LONWORKS™ MODULE
4-CHANNEL HIGH LEVEL DC INPUT

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>4-Channel High Level DC Input Module</td>
<td>27005-7</td>
<td>550L3-504-4V2-10-NCR</td>
</tr>
<tr>
<td>4-Channel High Level DC Input Module with Factory Calibration</td>
<td>27005-8</td>
<td>550L3-504-4V2-10-NCR-C</td>
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</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.

<table>
<thead>
<tr>
<th>TIC NORTH AMERICA</th>
<th>Tel: +1 215 646 7400, extension 4842, option 1</th>
</tr>
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<tbody>
<tr>
<td>Fax: +1 215 283 6343</td>
<td></td>
</tr>
<tr>
<td>E-mail: <a href="mailto:ticsg@mpco.com">ticsg@mpco.com</a></td>
<td></td>
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<tr>
<td>FaxRequest: +1 215 646 7400, extension 4842, option 2</td>
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<tr>
<td>Bulletin Board Service: +1 215 283 4968</td>
<td></td>
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<tr>
<td>Hours of Operation: 8 a.m. to 6 p.m. eastern time</td>
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<tr>
<td>Secure Web Site: <a href="http://www.mooreproducts.com/techservices">www.mooreproducts.com/techservices</a></td>
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<tr>
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<tr>
<td>E-mail: <a href="mailto:lohho@mpco.com">lohho@mpco.com</a></td>
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<tr>
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<td>Fax: +44 1935 706969</td>
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<tr>
<td>Hours of Operation: 8:30 a.m. to 5:15 p.m. GMT/BST</td>
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<td>Secure Web Site: <a href="http://www.mooreproducts.com/techservices">www.mooreproducts.com/techservices</a></td>
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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.

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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:
550L1-Function-Input-Power-Certification

B. Typical Model Number: 550L1-504-4V2-10-NCR

<table>
<thead>
<tr>
<th>Series/Network</th>
<th>Function</th>
<th>Inputs</th>
<th>Power</th>
<th>Cert. (1)</th>
<th>Cert. (2)</th>
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<tr>
<td>550L1</td>
<td>504</td>
<td>4V2</td>
<td>-10</td>
<td>NCR</td>
<td>Blank</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-C</td>
</tr>
<tr>
<td>550L3</td>
<td>504</td>
<td>4V2</td>
<td>-10</td>
<td>NCR</td>
<td>Blank</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-C</td>
</tr>
</tbody>
</table>

Notes (Table 1):
1. Consult the factory for current information on agency (e.g. Canadian Standards Association, etc.) approvals.
2. Unit can be ordered with or without factory calibration; if unit is factory calibrated to a customer’s specifications, the model number suffix “-C” will indicate this. Any customer specified calibration information will be included on a separate calibration label on the unit.

DESCRIPTION:

The Series 550L is a member of the Acromag SmartPack family. It converts four independent DC voltage inputs into corresponding network variables. The nominal input range for each input is fixed at -10V to +10VDC, or -100V to +100VDC. Through network variables, virtually any part of the input range can be scaled to output values in the range of -100% to +100%, as defined by the SNVTlev_percent network variable type. For example, a 0 to 5 V input can be scaled to output 0 to 100%. Or a -75 to +75 V input can be scaled to output -100 to +100%. For each analog input, network variable updates may occur due to changes in input level and/or at specified time intervals.

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.

IMPORTANT SAFETY CONSIDERATIONS

It is very important for the user to consider the possible adverse effects of power, wiring, component, sensor, or software failures in designing any type of control or monitoring system. This is especially important where economic property loss or human life is involved. It is important that the user employ satisfactory overall system design. It is agreed between the Buyer and Acromag, that this is the Buyer’s responsibility.
Smart Packs 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:

Note: All specifications are given for the Reference Test Conditions as listed later in this section.

DEFINITION: This DC-powered, Smart Pack module conditions four DC voltage inputs, and converts these signals to network variables using standard network variable types (SNVT). The analog inputs share a common ground. As a group they are isolated from the network and power. This module is DIN-rail mounted.

MODEL/SERIES: 550 (Color coded with a White label)

NETWORK (Designated by ‘LX’ of 550LX Model prefix):

Protocol: LonTalk®

L1: TP/ XF-78, Twisted Pair
Speed: 78.1 kb 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/FT-10, Free Topology
Speed: 78.1 kb 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 85102</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 (SI) 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.

-504: See the network variables section for a description of the module's standard network variable types and operation.

INPUT: This unit has four independent analog inputs with software selectable output scaling ranges. Zero and Full-Scale calibration/scaling of each input is done over the network. Virtually any part of the input range can be scaled to output values in the range of -100% to +100%. There are no potentiometers to adjust.

-4V2: Range A: ±100VDC
Range B: ±10VDC

Input Impedance: Range A: 1MΩ minimum
Range B: 100KΩ minimum

Isolation: Three-way isolation: input, network and power are isolated from each other for common-mode voltages 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 for all combinations except between the input and network circuits which will withstand 1000V AC dielectric strength test for one minute without breakdown). The 1500V AC dielectric strength test complies with test requirements outlined in ANSI/ISA-S82.01-1988 for the voltage rating specified.

POWER: Connect an external DC power supply to the Power (P) and (-) terminals. Currents specified are maximum values with full-scale input voltage (each input), 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 (refer to Table 3 below).

Table 3: Supply Current

<table>
<thead>
<tr>
<th>Supply Voltage</th>
<th>L1 Supply Current</th>
<th>L3 Supply Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>10V</td>
<td>50mA</td>
<td>35mA</td>
</tr>
<tr>
<td>12V</td>
<td>43mA</td>
<td>30mA</td>
</tr>
<tr>
<td>15V</td>
<td>37mA</td>
<td>25mA</td>
</tr>
<tr>
<td>24V</td>
<td>28mA</td>
<td>20mA</td>
</tr>
<tr>
<td>36V</td>
<td>23mA</td>
<td>17mA</td>
</tr>
</tbody>
</table>

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

Power Supply Effect:
DC Volts: Less than ±0.001% of input span change per volt DC, for rated power supply variations. 60/120 Hz ripple: Less than ±0.01% of input span per volt peak-to-peak of power supply ripple.

Reset/Service Toggle Switch:
Reset Position: Allows the module to be reset to power-up conditions (toggle right).
Service Position: Causes the Neuron® 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): LED remains ON indefinitely upon receiving an "offline" network management command. LED remains OFF upon receiving an "online" network management command (normal operation). LED blinks at a 2.5Hz rate for 10 seconds upon receiving a "wink" network command.

**Figure 1: Status LED Behavior**

1. Offline/Online Commands:

   - **ON**
   - **OFF**

   **Indefinite**

   **Offline Command**

   **Online Command**

2. Wink Command:

   - **ON**
   - **OFF**

   10 Seconds

   200 ms

   200 ms

Reference Test Conditions: Input Span: ±10VDC, Input Voltage Applied: ±10VDC; Network (78kΩ/8); 77°F (25°C); +15V DC supply.

Accuracy: Range A: ±0.05% of calibrated input span or ±3.81mV, whichever is greater. Range B: ±0.05% of input span, or 381μV, whichever is greater. The error includes the combined effects of module repeatability, hysteresis and terminal point linearity.

Analog Resolution: Range A A-to-D resolution: 3.61mV,
Range B A-to-D resolution: 381μV.

Conversion Rate: 5 conversions per second for each analog input.

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: Less than ±0.003% of input span effect per 6°F (± 0.005% per °C) over the ambient temperature range for reference test conditions. Specification includes the combined effects of zero and span over temperature.

Bandwidth: -3dB at 3Hz, typical.

Response Time: 300ms typical for the network variable value to reach 98% of the final value for a step change in input signal.

Noise Rejection:
- Common Mode: 120dB at 60 Hz, 100Ω unbalance, typical.
- Normal Mode: 26dB at 60 Hz, 100Ω source, typical.

**RFI Resistance:** Less than ±0.5% of input span effect with RFI field strengths of up to 10V/meter at frequencies of 27MHz, 151MHz, and 467 MHz.

**EMI Resistance:** Less than ±0.25% of input span effect with switching solenoids, commutator and drill motors.

**Surge Withstand Capability (SWC):** Input/Output 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:** (0) Mounting: General Purpose Housing with integrated DIN-Rail Mount. Supports "G" & "T" rails: "G" Rail (32mm), Type EN50035; "T" Rail (35mm), Type EN50022.

Refer to Drawing 4501-502 for outline and clearance dimensions. Shipping Weight: 1 pound (0.45 Kg) packed.

**Construction:**
- Circuit Boards: Military grade FR-4 epoxy glass circuit board.
- Circuit Board Coating: Fungus resistant acrylic conformal coat on analog input circuit board.
- Terminals: Compression type, wire size 14 AWG maximum.
- Case: Self-extinguishing NYLON Type 6.5 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 type of 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. The module is factory calibrated and ready for installation. Connect as shown in Connection Drawing 4501-509.

**Mounting:** Mount module assembly - refer to Drawing 4501-502 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 either the "T" or "G" Rail. Installation of the module to the rail depends on the type of DIN rail used. Units can be mounted side-by-side on 1.6 inch centers, if required.

"T" Rail (35mm), Type EN50022: To attach a module to this style of DIN rail, angle the top of the unit towards the rail and locate the top groove of the adapter over the upper lip of the rail. Firmly push the unit towards the rail until it snaps solidly into place. To remove a module, insert a screwdriver into the lower arm of the connector and pull downward while applying outward pressure to the bottom of the unit.
"G" Rail (32mm), Type EN50035: To attach a module to this style of DIN rail, angle the unit so that the upper groove of the adapter hooks under the top lip of the rail. Firmly push the unit towards the rail until it snaps solidly into place. To remove a module, pull the lower part of the unit outward until it releases from the rail, lift unit from rail.

Electrical Connections:

The wire size used to connect the unit to the control system is not critical. All terminal strips can accommodate wire from 14-28 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 power per Connection Drawing 4501-509. 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. This device includes reverse polarity protection. Refer to "POWER" in the preceding SPECIFICATIONS section for current requirements.

2. Network: Connect network per Connection Drawing 4501-509. Note: Network circuit is isolated from input 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. Input: Connect input per connection diagram and observe proper polarity (see label for input type). If unit is factory calibrated, the calibration label indicates range of input. NOTE: All inputs share a common, however, as a group they are electrically isolated from the network and power circuits, allowing the input to operate up to 250V AC, or 354V DC off ground, on a continuous basis.

NETWORK VARIABLES:

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

Figure 2: Series 550LX1-504-4V2-10 SNVT Diagram

```
  snvt_lev_percent
  snvt_lev_percent
  snvt_lev_percent
  snvt_lev_percent
```

All network variables are 4-element arrays. Analog input 1's network variables are referenced using an array subscript of 0; analog input 2's by a subscript of 1, and so on. Figure 3 illustrates the relationship between input voltage and SNVT_lev_percent value for the Factory calibration case. Figure 4 provides the general output graph & equation that relates output in terms of calibration constants.

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 and calibrate 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.
nvo_pvout[x]: Process Variable Output

Declaration
network output SNVT_lev_percent nvo_pvout[4];

Description
This output network variable contains the latest value of the corresponding analog input in units of SNVT_lev_percent. The update rate for this variable is controlled by nci_pvdb[x] and/or nci_pvtime[x]. The maximum update rate, regardless of the source of control, is limited to 5 updates per second.

Power-up/Reset Value
0% until first update occurs.

nci_pvdb[x]: Process Variable Deadband

Declaration
eeprom network input SNVT_lev_percent nci_pvdb[4];

Description
This configuration input network variable specifies the deadband, or the amount of change in the input necessary to cause an update of nvo_pvout[x]. Deadband is specified as a percentage of the input span. As an example, for a ±10V input signal (20V input span) scaled to output ±100%, 10% deadband corresponds to 2V. As another example, for a 0 to 5V input signal scaled to output 0 to 100%, 10% deadband corresponds to 0.5V. Deadband can be specified as either positive or negative. Negative values are automatically converted to positive values. Specifying a value of zero will cause an update every 0.2 second. To disable "change-by" updates, specify a large value such as 125% (25000). This variable is maintained in EEPROM, and does not take effect until the module is reset.

Initial Factory Value
0.01% (2).

nci_pvtime[x]: Process Variable Update Time

Declaration
eeprom network input SNVT_lev_percent nci_pvtime[4];

Description
This configuration input network variable specifies the period of time between updates of nvo_pvout[x]. Internal resolution is 2 second. The maximum allowable time expressed in DD:HH:MM:SS:LL format is 00:03:38:27:000. Anything greater will be clipped at 00:03:38:27:000. To disable periodic updates, set DD=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=55535, HH=00, MM=00, SS=00, LL=000: Periodic updates disabled.

nci_callo[x]: Calibration Low Variable

Declaration
eeprom network input SNVT_lev_percent nci_callo[4];

Description
This configuration input network variable contains the value corresponding to the nominal zero-scale input. The value must be less than the nci_calhi[x] value. See the Calibration section for a complete description of its use. This variable is maintained in EEPROM, and does not take effect until the module is reset.

Initial Factory Value
-100.0% of span (-20000), for an applied input voltage of -10VDC.

nci_calhi[x]: Calibration High Variable

Declaration
eeprom network input SNVT_lev_percent nci_calhi[4];

Description
This configuration input network variable contains the value corresponding to the nominal full-scale input. The value must be greater than the nci_callo[x] value. See the Calibration section for a complete description of its use. This variable is maintained in EEPROM, and does not take effect until the module is reset.

Initial Factory Value
100.0% of span (20000), for an applied input voltage of +10VDC.

Figure 3: Factory Calibration and Scaling (±10VDC)
Figure 4: General Output Graph & Equation

\[ \text{nvo_pvout} = \frac{(V_{\text{IN}} - V_{\text{LO}})}{V_{\text{HI}} - V_{\text{LO}}} \times \frac{(\text{nci_cahi} - \text{nci_callo})}{\text{nci_callo}} + \frac{\text{nci_callo}}{V_{\text{HI}} - V_{\text{LO}}} \]

Where:
- \( nvo_{pvout} \) = resulting output value (%)
- \( V_{\text{IN}} \) = input voltage (volts)
- \( \text{nci_callo} \) = percentage value corresponding to \( V_{\text{LO}} \)
- \( \text{nci_cahi} \) = percentage value corresponding to \( V_{\text{HI}} \)
- \( V_{\text{LO}} \) = voltage applied when \( \text{nci_callo} \) was written
- \( V_{\text{HI}} \) = voltage applied when \( \text{nci_cahi} \) was written

**Example 1:**
A 0 to 5V input is scaled to output 0 to 100%. This results in the following constants (raw SNVT_lev_percent values are shown in parenthesis):

\[
\begin{align*}
\text{nci_callo} & = 0\% (0) \\
\text{nci_cahi} & = 100\% (20000) \\
V_{\text{LO}} & = 0.00 \text{ VDC} \\
V_{\text{HI}} & = 5.00 \text{ VDC}
\end{align*}
\]

The resulting equation relating output percentage to input voltage looks like this:

\[ nvo_{pvout} = \frac{(V_{\text{IN}} - 0) \times 100}{5.00} + 0 \]

This reduces to:

\[ nvo_{pvout} = V_{\text{IN}} \times 20 \]

**Example 2:**
A -60V to +20V input is scaled to output -100 to 100%. This results in the following constants (raw SNVT_lev_percent values are shown in parenthesis):

\[
\begin{align*}
\text{nci_callo} & = -100\% (-20000) \\
\text{nci_cahi} & = 100\% (20000) \\
V_{\text{LO}} & = -60.0 \text{ VDC} \\
V_{\text{HI}} & = 20.0 \text{ VDC}
\end{align*}
\]

The resulting equation relating output percentage to input voltage looks like this:

\[ nvo_{pvout} = \frac{(V_{\text{IN}} - (-60)) \times 100}{20 - (-60)} + (-100) \]

This reduces to:

\[ nvo_{pvout} = (V_{\text{IN}} + 60) \times 2.5 - 100 \]

**CALIBRATION:**

All modules are calibrated at the factory for an input range of ±10VDC scaled to output ±100%. No additional calibration is normally required. If it becomes necessary to calibrate the module, follow the procedure outlined below for each analog input. Values shown in parenthesis indicate the SNVT_lev_percent value.

**Voltage Input:** Calibration can be done for any input range up to ±10.0VDC. For reference, this procedure will use an input range of ±10.0VDC, scaled to output ±100. Two network variables provide a means of software trimming the end points of the input range.

**Equipment Required**
1. Voltage source capable of accurately generating ±10.00 VDC. See Drawing 4501-508.
2. Network management tool capable of reading and writing the module’s network variables.

**Procedure**
1. Apply -10.00 V to the input. The input value does not have to be exactly -10.00 V, but its value must be known so that its SNVT_lev_percent value can be determined.
2. Write the SNVT_lev_percent value corresponding to the applied input to the nci_callo[ x ] network variable for the input. For a -10.00 V input, the nci_callo[ x ] value should be -100 00% (-20000).
3. Apply +10.00 VDC to the input. As in step 1, the input value does not have to be exactly +10.00 VDC, but its value must be known so that its SNVT_lev_percent value can be determined.
4. Write the SNVT_lev_percent value corresponding to the applied input to the nci_cahi[ x ] network variable for the input. For a +10.00 VDC input, the nci_cahi[ x ] value should be 100.00% (20000).
5. (Optional) Write new values to the nvo_pvdb[ x ] and nci_pvdtm[ x ] variables as required.
6. Reset the module. New internal calibration coefficients are now calculated using the nci_callo[ x ] and nci_cahi[ x ] values.
7. Apply 5.000 VDC to the input.
8. Read the nvo_pvout[ x ] network variable. It should indicate a value of 50.00% (10000) +/- 0.05% (20) of input.
GENERAL MAINTENANCE:

The module contains solid-state components and requires no maintenance, except for periodic cleaning and calibration 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.