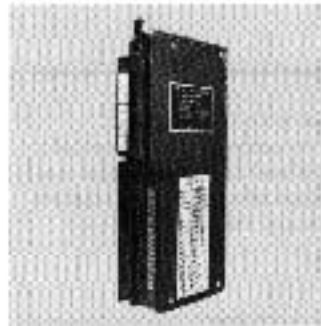




## **Allen-Bradley DC (5V) Multiplexer Input Module**

(Cat. No 1771-IS)

### Product Data

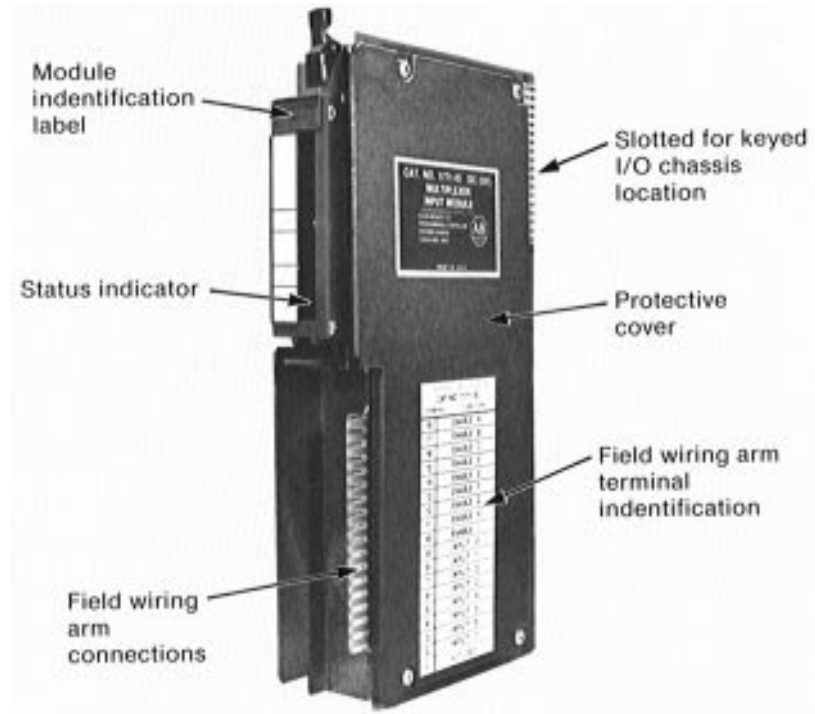


### **Description**

The 1771-IS DC (5V) Multiplexer Input Module (figure 1), reads the status of multiple 3-digit or 4-digit BCD thumbwheel switches. It can also read the status of up to 22 hard contact switch devices. You can use it to detect the off-to-on transition with each block transfer or the steady state status of switches.

This single-slot module is shipped with wiring arm (cat. no. 1771-WF).

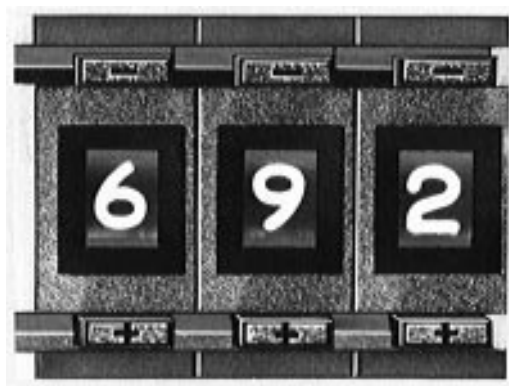
**Figure 1**  
DC (5V) Multiplexer Input Module (Cat. No. 1771-IS)



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 2).

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

**Figure 2**  
Typical 3-Digit Thumbwheel Switch



Switch contact data is transferred to the processor through block transfer programming. The module can be used with any Allen-Bradley programmable controller that uses the 1771 I/O structure. (If using the Mini-PLC-2 controller, you must use the 1772-LN3 processor.)

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

Module scanning of switch contacts is user-selectable at a normal or fast rate with contact debouncing. Contact scanning occurs until the module is interrupted by a read instruction from the processor. Contact status is stored in module memory until the module transfers the data to the processor. Switch scanning by the module is totally independent of I/O scanning by the processor.

The multiplexer input module saves I/O space by replacing up to nine discrete input modules. It saves user program that otherwise would be needed for multiplexing discrete inputs. It can handle the switch inputs from up to six 3-digit or four 4-digit BCD thumbwheel switches. It can also handle up to 72 discrete momentary (latched) or maintained contact switches.

Diode decoupling is used to prevent the appearance of false switch closures by unwanted currents.



**WARNING:** Outputs of any AC or DC 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 any power supply for processor with self-contained power supply) other than 1771-P1 or 1771-P2. To avoid damage to equipment and/or injury to personnel caused by equipment controlled by these outputs, use only multiplexer modules (cat. no. 1771-IS, hardware revision D or later) with any power supply or processor with self-contained power supply.

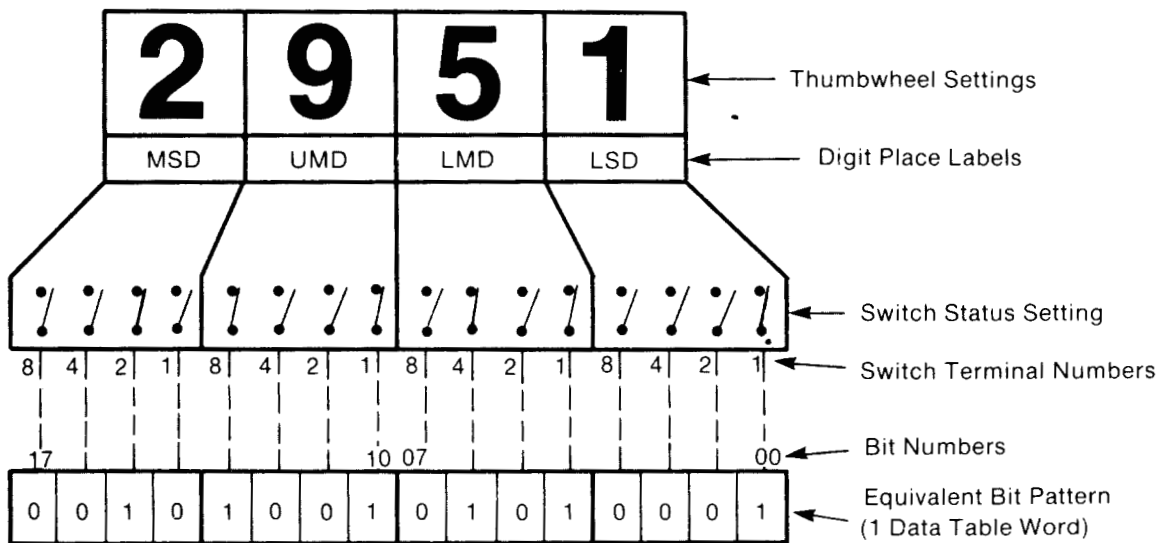
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**Note:** Hardware revision D is designated by Part No. XXXXXXXXX/D on the module nameplate. Earlier modules (cat. no. 1771-ISC) do not have this part No. /D designation.

## Programming and Operation

Switch status data such as a thumbwheel setting is stored in the module. The data is transferred to the data table when requested by the processor through block transfer programming. Data is then stored in a data table file until operated upon by user program instructions (figure 3).

**Figure 3**  
**Bit Pattern of a Thumbwheel Setting**



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### Module Scan of Switch Contacts

The module can scan a maximum of 72 switch contacts. The contacts are scanned within either the normal (15.3ms) or fast (5.1ms) scan time. Scan time is user-selectable. Up to nine switch banks of eight switch contacts (72 switch contacts in all) are scanned sequentially in one scan. The module allows for contact debouncing before the module's microprocessor reads the status of switch contacts.

Scanning is continuous unless interrupted by a user program instruction to transfer switch contact data to the data table. Scanning resumes after the data is transferred at the same point it was interrupted.

### Thumbwheel Switch Data

Data from up to four 4-digit thumbwheel switches or six 3-digit thumbwheel switches is scanned, multiplexed, and transferred to the processor. One data table word is required for each switch. In the maintained contact mode, data from 4-digit switches is read into data table words with the MSD stored in bits 17 thru 14 and the LSD stored in bits 03 thru 00. Data from 3-digit switches is read into data table words with the MSD stored in bits 13 thru 10 and the LSD stored in bits 03 thru 00.

The number of words transferred to the processor is one more than the number of thumbwheel switches scanned by the module because a diagnostic word accompanies switch data. The words are transferred to consecutive locations in a buffer file in the processor.

### **Discrete Contact Switch Data**

Data from up to 72 discrete contact switches is scanned, multiplexed, and transferred to the processor. Because module memory is organized in 8-bit bytes, the status of eight discrete contact switches (one switch bank) is scanned a byte at a time and stored in module memory. Switch bank data is transferred to the processor in pairs of bytes. One data table word is required for 16 discrete contact switches (one pair of switch banks). In the momentary contact mode, odd numbered switch bank data is stored in the lower byte and the data of even numbered switch banks is stored in the upper byte. If used, switch bank 9 data is stored in the low byte of the last data table word of the switch data file.

The number of words transferred is one more than the number of pairs of switch banks plus an additional word for switch bank 9, if used. A diagnostic word accompanies switch data. For example, when the data of nine switch banks is transferred, each block transfer will contain six words.

### **Diagnostic Word**

The diagnostic word contains a communications fault bit, bit 12. The module sets this bit and terminates the transfer when the module detects a communications fault. The diagnostic word is the first word transferred. When bit 12 = 0 (reset), data in the current transfer is valid. When bit 12 = 1 (set), the current transfer is invalid (terminated) and the data of the previous transfer is invalid.

### **Block Transfer Programming**

The processor transfers switch status data from the module to the data table by a block transfer read operation (figure 4). Refer to the user's manual for additional information.

**Figure 4**  
**Block Transfer Programming**

Block Transfer Instruction, PLC-2 Family Controllers

```

      | 113                                     +-----+ 012 |
Runs 1 +---| |-----+ BLOCK TRANSFER READ +---(EN)-+
      | 02                                     | DATA ADDR: 030| 17|
      |                                     | MODULE ADDR: 121| 112 |
      |                                     | BLOCK LENGTH: 03+---(DN)-+
      |                                     | FILE: 060-062| 17|
      |                                     +-----+
  
```

Block Transfer Instruction, PLC-3 Controller

```

      |WB001:0010                             +--BTR-----+ CNTL |
+---|/|-----+ BLOCK XFER READ +---(EN)-+
      | 15                                     | RACK: 001| 12 |
      |                                     | GROUP: 2| CNTL |
      |                                     | MODULE: 1=HIGH|---(DN)-+
      |                                     | DATA: FD002:0012| 15 |
      |                                     | LENGTH = 3| CNTL |
      |                                     | CNTL: FB001:0010|---(ER)-+
      |                                     +-----+ 13 |
  
```

Multiple GET Instructions, PLC-2 Family Controllers

```

      | 113 030 130                                     012 |
Runs 1 +---| | |-----| |-----+-----+ ( )---+
      | 02 121 060                                     17 |
      |                                     |
      |                                     | 012 |
Runs 2 +-----+-----+-----+ ( )---+
      |                                     | 10 |
      |                                     |
      |                                     | 012 |
Runs 3 +-----+-----+-----+ ( )---+
      |                                     | 11 |
      |                                     |
  
```

**Programming Considerations**

When the module is operating in momentary (latched) contact mode, latched data in module memory must be reset after its image is transferred to the processor. The method of resetting module memory is user-selectable. The module can be configured to perform the reset automatically, immediately after its memory content has been transferred. Or, the module can be configured so that its memory is reset by program logic after the done bit is returned.

## Electrostatic Damage

Under some conditions, electrostatic discharge can degrade performance or damage the module. If you observe the following precautions you can guard against electrostatic damage.

- Touch a grounded object to rid yourself of electrostatic charge before handling the module.
- Do not touch the backplane connector or connector pins.
- When you set internal switches, do not touch other circuit components inside the module. If available, use a static-safe work station.
- When not in use, keep the module in its static-shield bag.

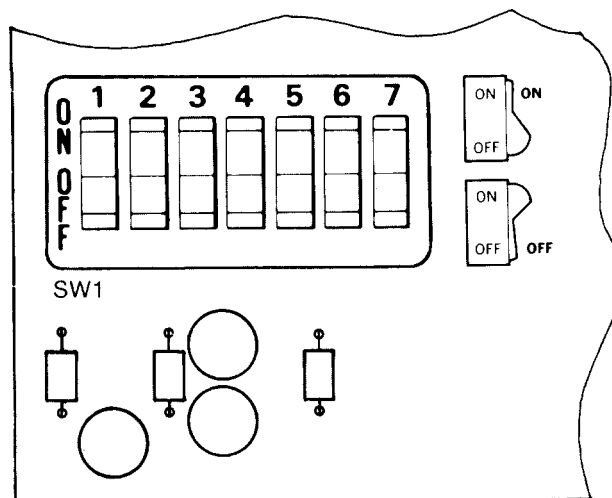
## Hardware

The module can operate in a variety of modes depending on the types of switches connected to it.

### Operating Modes

Operating modes can be selected using the seven-position switch assembly SW1 mounted on the circuit board under the left cover plate (figure 5). Switch settings are as follows:

**Figure 5**  
**Mode Select Switch Assembly**



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**Switch 1** — Always off

**Switch 2** — On for 4-digit BCD thumbwheel switches or for discrete contact switches (16-bit storage)

Off for 3-digit BCD thumbwheel switches (12-bit storage)

AB Parts

**Switch 3** — On for fast scan of switch contacts (5.1ms)

Off for normal scan of switch contacts (15.3ms)

**Switch 4** — On for momentary latched contacts (set by the off-to-on transition of switch contacts)

Off for maintained contacts (status is updated every scan)

**Switch 5, 6** — Always off

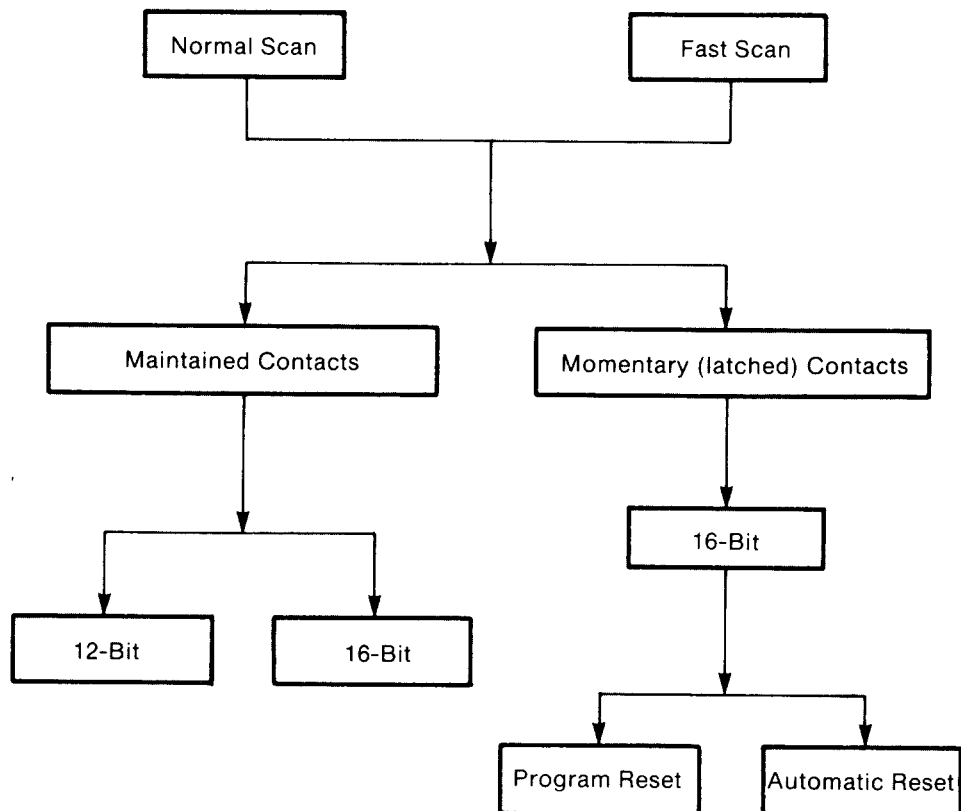
**Switch 7** — On for program reset of module memory data

Off for automatic reset of module memory data. This switch is inactive when operating the module in the maintained contact mode (switch 4 is off).

**Important:** Program reset can be used in remote I/O applications to prevent possible loss of data during block transfer of data to the processor. Program reset or automatic reset can be used in local I/O applications.

A flow chart of allowable operating modes is shown in figure 6.

**Figure 6**  
**Allowable Operating Modes**





## System Power Requirements

The module draws all of its power (0.80A) from the I/O chassis backplane power supply.



**CAUTION:** Backplane current requirements of all modules in the I/O chassis should not exceed the maximum rating of the I/O chassis backplane or backplane power supply.

---

The module provides power to the switch contacts.



**CAUTION:** Avoid connecting an external power source or TTL devices to the field wiring arm terminals. Damage to the module could result.

---

## Diagnostic Indicator

The module tests its memory and related circuits during power up. The detection of a fault during the test causes the fault indicator on the front panel to light.

## LOW-TRUE Logic

Module operation is based on LOW-TRUE logic. Enable lines, which power the switches, ground the inputs connected to them through the switch contacts. This LOW-TRUE condition is interpreted as a logic 1 (contact closed) by the module.

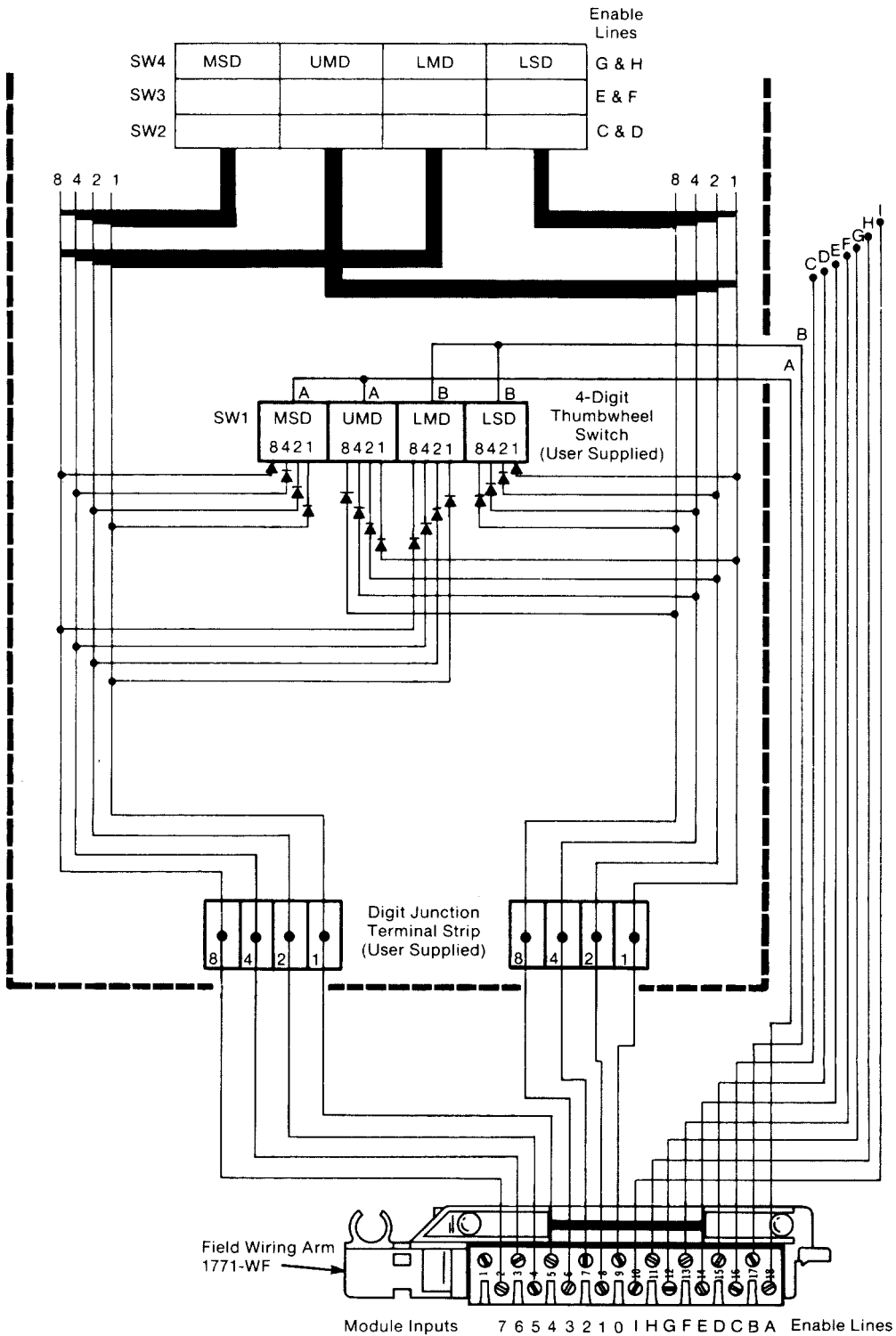
## Thumbwheel Switch Wiring

Each digit of the BCD thumbwheel switch assembly has five terminals. Enable lines provide power to switch contacts. Switch terminal numbers 8, 4, 2, and 1 connect to switches within the thumbwheel switch assembly to establish the binary bit pattern of each BCD digit (figure 3). Digit place labels refer to the position of each digit in the thumbwheel switch as follows:

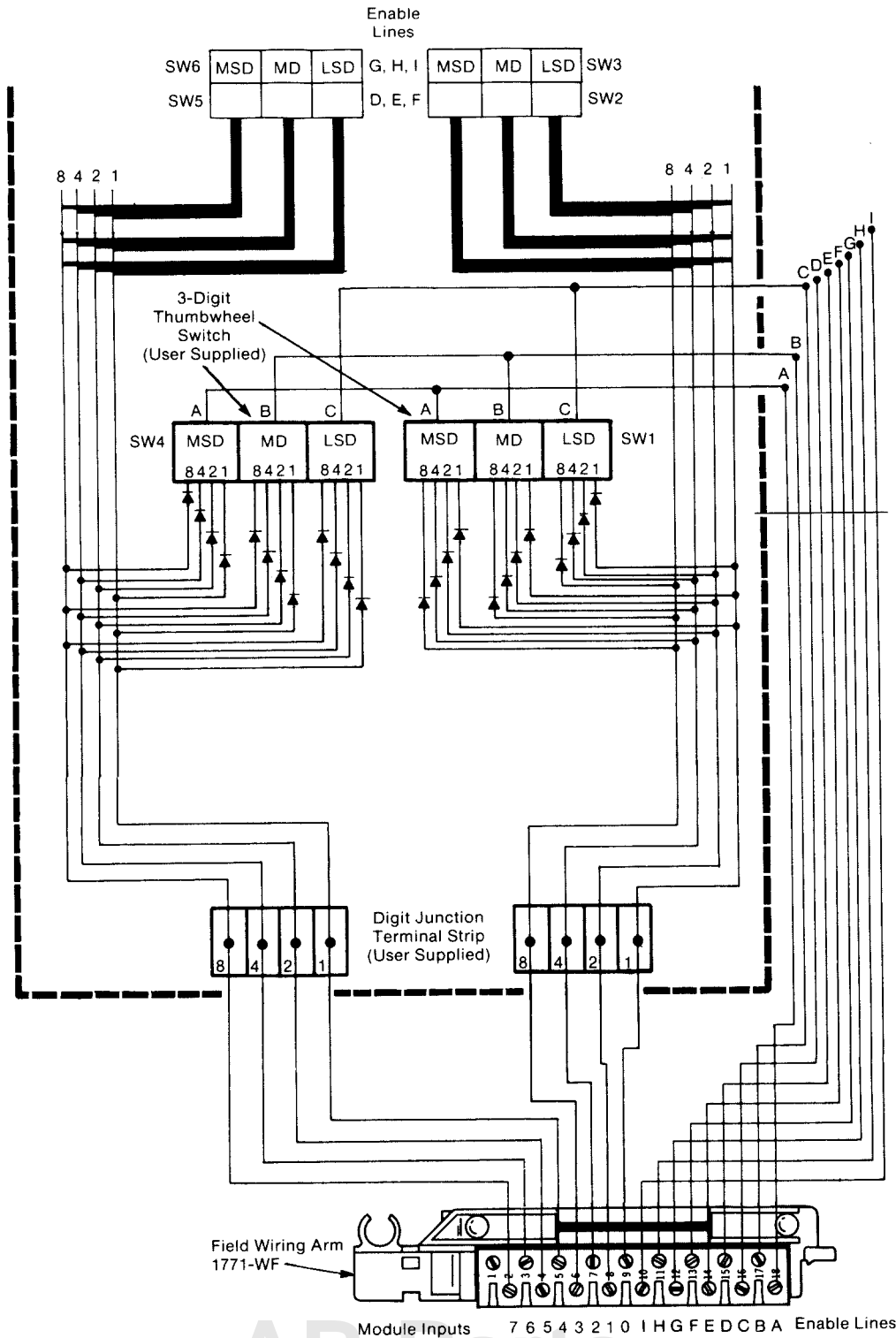
- MSD and LSD — Most and Least Significant Digit
- MD — Middle Digit
- UMD and LMD — Upper and Lower Middle Digit

Point-to-point wiring between thumbwheel switches and the module field wiring arm is shown in figure 7 for 4-digit thumbwheel switches and in figure 8 for 3-digit thumbwheel switches.

**Figure 7**  
**Typical Point-to-point Wiring for up to Four 4-digit Thumbwheel Switches**  
**(Maintained Switch Contact Mode)**



**Figure 8**  
Typical Point-to-point Wiring for up to Six 3-digit Thumbwheel Switches  
(Maintained Switch Contact Mode)



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Note the polarity of decoupling diodes connected to switch terminals 8, 4, 2 and 1 shown in figures 7 and 8.

### **Discrete Switch Bank Wiring**

Discrete contact switches are arranged in switch banks. Each bank contains up to eight switches. A switch bank is powered by one enable line. Note the polarity of the decoupling diodes connected to the discrete contact switches (figure 9).

### **Diode Decoupling**

Decoupling diodes prevent unwanted currents from circulating through switch circuits and causing false appearances of switch closures. Decoupling diodes should be used when the application calls for more than eight switch contacts (more than one switch bank). A 1N914 is a typical diode that can be used.

### **Switch Selection**

Select contact closure switches rated at 8 to 14mA at 5V DC. The minimum off resistance can be 10K ohms. The maximum on resistance can be 10 ohms including the cable resistance.



**CAUTION:** The module is not compatible with TTL devices or active sensors. External power can damage the module.

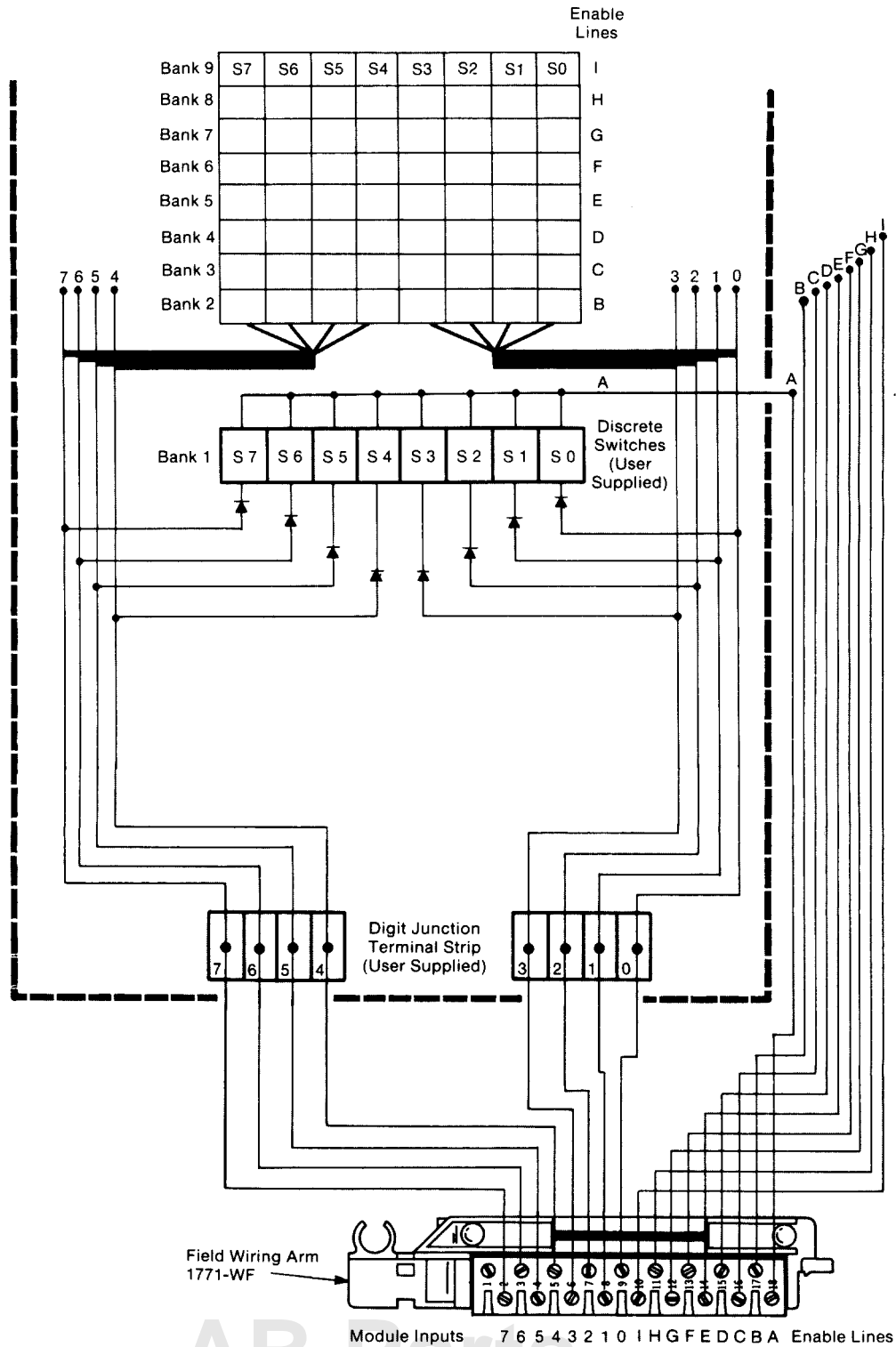
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When selecting thumbwheel switches, be sure to select a BCD type. Decimal thumbwheel switches should be avoided because the 10 discrete connections for each digit would not be compatible with the 4 BCD coded input terminals for each digit on the module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

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.

Diode polarity must be set for LOW-TRUE operation. Cathodes must be connected to switch contact terminals 8, 4, 2, 1 and anodes to the module inputs.

**Figure 9**  
Typical Point-to-point Wiring for up to 72 Discrete Contact Switches  
(Maintained Switch Contact Mode)



AB Parts

## Cable Selection

The maximum cable capacitance between field wiring arm terminals can be 0.039 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

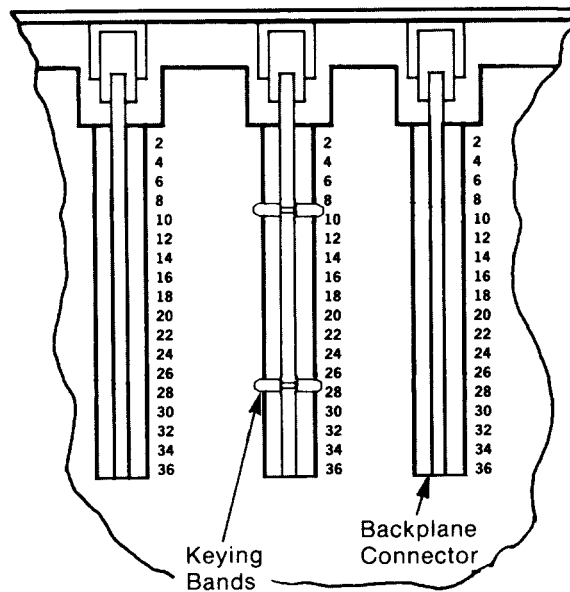
The backplane connector can be keyed to accept only this module after its position in the I/O rack has been determined. Plastic keying bands shipped with the I/O chassis should be used. The position of the keying bands on the upper backplane connector must correspond to the mating slots on the module circuit board.

Keying bands are located on the backplane connector between these numbers (figure 10):

- Between 8 and 10
- Between 26 and 28

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

**Figure 10**  
**Keying Diagram**



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## 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 chassis, single I/O slot location

### Switch Power Requirement

- Supplied by the module
- Nominal 13mA @ 5V DC per switch contact

### Backplane Current

- 800mA

### Maximum Switch Cable Distance

- 400 feet

### Environmental Conditions

- Operating Temperature: 0 to 60°C (32 to 140°F)
- Storage Temperature: -40 to 85° C (-40 to 185° F)
- Relative Humidity: 5 to 95% (without condensation)

### Keying

- Between 8 and 10
- Between 26 and 28

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