LONWORKSTM MODULE
8-CHANNEL DC DISCRETE OUTPUT

This Instruction contains installation and servicing procedures for the LonWorks module(s) listed in the table below. Acromag, Inc. manufactures the module(s). The table provides the module description, the Moore part number, and the equivalent Acromag model number.

<table>
<thead>
<tr>
<th>MODULE DESCRIPTION</th>
<th>MOORE P/N</th>
<th>ACROMAG MODEL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-Channel DC Discrete Output Module</td>
<td>27005-15</td>
<td>560L3-610-8DO-10-NCR</td>
</tr>
</tbody>
</table>

Two major sections are found in this Instruction. General information on a LonWorks module ordered from Moore is located in this section. The Acromag User’s Manual for the module is the second section.

Go to the Acromag section of this Instruction to install or calibrate a module. For product support or repair, read the following paragraphs. These statements supersede or amend similar information in the Acromag section.

PRODUCT SUPPORT

Product support can be obtained from a Technical Information Center (TIC). Each regional TIC is a customer service center that provides direct telephone support on technical issues related to the functionality, application, and integration of all products supplied by Moore. Regional TIC contact information is provided in the following table. Your regional TIC is the first place you should call when seeking product support information. When calling, it is helpful to have the following information ready:

- Caller ID number or name and company name - When you call for support for the first time, a personal caller number is assigned. Having the number available when calling for support will allow the TIC representative taking the call to use the central customer database to quickly identify the caller’s location and past support needs.

- Product part number or model number and version

- If there is a problem with product operation:
  - Whether or not the problem is intermittent
  - The steps performed before the problem occurred
  - Any error messages or LED indications displayed
  - Installation environment

Customers that have a service agreement (ServiceSuite or Field Service Agreement) are granted access to the secure area of our Web site (www.mooreproducts.com/techservices). This area contains product support information. To log on, you will be prompted to enter your username and password.
TIC North America also offers a free faxback service called FaxRequest. You can dial-in to this service to access documents such as press releases, product information sheets, and training schedules. The service is completely automated and available 24 hours a day. To access this service, call the FaxRequest number listed in the tables below. The first document you should request is the directory (document number 9999). This document is updated as new documents are added. Each document has a number code assigned to it that you enter along with your fax number (area code entry is **always** required). Upon completing your entry, the FaxRequest computer automatically calls your fax machine and sends the requested documents.

### TIC NORTH AMERICA

<table>
<thead>
<tr>
<th></th>
<th>Tel:</th>
<th>Fax:</th>
<th>E-mail:</th>
<th>FaxRequest:</th>
<th>Bulletin Board Service:</th>
<th>Hours of Operation:</th>
<th>Secure Web Site:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+1 215 646 7400, extension 4842, option 1</td>
<td>+1 215 283 6343</td>
<td><a href="mailto:tiegroup@mpco.com">tiegroup@mpco.com</a></td>
<td>+1 215 646 7400, extension 4842, option 2</td>
<td>+1 215 283 4968</td>
<td>8 a.m. to 6 p.m. eastern time</td>
<td><a href="http://www.mooreproducts.com/techservices">www.mooreproducts.com/techservices</a></td>
</tr>
</tbody>
</table>

### TIC ASIA

<table>
<thead>
<tr>
<th></th>
<th>Tel:</th>
<th>Fax:</th>
<th>E-mail:</th>
<th>Hours of Operation:</th>
<th>Secure Web Site:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+65 299 6454</td>
<td>+65 299 6053</td>
<td><a href="mailto:lohho@mpco.com">lohho@mpco.com</a></td>
<td>9 a.m. to 6 p.m. Singapore time</td>
<td><a href="http://www.mooreproducts.com/techservices">www.mooreproducts.com/techservices</a></td>
</tr>
</tbody>
</table>

### TIC EUROPE

<table>
<thead>
<tr>
<th></th>
<th>Tel:</th>
<th>Fax:</th>
<th>E-mail:</th>
<th>Hours of Operation:</th>
<th>Secure Web Site:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+44 1935 470172</td>
<td>+44 1935 706969</td>
<td><a href="mailto:uktic@mpco.com">uktic@mpco.com</a></td>
<td>8:30 a.m. to 5:15 p.m. GMT/BST</td>
<td><a href="http://www.mooreproducts.com/techservices">www.mooreproducts.com/techservices</a></td>
</tr>
</tbody>
</table>
RETURN FOR REPAIR
This section modifies the General Maintenance section in the Acromag User’s Manual.

During the warranty period, remove a failed instrument from service and proceed as follows to return it to Moore for repair. For out of warranty repair, return the module to either Moore or Acromag.

TO RETURN EQUIPMENT

- Call Moore Products Co. at (215) 646-7400, ext. 4RMA (4762) weekdays between 8:00 a.m. and 4:45 p.m. Eastern Time. If outside of North America go to www.mooreproducts.com for the address and telephone and FAX numbers of your nearest Moore Products Co. subsidiary. Ask for an RMA (Return Material Authorization) number and be sure to mark the RMA number prominently on the outside of the shipment.

When calling for an RMA number, provide the reason for the return. If returning equipment for repair, failure information (e.g., error code, failure symptom, installation environment) will be requested. A purchase order number will also be needed.

MATERIAL SAFETY DATA SHEET

- A Material Safety Data Sheet (MSDS) must be included with each item being returned that was stored or used anywhere hazardous materials were present.

PACKAGING

- Package assembly in original shipping materials. Otherwise, package it for safe shipment or contact the factory for shipping recommendations.

An electronic module must be placed inside a static shielding bag to protect it from electrostatic discharge.

The Moore logo is a registered trademark of Moore Products Co.
Other trademarks are the property of their respective owners.

Moore Products Co. assumes no liability for errors or omissions in this and any attached documents or for the application and use of information included in this and any attached documents. The information herein is subject to change without notice.

Procedures in this document have been reviewed for compliance with applicable approval agency requirements and are considered sound practice. Neither Moore Products Co. nor these agencies are responsible for repairs made by the user.
INTRODUCTION:

These instructions cover the model types listed in Table 1 below. Supplementary sheets are attached for units with special options or features.

Table 1:
A. Model Number Format:
   - Function - Output - Power - Certification
B. Typical Model Number: 560L1-810-8DO-10-NCR

<table>
<thead>
<tr>
<th>Series/Network</th>
<th>-Function</th>
<th>-Output</th>
<th>-Power</th>
<th>-Cert.</th>
</tr>
</thead>
<tbody>
<tr>
<td>560L1</td>
<td>-810</td>
<td>-8DO</td>
<td>-10</td>
<td>-NCR</td>
</tr>
<tr>
<td>560L3</td>
<td>-810</td>
<td>-8DO</td>
<td>-10</td>
<td>-NCR</td>
</tr>
</tbody>
</table>

Notes (Table 1):
1. Consult the factory for current information on agency (e.g., Canadian Standards Association, etc.) approvals.

DESCRIPTION:

The Series 550L is a member of the Acromag SmartPack family. It provides eight general purpose discrete outputs. Associated with each digital output is an input network variable to control the output's state, and a watchdog timer that allows the user to specify the maximum time that may expire between updates for each output.

All SmartPack modules are designed for harsh industrial environments. They feature RFI and EMI protection, a wide operating temperature range, and isolation between power, network and I/O. They are DC powered, DIN-rail mountable, and available with either a twisted pair (TP/XF-78) or free topology (TP/FT-10) transceiver. Up to 64 modules can be connected on a single network segment. Multiple segments may be connected using repeaters to increase the number of modules and distance.

SmartPacks are interoperable with LONWORKS products from other manufacturers that use standard network variable types (SNVTs). Module calibration, configuration and network management are performed using a Windows™ configuration program on a PC.
SPECIFICATIONS:

DEFINITION: This DC-powered, SmartPack, LONWORKS module converts eight independent input network variables to eight discrete outputs. Unit provides three-way isolation between the output circuits, the network, and power circuit. The module is DIN-rail mounted.

MODEL/SERIES: 560 (Color coded with a Red label)

NETWORK (Designated by 'LX' of 560LX Model prefix):

Protocol: LonTalk®

L1: TP/TF-78, Twisted Pair
   Speed: 78.1kb per second.
   Media: Unshielded twisted pair, UL Level IV, No. 22 gauge wire.
   Distance: Up to 6500 feet (2000 meters).
   Nodes per Network Segment: 64 (0 to +70°C), 44 (-25 to +85°C). A LONWORKS router configured as a repeater is required for more than 64 nodes.

L3: TP/ET-10, Free Topology
   Speed: 78.1kb per second.
   Media: See Cable Type in Table 2 below.
   Distance: See Table 2 below.

Table 2: Free Topology Specifications

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Maximum module-to-module distance</th>
<th>Maximum total wire length for SmartPack Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belden 851C2</td>
<td>1640 ft (500 m)</td>
<td>1640 ft (500 m)</td>
</tr>
<tr>
<td>Belden 8471</td>
<td>1312 ft (400 m)</td>
<td>1640 ft (500 m)</td>
</tr>
<tr>
<td>Level IV, 22 AWG</td>
<td>1312 ft (400 m)</td>
<td>1640 ft (500 m)</td>
</tr>
<tr>
<td>JY (St) Y 2x2x0.8</td>
<td>1050 ft (320 m)</td>
<td>1640 ft (500 m)</td>
</tr>
</tbody>
</table>

Nodes per Network Segment: 64. A LONWORKS router configured as a repeater is required for more than 64 nodes.

FUNCTION: Code number used to represent the module's firmware functionality.

-610: See the network variables section for a description of the module's standard network variable types and operation.

OUTPUT: This module has eight general purpose discrete outputs (open drain FETs with a common return). The output state of each discrete output is available as a network variable output to be used to control other modules on the network.

-8DO: Eight Independent Open Drain FET Outputs, sharing a common return. Form A (Normally Open) SPST output. To control a higher amperage device, such as a pump, an interposing relay may be used (see Drawing 4501-476).

Output Voltage (OFF): 0 to 42VDC,
Output Current (ON):
   -25°C to 50°C: 0 to 275mA DC continuous,
   Above 50°C: derate 2mA/°C
Output (OFF) Leakage Current: 10µA DC @ 42VDC,
Output (ON) Resistance: 1.5Ω Maximum
Output (ON) Voltage @ 275mA DC: 0.30VDC, typical.

Excitation Supply: 4VDC nominal, current limited to 24 mA.

Isolation: Three-way isolation is provided between the digital output circuits, DC power, and the network. Outputs share a common return.

Outputs-to-Power and Network-to-Power: Outputs, as a group, can operate at up to 250V AC, or 354V DC off DC power ground, on a continuous basis (will withstand 1500V AC dielectric strength test for one minute without breakdown). This complies with test requirements outlined in ANSI/ISA-S82.01-1988 for the voltage rating specified.

Network-to-Outputs: The network can operate at up to 277V AC off DC power ground, on a continuous basis (will withstand 1000V AC dielectric strength test for one minute without breakdown).

POWER: Connect an external DC power supply to the Power (P) and (-) terminals. Currents specified are maximum values with outputs ON (each output) and the module transmitting on the network. An internal diode provides reverse polarity protection.

-10: +10 to 36V DC, current draw is a function of supply voltage and output type (refer to Table 3 below).

Table 3: Supply Current

<table>
<thead>
<tr>
<th>Supply Voltage</th>
<th>L1 without excitation</th>
<th>L1 with excitation</th>
<th>L3 without excitation</th>
<th>L3 with excitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10V</td>
<td>45mA</td>
<td>60mA</td>
<td>35mA</td>
<td>48mA</td>
</tr>
<tr>
<td>12V</td>
<td>40mA</td>
<td>50mA</td>
<td>31mA</td>
<td>41mA</td>
</tr>
<tr>
<td>15V</td>
<td>35mA</td>
<td>45mA</td>
<td>27mA</td>
<td>35mA</td>
</tr>
<tr>
<td>24V</td>
<td>25mA</td>
<td>30mA</td>
<td>21mA</td>
<td>26mA</td>
</tr>
<tr>
<td>36V</td>
<td>20mA</td>
<td>25mA</td>
<td>15mA</td>
<td>21mA</td>
</tr>
</tbody>
</table>

CAUTION: Do not exceed 36V DC peak, to avoid damage to the module.

Power Supply Effect: None.

Reset/Service Toggle Switch:
Reset Position: Allows the module to be reset to power-up conditions (toggle right).
Service Position: Causes the Network® chip inside the node to transmit its unique 48-bit ID and 8-byte program ID string (toggle left).
LED Indicators:
Power LED (Green): Indicates power applied to unit.
Service LED (Red): LED blinks at a 1/2 Hz rate for an unconfigured node. LED OFF for a properly functioning node. LED ON for failed node.
Status LED (Yellow): (See Figure 1) LED remains ON indefinitely upon receiving an "offline" network management command. LED remains OFF upon receiving a "online" network management command (normal operation). LED blinks at a 2.5 Hz rate for 10 seconds upon receiving a "wink" network command. LED flashes quickly 3 times each second to indicate that the watchdog timer has timed out on one of the discrete input variables.

Figure 1: Status LED Behavior

1. Offline/Online Commands:
   - ON
   - OFF
   - Offline Command
   - Online Command

2. Wink Command:
   - ON
   - OFF
   - 10 Seconds
   - 200 mS
   - 200 mS

3. Fault Sequence:
   - ON
   - OFF
   - 1 Second
   - Fault Removed

Reference Test Conditions: Network (78kB/S); 77°F (26°C); +15V DC supply.

Ambient Temperature Range: L1 (44 nodes): -13°F to +185°F (-25°C to +85°C), L1 (64 nodes): +32°F to +158°F (0°C to 70°C), L3 (64 nodes): -13°F to +185°F (-25°C to +85°C).

Ambient Temperature Effect: None.

Response Time: For a network variable change in value, the output will change states within 20ms. Typical.

RFI Resistance: Outputs do not change states under influence of RFI for field strengths up to 10V/meter at frequencies of 27MHz, 151MHz, and 467 MHz.

EMI Resistance: Outputs do not change states under the influence of EMI from switching solenoids or commutator motors.

Surge Withstand Capability (SWC): Input/Output power and network terminations are rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference) observed in actual installations.

Mounting: General Purpose Housing with integrated DIN-Rail Mount compatible with "G" & "T" rails. "G" Rail (32mm), Type EN50035, "T" Rail (35mm), Type EN50022. Refer to Drawing 4501-475 for outline and clearance dimensions. Shipping Weight: 1 pound (0.45 Kg) packed.

Construction:
Circuit Boards: Military grade FR-4 epoxy glass circuit board.
Terminals: Compression type, wire size 14 AWG maximum.
Mounting Position: Position insensitive.
Case: Self-extinguishing NYLON Type 6.6 polyamide thermoplastic UL94 V-2, color black. General Purpose, NEMA Type 1 enclosure.

CERTIFICATION: Consult the factory for current information on the availability of agency (e.g. Canadian Standards Association, Factory Mutual, etc.) approvals.

-NCR: No Certification Required.

INSTALLATION:

The module is packaged in a general purpose enclosure. Use an auxiliary enclosure to protect against unfavorable environments and locations. Maximum operating ambient temperatures should be within -13°F to 185°F (-25°C to 85°C) for satisfactory performance. Connect module as shown in Connection Drawing 4501-474.

Mounting: Mount module assembly as noted below refer to Drawing 4501-475 for mounting and clearance dimensions.

DIN Rail Mounting: Use suitable fastening hardware to secure the DIN rail to the designated mounting surface. A module can be mounted to a "T" or "G" Rail. Installation of the module to the rail depends on the type of DIN rail used (see Drawing 4501-474). Units can be mounted side-by-side on 1.6 inch centers, if required.

Electrical Connections:

The wire size used to connect the unit to the control system is not critical. All terminal strips can accommodate wire from 14-26 AWG. Strip back wire insulation 1/4-inch on each lead before installing into the terminal block. Input wiring may be shielded or unshielded twisted pair. Network wires should be twisted pair. Since common mode voltages can exist on signal wiring, adequate wire insulation should be used and proper wiring practices followed. It is recommended that network and power wiring be separated from the signal wiring for safety, as well as for low noise pickup.

1. Power: Connect DC power supply per Connection Drawing 4501-474. These modules operate from DC power supplies only. Power supply voltage is not critical and normally should be from 10.0V to 36V DC. The supply voltage must not exceed 36 Volts, even momentarily. Variations in power supply voltage, above the minimum required have negligible effect on module accuracy. Refer to "POWER" in the preceding SPECIFICATIONS section for current requirements. This device includes reverse polarity protection.
2. **Network**: Connect network per Connection Drawing 4501-474. Note: Network circuit is isolated from output and power circuits. See NETWORK specifications for the maximum number of nodes per network segment.

3. **Grounding**: The module housing is plastic and does not require an earth ground connection.

4. **Output Contacts**: Wire outputs as shown in Connection Drawing 4501-474. Refer to Drawing 4501-476 for interfacing to a DC interposing relay and for suggestions on relay contact protection.

**Open Drain FET Protection**: When driving relay coils or other inductive loads, diodes should be placed across each load to limit the voltage spike generated when an inductive load is switched off quickly. For DC inductive loads, place a diode across the load (1N4006 or equivalent) with the cathode to (+) and anode to (-), see Drawing 4501-474.

**NETWORK VARIABLES**:  

To provide interoperability, standard network variable types are used for all external interface and configuration variables. Figure 2 below illustrates the 550L's network variable types.

**Figure 2: Series 560L-810-8DO-10 SNVT Diagram**

```
HARDWARE OUTPUT

Output 1          Output 8

nv1_instate[ 8 ]
SNVT_lev_disc

nv0_statef[ 8 ]
SNVT_lev_disc

nv0_wd_status[ 8 ]
SNVT_lev_disc

External Interface Section

nci_op_mode[ 8 ]
SNVT_state

nci_watchdog[ 8 ]
SNVT_elapsed_tm

Configuration Section
```

All network variables are eight-element arrays. Discrete output 1's network variables are referenced with an array subscript of 0, 1 for discrete output 2, and so on.

Network variables within the External Interface Section are intended to be bound, polled, or written by other nodes on the network. These variables are maintained in RAM. Network variables within the Configuration Section are intended to be accessed by a network management tool to configure the module. These variables are maintained in EEPROM and are limited to 10000 write cycles. In addition, values written into configuration network variables do not take effect until the module is reset. Reset can occur as the result of powering-up, toggling the RESET switch, or issuing a "reset" network management command to the module.

**nv1_instate[ x ]**: Discrete Variable Input (ON/OFF)

**Declaration**

network input SNVT_lev_disc nv1_instate[ 8 ];

**Description**

This input network variable, in conjunction with nci_op_mode[x], controls the state of the corresponding discrete output. See the truth table in Table 4 below. Associated with this network variable is a Watchdog Timer configuration variable. When this module is powered up or reset, all bound nv1_instate[x] variables are polled to obtain the most recent values.

**Power-up/Reset Value**

ST_OFF

**nci_op_mode[ x ]**: Operating Mode Configuration Variable

**Declaration**

eeprom network input SNVT_state nci_op_mode[ 5 ];

**Description**

This configuration input network variable configures the input state that energizes the relay, and the power-up/reset default state of the relay. Three of the sixteen available bits are currently defined. Bit 0 is the invert bit, which determines the state (ST_ON or ST_OFF) of the value written to nv1_instate[ x ], that causes the relay to turn on and conduct load current. Bits 8 and 9 determine the reset behavior of the relay. Tables 4 and 5 below summarize the functions of the configuration bits. This variable is maintained in EEPROM, and does not take effect until the module is reset.

**Table 4: Input Network Variable Truth Table**

<table>
<thead>
<tr>
<th>bit0 (invert)</th>
<th>nv1_instate[x]</th>
<th>relay</th>
<th>nvo_statef[x]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ST_OFF</td>
<td>De-energized</td>
<td>ST_OFF</td>
</tr>
<tr>
<td>0</td>
<td>ST_ON</td>
<td>Energized</td>
<td>ST_ON</td>
</tr>
<tr>
<td>1</td>
<td>ST_OFF</td>
<td>Energized</td>
<td>ST_ON</td>
</tr>
<tr>
<td>1</td>
<td>ST_ON</td>
<td>De-energized</td>
<td>ST_OFF</td>
</tr>
</tbody>
</table>
**Table 5: Relay Reset Behavior Truth Table**

<table>
<thead>
<tr>
<th>Reset Conditions</th>
<th>Config. Bits</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HW/SW/PU Reset</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST_OFF set to</td>
<td>bit9 Reset Enable</td>
<td>bit8 Reset Value</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>ST_ON expires</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Initial Factory Value**
- bit0: 0 (ST_ON written to nvi_instat[x] energizes relay)
- bit8: 0 (reset value 0, relay resets to de-energized)
- bit9: 0 (default reset used, relay resets to de-energized)

**nvo_wd_status[x]: Watchdog Timer Status**

**Declaration**

```c
network output SNVT_lev_disc nvo_wd_status[8];
```

**Description**

This output network variable contains the status of the output watchdog timer for the corresponding input network variable. Under normal conditions, its value is ST_OFF. Upon timing out, its value becomes ST_ON, and the Status LED flashes its fault sequence. In addition, the output relay is optionally reset. The next update of the corresponding state input network variable updates the output to the new value, returns nvo_wd_status[x] to ST_OFF and removes the Status LED fault. See Figure 1 for an illustration of the Status LED behavior.

**Power-up/Reset**

ST_OFF

**nci_watchdog[x]: Watchdog Timer Configuration Variable**

**Declaration**

```c
eeprom network input SNVT_elapsed_tm nci_watchdog[8];
```

**Description**

This configuration input network variable allows the user to specify the maximum amount of time that can expire between updates of the associated nvi_instat[x] variable. Failure to update nvi_instat[x] within the specified time period sets the corresponding nvo_wd_status[x] variable to ST_ON, and causes the Status LED to flash its fault sequence. The maximum allowable time expressed in DD:HH:MM:SS:LL format is 00:17:59:59:00 (64799 seconds). Anything greater will be clipped at 00:17:59:59:00. The internal resolution of the timer is 1 second. The millisecond (LL) member is ignored. To disable the output watchdog timer function, set the day (DD) member to 55535, or all members to 0. This variable is maintained in EEPROM, and does not take effect until the module is reset.

**Initial Factory Value**

DD=65535, HH=0, MM=0, SS=0, LL=0: Output watchdog timer disabled.

**nvo_statefb[x]: State Feedback Variable**

**Declaration**

```c
network output SNVT_lev_disc nvo_statefb[8];
```

**Description**

This output network variable is used to determine the present state of the discrete output. A value of ST_ON indicates the output is energized and any other value indicates the output is not energized.

**Power-up/Reset Value**

ST_OFF
GENERAL MAINTENANCE:

This module contains solid-state components and requires no maintenance, except for periodic cleaning and verification. When a failure is suspected, a convenient method for identifying a faulty module is to exchange it with a known good unit. It is highly recommended that a non-functioning module be returned to Acromag for repair, since Acromag makes use of tested and burned-in parts, and in some cases, parts that have been selected for characteristics beyond that specified by the manufacturer. Further, Acromag has automated test equipment that thoroughly checks the performance of each module.
**ENCLOSURE DIMENSIONS FOR DIN RAIL MOUNTING**

**FIGURE A: DC INDUCTIVE LOADS**

OUT (+)  
1N4004 (OR EQUIVALENT)  
DCV  
C  
RELAY CONTACTS OR 800 OUTPUT  

**FIGURE B: AC INDUCTIVE LOADS**

MECHANICAL RELAY CONTACTS  
RELAY CONTACTS  
RELAY CONTACT PROTECTION

**SERIES 56B1 (800) INTERPOSING RELAY CONNECTIONS**

NOTE: 1N4004 RELAY SHOWN; OTHER RELAY TYPES MAY BE USED.

NOTE: DC RELAY CONNECTORS OBSERVE PROPER POLARITY AS SHOWN.