GENERAL DESCRIPTION

The Model 380AX3 Discrete Relay Output Card must be driven by a MYCRO Satellite Station's Discrete DC Output Module (Part No. 15495-34) or other functionally similar device. The Relay Output Card contains two SPDT relays that can be set to operate in momentary or sustained modes, thus enabling it to switch various motor start/stop or similar circuits.

With the Card set for momentary operating mode (jumpers J1 at +P and J2 at -P), a HI to LO signal transition appearing at its input will momentarily activate relay K1 (for approximately 250mS); relay K2 will not react. Similarly, a LO to HI transition at the input will momentarily activate K2 while K1 remains unaffected.

In the sustained operating mode (jumpers J1 and J2 set to C), the Card functions as a SPDT relay, a steady LO signal at the input will keep both relays energized, switching the input to HI will deactivate both relays.

The Relay Output Card is made to be plugged into any slot of a Model Series 380 Card Cage Enclosure that contains a common power supply (see Service Instruction SD3801).

GENERAL SPECIFICATIONS

A. POWER REQUIREMENT (from card cage power supply)
   - Pin R .............................................. +15 Vdc regulated ±10% @ 30 mA (max.)
   - Pin P .............................................. +24 Vdc regulated ±10% @ 85 mA (max.)
   - Pin S .............................................. Common

   Ambient Operating Temperature: 32 to 122° F (0 to 50° C)

B. INPUT

   Card Cage Terminals:
   - Terminal 1 (+) .................................. Pulled up to +15V via 1K Ohm resistor
   - Terminal 2 (-) .................................. Common (signal & power supply)

   Drive Requirements:
   - "ON" state voltage ("LO" input logic) ........ 1.5 Vdc (max.)
   - "ON" state current (sourced by 380AX3) .......... 16 mA (max.)
   - 13.5 mA (min.)
   - "OFF" state voltage ("HI" input logic) .......... 4.2 Vdc (min.)
   - "OFF" state leakage current (to common) .......... 1 mA (max.)
   - Breakdown Voltage ................................ 30 Vdc (min.)

   Recommended Drive Module:
   - DC Output Module (Red), Part No. 15495-34 (or equivalent)

   Input Overload:
   - (Across terminals 1 and 2)
     - Continuous .................................. ±15 Vdc (max.)
     - Surge ........................................ 2500V (max.)

   Input/Output Isolation .......................... 500 Vac (max), 60 Hz

MOORE PRODUCTS CO., Spring House, PA 19477
C. OUTPUT

Card Cage Terminals for Relay K1:
Terminal 6 ................................................. Movable Contact
Terminal 5 .................................................. Normally Open (N.O.) Fixed Contact
Terminal 4 .................................................. Normally Closed (N.C.) Fixed Contact

Card Cage Terminals for Relay K2:
Terminal 9 .................................................. Movable Contact
Terminal 8 .................................................. Normally Open (N.O.) Fixed Contact
Terminal 7 .................................................. Normally Closed (N.C.) Fixed Contact

Contact Ratings (each relay):
a) Resistive Load ........................................... 3A @ 30 Vdc or 120 Vac
b) Motor Control ........................................... 75 VA (0.1 HP) continuous 200 VA inrush
c) Contact Life ............................................. 100,000 operations (min.)

Contact Arc Suppressor (100 Ohm resistor in series with 0.1 μF capacitor) internally connected across the following relay contacts:
a) Standard Configuration

<table>
<thead>
<tr>
<th>RELAY</th>
<th>CONTACTS</th>
<th>TERMINALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1</td>
<td>N.O.</td>
<td>6 and 5</td>
</tr>
<tr>
<td>K2</td>
<td>N.C.</td>
<td>9 and 7</td>
</tr>
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</table>

b) Special Configuration

<table>
<thead>
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<th>RELAY</th>
<th>CONTACTS</th>
<th>TERMINALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1</td>
<td>N.C.</td>
<td>6 and 4</td>
</tr>
<tr>
<td>K2</td>
<td>N.O.</td>
<td>9 and 8</td>
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</table>

D. OPERATING MODES

<table>
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<tr>
<th>JUMPER SETTING (1)</th>
<th>INPUT</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1 J2</td>
<td>Driver Action (2)</td>
<td>Input Logic (3)</td>
</tr>
<tr>
<td>Momentary Operating Mode</td>
<td>−P −P</td>
<td>OFF to ON Transition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ON to OFF Transition</td>
</tr>
<tr>
<td>Sustained Operating Mode</td>
<td>C C</td>
<td>Steady ON</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steady OFF</td>
</tr>
</tbody>
</table>

NOTES:
1. Operating Mode is selected by setting both jumper plugs as shown.
2. The driving device is typically equipped with an open collector transistor that is powered via the pull-up resistor in the Relay Output Card.
3. Input Logic refers to voltage level appearing at input terminal 1 as referenced to common terminal 2 (see Drive Requirements under part B).
4. Duration of momentary relay activation is 250 ms, ±30%.
INSTALLATION

CARD HANDLING
A special handling procedure must be used whenever the Relay Output Card is removed from or installed in a card cage. Inspected, cleaned, adjusted, tested, repaired, or stored. This procedure deals with the electrostatic discharge hazard to which CMOS (complementary metal-oxide semiconductor) devices are vulnerable. The card handling procedure is given in the section titled Replacing Circuit Card Components.

CARD IDENTIFICATION
The Relay Output Card is identified by a label located on the card ejection lever. The label shows the card model number:
380AX3

In addition, the card is imprinted with its assembly and issue numbers:
ASSY NO. 15680-1 ISS. 

These identification numbers are silk screened on the component side of the card at the location shown in Figure 1.

CARD PREPARATION
The Relay Output Card must be set to operate in either the momentary or the sustained mode. Jumper plugs J1 and J2 (see Figure 1) are used to select the desired operating mode. Part D of General Specifications describes the two operating modes of the Card and gives the required jumper plug settings.
In a typical application (see Figure 2), the Relay Output Card is set to the momentary operating mode to perform the necessary switching in a motor start/stop circuit. The

---

FIGURE 1  P.C. Board, Discrete Relay Output Card
momentary contact closure (250 mS) needed to energize and latch the motor activator is provided by the ON relay (K1). The momentary contact opening needed to unlatch the motor activator is accomplished by the OFF relay (K2).

Other applications may require the sustained operating mode.

Determine the needed operating mode and perform step A or step B below.

A. To select the momentary operating mode, place jumper plug J1 in position +P and jumper plug J2 in position -P.

OR

B. To select the sustained operating mode, place jumper plugs J1 and J2 in their respective C positions.

Note the standard connection of internal arc suppressors across the relay contacts (see part C of General Specifications). The standard connection will accommodate the typical motor start/stop circuit (see Figure 2). The special arc suppressor connections can be requested at the time of order.

No other settings or adjustments are needed or provided on the Discrete Relay Output Card.

CARD LOCATION

The Relay Output Card must be installed in a Model Series 380 Card Cage Enclosure. It can be plugged into any slot of the enclosure. Refer to user's system drawings for the designated slot or assign a convenient slot for it.

The Relay Output Card is not equipped with key tabs that are used on other Series 380 cards to code their slot locations. Therefore, the safety keys in the card cage do not have to be set at any specific position to accept this card. The Card will enter any slot regardless of the safety key settings.

CARD CONNECTIONS

The input and output connections of the Relay Output Card are made to one of the terminal strips located at the front or the rear of the card cage (depending on model). Each terminal strip is identified by a number that matches the number of the slot that contains the Relay Output Card.

WARNING

Remove all power from equipment before wiring to the terminals of the card cage.

For specific input and output terminal assignments, refer to the connection diagram shown in Figure 2. Service Instruction SD3801 describes the various card cage enclosures and the available power supplies.

NOTE

All the plug-in cards in the card cage enclosure share the same SIGNAL COMMON due to the common power supply. Be careful when connecting various signal lines to avoid possible ground loops or shorts.
CIRCUIT DESCRIPTION

A complete schematic of the Discrete Relay Output Card is presented in Figure 4. Two SPDT relays (K1 and K2) are used as the output devices. Access to their contacts is made available at the card cage terminal strip. Ancillary sleepers are provided across the relay contacts in standard or optional positions as shown in the schematic. Each relay coil is switched by an FET (Q3 at relay K1 and Q4 at K2). Diodes CR2 and CR3, appearing across the coils, serve as switching transient suppressors to protect the FET's. A Hi switching signal (nominal +5V) applied to the gate (G) of either FET will turn it on, thus activating the relay. A LO switching signal (nominal 0V) at the gate keeps the FET off.

Inverter Q5 serves as an input buffer. It requires a small current sink from an external switching device, while providing sufficient output for the FET's and monostable multivibrators U1A and U1B.

Each multivibrator uses a 2.4 Megohm/0.1 uF RC circuit (R3, C3 and R4, C4) to provide an approximately 250 mS output pulse upon triggering. U1B is configured to trigger on the rising edge of its input signal, U1A triggers on the falling edge. Inverter Q5 supplies the input signals. Both reset lines (pins 3 and 13 of U1) are switched to and held at +5V after a short power-up delay is provided by Q1 and Q2.

With jumper plugs J1 and J2 set for the sustained operating mode (in positions C), both FET's obtain their switching signals directly from inverter Q5. In this mode, a LO signal at the input terminal will switch on Q5, produce a Hi signal at the FET gates, and result in the activation of both relays. When the input goes HI (open circuit), the relays will be deactivated.

With jumper plugs set for the momentary operating mode (in positions -P and -P), FET Q3 obtains its switching signal from U1B, while FET Q4 is connected to U1A. In this operating mode, the triggered monostable multivibrator provides a 250 mS positive pulse that momentarily switches on the connected FET and its relay. A HI to LO signal transition at the input terminal is inverted by Q5 and appears as a rising signal transition at both multivibrator inputs. U1A does not react, but U1B is triggered, producing a 250 mS pulse that activates relay K1 for the same duration. When the input signal changes from LO to HI, a falling signal transition appears at both multivibrators. This time, U1B does not react, while U1A triggers and activates relay K2 for 250 mS.

The circuit is powered by the card cage power supply. Both relay coils are connected to the +24V bus line. The remaining circuitry requires +5 Volts which appears across zener CR1.

FIGURE 3 Connection Diagram
MAINTENANCE

GENERAL
The Discrete Relay Output Card requires minimal maintenance. Some routine maintenance is recommended in the form of a visual inspection and possibly cleaning. No other adjustments are needed once the operating mode is selected via J1 and J2. Malfunctions are usually corrected by narrowing the problem to a specific discrete module or Relay Output Card and replacing the defective unit.

PREVENTIVE MAINTENANCE
Preventive maintenance for this card consists of periodic cleaning and visual inspection. The severity of the environment in which the card is located will determine the required frequency of maintenance.

Cleaning
The card should be cleaned as often as operating conditions require. The accumulation of dust and dirt on the components prevents efficient heat dissipation which can cause overheating and component breakdown. Blow off accumulated dust and dirt with dry, low velocity air. Any dust or dirt that remains should be removed with a soft brush or cloth dampened with a mild detergent and water solution. Cotton-tipped swabs are useful for cleaning in narrow spaces.

CAUTION
Avoid the use of chemical agents which may damage the plastic components or the circuit board coating.

Visual Inspection
The card should be inspected occasionally for defects such as loose or broken connections, damaged circuit board, and heat-damaged components. The corrective action for most visible defects is obvious. However, if a heat damaged component is found, the cause of overheating must be corrected to prevent a recurrence of the damage.

CAUTION
Exceeding the specified ambient temperature limits can adversely affect performance and may cause damage.

TROUBLESHOOTING
If the Relay Output Card does not operate properly when initially installed, check the terminal strip wiring. Most problems in new installations can be traced to wiring mistakes. Also, verify that the equipment associated with the input and output circuits is functioning properly.

If the trouble is traced to the Card, replace it with a good spare. Troubleshooting of the defective card should be performed at an electronic shop area equipped to handle such cards. Refer to the Replacing Circuit Card Components section for the required handling procedures.
A Part No. 15378-27 Card Extender can be ordered. It extends the card beyond the front edge of the card cage enclosure, providing easy access to both sides of the card.
Before proceeding to troubleshoot the card, review the Circuit Description section. The circuit of the Discrete Relay Output Card is very straightforward (see Figure 4); consequently, no special troubleshooting techniques are required.

REPLACING CIRCUIT CARD COMPONENTS
All card components are identified on the parts list at the rear of this Instruction.

WARNING
Disconnect the module from all power sources before soldering or unsoldering.

The circuit card contains CMOS integrated circuits. Care must be exercised when handling the card or an individual CMOS device. Although most CMOS devices have built-in protection to prevent damage due to static electric discharge, additional precautions should be followed to assure trouble-free performance. The following guidelines for handling cards and CMOS devices are suggested:

1. Wear a grounding wrist strap whenever handling a card or CMOS device.
2. Card must always be in a static shielding bag except when installed in a card cage or being serviced.
3. When repairing a card, use a conductive, grounded working surface - attach wrist strap to working surface.
4. Store CMOS devices in special conductive envelopes or conductive foam - never in non-conductive foam.
5. Keep the devices at a common potential.
6. Insert CMOS devices last to avoid overhandling.
7. Use a grounded tip soldering iron.

IMPORTANT
Moore Products Co. assumes no responsibility for product performance on devices repaired by users.

The following points are suggested when soldering on the circuit card:

1. Use a pencil-type soldering iron with a power rating from 15 to 30 Watts.
2. Use electronic grade 60-40 tin-lead solder.
REPLACEMENT PARTS

All parts for the card can be obtained from Moore Products Co., Spring House, Pa. 19477. Most of the circuit board components can be obtained locally. Before purchasing locally, check the parts list at the rear of this Instruction for the description, value, tolerance, and rating of any given component.

IMPORTANT

All circuit card replacement parts should be identical replacements. An alternate would only be used if it is known that it will not affect the card's performance.

Special electronic components (if any) are identified on the parts list by the word "Selected" immediately following the component description. These components are selected by Moore Products Co. to meet specific performance requirements. Selected parts must be obtained from Moore Products Co.

When ordering parts from Moore Products Co., include the following information:

1. Description of the card (i.e., Discrete Output Relay Card, Model 380AX3).
2. Circuit card assembly number and issue number.
3. Component part number from parts list.
4. Description of component (e.g., resistor, 1K Ohms, 10%, 1/4 Watt).

RECOMMENDED SPARES

There are no recommended spare parts for the Relay Output Card.

One spare card is recommended for every 1 to 10 in service.

WARRANTY

The Company warrants all equipment manufactured by it and bearing its name plate, and all repairs made by it, to be free from defects in material and workmanship under normal use and service. If any part of the equipment hereon described, and sold by the Company, proves to be defective in material or workmanship and if such part is within twelve months from date of shipment from the Company's factory, returned to such factory, transportation charges prepaid and if the same is found by the Company to be defective in material or workmanship, it will be replaced or repaired, free of charge, if it is, Company's factory. The Company assumes no liability for the consequence of its use or release by Purchaser, his employees or others. A defect in the meaning of this warranty in any part of said equipment shall not, when such part is capable of being removed, repaired or replaced, require the condemnation of such equipment. This warranty is expressly in lieu of all other warranties, guaranties, obligations or liabilities, expressed or implied by the Company or its representatives. All statutory or implied warranties other than those hereby expressly negated and excluded.

Warranty repair or replacement requires the equipment to be returned to one of the following addresses:

Equipment manufactured or sold by MOORE PRODUCTS CO.
MOORE PRODUCTS CO.
Southdown Pkwy.
Spring House, Pa. 19477

Equipment manufactured or sold by MOORE INSTRUMENT CO.
MOORE INSTRUMENTS LTD. TEE
2150 West of Mississauga Pk. Hwy. 7
Brampton, Ontario, Canada

The warranty will be null and void if repair is attempted without prior authorization by a member of the MOORE PRODUCTS CO. Service Department.
FIGURE 4 Schematic, Discrete Relay Output Card
### Parts List

**DISCRETE RELAY OUTPUT CARD**

**P/N 15680-1 ISS. 2**

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#### Capacitors

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>14715-44</td>
<td>4.7μF 35V Tantalum</td>
</tr>
<tr>
<td>C2</td>
<td>14715-44</td>
<td>4.7μF 35V Tantalum</td>
</tr>
<tr>
<td>C3</td>
<td>14716-104</td>
<td>1.0μF 20% 50V Ceramic</td>
</tr>
<tr>
<td>C4</td>
<td>14716-104</td>
<td>1.0μF 20% 50V Ceramic</td>
</tr>
<tr>
<td>C5</td>
<td>14710-2</td>
<td>1.0μF 250V RF Filter</td>
</tr>
<tr>
<td>C6</td>
<td>14710-2</td>
<td>1.0μF 250V RF Filter</td>
</tr>
<tr>
<td>C7</td>
<td>14716-224</td>
<td>22μF 20% 100V Ceramic</td>
</tr>
<tr>
<td>C11</td>
<td>14715-15</td>
<td>10μF 10% 25V Tantalum</td>
</tr>
<tr>
<td>C13</td>
<td>14714-301</td>
<td>300μF 1000V Ceramic</td>
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#### Diodes

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<td>14711-3</td>
<td>Type IN5231</td>
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<tr>
<td>CR2</td>
<td>14711-37</td>
<td>Type IN4005</td>
</tr>
<tr>
<td>CR3</td>
<td>14711-37</td>
<td>Type IN4005</td>
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#### Connectors

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<tr>
<td>J1</td>
<td>14780-3</td>
<td>3 Contact Amp P/N 102443-3</td>
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<tr>
<td>J2</td>
<td>14785-3</td>
<td>3 Contact Amp P/N 102443-3</td>
</tr>
<tr>
<td>P1</td>
<td>14761-906</td>
<td>15 Contact Aetromag P/N 1004-142</td>
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#### Resistors

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<tr>
<td>R1</td>
<td>14701-102G</td>
<td>1KΩ 5% 50W Carbon</td>
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<tr>
<td>R2</td>
<td>14700-102G</td>
<td>1KΩ 5% 50W Carbon</td>
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<tr>
<td>R3</td>
<td>14700-245G</td>
<td>2.4M 5% 25W Carbon</td>
</tr>
<tr>
<td>R4</td>
<td>14700-245G</td>
<td>2.4M 5% 25W Carbon</td>
</tr>
<tr>
<td>R5</td>
<td>14700-104G</td>
<td>100KΩ 5% 25W Carbon</td>
</tr>
<tr>
<td>R6</td>
<td>14700-104G</td>
<td>100KΩ 5% 25W Carbon</td>
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<tr>
<td>R7</td>
<td>14700-155G</td>
<td>1.5MΩ 5% 25W Carbon</td>
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<td>14700-474G</td>
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<td>14700-102G</td>
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<td>R10</td>
<td>14700-102G</td>
<td>1KΩ 5% 25W Carbon</td>
</tr>
<tr>
<td>R11</td>
<td>14700-372G</td>
<td>270Ω 5% 25W Carbon</td>
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<tr>
<td>R12</td>
<td>14701-105G</td>
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</tr>
<tr>
<td>R14</td>
<td>14700-102G</td>
<td>10KΩ 5% 25W Carbon</td>
</tr>
<tr>
<td>R15</td>
<td>14700-102G</td>
<td>1KΩ 5% 25W Carbon</td>
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#### Integrated Circuits

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<tbody>
<tr>
<td>U1</td>
<td>14723-143</td>
<td>Type MC14538B Dual Multivibrator</td>
</tr>
</tbody>
</table>

#### Miscellaneous

- **Card Ejector (with Mtg. Hrdw.)**
  - 14784-14
  - 14784-58

- **Relay Contact**
  - K1 14792-9
  - K2 14792-9

**Hardware**

- **WFA**
  - #4 Split Lockwasher
  - #4-40 Hex Nut
  - BFH

*Recommended On-Hard Spare Parts. Always Specify Range, Serial No., or Other Nameplate Information When Ordering Spare Parts.*