Bailey®
network 90®

Digital Slave Module (DSM05)

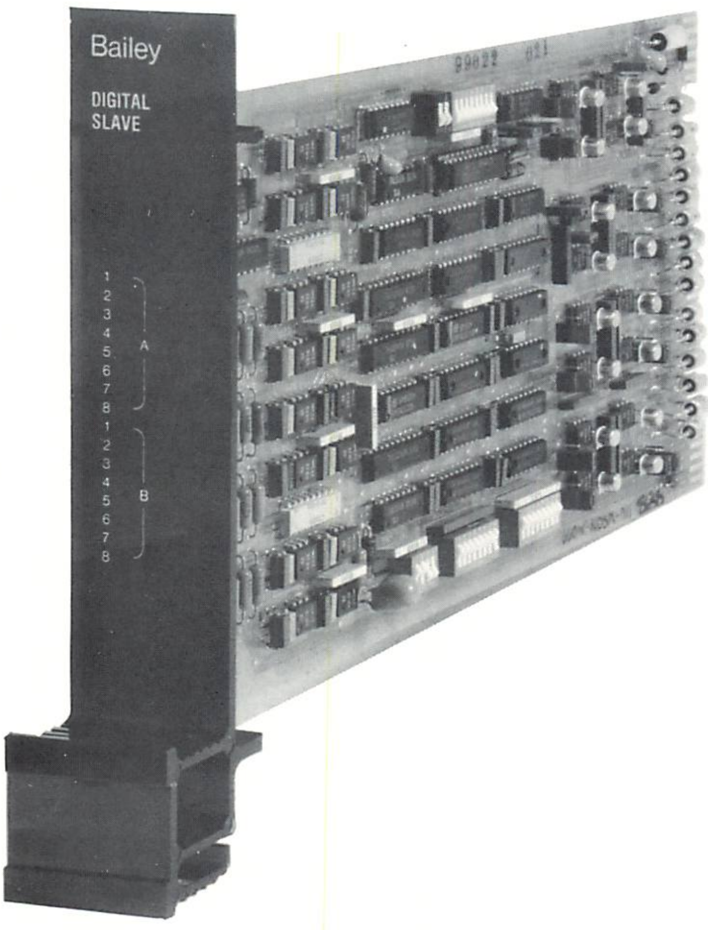

FIGURE 1 — The NETWORK 90 Digital Slave Module (DSM05)

Bailey® Seamless, Real-Time Process Management Solutions

Product Instruction

E93-913-7

WARNING notices as used in this manual apply to hazards or unsafe practices which could result in personal injury or death.
CAUTION notices apply to hazards or unsafe practices which could result in property damage.
NOTES highlight procedures and contain information which assist the operator in understanding the information contained in this manual.

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GENERAL DESCRIPTION

Introduction

Figure 1 is a photograph of the NETWORK 90® Digital Slave Module (DSM05). The module occupies a single slot in a NETWORK 90 Module Mounting Unit (MMU). As Figure 1 shows, the DSM05 consists of a front panel and a single printed circuit card. Behind the front panel of the module are two types of solid state, Light Emitting Diodes (LEDs): a "status" LED and two sets of eight "group signal" LEDs. The user can read the LEDs through the plastic front-plate of the front panel. A thorough description of these LEDs is in the "**Indicators**" section of this publication.

The DSM05 printed circuit card is a double-sided board that supports various integrated circuits, jumpers, plug connectors, and switches. Figure 2 is a photograph of the DSM05 printed circuit card. For more information on both the front panel and the printed circuit card, see the "**Functional Overview**" section of this publication.

This Product Instruction begins with this general description of the DSM05. A functional overview presents a brief explanation of how the module works. Following the general description are the installation procedures. This section forms the bulk of the publication. It gives the reader all of the information necessary to install the DSM05 properly. A "**Theory of Operations**" section is next. Here, the text expands upon the functional overview. Detailed descriptions of the electrical operation of the DSM05 appear in this section. Concluding the publication is configuration and tuning information. This section describes the "operator interface" (that is, the indicators) of the DSM05. It also refers the reader to information that will help him configure and tune the module. Illustrations (figures) and tables support the text throughout.

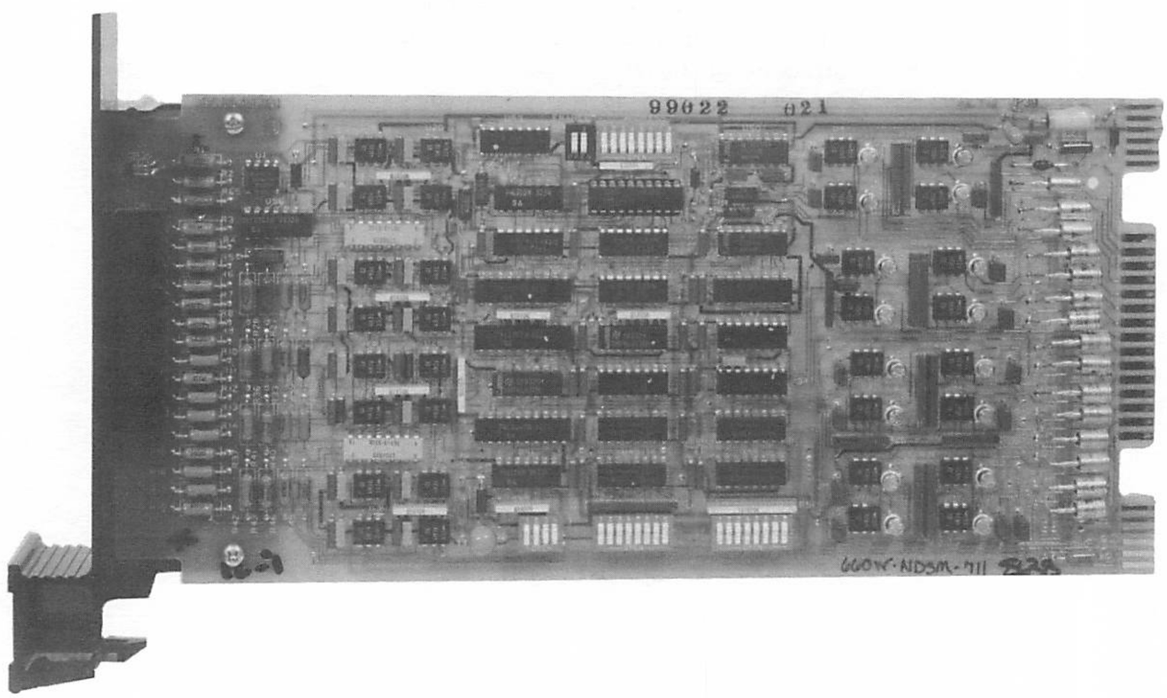


FIGURE 2 — The DSM05 Printed Circuit Card.

NETWORK 90 is a certified trademark of the Bailey Controls Company.

Functional Overview

The Digital Slave Module (DSM05) is a single printed circuit card that handles input and output signals:

- Between NETWORK 90 Process Control Units (PCUs).
- Between a PCU and other devices (such as relays, lamps, and pushbuttons).
- Between a PCU and a Digital Logic Station (DLS01).

Functionally, the DSM05 is an I/O "slave" interface that works with either of two "masters": the Mult-Function Controller (MFC) or the Logic Master Module (LMM). These masters monitor the two groups of eight digital input or digital output signals that the DSM05 handles. For a detailed description of the electronic functions of the DSM05, see the **"Theory of Operation"** section of this publication. Brief descriptions of what the module does during "normal" and "default" system operation follow.

Normal Operation. During normal operation, either master "queries" the DSM05 to determine the configuration and state of the signal groups. The master:

- Makes sure the state of the group (input or output) as configured in the master matches the state defined by the configuration switch on the slave.
- Reads the state of the input group(s).
- Sets the state of the output group(s).

The DSM05 drives the "status" LED on its front panel green to show that the system is operating normally. The module also uses 16 front panel, "group signal" LEDs to show whether the input/output signals are "on" or "off."

Default Operation. During "default" the DSM05 performs either of two special functions. Should either master fail (or be removed from the system), the DSM05 control logic either drives all outputs to a preset "default" state or holds the state of the outputs as they were when the default occurred (depending on the setting of the module configuration switch; see the **"Setting the Module Configuration Switch"** section of this publication). The DSM05 also drives its "status" LED to red and lights the "group signal" LEDs to show which outputs are on.

Specifications

Table 1 lists the specifications for the DSM05 module. These specifications are subject to change without notice.

TABLE 1
Specifications

Mounting	Single slot spacing in standard Module Mounting Unit
Certification	CSA certified for use as process control equipment in an ordinary (non-hazardous) location.
Environmental	Standard environmental specification for the system apply (see CE93-9000).
Power	
Supplies	5 V module supply (±5% maximum variation) 24 V I/O supply (21.6 - 26.4 V maximum variations)
Current Consumption	757 mA (typical) 867 mA (maximum) } From ±5 V dc
Dissipation	4.6 watts (logic) 5.0 watts (I/O)
24 V logic high level input voltage	V I/O - 4.0 V (minimum)
24 V logic low level input voltage	V I/O - 16.5 V (maximum)
24 V logic low level input current	—11.8 mA
24 V logic high level output current (Source circuit = 100 uA)	100 uA (maximum)
24 V logic low level output voltage (sink current = 120 mA)	1.0 V (typical) 2.0 V (maximum)
24 V maximum sink current	120 mA
Propagation Delay Times	Input: Low to high 50 usec (typical) High to low 25 usec (typical) Output: High to low 25 usec (typical) Low to high 100 usec (typical)
Pin Connections	See Tables 8, 9, and 10.
Isolation Voltages	150 V RMS (channel to channel) 150 V RMS (channel to system [logic])
Surge Withstand	The DSM05 meets the requirements of IEEE Standard 472-1974, "Guide for Surge Withstand Capability Test" on both its input and output channels.
Maximum Wire Size	12 AWG (from field wiring to TDI01)

Installation

Handling Considerations

Users should take certain routine precautions to detect and prevent damage to the module during shipping and handling. These precautions follow:

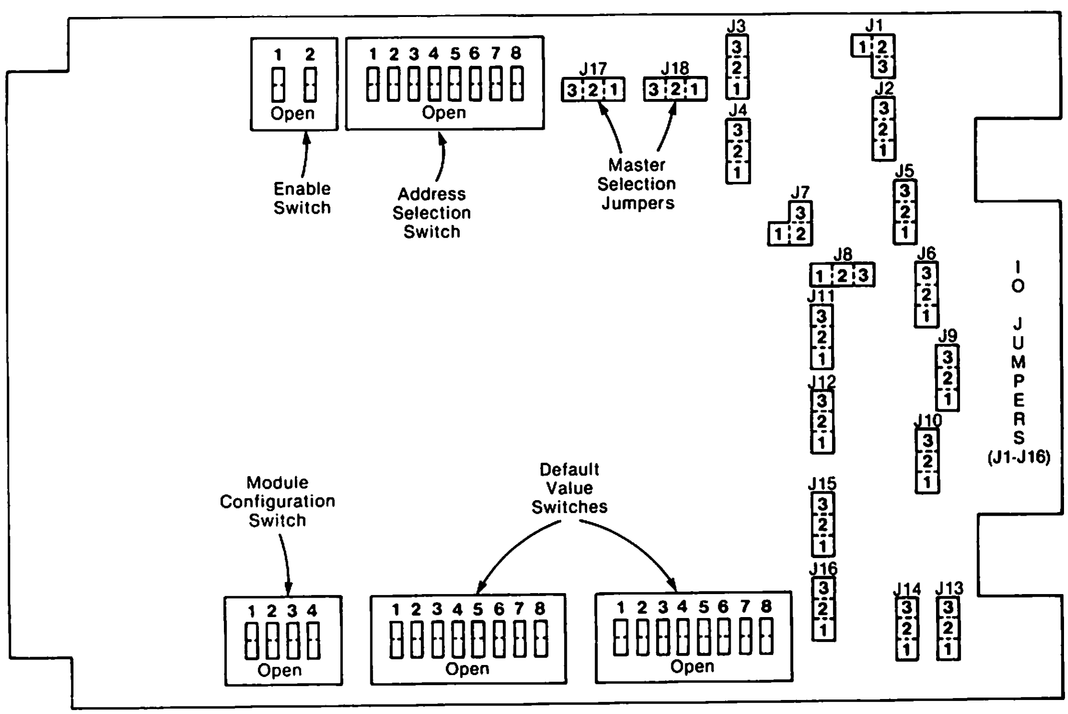
- Examine the module immediately to make sure that it has sustained no damage in transit.
- Notify the nearest Bailey Sales Office of any such damage.
- File a claim for any damage with the transportation company that handled the shipment.
- Use the original packing material and/or container to store the module.
- Store the module in an environment that is free of extremes in temperature, humidity, and air quality.
- Avoid touching the circuitry when handling the module.

Preparing for Installation

Before installing the DSM05 into the NETWORK 90 system, the user must:

- Prepare the switches and jumpers on the DSM05 printed circuit card so that their settings apply to his application.
- Prepare the dipshunts and terminal blocks on the termination unit for the DSM05 so that their settings apply to his application.

Detailed descriptions of these preparation procedures follow.



SETTINGS FOR MASTER SELECTION JUMPERS	
LMM OPERATION	MFC OPERATION
J17 = Posts 1-2 J18 = Posts 1-2	J17 = Posts 2-3 J18 = Posts 2-3

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FIGURE 3 — Switches and Jumpers on the DSM05.

Preparing Components

Figure 3 symbolically shows the various switches and jumpers on the DSM05. Notice that the module has:

- An Address Selection switch and an "ENABLE" switch.
- A Module Configuration switch.
- Two Default Value switches.
- Sixteen three-position jumpers and two Master Selection jumpers.

A detailed explanation of set-up of these components follows.

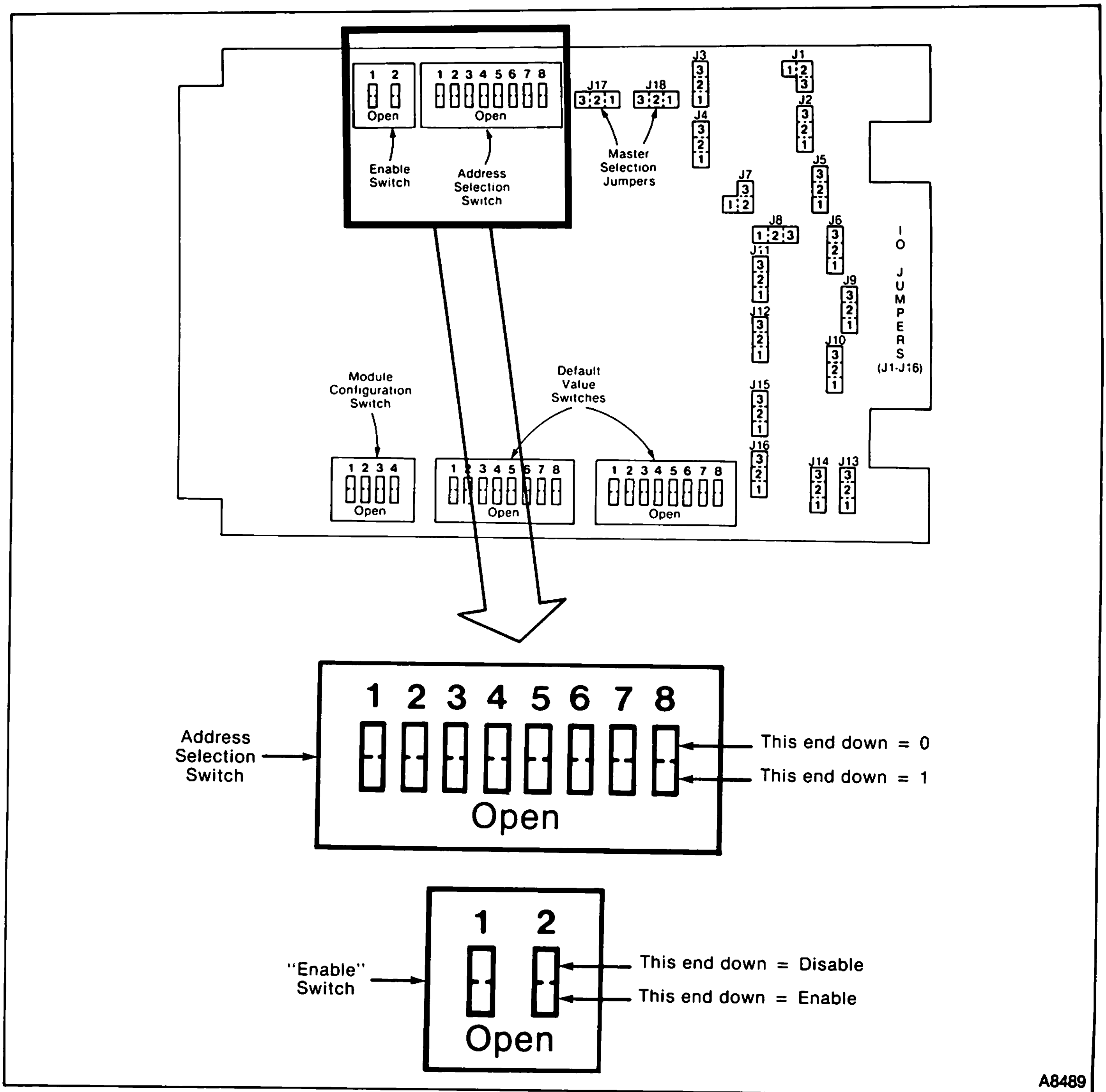


FIGURE 4 — Address Selection and "ENABLE" Switches.

Setting Address and "ENABLE" Switches. Figure 4 shows the address selection switch and the "ENABLE" switch for the DSM05. These switches work differently with either of the two masters that the DSM05 serves.

For the Logic Master Module, the two-contact "enable" switch activates the contacts that define the group addresses of the module. The contact on the left (contact 1) activates or deactivates contacts 1-4 of the address selection switch. The contact on the right (contact 2) activates or deactivates contacts 5-8 of the address selection swtich. Table 2 illustrates this graphically:

TABLE 2
"ENABLE" Switch Setting for LMM Operation

IF:	THEN:
Contact 1 on the enable switch is at "ENABLE"	Contacts 1-4 on the address selection switch are active
Contact 2 on the enable switch is at "ENABLE"	Contacts 5-8 on the address selection switch are active
Both contacts on the enable switch are at "ENABLE"	Contacts 1-8 on the address selection switch are active

TABLE 3
Possible Group Address for LMM Operation

CONTACT	GROUP A 1	2	3	4	DECIMAL VALUES
	0	0	0	0	0
	0	0	0	1	1
	0	0	1	0	2
	0	0	1	1	3
	0	1	0	0	4
	0	1	0	1	5
	0	1	1	0	6
	0	1	1	1	7
	1	0	0	0	8
	1	0	0	1	9
	1	0	1	0	10
	1	0	1	1	11
	1	1	0	0	12
	1	1	0	1	13
	1	1	1	0	14
	1	1	1	1	15

CONTACT	GROUP B 5	6	7	8	DECIMAL VALUES
	0	0	0	0	0
	0	0	0	1	1
	0	0	1	0	2
	0	0	1	1	3
	0	1	0	0	4
	0	1	0	1	5
	0	1	1	0	6
	0	1	1	1	7
	1	0	0	0	8
	1	0	0	1	9
	1	0	1	0	10
	1	0	1	1	11
	1	1	0	0	12
	1	1	0	1	13
	1	1	1	0	14
	1	1	1	1	15

NOTE: 0 = Contact closed (switch up)
1 = Contact opened (switch down)

The enable switch allows the DSM05 to use the address selection switch to set two group addresses for LMM operation. The four contacts on the left of the address selection switch (contacts 1-4) set one 4-bit group address (group A). The four contacts on the right of the address selection switch (contacts 5-8) set a second 4-bit group address (group B). Table 3 lists the 4-bit addresses that are possible for each group.

For more information about the address switches and their function within the operation of the LMM system, see the "**Theory of Operation**" section of this publication.

When the DSM05 interfaces the Multi-Function Controller, the right contact (contact 2) of the enable switch must be down (that is, at "enable") for the module to respond. Contacts 3-8 (that is, the six right-most contacts) on the address selection switch then set the 6-bit address of the DSM05 module. Table 4 shows the possible 6-bit addresses.

TABLE 4
Possible Module Addresses for MFC Operation

CONTACT	3	4	5	6	7	8	DECIMAL VALUES
RESERVED	0	0	0	0	0	0	0
	0	0	0	0	0	1	1
	0	0	0	0	1	0	2
	0	0	0	0	1	1	3
	0	0	0	1	0	0	4
	0	0	0	1	0	1	5
	0	0	0	1	1	0	6
	0	0	0	1	1	1	7
	0	0	1	0	0	0	8
	0	0	1	0	0	1	9
	0	0	1	0	1	0	10
	0	0	1	0	1	1	11
	0	0	1	1	0	0	12
	0	0	1	1	0	1	13
	0	0	1	1	1	0	14
	0	0	1	1	1	1	15
	0	1	0	0	0	0	16
	0	1	0	0	0	1	17
	0	1	0	0	1	0	18
	0	1	0	0	1	1	19

CONTACT	3	4	5	6	7	8	DECIMAL VALUES
	0	1	0	1	0	0	20
	0	1	0	1	0	1	21
	0	1	0	1	1	0	22
	0	1	0	1	1	1	23
	0	1	1	0	0	0	24
	0	1	1	0	0	1	25
	0	1	1	0	1	0	26
	0	1	1	0	1	1	27
	0	1	1	1	0	0	28
	0	1	1	1	0	1	29
	0	1	1	1	1	0	30
	0	1	1	1	1	1	31
	1	0	0	0	0	0	32
	1	0	0	0	0	1	33
	1	0	0	0	1	0	34
	1	0	0	0	1	1	35
	1	0	0	1	0	0	36
	1	0	0	1	0	1	37
	1	0	0	1	1	0	38
	1	0	0	1	1	1	39

TABLE 4
Possible Module Address for MFC Operation (Cont.)

CONTACT	3	4	5	6	7	8	DECIMAL VALUES
	1	0	1	0	0	0	40
	1	0	1	0	0	1	41
	1	0	1	0	1	0	42
	1	0	1	0	1	1	43
	1	0	1	1	0	0	44
	1	0	1	1	0	1	45
	1	0	1	1	1	0	46
	1	0	1	1	1	1	47
	1	1	0	0	0	0	48
	1	1	0	0	0	1	49
	1	1	0	0	1	0	50
	1	1	0	0	1	1	51
	1	1	0	1	0	0	52
	1	1	0	1	0	1	53
	1	1	0	1	1	0	54
	1	1	0	1	1	1	55
	1	1	1	0	0	0	56
	1	1	1	0	0	1	57
	1	1	1	0	1	0	58
	1	1	1	0	1	1	59
	1	1	1	1	0	0	60
	1	1	1	1	0	1	61
	1	1	1	1	1	0	62
	1	1	1	1	1	1	63

NOTE: 0 = Contact closed (switch up)
1 = Contact opened (switch down)

For more information about these address switches and their function within the MFC system, see the "**Theory of Operation**" section of this publication.

In both cases, these switches determine the "address bytes" which precede every data transfer operation between a DSM05 and a master. The format of these address bytes differs. The LMM uses

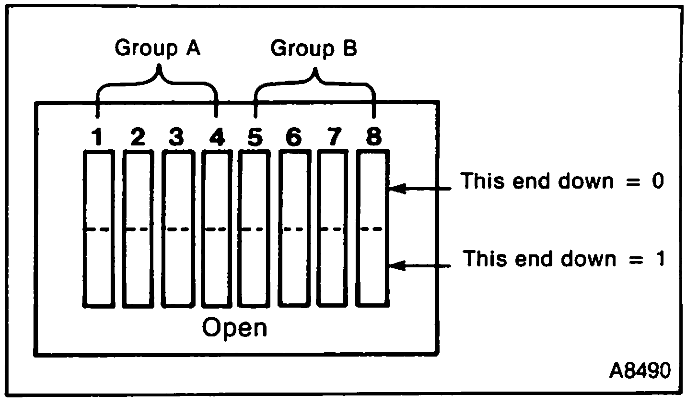


FIGURE 5 — Address Selection Switch Grouped for LMM Operation.

two "group" address bytes; the MFC uses one "module" address byte. For either master, however, the user defines address bytes by setting the contacts on the address selection switch.

Figure 5 shows the format of the address selection switch for LMM operation. Note that the eight contacts are separated into two groups: group A and group B (see Table 3). Each of these groups contains four contacts. These contacts set a binary address for their respective groups. Table 3 lists the possible addresses for these groups in several series of ones (1s) and zeros (0s). These ones and zeros are binary digits. Four binary digits — or "bits" — make up each address. Each contact in each group corresponds to a bit. Each contact's position corresponds to an equivalent decimal value for that bit. Table 5 lists each contact in group A and its equivalent decimal value.

TABLE 5
Contact Values for Group A (LMM Operation)

CONTACT	DECIMAL VALUE
1	8
2	4
3	2
4	1

As the table shows, contact 1 and its corresponding bit have the largest decimal value. This makes it the most significant bit (MSB). It occupies the leftmost position of the group address. Conversely, contact 4 and its corresponding bit have the smallest decimal value. This makes it the least significant bit (LSB). It occupies the right-most position of the group address.

By keeping the decimal values and the position of the contacts in mind, the user can set either group to any of 16 addresses. Setting a contact down (or open) defines that contact's corresponding bit as a binary 1. Setting a contact up (or closed) defines that contact's corresponding bit as a binary 0. The user must set the contacts in a group so that their combined decimal values define the address that he wants for the group.

For example, if a user wants to define the address for group A as 9, he must set the contacts in the group as follows:

CONTACT	SETTING	BINARY VALUE	DECIMAL VALUE
1	DOWN/OPEN	1	8
2	UP/CLOSED	0	0
3	UP/CLOSED	0	0
4	DOWN/OPEN	1	1
		BINARY 1001 ADDRESS	DECIMAL 9 ADDRESS

In this example, note that the binary address is 1001 and the decimal address is 9. The numeric values of these two addresses are identical.

If the user wants to define the address for group B as 12, he must set the contacts in the group as follows.

CONTACT	SETTING	BINARY VALUE	DECIMAL VALUE
5	DOWN/OPEN	1	8
6	DOWN/OPEN	1	4
7	UP/CLOSED	0	0
8	UP/CLOSED	0	0
		BINARY 1101 ADDRESS	DECIMAL 12 ADDRESS

Once again, the numeric values of the binary address and the decimal address are identical.

Settings for the address switch differ when the DSM05 interfaces a Multi-Function Controller. Here the DSM05 can use any of 63 addresses. This means that the six right-most contacts (contacts 3-8) define a module address. Once again, each contact's position corresponds to an equivalent decimal value for that bit. Table 6 lists the values for each contact.

TABLE 6
Contact Values in MFC Operation.

CONTACT	DECIMAL VALUE
3	32
4	16
5	8
6	4
7	2
8	1

Any of 63 addresses are possible here (see Table 4). Once again, the user must keep the decimal values and the position of the contacts in mind. If, for example, the user wants to define the module address of the DSM05 as 22 he must set contacts 3-8 as follows:

CONTACT	SETTING	BINARY VALUE	DECIMAL VALUE
3	UP/CLOSED	0	0
4	DOWN/OPEN	1	16
5	UP/CLOSED	0	0
6	DOWN/OPEN	1	4
7	DOWN/OPEN	1	2
8	UP/CLOSED	0	0
		BINARY 010110 ADDRESS	DECIMAL 22 ADDRESS

Setting the Module Configuration Switch. The module configuration switch (see Figure 6) of the DSM05 mounts four contacts. These contacts:

- Allow the module to interface a master and various field devices.
- Allow the module to interface a master and a DLS01.
- Set the operation (input or output) of each point group within the I/O circuitry.
- Set the operation of the output points during "default."

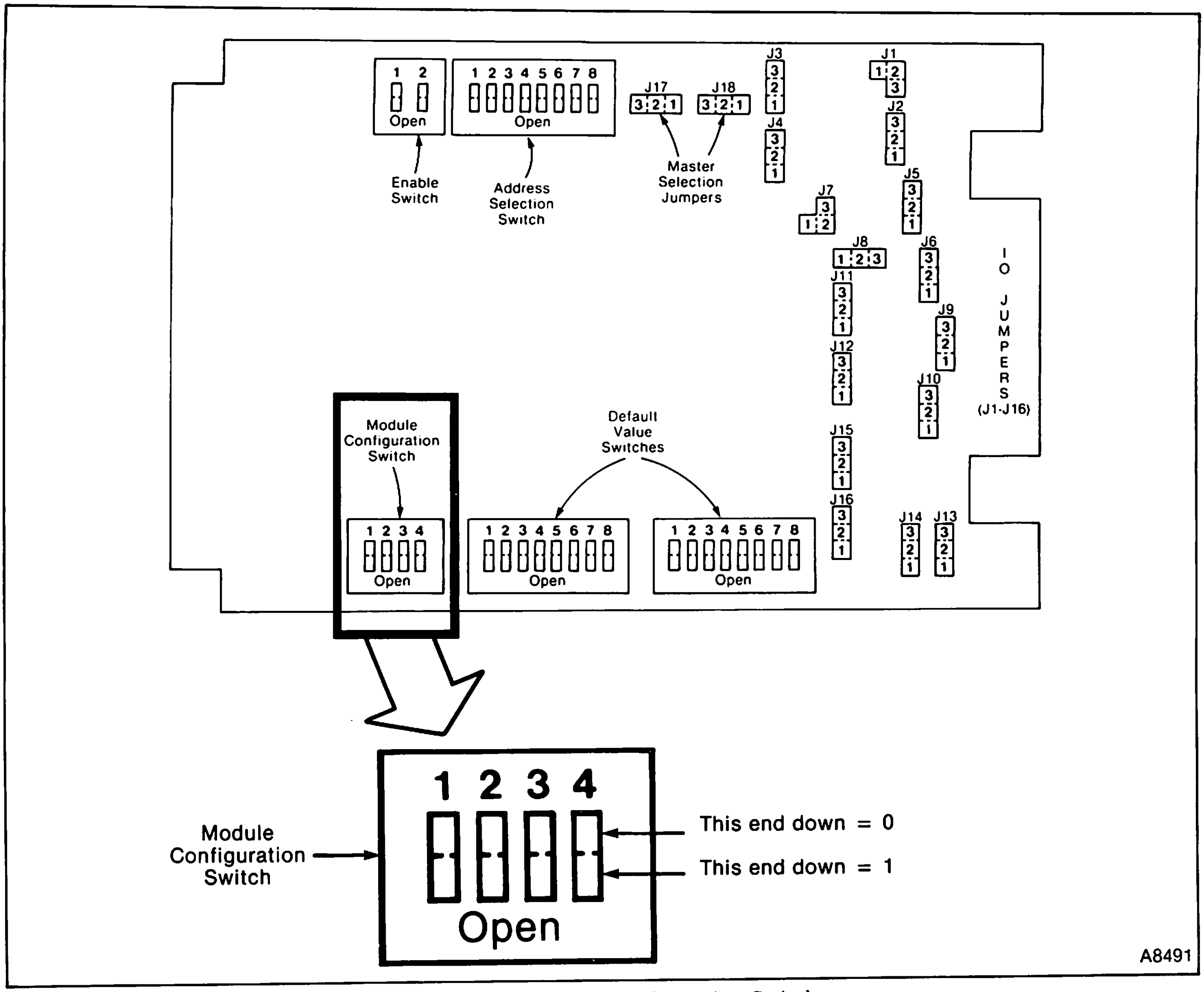


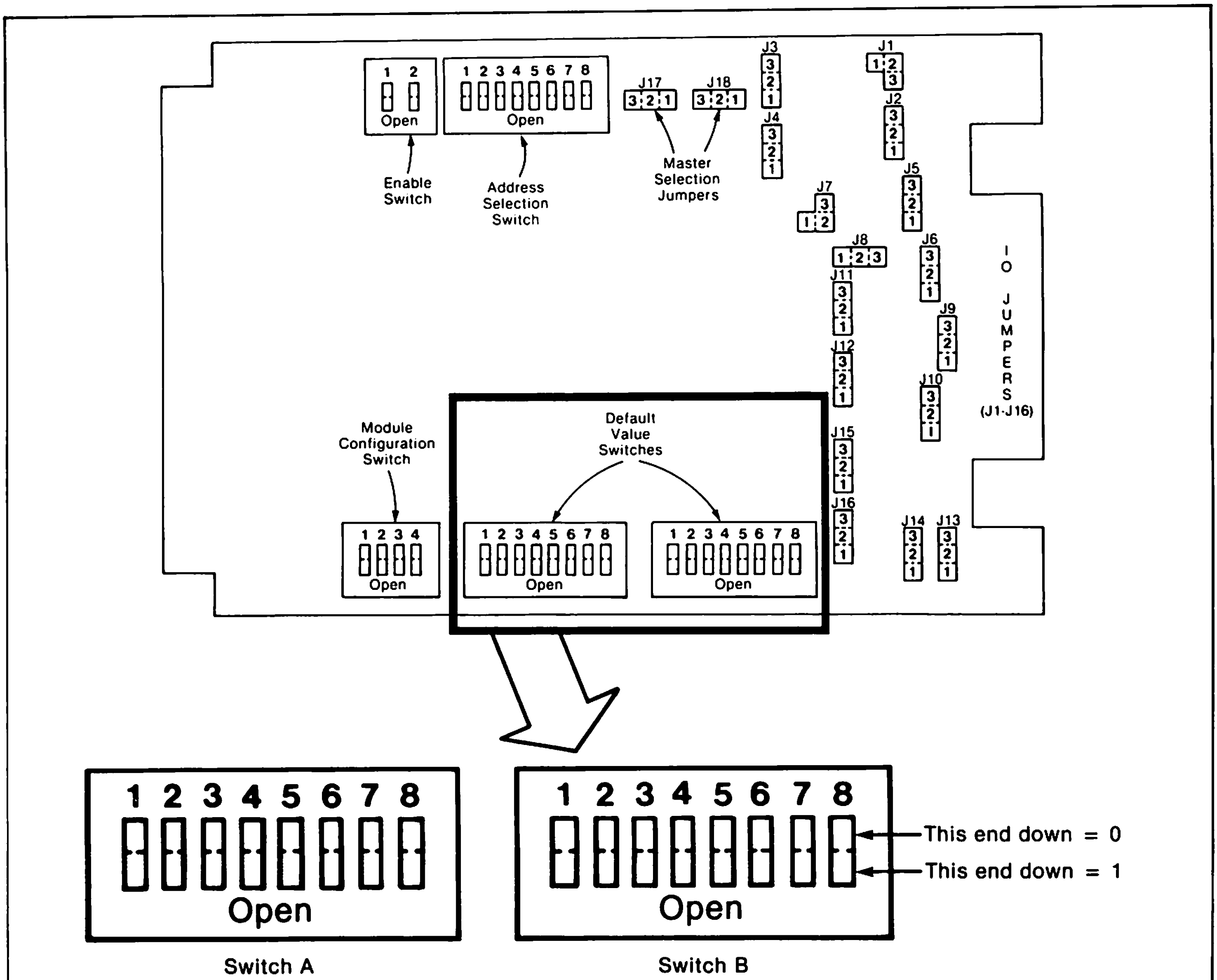
FIGURE 6 — Module Configuration Switch.

Contact 3 of the module configuration switch determines the unit to which the module interfaces. If the module is an I/O interface between a master and field devices (such as pushbuttons or relays), then the contact must be up; that is, in the 0 or "closed" position. If the module is to interface a master to a Digital Logic Station (DLS01), then the contact must be down; that is, in the 1 or "open" position.

In either of these DSM05 applications, the first two contacts of the configuration switch (contact 1 and contact 2) set the operation of two separate point groups in the I/O circuitry (see the **"I/O Circuitry of the DSM05"** section of this publication). Contact 1 sets the operation of one point group (group A). Contact 2 sets the operation of the other point group (group B). To set these groups for input, these contacts must be up; that is, in the 0 or "closed" position. To set these groups for output, these contacts must be down; that is, in the 1 or "open" position. (NOTE: When the DSM05 interfaces an LMM or an MFC to field devices, the user can set these contacts to make the I/O point groups either input or output. However, when the DSM05 interfaces a master to a DLS01, both point groups must be outputs. That is, contact 1 and 2 of the configuration switch must be "open.")

Contact 4 on the configuration switch defines the values of output signals during "default." This contact allows the DSM05 to set the operation of the output points if a master fails. When the DSM05 operates with a master, this contact supplies two options. Setting this contact up (that is, to 0 or "closed") drives all outputs to preset default values if a master fails (see **"Setting Default Value Switches"**).Setting this contact down (that is, to 1 or "open") freezes outputs as they are if a master fails. (NOTE: When the DSM05 interfaces a master to a DLS01, this contact must always be up to drive all outputs to preset levels.)

Setting Default Value Switches. Figure 7 shows the default value switches. If either master fails, these switches cause the point groups in the I/O circuitry of the DSM05 to output default values (if contact 4 of the configuration switch is closed). Default value switch A defines the default value of point group A. Default value switch B defines the default value of point group B. Each of these switches supports a group of eight contacts that correspond to the eight points in its related point group. Setting any contact to "open" energizes that contact and allows it to feed output signals from its I/O point during default. No restrictions apply to the setting of any of these contacts when a master interfaces field devices. However, when the DSM05 interfaces a master to a DLS01, contact 8 of default switch B must be set to de-energize (that is, up or "closed").



Default Value Switches

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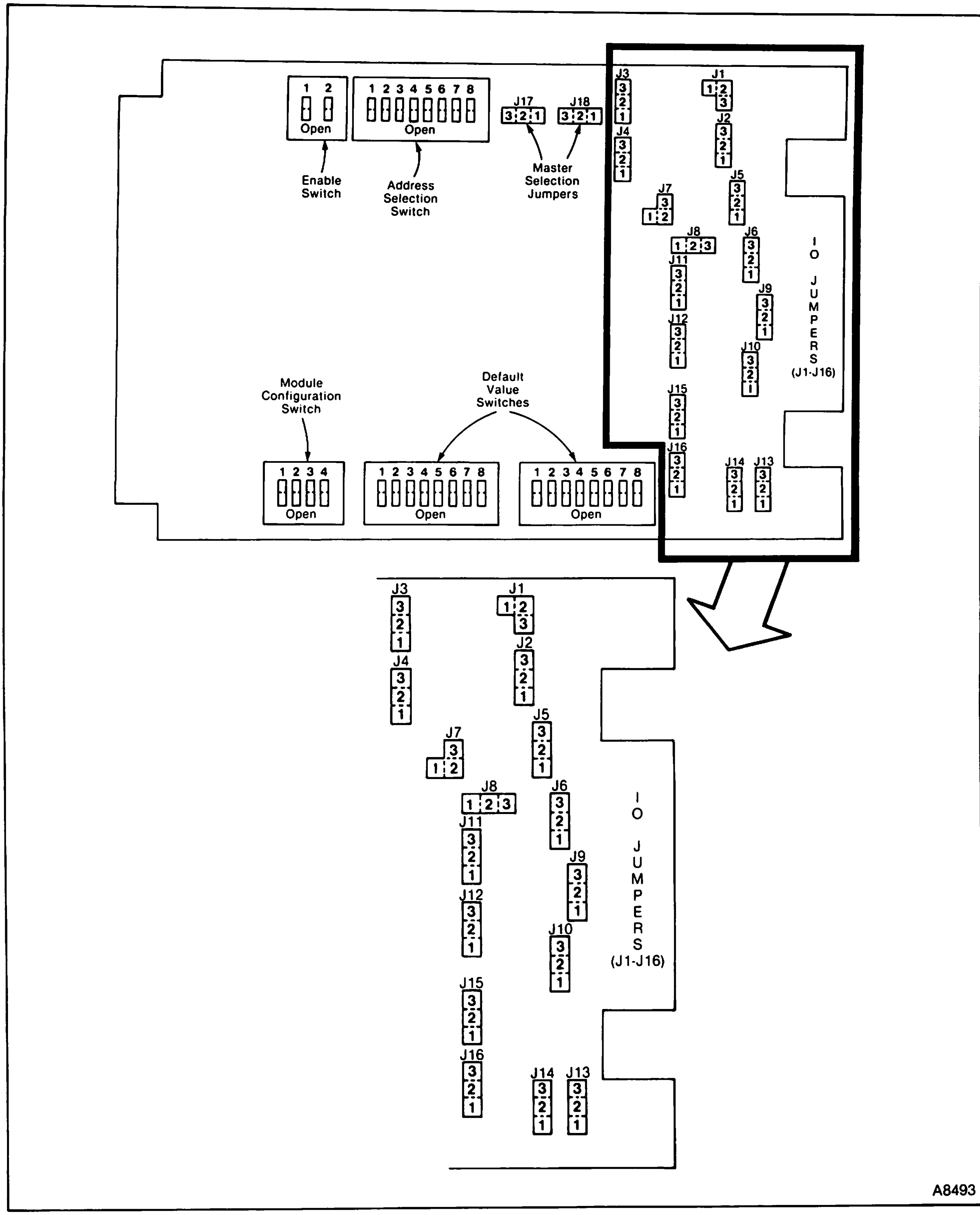

FIGURE 8 — Jumpers.

Setting Jumpers. Each of the I/O points has a removable jumper (see Figure 8). The user can mount this jumper between two of three posts for each input or output point. When selecting an I/O point for input, always place these jumpers between posts 1 and 2. Variation begin only when choosing an I/O point for output. For outputs, placing the jumper between posts 1 and 2 causes the DSM05 to operate normally. When the jumper is between posts 2 and 3, it isolates the outputs from each other and from inputs. This jumper setting makes the output a "two-wire isolated" output. (NOTE: In this configuration, the front panel LED for the I/O point does not light and the DSM05 cannot sense the state of the I/O point's signal line.)

The user must set the jumpers so that they relate to the type of output he has chosen for the DSM05. For "common" outputs (that is, outputs going to an electrically common destination), the jumper must be between posts 1 and 2. For "isolated" outputs (that is, outputs going to destinations which are not electrically common), these jumpers must be between posts 2 and 3. Precise setting information for these jumpers appears in the **"Setting Up Dipshunts and Terminal Blocks"** section of this publication.

The DSM05 printed circuit card also has two "Master Selection" jumpers (see the upper portion of Figure 8). The user must set these jumpers according to the type of master he uses in his system. If the DSM05 interfaces an LMM01, the user must place jumpers J17 and J18 between posts 1 and 2. If the DSM05 interfaces an MFC, the user must place jumpers J17 and J18 between posts 2 and 3.

Preparing the Termination Unit (TDI01)

Figure 9 is a photograph of the termination unit (TDI01) for the DSM05. To prepare the termination unit for installation, the user must:

- Set up the dipshunts on the unit for his particular application.
- Set up the terminal blocks on the unit for his particular application.

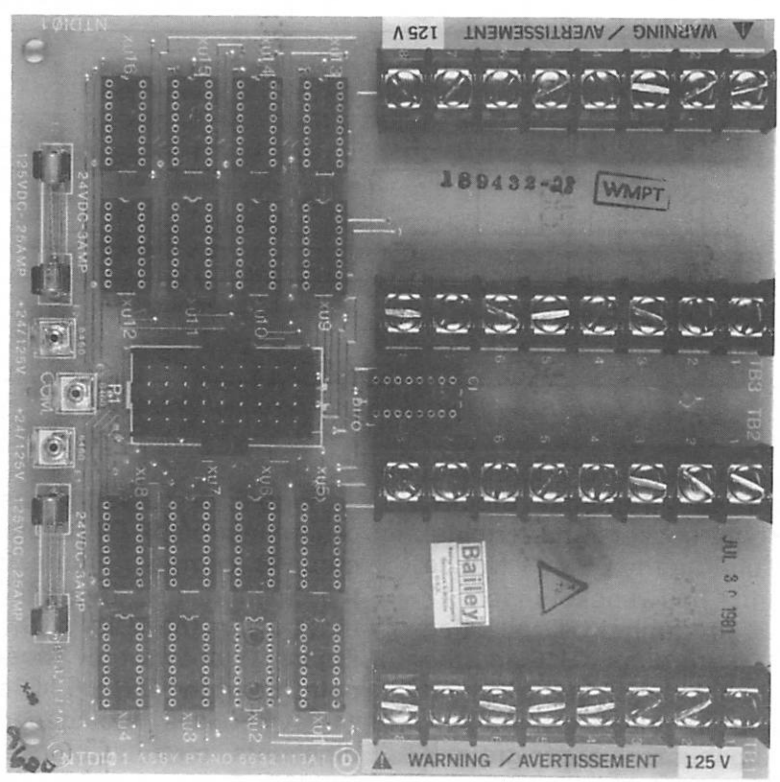

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FIGURE 9 — Termination Unit TDI01.

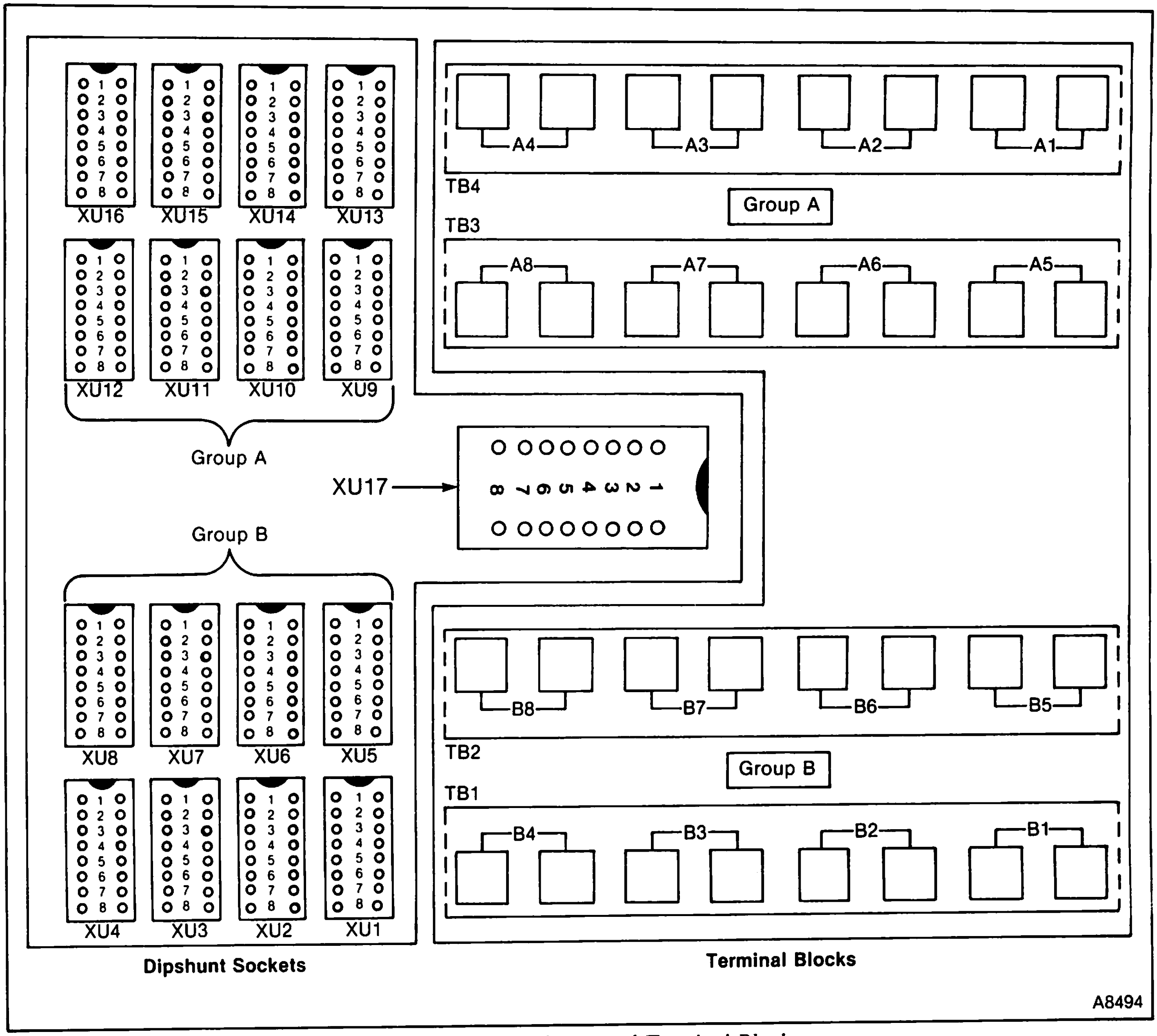

FIGURE 10 — Dipshunts and Terminal Blocks.

Setting Up Dipshunts and Terminal Blocks. Figure 10 shows the dipshunt sockets and terminal blocks on the termination unit for the DSM05. Notice that the termination unit has sockets for 17 dipshunts (numbered XU1 through XU17). Notice also that both dipshunts XU1 through XU16 and the terminal blocks fit into two groups: group A and group B. Group A dipshunts relate to group A terminal blocks. Group B dipshunts relate to group B terminal blocks. Both dipshunts and terminal blocks relate to I/O circuitry on the DSM05 module. Figure 11 shows an example of this.

Figure 11 shows the positive and negative posts of terminal block B1 as they tie to dipshunt XU1 in group B (compare Figure 10). It further shows how the dipshunt ties (through posts 4 and 5) to cables that go from the TDI01 to the DSM05 module. Finally, Figure 11 shows how those cables connect to I/O point B1 in the DSM05 I/O circuitry. In short, Figure 11 symbolizes the general relationship of the dipshunts, terminal blocks, and I/O points on the DSM05. This general relationship is a framework upon which users can build specific input or output systems. The user must build such systems before

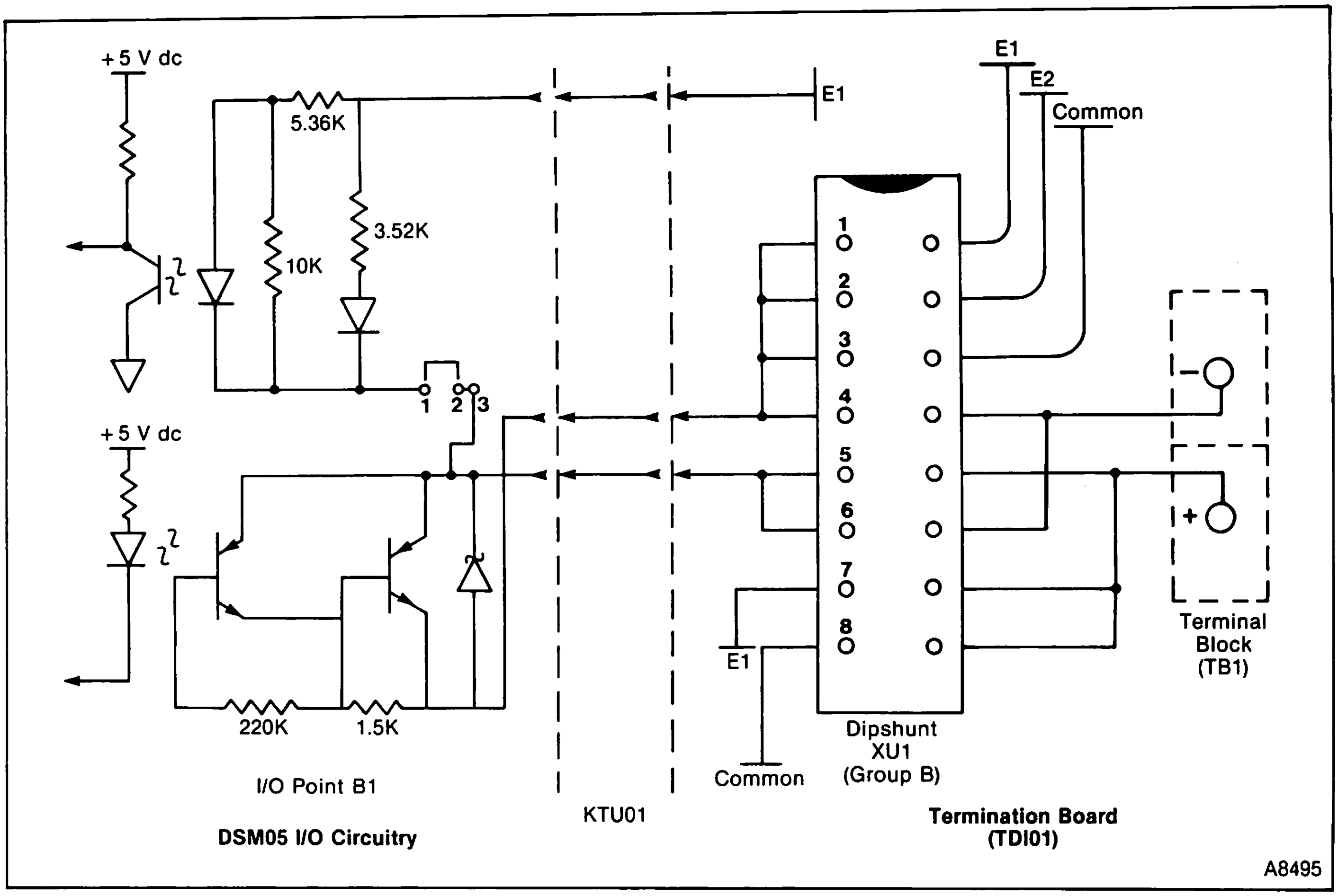

FIGURE 11 — Relationship Among Terminal Blocks, Dipshunts, and I/O Points.

he mounts the DSM05 into the NETWORK 90 MMU. Specific examples follow.

Building an Input System. Building an input system for the DSM05 is simple. For example, if the I/O points in group B are inputs, set the I/O point/dipshunt/terminal block relationship as shown in Figure 12.

For a system such as that in Figure 12, the user connects dry contacts or solid state switches from somewhere in the circuitry of his process to the terminal blocks of group B. He also configures the dipshunts of group B exactly as shown in the figure. That is:

- The user cuts straps 1, 2, 6, 7, and 8.
- The user leaves straps 3, 4, and 5 intact.

When the user's dry contacts or solid state switches close, 24 V dc flows through the DSM05 and TDI01 to the user's process. (NOTE: Closing these contacts/switches lights the LEDs on the front panel of the DSM05.) When the user's dry contacts or solid state switches open, 24 V dc does not flow to ground from the TDI01. (NOTE: Opening these contacts/switches extinguishes the LEDs on the front panel of the DSM05). Notice, here, that jumpers J1-J16 are between posts 1 and 2 for all active input points.

Building an Output System. When the user defines a point group for output, he may use either the internal power of the NETWORK 90 system or another 24 V dc source as his power supply. In either case, the user may configure his outputs as "common" outputs or as "isolated" outputs. Common outputs send power to some electrically common destination. Isolated outputs send power to destinations which are not electrically common. I/O jumper settings and dipshunt configurations are vital here. They must relate exactly to the type of output the user requires. Examples follow.

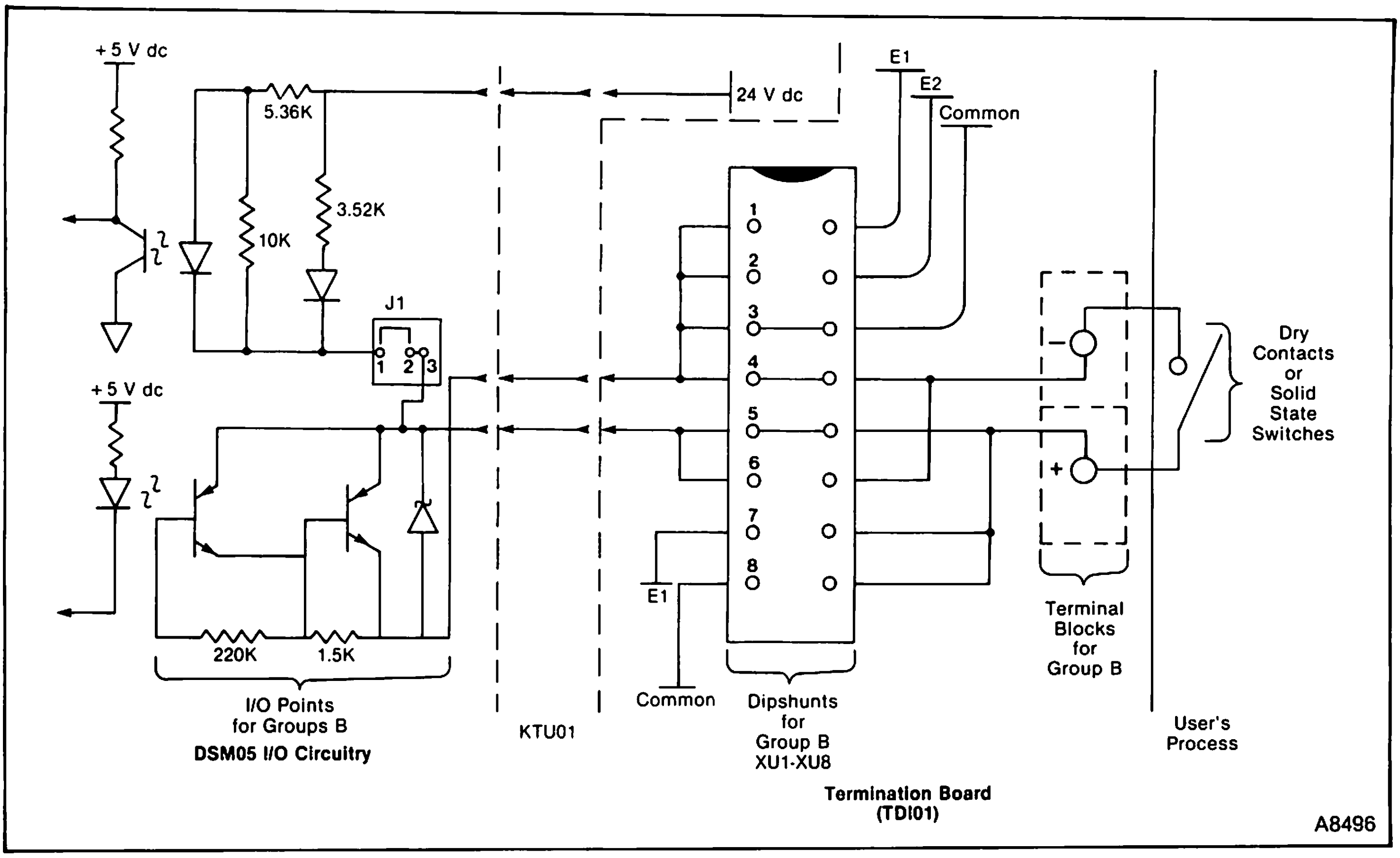

FIGURE 12 — Logic Input Set Up (24 V dc internal power)

Example 1: Powering an External Load. Figure 13 shows an example of how the user sets up an I/O point so that the DSM05 can power an external load. Note that the user has attached an external load to terminal block B1. He is bringing 24 V dc from the NETWORK 90 system into the I/O point (through strap 7 on dipshunt XU1). To complete the circuit, the user must:

- Cut dipshunt straps 1, 2, 4, 5, and 8.
- Leave dipshunt straps 3, 6, and 7 intact.

A transistor in the I/O circuitry on the DSM05 controls current flow.

In Figure 13, jumper J1 is between posts 1 and 2. In this case, this makes output B1 a "common" output. All other output points in group B with jumpers between posts 1 and 2 send their outputs to the same destination as B1 (a "common" destination). To "isolate" any output in group B, the user simply moves this jumper to posts 2 and 3. This allows the user to send the 24 V dc internal power of the NETWORK 90 system to a destination that is different from the destination of his "common" outputs. In "isolated" applications, the DSM05 cannot sense the status of the output line and the front panel LED for that output point does not light.

Example 2: Sinking an External Load. Figure 14 shows an example of how the user sets up an I/O point so that the DSM05 can "sink" an external load. A transistor in the DSM05 circuitry again controls current flow. The transistor allows current to flow from the user's process, through output point B1, across dipshunt XU1, and back across dipshunt XU1 to ground (common). Here, the user need attach only one wire from his process to the negative terminal of terminal block B1. He must also:

- Cut dipshunt straps 1, 2, 4, 5, 7, and 8.
- Leave dipshunt straps 3 and 6 intact.

If he wants this output to be a "common" output, he must place jumper J1 across posts 1 and 2 (as shown in Figure 14). If he wants this output to be an isolated output, he must place jumper J1 across posts 2 and 3.

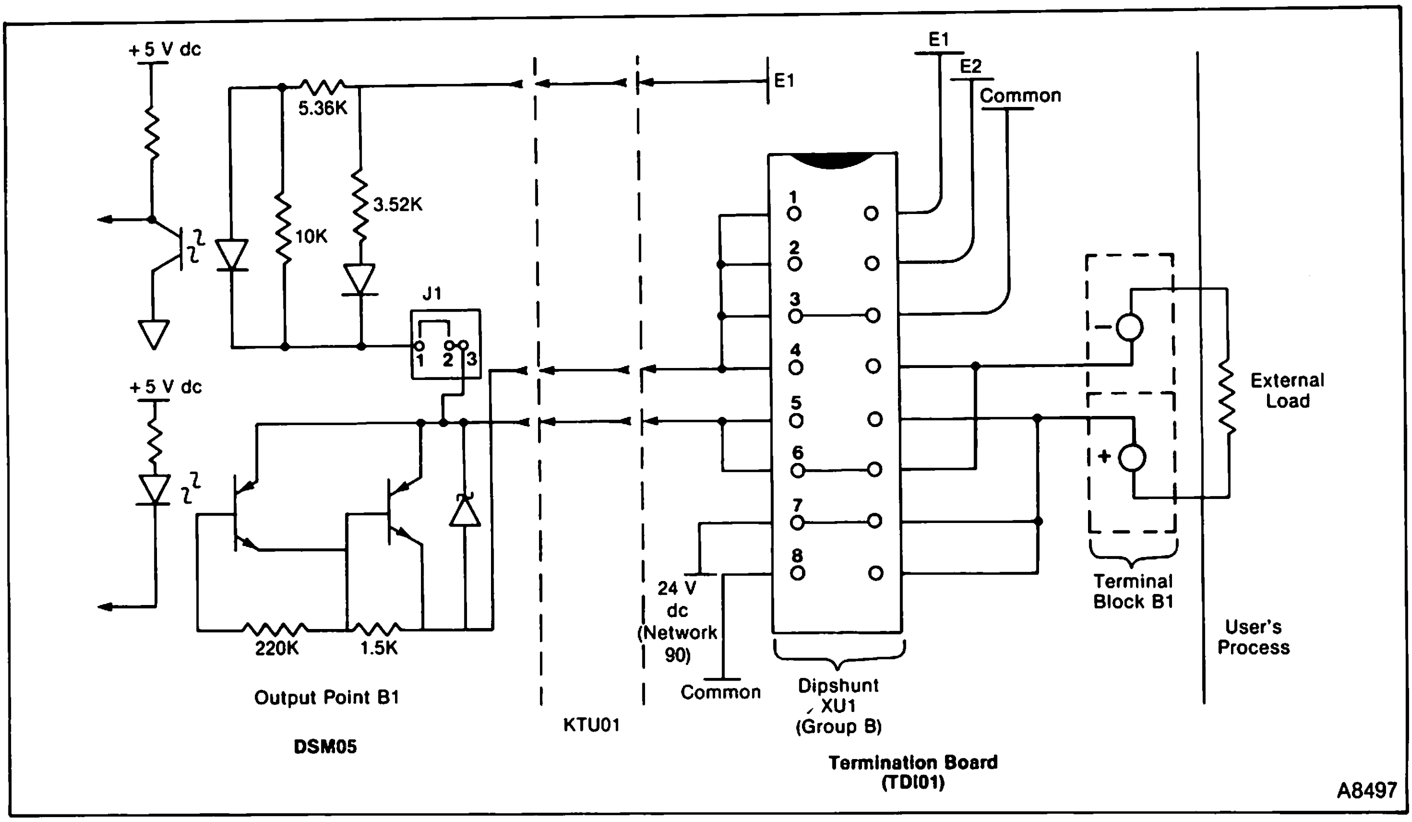

FIGURE 13 — Using the DSM05 to Power an External Load.

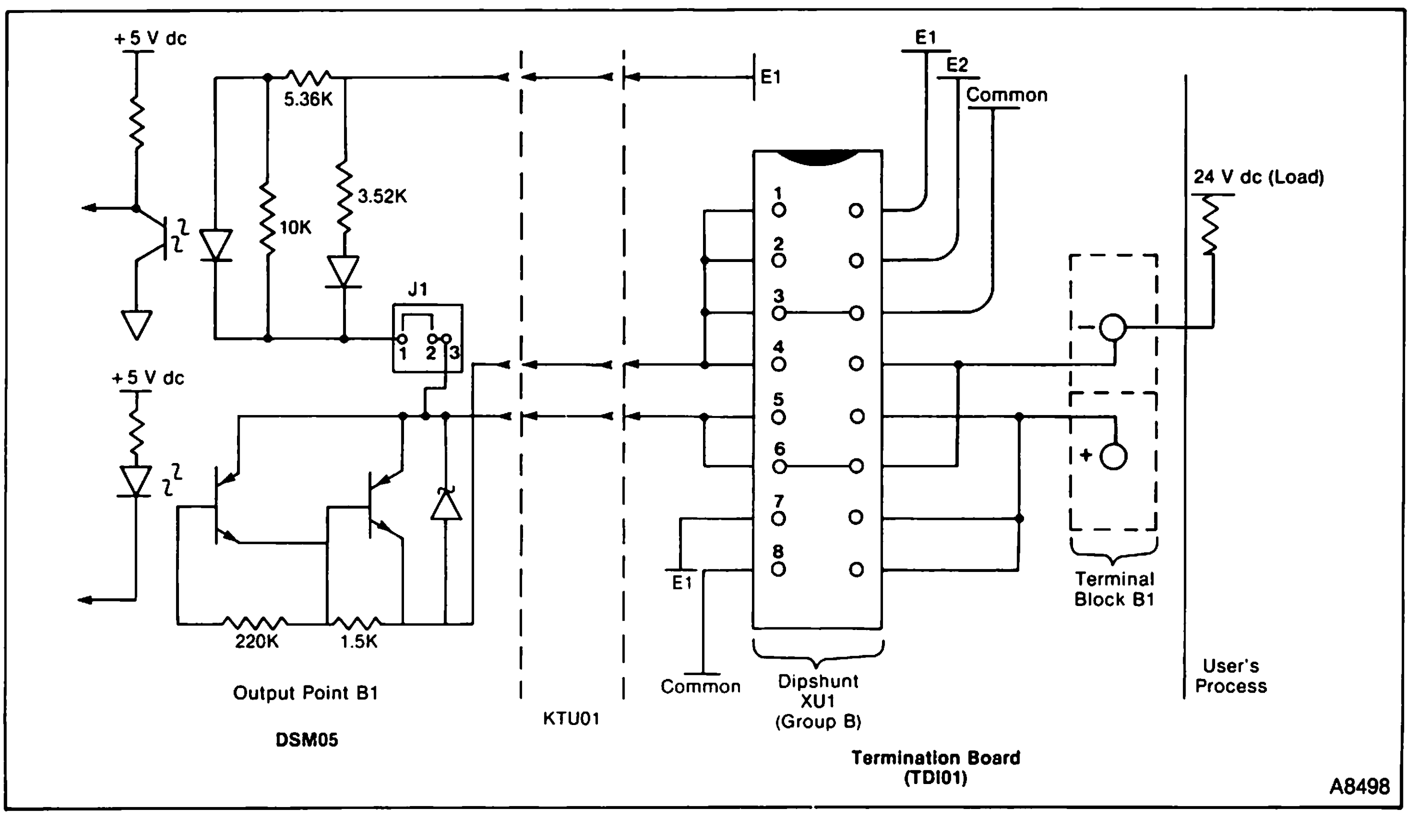

FIGURE 14 — Using the DSM05 to Sink an External Load.

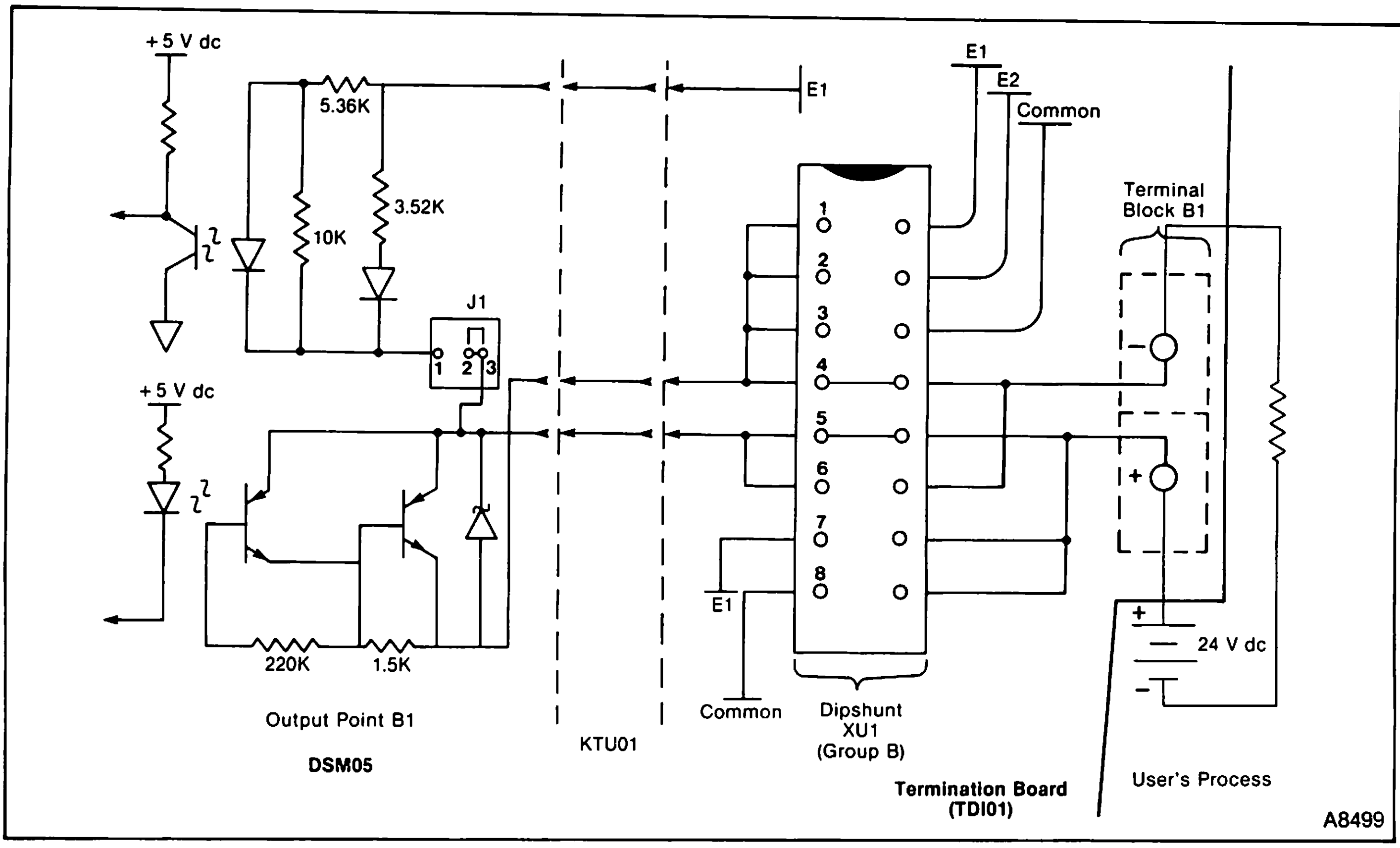

FIGURE 15 — Using the DSM05 for Isolated Outputs.

TABLE 7
Summary of Installation Relationships

APPLICATION	POSITION OF I/O JUMPER	DIPSHUNT CONFIGURATION	TERMINAL BLOCK WIRING
Input • All	Posts 1 and 2 I(All active I/O points)	Strap: 3, 4, 5 Cut: 1, 2, 6, 7, 8	Dry contacts or solid state switches
Output • Powering external load	Posts 1 and 2 (common output)	Strap: 3, 6, 7 Cut: 1, 2, 4, 5, 8	Common external load requiring 24 V dc.
	Posts 2 and 3 (isolated output		Isolated external load requiring 24 V dc.
• Sinking external load	Posts 1 and 2 (common output)	Strap: 3, 6 Cut: 1, 2, 4, 5, 7, 8	Common external power source of 24 V dc (one wire from each source to negative post of terminal block)
	Posts 2 and 3 (isolated output)		Isolated external power source of 24 V dc (one wire from each source to negative post of terminal block)
• Isolated outputs	Posts 2 and 3 (isolated only)	Strap: 4, 5 Cut: 1, 2, 3, 6, 7, 8	User supplies both 24 V dc (to positive post of terminal block) and ground (common; to negative post of terminal block)

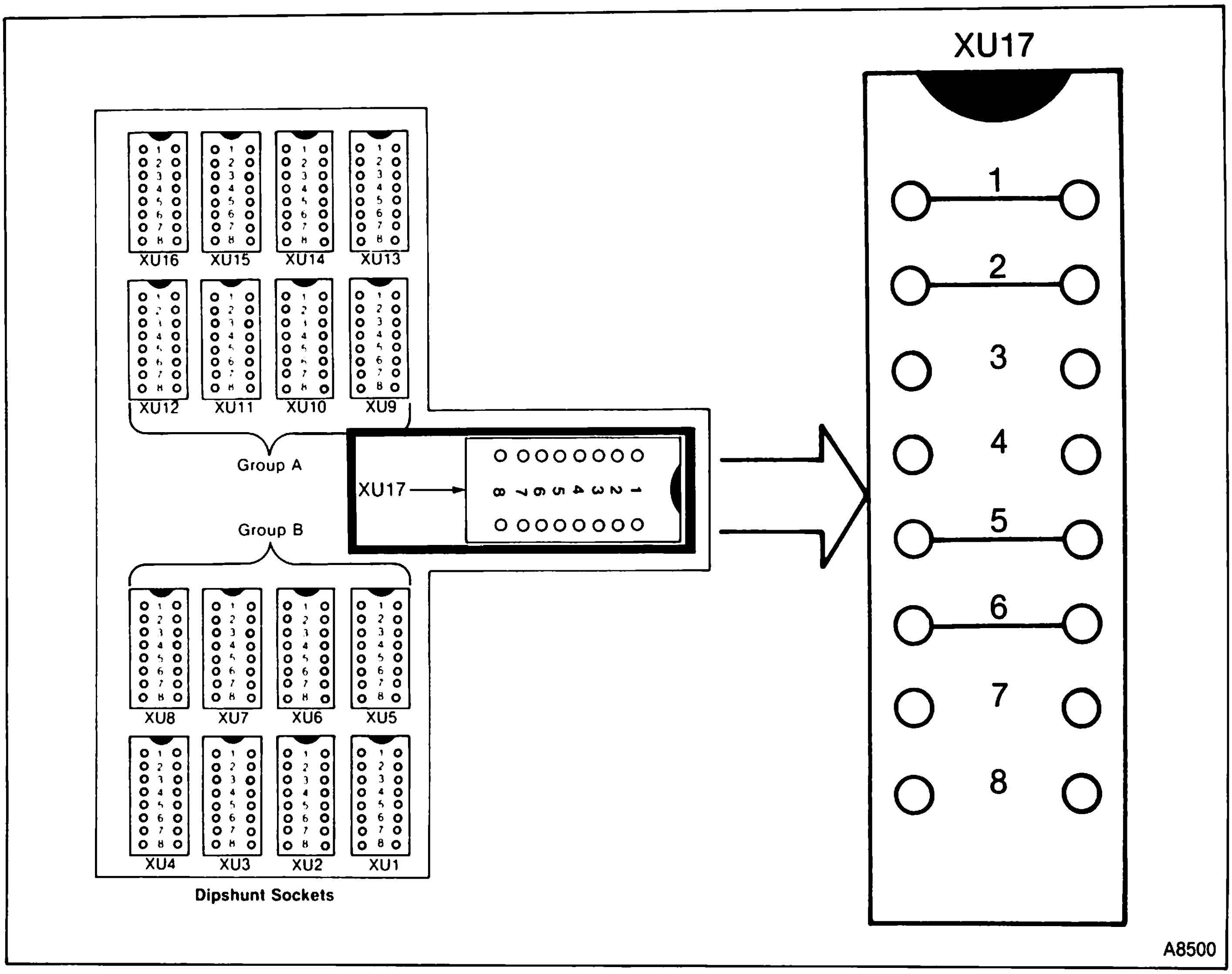

FIGURE 16 — Dipshunt XU17.

Example 3: Isolated Outputs. Figure 15 shows how the user sets up an I/O point so that the DSM05 can handle certain types of isolated outputs. Note that, in this example, jumper J1 is between posts 2 and 3. Here, the user supplies both 24 V dc and ground (common) in his process. He:

- Cuts dipshunt straps 1, 2, 3, 6, 7, and 8.
- Leave dipshunt straps 4 and 5 intact.

A transistor in the DSM05 circuitry once again controls current flow. Front panel LEDs do not light in this application.

Table 7 summarizes all of the information the user needs to prepare the DSM05 for installation. It lists the relationships among the possible applications the user can choose, the placement of the I/O jumpers, the strapping of the dipshunts, and the wiring of the terminal blocks.

Preparing Dipshunt XU17. The setting of dipshunt XU17 defines a termination unit specifically for the DSM05. Figure 16 shows the XU17 dipshunt as it applies to DSM05 applications. All XU17 dipshunts for termination boards that interface the DSM05 to field devices must be configured as Figure 16 shows; that is:

- Straps 3, 4, 7, and 8 must be cut.
- Straps 1, 2, 5, and 6 must be intact.

General Installation Procedures

After the user has prepared both the printed circuit card and the termination unit for the DSM05, he may install both. General installation procedures for each follow.

Installing the DSM05 Printed Circuit Card. The DSM05 fits any slot on the MMU. Electrically, the module should be in a slot where its expander bus interface connects to the MMU expander bus. All electrical connections for the module go through a 12-strap dipshunt that is inserted onto the back of the MMU backplane. The module slides into the plastic guides that line each slot. A latch on the bottom of the faceplate "clicks" into the frame of the MMU when the module is fully inserted. The top and bottom of the faceplate should then be flush with the MMU. To remove the module, squeeze the "front plastic frame." This lifts the securing latch from the frame of the MMU and allows the user to slide the module out (see Figure 17).

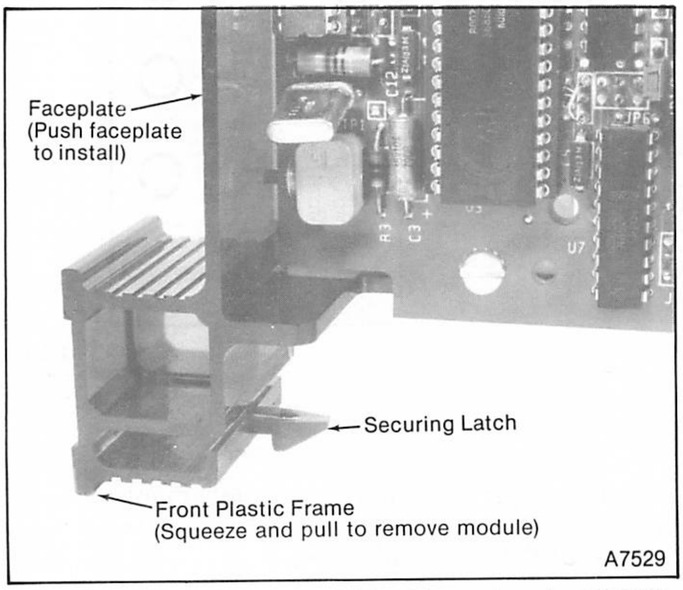

FIGURE 17 — Installing and/or Removing the DSM05.

The module has three gold plated connectors along the edge of its printed circuit card. The 12-pin connector along the upper edge of the card (P1) supplies the module's +5 V (±5%) logic power from the MMU backplane. A 12-pin connector along the lower edge of the card (P2) ties the DSM05 to the expander bus. The 16 digital I/O signals, and the 24 V power for those signals, flow through a 30-pin connector (P3) along a termination unit cable (KTU01) from the termination unit (TDI01). Figure 18 shows the normal position of the DSM05 in the MMU.

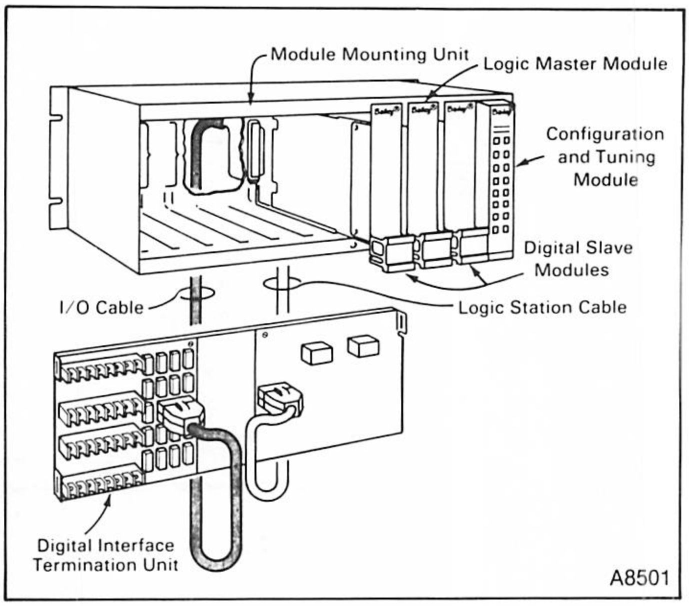

FIGURE 18 — Normal Position of the DSM05.

Tables 8, 9, and 10 list the pinouts for P1, P2, and P3 connectors.

TABLE 8
Pinouts for the P1 Connector

Pin 1	+5 V power	Pin 7	Unused
Pin 2	+5 V power	Pin 8	Unused
Pin 3	Unused	Pin 9	Unused
Pin 4	Unused	Pin 10	Unused
Pin 5	Power common	Pin 11	Unused
Pin 6	Power common	Pin 12	Unused

Installing the TDI01 Termination Unit. Installing the termination unit (TDI01) is a seven step procedure as follows:

a. Cut dipshunts for XU1-XU16 per application(s). (See **"Setting Up Dipshunts and Terminal Blocks"** and Table 7.)

b. Cut dipshunt straps for XU17 (See **"Preparing Dipshunt XU17."**).

c. Mount dipshunts into dipshunt sockets. (See Figure 19.)

CAUTION: Make sure strap 1 of all dipshunts matches socket 1 of dipshunt sockets. This socket is always immediately below the "half-moon" indentation on the dipshunt socket. A "punched" hole (or dot) implies strap 1 on most dipshunts.

TABLE 9
Pinouts for the P2 Connector

PIN	LMM	MFC	PIN	LMM	MFC
2	BX0-Addr. 0, Data 0	Addr. 0, Data 0	8	BX6 Data 6	Data 6
1	BX1-Addr. 1, Data 1	Addr. 1, Data 1	7	BX7 Data 7	Data 7
4	BX2-Addr. 2, Data	Addr. 2, Data 2	10	$\overline{\text{Data Strobe}}$	$\overline{\text{Sync}}$
3	BX3-Addr. 3, Data	Addr. 3, Data 3	9	$\overline{\text{Address Strobe}}$	Clock
6	BX4 Read/$\overline{\text{Write}}$, Data 4	Addr. 4, Data 4	12	$\overline{\text{Reset}}$	GND
5	BX5 $\overline{\text{Data}}$/Status, Data 5	Addr. 5, Data 5	11	Default	+5 V

TABLE 10
Pinouts for the P3 Connector

Pin 1	Point 1 signal		I/O Group A	Pin 9	Point 1 signal		I/O Group B
Pin A	Point 1 common			Pin K	Point 1 common		
Pin 2	Point 2 signal			Pin 10	Point 2 signal		
Pin B	Point 2 common			Pin L	Point 2 common		
Pin 3	Point 3 signal			Pin 11	Point 3 signal		
Pin C	Point 3 common			Pin M	Point 3 common		
Pin 4	Point 4 signal			Pin 12	Point 4 signal		
Pin D	Point 4 common			Pin N	Point 4 common		
Pin 6	Point 5 signal			Pin 13	Point 5 signal		
Pin E	Point 5 common	shared pin		Pin P	Point 5 common	shared pin	
Pin 5	Point 6 signal			Pin 14	Point 6 signal		
Pin E	Point 6 common	shared pin		Pin P	Point 6 common	shared pin	
Pin 7	Point 7 signal			Pin 15	Point 7 signal		
Pin H	Point 7 common	shared pin		Pin S	Point 7 common	shared pin	
Pin J	Point 8 signal			Pin 8	Point 8 signal		
Pin H	Point 8 common	shared pin		Pin S	Point 8 common	shared pin	
Pin F	+24 V I/O power			Pin R	+24 V I/O power		

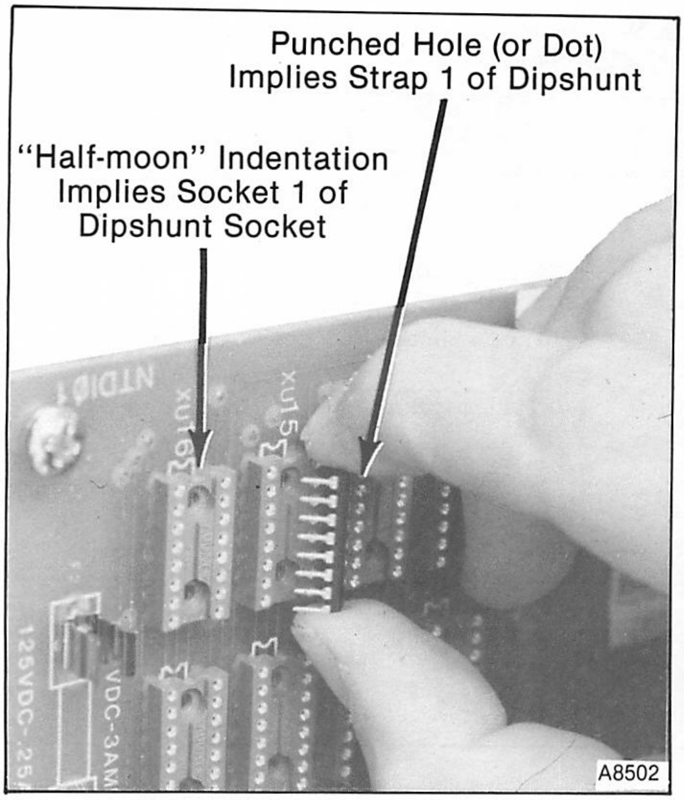

FIGURE 19 — Inserting Dipshunts.

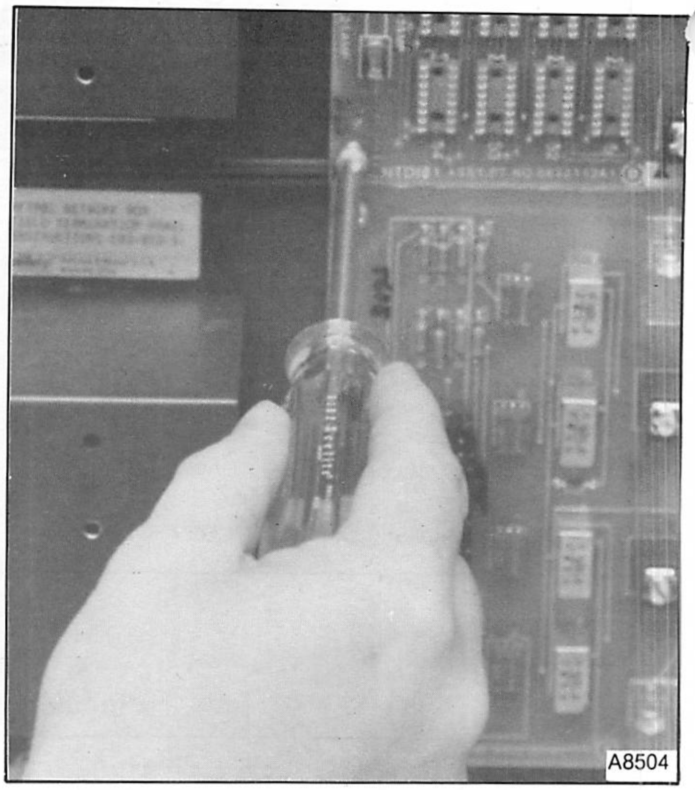

FIGURE 21 — Threading Screws to Secure TDI01.

FIGURE 20 — Sliding Termination Unit into Field Termination Panel.

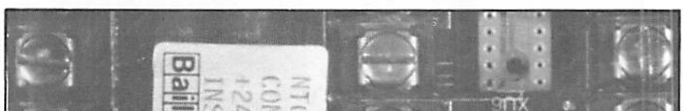

FIGURE 22 — Attaching Process Wire to Terminal Blocks

d. Slide edge (that is, "tabs") of TDI01 into slots ("stand-off") on field termination panel (see Figure 20).

e. Thread screws through panel mounting slots ("stand-off") and "tabs" (see Figure 21).

f. Attach wire(s) from process(s) to terminal block(s) (see Figure 22).

g. Attach NETWORK 90 power and ground wiring (see Figure 23).

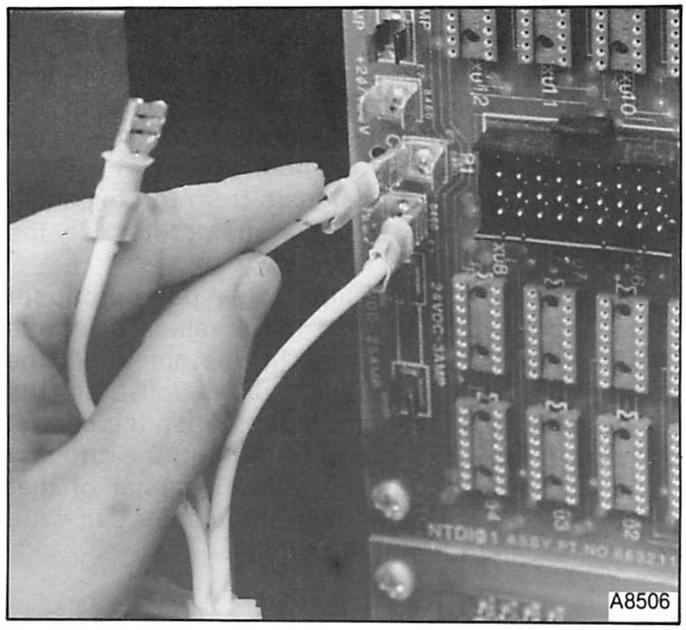

FIGURE 23 — Attaching NETWORK 90 Power and Ground Wiring.

THEORY OF OPERATION

To understand the way that the DSM05 works, the user must understand its:

- Expander bus interface
- Control circuitry
- I/O circuitry
- Isolation blocks
- Method of data transfer

Detailed descriptions follow.

The Expander Bus Interface

The expander bus interface carries address, data, and control signals between the DSM05 and a Logic Master Module (LMM) or a Multi-Function Controller (MFC). Address information (two 4-bit group addresses from the LMM; a 6-bit module address from the MFC) enters the interface through the expander bus. The interface compares the incoming address with the address of the DSM05. (NOTE: The address selection switches set this address. For more information about these switches, see the "**Installation**" section of this publication.) If the addresses match:

- The master can read the status from the configuration switches in the DSM05 across the bus interface.
- The master can read the point data from the I/O circuitry across the bus interface.
- The master can write point data to the I/O circuitry across the bus interface.

The Control Circuitry

The control circuitry of the DSM05 is the heart of the module. It responds to signals from either master across the expander bus and allows either master:

- To read input data
- To write output data
- To read group status

This circuitry, therefore, is the DSM05 component that handles the point and status data for the module. The control circuitry sets the input or output state of the two point groups according to the settings of the module configuration switch (see the "**Installation**" section of this publication). This block of circuitry responds to signals from the expander bus interface to allow either master to use the DSM05.

When the control circuitry sets a point group for input, the master can read input values or status information from that group. In this operation, the control circuitry "disables" or deactivates the output register of the point group. When the control circuitry sets a point group for output, the circuitry "enables" or activates the output register of that point group. In this operation, the master can write output data to that output register.

The I/O Circuitry

The DSM05 has two identical but independent I/O groups. Each of these groups has eight I/O points (that is, circuits). Each group of circuits can operate as eight inputs or eight outputs. Each point in each group handles one input or output signal. Figure 24 illustrates the basic structure of each I/O point. A description of the electronic function of an I/O point follows that figure.

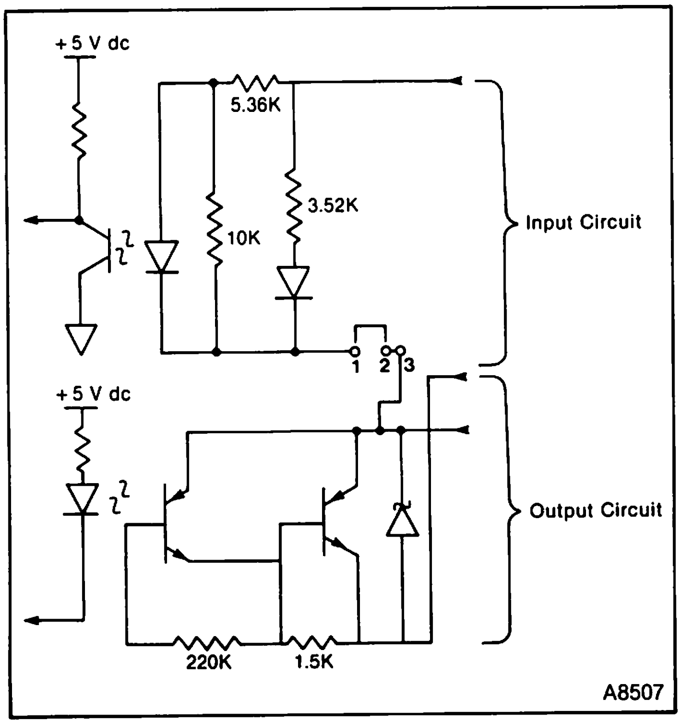

FIGURE 24 — Basic Structure of an I/O Circuit

Electronic Function. When the DSM05 uses an I/O point as an input, a signal from an external source controls the "logic level" of the circuit's signal line. External signals may set the line to "logic common" (0 V) or to "high" (24 V). When the signal is "low," current flows through the input circuit. Other circuitry in the DSM05 senses the current flow, lights the front panel LED that corresponds to the I/O point, and passes a logic "1" to the module. When the signal is "high," no current flows through the input circuit. Here, the front panel LED does not light and a logic "0" passes into the module.

When the DSM05 uses an I/O point for output, the module uses the circuit's transistor to control the "logic level" of the signal. By energizing the transistor, the module switches the signal line to low. This lights the front panel LED associated with the I/O point and allows the module to sense the output of the point as a logic "1." When the transistor is not energized, the circuitry sets the signal line to high. In this instance, the front panel LED does not light and the module senses the output of the point as a logic "0." (NOTE: During any "power-on reset" of the DSM05 [such as during installation, before reconfiguration, or after a power outage], the module latches all of its outputs off if the user sets the configuration switch so that outputs hold values on default. The outputs remain off until a master re-establishes communication with the DSM05. The outputs go to preprogrammed default states if both:

- The master module is active.
- The user sets the configuration switch so that the outputs go to preprogrammed states on default. See the "**Setting the Module Configuration Switch**" section of this publication.)

Typical Applications. The structure of the I/O points allows the DSM05 to sense 24 V input signals from and drive 24 V I/O signals to exterior devices. In certain NETWORK 90 configurations, the DSM05 can sense "contact closures" (such as pushbuttons or switches) from other devices. The DSM05 treats these contact closures as input signals. The DSM05 can also use its output transistor to drive I/O signals to various 24 V devices in some NETWORK 90 configurations (see "CAUTION").

CAUTION

In each I/O group, the logic common of point 5 ties to point 6 and the logic common of point 7 ties to

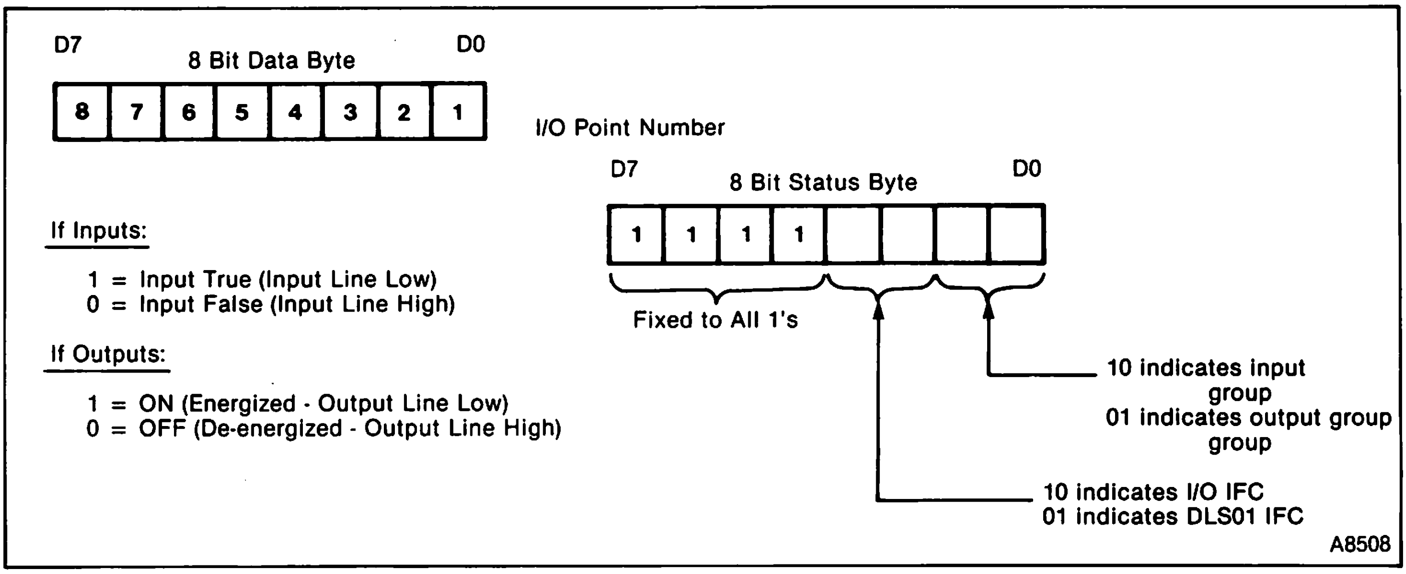

FIGURE 25 — Status and Data Bytes

point 8. This commonality may affect the performance of the DSM05 when it interfaces some field devices.

The Isolation Blocks

The isolation blocks on the DSM05 are optoelectronic integrated circuits. These circuits isolate or electrically separate the control circuitry (which uses a 5 V power supply) from the I/O circuity (which uses a 24 V power supply).

Data Transfer

The DSM05 transfers status information or input/output data in eight-bit bytes. Figure 25 illustrates the format of these bytes. A brief description of the data transfer operation that the DSM05 performs for each master follows that figure.

Data Transfer with the LMM. When the DSM05 interfaces the LMM, the DSM05 transfers one status or data byte at a time. The LMM addresses a point group and reads the status bytes associated with that point group. This status byte tells the LMM whether the point group is set for input or output. The LMM can then:

- Read input data from point groups set as inputs.
- Write output data to point groups set as outputs.

Data Transfer with the MFC. When the DSM05 interfaces the MFC, the DSM05 transfers two status bytes or data bytes at once. One byte corresponds to point group A. The other byte corresponds to point group B. Here, the MFC reads one status byte from each point group. These status bytes tell the MFC:

- That point group A is set to input while point group B is set to output.

  \- or -
- That point group A is set to output while point group B is set to input.

  \- or -
- That both the point groups are set to input

  \- or -
- That both the point groups are set to output.

The MFC can then:

- Read input data from one point group.

  \- or -
- Write output data to one point group.

  \- or -
- Read input data from both point groups.

  \- or -
- Write output data to both point groups.

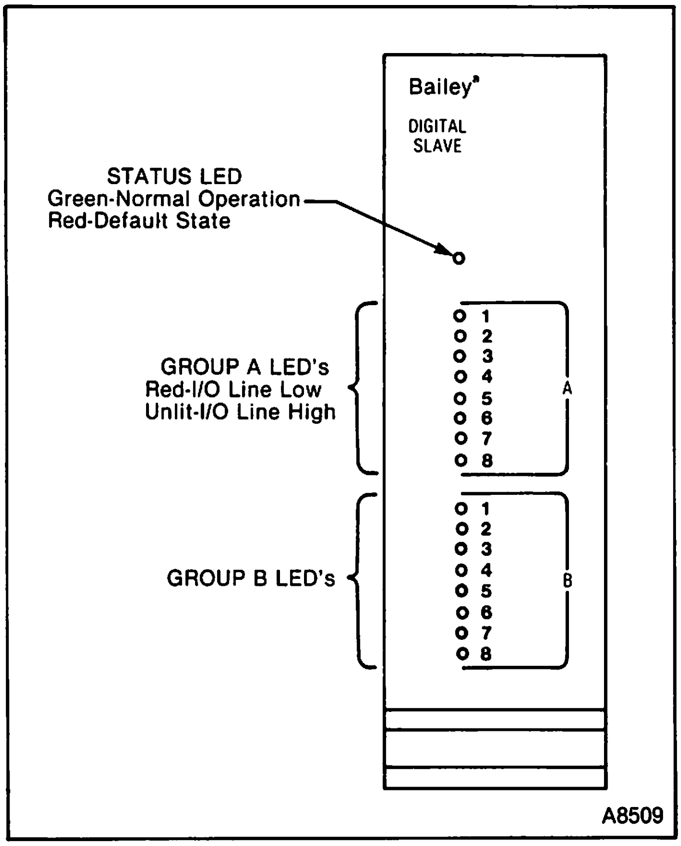

FIGURE 26 — DSM05 Front Panel and LEDs.

Configuration and Tuning

Indicators

Behind the front panel of the DSM05 are 17 LEDs. These LEDs indicate the operating state of both the DSM05 and the system that the DSM05 serves. The user can see these LEDs through the plastic faceplate of the panel. Figure 26 shows the location of the LEDs. Brief descriptions of the meanings of the LEDs follow that figure.

The "Status LED. The "status" LED is a solid state, two-color lamp that shows the operating state of the system. In LMM systems, the DSM05 control circuitry always drives the status LED green to show that the LMM is operating normally in the "execute" mode. If the LMM enters the "configure" or the "error" mode (or if the LMM is removed from the MMU), the control circuitry drives the status LED red. In MFC systems, the control circuitry drives the status LED only when the MFC communicates with the DSM05. When the user first plugs the DSM05 into the system, the LED remains off until the MFC communicates with the slave. The LED glows green when the communication link is complete. If the MFC fails (or is removed from the MMU), the control circuitry drives the status LED red. The LED remains red until a working MFC "re-enters" the system (that is, is installed in one of the slots of the MMU). The control circuitry then turns the red LED off. Once the new MFC establishes communication with the slave module, the DSM05 control circuitry again drives the status LED green.

The "Group Signal" LEDs. The LEDs in the "group signal" section of the panel are solid state, ON/OFF lamps. Each of these LEDs show the operating state of one of the I/O points in the DSM05 (see the "I/O Circuitry" section of this publication). When the input/output line of the IO point is low, its associated LED glows red. This implies that the DSM05 I/O point is passing a logic 1 through the control logic to the master. When the input/output line of the I/O point is high, its associated LED remains unlit. This implies that the DSM05 I/O point is passing a logic 0 through the control logic to the master.

How to Configure and Tune the DSM05

See the "**Installation**" section of this publication to learn how to configure the DSM05. The DSM05 is not tunable.

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