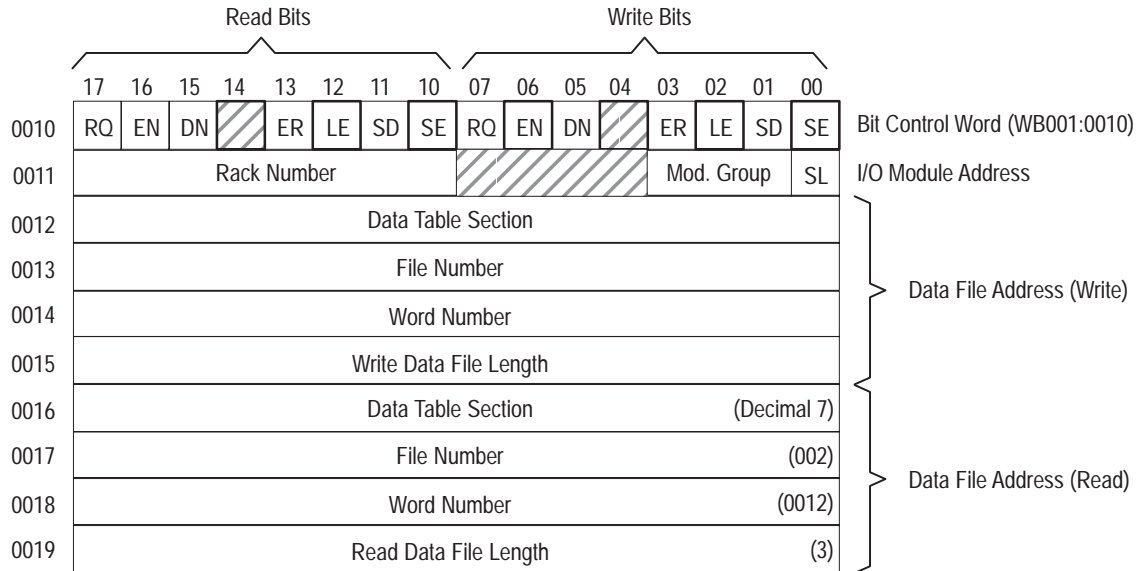
Block Transfer Programming, PLC-3

The processor transfers switch status data from the module to the data table by a block transfer read operation. The following information must be specified in order to program block transfer with the PLC-3 processor. Values entered in parentheses correspond to the programming example in paragraph titled “Programming Example PLC-3” and Figure 3.9.

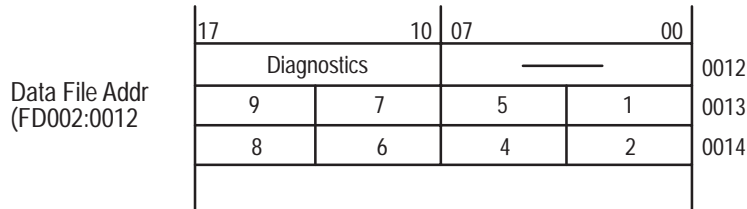
Figure 3.9
Example Block Transfer Programming, PLC-3

Data Table Maps

a) Control File (FB001:0010)



b) Data File (FD002:0012)

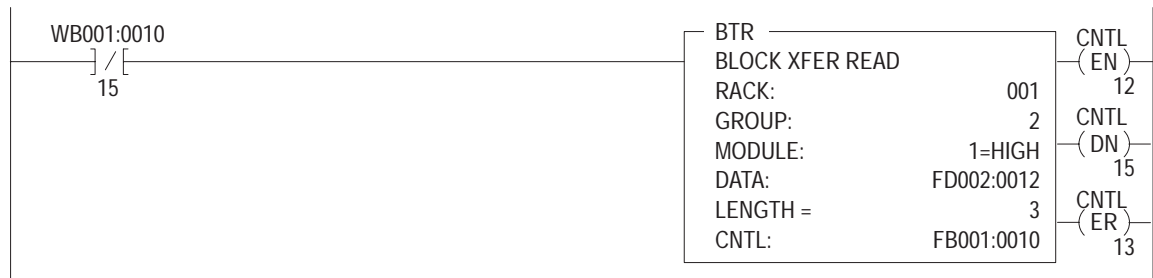


Bit Legend

RQ = Request LE = Latched Enable
 EN = Enable SD = Scanner Done
 DN = Done SE = Scanner Error
 ER = Error SL = Slot Number

Prefix Legend

F = File Address
 W = Word Address
 B = Binary File
 D = Decimal File



- **length:** the number of words to be transferred can be 0-7 depending on the number of switch assemblies. (03)
- **module address:** rack, module group and slot number where 1 = HIGH = upper slot, 0 = LOW = lower slot. (121)
- **control file address:** location of a 10-word file necessary for block transfer read and write operations, contains the module address in binary, the address of the data file and the block transfer status/control bits. (FB002:0010)
- **data file address:** location of the source or destination of block transfer data, generally equal in length to the maximum number of transfer words. (FD002:0012)

For additional information on programming block transfer instructions, refer to paragraph titled “Other Programming Considerations, PLC-2 Family and PLC-3” and the Programming and Operation Manual for the PLC-3 processor.

Programming Example, PLC-3

To program block transfer with a PLC-3 processor, you must create a control file and a data file (Figure 3.9). The control file can be located anywhere in the binary section of the processor data table. The data file for thumbwheel switches should be entered in the decimal section of the processor data table; the data file for discrete switches in the binary section of the processor data table. Neither block transfer file should overlap other assigned storage words.

This example is similar to the one described in paragraph titled “Programming Example, PLC-2 Family,” except that the rung is programmed for recurring block transfers. Three words of data are used to transfer the settings of two 4-digit thumbwheel switches. The settings are 9751 and 8642 for thumbwheel switch assemblies 1 and 2, respectively. (The first word is reserved for diagnostic data.) The module is located in the upper slot of module group 2 in I/O rack 1. The explanation of the single programming rung is that described for block format instructions in paragraph titled “Programming Example, PLC-2 Family.”

Other Programming Considerations, PLC-2 Family and PLC-3

When programming block transfer instructions the following should also be considered.

Automatic/Program Reset, switch #7

When in momentary (latched) contact mode, latched data should be reset after its image is transferred to the data table. It can be reset by program logic (program reset mode) or automatically by the module (automatic reset mode).

In program reset mode, module memory can be reset by user program after a successful transfer has occurred by setting bit 6 or 16 in the module's output image table byte. (Bit 6 is set when the module is in the lower slot, bit 16 when in the upper slot.) If bit 6 or 16 is set by mistake during a request for block transfer, the module will respond that it is not ready to transfer.

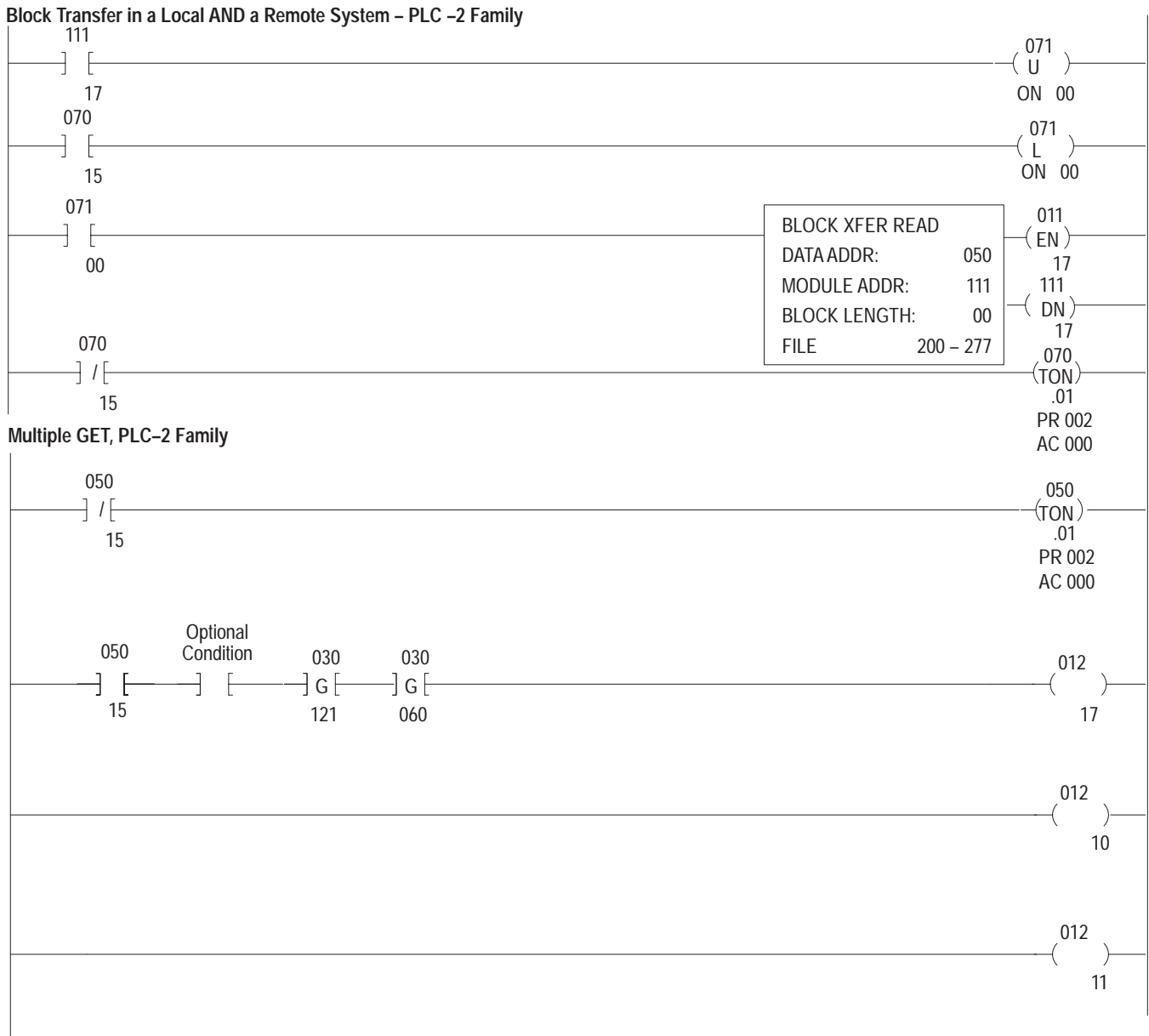
Important: Bit 6 or 16 should be programmed only when mode selection switch #4 and #7 are both in the ON position. Refer to paragraph titled “Switch Selection of Operating Modes” (Chapter 2).

Reset rungs are illustrated for the PLC-2 family and PLC-3 programmable controllers in Figure 3.10. The reset condition can be conditioned upon the completion of a successful block transfer. The output energize instruction sets the reset bit of the module.

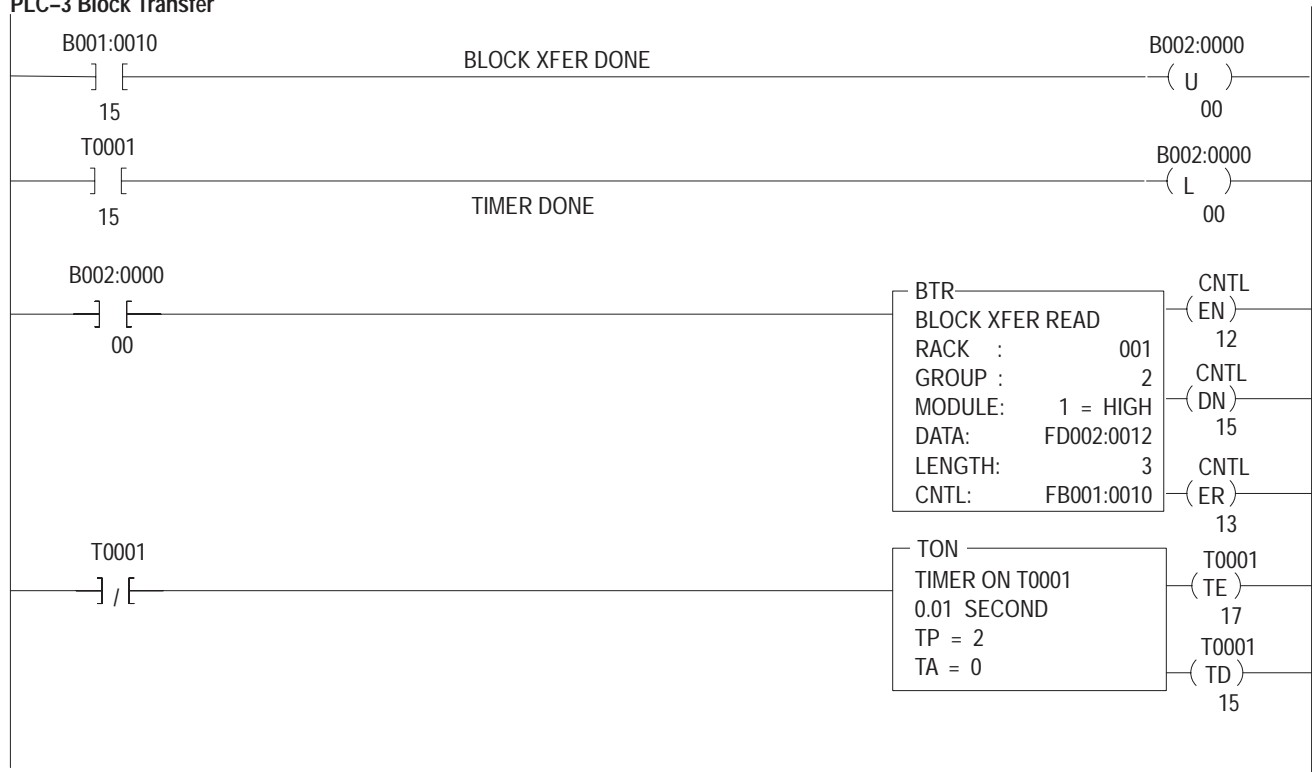
In program reset mode, if any bit in addition to bit 6 or 16 is on, the module will not reset.

In automatic reset mode, the module resets its data and stores new latched data after each block transfer. Allow at least 20ms between block transfers for the module to store new data. A method for doing this is shown in Figure 3.11.

Figure 3.11
Example Logic for Automatic Reset, Latched Contacts Mode



PLC-3 Block Transfer



NOTES:

- a) Module located in rack 1, module group 2, slot 1.
- b) Timer allows at least 20ms between block transfers.

Diagnostics

Bit 12 of the block transfer diagnostic word is the communication fault bit. A communication fault can be caused either by cycling power to the processor, by a break in I/O communications or by excessive electrical noise radiating into the I/O communication cable. This bit will go ON if the transfer is aborted. The I/O communication cable and system grounding should be checked thoroughly in accordance with grounding and shielding recommendations presented in the processor Assembly and Installation Manual. This bit can be reset only by cycling power to the module.

Data Buffering

Data that is block transferred to the data table should be buffered before it is used to guard against the manipulation of invalid data by subsequent user program instructions.

This can be done by examining the block transfer done bit for an ON condition. An EXAMINE ON instruction addressed to the done bit should be a logic condition for any further manipulation of transferred data. The done bit for the PLC-2 family and PLC-3 programming example is 112/17 and WB001:0010/15, respectively.



WARNING: Program the examination of the block transfer done bit as a condition for subsequent data manipulation following each block transfer. Otherwise, invalid data could be operated upon causing unexpected machine operation with possible damage to equipment and/or injury to personnel.

The communication fault bit, bit 12 of the diagnostic word, can be examined as an additional buffering condition. This can be done by using an EXAMINE OFF instruction addressed to bit 12 of the diagnostic word's location in the data table (060/12 for PLC-2 family, WD002:0012/12 for PLC-3 in this example). If transfer was aborted, the next transfer of data would contain bit 12 ON, in the diagnostic word.

Specifications

Module Inputs

Up to four 4–digit BCD
Thumbwheel Switches or

Up to six 3–digit BCD
Thumbwheel Switches or

Up to 72 Discrete Contact
Switches (Maintained or
Momentary contact)

Diode Decoupling is required
for more than 8 Switch
Contacts

Module Location

Any Bulletin 1771 I/O Rack
location except the left–most
slot

Switch Power Requirement

Supplied by the module

Nominal 13 mA @ 5V DC
per switch

Module Current Requirement

800 mA max @ 5V DC from
the backplane

Maximum Switch Cable Distance

400 feet

Ambient Temperature Rating

0–60 °C Operational

–20 to +85° C Storage

Humidity

5% to 95%
(without condensation)

Keying

Keying positions are between
8 and 10 and between 26 and
28

Symbols

Empty, 2-11 , 3-19

Numbers

4-digit thumbwheel switch data, 3-2

A

automatic, 3-22

D

Data buffering, 3-23

data storage, 3-6

Decoupling, 2-10

Diagnostics, 3-23

Dip switch settings, 2-1

Discrete contact switch data, 3-6

Discrete switch bank wiring, 2-8

E

external power, 2-10

K

Keying, 2-11

L

Low = TRUE, 2-10



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