LONWORKSTM MODULE
4-CHANNEL LOW 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 Low Level DC Input Module</td>
<td>27005-5</td>
<td>550L3-503-4V1-10-NCR</td>
</tr>
<tr>
<td>4-Channel Low Level DC Input Module with Factory Calibration</td>
<td>27005-6</td>
<td>550L3-503-4V1-10-NCR-C</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.

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

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

<table>
<thead>
<tr>
<th>TIC EUROPE</th>
<th>Tel: +44 1935 470172</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fax: +44 1935 706969</td>
</tr>
<tr>
<td></td>
<td>E-mail: <a href="mailto:uktec@mpeco.com">uktec@mpeco.com</a></td>
</tr>
<tr>
<td></td>
<td>Hours of Operation: 8:30 a.m. to 5:15 p.m. GMT/BST</td>
</tr>
<tr>
<td></td>
<td>Secure Web Site: <a href="http://www.moorerecords.com/techservices">www.moorerecords.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:
550L1-Function-Input-Power-Certification-Calibration
B. Typical Model Number: 550L1-503-4V1-10-NCR-C

<table>
<thead>
<tr>
<th>Series/Network</th>
<th>-Function</th>
<th>-Inputs</th>
<th>-Power</th>
<th>-Cert. (1)</th>
<th>-Cal. (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>550L1</td>
<td>-503</td>
<td>-4V1</td>
<td>-10</td>
<td>-NCR</td>
<td>Blank</td>
</tr>
<tr>
<td>550L3</td>
<td>-503</td>
<td>-4V1</td>
<td>-10</td>
<td>-NCR</td>
<td>Blank</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 -1V to 1V DC, or -10V to 10V DC. 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 SNV_T lev_percent network variable type. For example, a 0 to 0.5 V input can be scaled to output 0 to 100%. Or a 0.75 to +0.75 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.

For each analog input, an internal 50Ω shunt resistor is provided to convert current to voltage. This allows a standard 4-20mA signal to be measured. To measure AC currents, up to 20A AC, a special current sensing transducer (Acromag model 5202-350, ordered separately) is used.

Acromag, Inc.
30765 Wixom Road, P.O. Box 437
Wixom, Michigan 48393-7037, USA
Tel: (810) 624-1541
Fax: (810) 624-9234

Copyright 1996, Acromag, Inc. Printed in the USA.
Data and specifications are subject to change without notice.
LON, Neuron, and LonTalk are U.S. registered trademarks of Echelon Corporation. LonWorks is a trademark of Echelon Corporation. Windows is a trademark of Microsoft Corporation.

8500-525-B95M011
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 (TPXF-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 LOWWORKS 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, SmartPack module conditions four DC voltage or DC milliampere 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:** TPFX-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, -25 to +85°C). A LOWWORKS router configured as a repeater is required for more than 64 nodes.

**L3:** TP/FT-10, Free Topology

- Speed: 78.1kb per second.
- Media: See Cable Type in Table 2 below.
- Distance: See Table 2 below.

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

- 553: 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.

- 4V1: ±1.0VDC voltage or ±20mA DC current inputs.

  - Note: For a current input, a jumper is required between the A and B input terminals. Current is then delivered into the AB input and returned via common.

**Input Impedance:** Voltage Input Terminals: 100KΩ minimum.

  - Current Input Terminals: 50Ω.

**Isolation:** Three-way isolation: input, network and power are isolated from each other for common-mode voltages up to 250V AC, or 35V DC of 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.

**AC Current Sensor (9026-350):** The sensor is a highly accurate toroidal instrument transformer used to convert an AC current signal to a few low DC milliamperes signal (0 to 11.17mA). The input AC current range is a simple function of the number of turns placed on the AC Current Sensor (see Table 3 below).

The user configures the AC current sensor with the required number of primary turns to obtain the desired input span.

<table>
<thead>
<tr>
<th>Table 3: AC Sensor Turns</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC CURRENT INPUT RANGE</td>
</tr>
<tr>
<td>0 to 5 Amps AC</td>
</tr>
<tr>
<td>0 to 10 Amps AC</td>
</tr>
<tr>
<td>0 to 20 Amps AC</td>
</tr>
<tr>
<td>0 to 30 Amps AC</td>
</tr>
</tbody>
</table>

The output wires on the sensor are polarized: the Red wire is (+) plus and Black wire is (-) minus. Normally, these output wires are attached to one end of a cable (user supplied) and the other end connects to one of the analog inputs (+) and (-) terminals.

**Cable Type**

<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 6471</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) V 2x2x0.8</td>
<td>1050 ft (320 m)</td>
<td>1640 ft (500 m)</td>
</tr>
</tbody>
</table>

Nodes per Network Segment: 64. A LOWWORKS router configured as a repeater is required for more than 64 nodes.
Input Burden: A function of the wire gauge resistance used for the primary turns.

Input Overload: The AC Current Sensor withstands overloads as follows:
- 20 times full-scale for 0.01 second
- 10 times full-scale for 0.1 second
- 5 times full-scale for 1.0 second

AC Current Sensor to Transmitter Wiring Distance: 400 feet maximum for 15 AWG wire gauge. Other wire gauges can be used as long as the resistance of both wires is less than 5.0Ω.

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 4 below).

Table 4: 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>29mA</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): (See Figure 1) 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: Indefinite
   - OFF: Offline Command
   - M: Online Command

2. Wink Command:
   - ON: 10 Seconds
   - OFF: mS (100 mS)


Accuracy: Voltage Input: ±0.05% of calibrated input span or ±100µV, whichever is greater. Current Input: ±0.05% of input span. The error includes the combined effects of module repeatability, hysteresis and terminal point linearity.

Analog Resolution: A-to-D resolution: 38.1µV.

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 °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 50% of the final value for a step change in input signal.

Noise Rejection:
- Common Mode: 120dB at 60 Hz, 1000 unbalance, typical.
- Normal Mode: 26dB at 60 Hz, 1000 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/EIEEE 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: (G) 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.
Case: Self-extinguishing NYLON Type 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 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 modules are factory calibrated and ready for installation. Refer to instructions in the Connection Drawing 4501-504.

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 1.5 inch centers, if required.

"G" Rail (32mm), Type EN50035: To attach a module to this style of DIN rail, angle the top of the unit towards the rail and locate the bottom 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.

"T" Rail (35mm), Type EN50022: 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 14-26 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 wiring 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 4501-504. 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 35 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 4501-504. 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. VmA 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.

5. AC Current Input: The AC Current Sensor is isolated and can be used in AC circuits up to 250V AC, 50 or 60 Hz. It is designed to be mounted at the source of the AC current to be measured. The sensor outputs a low-level DC milliamperes signal, allowing the transmitter to be mounted remote from the AC signal using small gauge wires. The sensor's output (Red/Black) wires can be shorted, open-circuited, or removed from the transmitter's input terminals, without hazard to personnel or the AC Current Sensor.

AC Current Sensor: Per Table 3, loop the required number of turns through the toroid for the full-scale range that you need in your application. Use the cable tie provided to mechanically secure the sensor. Refer to Drawing 4501-505.
Network variables within the External Interface Section are intended to be bound, polled, or written to 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_lew_percent nvo_pvout[ 4 ];

Description
This output network variable contains the latest value of the corresponding analog input in units of SNVT_lew_percent. The update rate for this variable is controlled by nci_pvdb[ x ] and/or nci_pvdim[ 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_lew_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 ±1V input signal (2V input span) scaled to output ±100%, 10% deadband corresponds to 0.2V. As another example, for a 4 to 20mA input signal (1.6mA input span) scaled to output 0 to 100%, 10% deadband corresponds to 0.16mA. 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)

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_lew_percent value for the factory calibration case. Figure 4 provides the general output graph & equation that relates output in terms of calibration constants.
nci_pvtime[x]: Process Variable Update Time

Declaration
eeprom network input SNVT_elapsed_tm nci_pvtime[4];

Description
This configuration input network variable specifies the period of time between updates of nvo_pvout[x]. Internal resolution is 2 seconds. 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=65535, 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=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_calh[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 -1VDC.

nci_calh[x]: Calibration High Variable

Declaration
eeprom network input SNVT_lev_percent nci_calh[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 +1VDC.

---

Figure 3: Factory Calibration and Scaling (<1 VDC)

<table>
<thead>
<tr>
<th>SNVT_lev</th>
<th>% of span</th>
</tr>
</thead>
<tbody>
<tr>
<td>30000</td>
<td>150</td>
</tr>
<tr>
<td>20000</td>
<td>100</td>
</tr>
<tr>
<td>10000</td>
<td>50</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>-10000</td>
<td>-50</td>
</tr>
<tr>
<td>-20000</td>
<td>-100</td>
</tr>
<tr>
<td>-30000</td>
<td>-150</td>
</tr>
</tbody>
</table>

nominal input range: V_in

\[ \text{SNVT_lev\_percent} = \frac{V_{in} \times 20000}{V_{in} \times 100} \]

Figure 4: General Output Graph & Equation

\[ V_{nvo} = \left( \frac{V_{in} - V_{LO}}{V_{HI} - V_{LO}} \right) \times \frac{\text{nci\_calh} - \text{nci\_callo}}{\text{nci\_callo}} + V_{LO} \]

Where:
\( nvo\_pout = \) resulting output value (%)
\( V_{LO} = \) input voltage (volts)
\( nci\_callo = \) percentage value corresponding to \( V_{LO} \)
\( nci\_calh = \) percentage value corresponding to \( V_{HI} \)
\( V_{HI} = \) voltage applied when \( nci\_callo \) was written
\( V_{in} = \) voltage applied when \( nci\_calh \) was written

- 6 -
Example 1:
A 0 to 0.5V input is scaled to output 0 to 100%. This results in the following constants (raw SNVT_{lev} percent values are shown in parenthesis):
\[
\begin{align*}
\text{nco} \_\text{call} & = 0\% (0) \\
\text{nco} \_\text{callh} & = 100\% (20000) \\
V_{LO} & = 0.000 \text{ VDC} \\
V_{LO} & = 0.500 \text{ VDC}
\end{align*}
\]
The resulting equation relating output percentage to input voltage looks like this:
\[
\text{nvo} \_\text{pivout} = \left( \frac{V_{IN} - 0}{0.500 - 0} \right) \times 0 + 100 = 200
\]
This reduces to: \[
\text{nvo} \_\text{pivout} = V_{IN} \times 200
\]

Example 2:
A -0.6V to +0.2V input is scaled to output -100 to 100%. This results in the following constants (raw SNVT_{lev} percent values are shown in parenthesis):
\[
\begin{align*}
\text{nco} \_\text{call} & = 100\% (-20000) \\
\text{nco} \_\text{callh} & = 100\% (20000) \\
V_{LO} & = 0.6 \text{ VDC} \\
V_{HI} & = 0.2 \text{ VDC}
\end{align*}
\]
The resulting equation relating output percentage to input voltage looks like this:
\[
\text{nvo} \_\text{pivout} = \left( \frac{V_{IN} - (-0.6)}{0.20 - (-0.6)} \right) \times (-100.0) + 100 = 200
\]
This reduces to: \[
\text{nvo} \_\text{pivout} = \left( \frac{V_{IN} + 0.6}{2.2} \right) \times 250 = 100.0
\]

**CALIBRATION:**

All modules are calibrated at the factory for an input range of ±1VDC 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 ±1.0VDC. For reference, this procedure will use input range of ±1.0VDC, 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 ±1.000 VDC. See Drawing 4501-503.
2. Network management tool capable of reading and writing the module’s network variables.

**Procedure**
1. Apply -1.000 VDC to the input. The input value does not have to be exactly -1.000 VDC, 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 nco_call[ x ] network variable for the input. For a -1.000 VDC input, the nco_call[ x ] value should be -100.00% (-20000).
3. Apply +1.000 VDC to the input. As in step 1, the input value does not have to be exactly +1.000 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 nco_call[ x ] network variable for the input. For a +1.000 VDC input, the nco_call[ x ] value should be 100.00% (20000).
5. (Optional) Write new values to the nco_pivot[ x ] and nco_grd[ x ] variables as required.
6. Reset the module. New internal calibration coefficients are now calculated using the nco_call[ x ] and nco_callh[ x ] values.
7. Apply 0.500 VDC to the input.
8. Read the nvo_pivot[ x ] network variable. It should indicate a value of 50.00% (10000) +/- 0.05% (20) of input span.

**Current Input:** Calibrator can be done for 4 to 20mA DC range or 0 to 11.7mA DC range. Notes: Make sure a jumper is placed between terminals 'A' and 'B'. Connect current source to only one input at a time or all are to be calibrated with a current input - connect all inputs in series. For reference, this procedure will use a 4 to 20mA DC input range, scaled to output 0 to 100%. Two network variables provide a means of software trimming the end points of the input range.

**Equipment Required**
1. Current source capable of accurately generating 0.000 to 20.000mA DC. See Drawing 4501-503.
2. Network management tool capable of reading and writing the module's network variables.

**Procedure**
1. Apply 4.000mA DC to the input. The input value does not have to be exactly 4.000mA, 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 nco_call[ x ] network variable for the input. For a 4.000mA input, the nco_call[ x ] value should be 0.000% (0).
3. Apply 20mA DC to the input. As in step 1, the input value does not have to be exactly 20.000mA DC, 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 nco_call[ x ] network variable for the input. For a 20.000mA DC input, the nco_call[ x ] value should be 100% (20000).

- 7 -
5. (Optional) Write new values to the nci_pvdo[x] and nci_pvtime[x] variables as required.
6. Reset the module. New internal calibration coefficients are now calculated using the nci_calib[x] and nci_calib[x] values.
7. Apply 12.000mA to the input.
8. Read the nvo_pvdo[x] network variable. It should indicate a value of 50% (10000) +/- 0.05% (10) of input span.

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 burn-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

VOLTAGE INPUT

CURRENT INPUT

SERIES 558L V/MA INPUT
MODULE CALIBRATION CONNECTIONS
**APPLICATION EXAMPLE A: AC CURRENT TRANSFORMER (C.T.)**

**DANGER:**
AC CURRENT TRANSFORMER (C.T.) CONNECTIONS:
DISCONNECT POWER TO C.T. OR SHORT OUTPUT OF C.T.
BEFORE REMOVING INPUT CONNECTIONS TO AC CURRENT SENSOR. IF THIS PROCEDURE IS NOT FOLLOWED, AN OPEN CIRCUIT C.T. WILL GENERATE HIGH VOLTAGES AND POSSIBLE C.T. DAMAGE WILL RESULT.

**APPLICATION EXAMPLE B: 115V/230VAC ELECTRICAL CIRCUIT**

**DANGER:**
HIGH VOLTAGE

---

**TABLE 1: TURNS CHART**

<table>
<thead>
<tr>
<th>INPUT RANGE (Amp)</th>
<th>TURNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 TO 3mA</td>
<td>1</td>
</tr>
<tr>
<td>0 TO 10mA</td>
<td>2</td>
</tr>
<tr>
<td>0 TO 50mA</td>
<td>10</td>
</tr>
<tr>
<td>0 TO 100mA</td>
<td>25</td>
</tr>
</tbody>
</table>

**CAUTION:** DO NOT CONNECT AC CURRENT DIRECTLY TO TRANSMITTER INPUT TERMINALS.
4-CHANNEL LOW LEVEL DC INPUT MODULE CALIBRATION USING THE METAVISION NETWORK MANAGER

This Instruction Addendum contains a calibration procedure for the Moore PN 27005-5 or PN 27005-6 (Acromag Model 550L3-503-4V1-10-NCR) LonWorks module. Follow this procedure when using the MetaVision Network Manager Version 3.03. Follow the calibration procedure in the accompanying Acromag, Inc. user’s manual when a different network manager is used.

The module converts an analog input signal into a Standard Network Variable Type (SNVT_lev_percent) for transmission through a LonTalk network. It is used to provide additional analog inputs to a Model 352P, 353 or 354 controller equipped with a LonWorks communication board. The module has 4 channels that accept 0-1V inputs. A 4-20 mA signal can be converted into voltage using one of the module’s internal 50Ω resistors.

The module is supplied with standard factory calibration of 0-1V or 0-2-1V. Calibration pertains to the scaling between the input signal to the SNVT_lev_percent value, as shown in the table.

<table>
<thead>
<tr>
<th>CALIBRATION</th>
<th>INPUT SIGNAL</th>
<th>SNVT_lev_percent value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1V</td>
<td>0V</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>1V</td>
<td>100%</td>
</tr>
<tr>
<td>4-20 mA</td>
<td>4 mA (0.2V)</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>20 mA (1.0V)</td>
<td>100%</td>
</tr>
</tbody>
</table>

This addendum explains the procedure for calibrating the module using the MetaVision Network Manager Version 3.03 utility. In this procedure, the module is calibrated for a 4-20 mA input.

EQUIPMENT NEEDED

1. MetaVision Network Manager, Version 3.03, running on a personal computer
2. LonWorks network interface device, i.e. SLTA-2
3. Power Supply, 10-36 Vdc
4. An accurate current source with wire leads for connecting to the module input terminals

INITIAL STEPS

1. Wire the module(s) to the power supply. Connect the module(s) and interface device to a Lon network using twisted pair wiring. Refer to the Acromag User’s Manual.
2. Power up the network.
3. Start the MetaVision Network Manager
4. In the Network Manager, create a new project or open the project containing the module(s) to be calibrated.
NODE INSTALLATION

1. In design mode, click on Echelon Neuron Chip toolbar button and create a node object on the screen.
2. Double click on the node object to open the Neuron Node dialog box.
3. In the Node Name text box, enter a meaningful name (i.e. Ac550VI) if it is the first installation of this type of module. (Note: In order to install a node, an XIF file is required. An XIF file contains information on the node and the network variables that it supports. An XIF file is required for each different type of node. If an XIF file does not exist in the project database, the utility will build a file by querying the node, and the file is assigned the name in the Node Name text box. After the installation, the XIF file name is displayed in the Program Name text box).
4. Click on the Install button and push the Service pin on the module when the message box appears.
5. When the installation is complete, give the node a new node name, i.e. M01. (This is to avoid confusion when installing several modules of the same type).
6. Wink the node in order to verify that you installed the correct module.
7. Close the dialog box.

NETWORK VARIABLES

The calibration procedure requires writing to the module's calibration network variables, nci_calh[4] and nci_calh[4], and viewing the input signal's corresponding network variable, nvo_pvout[4]. To write to an input network variable or monitor a variable, the variable must first be specified in the Variable Editor dialog box.

VARIABLE EDITOR

Specify network variables.

1. From the Menu Bar, select Tools/Variable Editor. This will open the Variable Editor dialog box.
2. In the Data Source drop down list box, choose Pol Variable. This will open the Node Name list box that shows all installed network nodes.
3. In the Node Name list box, select the module (M01). All the network variables supported by the node will be shown in the adjacent Variable Name list box.
4. Select nci_calh[0] and click on the Add button or double click on the selection. The selected variable is added to the bottom Variable Name list box as M01_nsi_calh. The network variable is now available for polling or writing to.
5. Add the following variables to the list:
   nci_calh[1]
   nci_calh[2]
   nci_calh[4]
   nci_calh[0]
   nci_calh[1]
   nci_calh[2]
   nci_calh[3]
   nvo_pvout[0]
   nvo_pvout[1]
   nvo_pvout[2]
   nvo_pvout[3]
6. Close dialog box
RUNTIME MODE

Place the network manager in the runtime mode to allow monitoring or writing of network variables.

1. From the Menu Bar, select View/Switch to Runtime. RUNTIME will appear on the title bar following the project name.

POLLED GROUP

Create a polled group to monitor the input signals’ corresponding network variable values, nvo_pvout[4].

1. From the Menu Bar, select Tools/Variable Group Editor. This will display the Polled Group Editor dialog box.

2. In the Polled Variables list box, select M01_nvo_pvout[0] and click on the Add button. This will add the variable to the Group to Poll list box.

3. Add the following variables:
   - M01_nvo_pvout[1]
   - M01_nvo_pvout[2]
   - M01_nvo_pvout[3]

4. Enter a meaningful group name in the Polled Groups drop down list box, i.e. M01_pvout, and click on the Save Group button. (Leave the poll time at 1 second).

5. Close the dialog box.

MONITOR POLLED VARIABLES

Start monitoring the group of polled variables.

1. From the Menu Bar, select Browser/Polled Variables. This will open the Polled Variables Group dialog box.

2. Select M01_pvout group and click on the OK button. This will open a monitoring window that lists all the variables in the group and their runtime values.

WRITE VARIABLE

The physical calibration of the module is done from the Write Variable dialog box. The monitoring window is left in the background in order to verify the calibration.

1. From Menu Bar, select Tools/Write Variables. This will open the Write Variables dialog box. It will float in front of the monitoring window.

CALIBRATION

1. Connect the positive lead from the current source to terminal 1A (channel 1 input). A jumper from terminal 1A to 1B is required to convert the current into a voltage drop, across the module’s internal 50Ω resistor. Connect the negative lead from the current source to the COM terminal.

2. Apply a 4 mA current to the module.

3. In the Write Variable dialog box select M01_nci_callo[0].

4. In the text box enter 0 and click on the Apply button.

5. Apply a 20 mA current to the module.

6. Select M01_ncli_calhi[0].

7. In the text box enter 100 and click on the Apply button.

8. Push the Reset pin on the module. This causes the new calibration data to be written to the module’s EEPROM.

9. Apply a 12 mA current to the module.
10. On the monitoring window, verify that the value of M01_pvout[0] is 50.000 +/-0.050. This validates the calibration.

11. Repeat the above calibration procedure for the next three inputs.

12. When finished, close the Write Variables dialog box, close the monitoring window, and return to Design mode.