INSTALLATION AND SERVICE INSTRUCTION
MYCRO 352
SINGLE LOOP DIGITAL CONTROLLER
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IV.
Section 1

1.0 INTRODUCTION

This Installation And Service Instruction for the MYCRO 352 Single Loop Digital Controller is divided into six sections as follows:

Section 1, INTRODUCTION, gives general information pertaining to product description, model designation, and specifications.

Section 2, INSTALLATION provides general installation considerations, mounting and wiring guidelines, and specific mounting procedures.

Section 3, OPERATION, defines the controls, signal displays, and operating modes.

Section 4, CALIBRATION, provides field calibration procedures for analog inputs and outputs plus those No.3 Input Boards that require calibration.

Section 5, CIRCUIT DESCRIPTION, supplies general circuit descriptions of the Controller Board, Expander Board, No.3 Input Boards, Link Interface Board, and the Display Assembly.

Section 6, MAINTENANCE, furnishes preventive maintenance guidelines, troubleshooting, and subassembly replacement procedures. A Parts List is at the end of this section.


IMPORTANT
Save this Instruction and make it available for installation and maintenance of the Controller.

1.1 PRODUCT DESCRIPTION

The MYCRO 352 Single Loop Digital Controller (SLDC) is a microprocessor-based, self-contained, stand alone industrial controller. Its design provides for user configuration of the desired station type and control strategy via software interconnection of function blocks. Two standard models offer the flexibility for application of basic through complex process objectives.

The Model 352B basic version is for typical single loop strategies including ratio and external-set. The Model 352E expanded version has the capabilities of the 352B plus additional I/O capacity and additional functional blocks. Expansion allows for use of complex control schemes such as feedforward and pressure/temperature compensation of flow.

Optional No. 3 Input Boards allow an SLDC to receive a pulse, voltage, thermocouple, resistance temperature detector, or frequency input.

A Link Interface Board option provides communications with other stations over the Local Instrument Link and, with the addition of a Model 321 Expansion Satellite, the Hi-Level Link.

Both SLDC versions are pre-configured for basic single loop control and advanced multivariable control strategies. Several ROM-stored Factory Configured Options (FCO) are available. For example, FCO-01, which can be called up during configuration, supplies a PID controller, Hi/Lo process alarms, and setpoint tracking.

The SLDC is shown in Figure 1-1. Front panel dimensions conform to DIN standards. The Display Assembly contains the controls, mode switches, and signal displays required for local operation and configuration. Hardware and software for a basic SLDC and extra sockets for options and expansion are located on the Controller Board. All user electrical connections are made to terminals on the rear of the case.

Optional boards are plug-in assemblies. They can be installed at the factory or in the field without SLDC modification — configuration will be needed and some boards require calibration.

1.1.1 CONFIGURATION

Configuration is user selection and interconnection of function blocks to establish the control strategy. Configuration data is stored in nonvolatile memory to prevent loss of data should an electrical power interruption occur.

A keyboard, displays and controls for configuration are located on the front of the SLDC Display Assembly. A link interface equipped SLDC may be configured using the front panel keyboard or by a personal computer via a Link Interface Board.

Refer to SLDC User’s Manual for specific details and procedures.
FIGURE 1-1 Single Loop Digital Controller
1.1.2 STATION FUNCTIONS

The SLDC can be configured to cover all standard industrial controller station functions. Most station types presented in the following list can be structured with either a Model 352B or 352E. Variations which require the addition of an option board, or the use of a Model 352E are noted along with the applicable station type.

- Indicating Station
- Loading Station
- Auto/Manual Station
- Auto/Manual Station with Tracking
- Auto/Manual Bias Station with Tracking
- Single Loop Controller
- Single Loop Controller with Tracking Setpoint
- Remote-Set Controller
- Remote-Set Controller with Tracking Setpoint
- Ratio Controller
- Computer-Set Supervisory Controller - option board required
- Computer-Set DDC Controller - option board required
- Computer Manual Station - option board required
- Single Station Cascade Controller - Model 352E required

1.1.3 CONTROL STRATEGIES

A sampling of the control strategies an SLDC loop can provide is listed below. Note that all strategies listed for the Model 352B can also be accommodated by the Model 352E.

**MODEL 352B**
- Standby Synchronization
- Emergency Manual
- Adaptive Gain
- Override
- Ratio
- Bias

**MODEL 352E**
- Pressure/Temperature Compensation of Flow
- Dead Time Compensation
- Single Station Cascade
- Rate Limiting
- Batch Startup
- Sampled Data
- Feedforward

1.2 MODEL DESIGNATION

The station nameplate is located on the Controller Board and contains the station's model number. Model numbers are decoded as indicated below. Before installing a station or applying power to a station, check for the correct station model, options, power input, and electrical classification.

Sample Model Number

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<td>B — Basic</td>
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<td>E — Expanded</td>
<td></td>
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<td>Power Requirement</td>
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<tr>
<td>A — 120 Vac (+10%, -15%) 47 to 63 Hz</td>
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<tr>
<td>B — 24 Vac (+10%, -15%) 47 to 63 Hz</td>
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<tr>
<td>C — 24 Vdc (+20%, -15%)</td>
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<tr>
<td>E — 220/240 Vac (+10%, -15%) 47 to 63 Hz</td>
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<td>N — Not Required</td>
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<td>Operator’s Panel</td>
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<td>1 — Analog and Digital Displays; standard</td>
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<td>D — Delete; Panel Not Included</td>
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<td>N — Not Required: Includes Blank Panel</td>
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<tr>
<td>Input Number 3 - Options</td>
<td></td>
</tr>
<tr>
<td>V — Voltage (Additional 1 to 5 Vdc)</td>
<td></td>
</tr>
<tr>
<td>T — Thermocouple (J, K, T, E, S, R, B) and Millivolt</td>
<td></td>
</tr>
<tr>
<td>H — Hi Common Mode Thermocouple</td>
<td></td>
</tr>
<tr>
<td>D — RTD (DIN curve and US curve)</td>
<td></td>
</tr>
<tr>
<td>F — Frequency</td>
<td></td>
</tr>
<tr>
<td>C — Computer (Dual Pulse and Pulse Direction)</td>
<td></td>
</tr>
<tr>
<td>N — Not Required</td>
<td></td>
</tr>
<tr>
<td>Link Interface</td>
<td></td>
</tr>
<tr>
<td>1 — RS422, Half-Duplex</td>
<td></td>
</tr>
<tr>
<td>N — Not Required</td>
<td></td>
</tr>
<tr>
<td>Electrical Classification</td>
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</tr>
<tr>
<td>C — CSA</td>
<td></td>
</tr>
<tr>
<td>F — FM</td>
<td></td>
</tr>
<tr>
<td>N — Not Available</td>
<td></td>
</tr>
</tbody>
</table>
1.3 SPECIFICATIONS

1.3.1 MECHANICAL

DIMENSIONS
Panel Cutout ......................... See Figure 2-1
SLDC .................................. See Figure 2-2
Front ................................... German standard - Deutsche Industrie Normen - DIN 43831 - 72mm W x 144mm H

MOUNTING ............................. Single station or row mounting

1.3.2 POWER REQUIREMENTS

POWER SUPPLY OPTIONS
A — Standard ................................ 120 Vac (+10%, -15%) 47 to 63 Hz
B — Optional .......................... 24 Vdc (+10%, -15%) 47 to 63 Hz
C — Optional .......................... 24 Vdc (+20%, -15%)
E — Optional .......................... 220/240 Vac (+10%, -15%). 47 to 63 Hz

POWER INPUT .......................... 25 Watts, 45 VA

1.3.3 2-WIRE TRANSMITTER AND DIGITAL LOGIC POWER

VOLTAGE ................................ 26 Vdc ±7.5%
CURRENT ............................... 80 mA at 26 Vdc (maximum)

1.3.4 ANALOG INPUTS

Input Range ............................ 0 to 5 Vdc
Standard Calibration ................. 1 to 5 Vdc
Zero ..................................... 0 to 1 Vdc
Span ..................................... 4 to 5 Vdc
Input Type ............................. Single ended
Normal Mode Rejection ................. 6dB @ 2Hz, 60dB @ 60Hz
(2-pole filter with breakpoint frequency @ 2Hz)
Digital Filter Range ................... 0.001 to 10 Hz (breakpoint frequency)
Input Impedance ...................... >1 Megohm
Calibration Accuracy ................ 0.05% of span
A/D Resolution ......................... 12 bits
A/D Linearity .......................... ±1/2 LSB
Maximum Continuous Input .......... ±30 Vdc
Ambient Temperature Effect .............. < ±0.5% of span for a 100°F ambient temperature change

1.3.5 DIGITAL INPUTS

Logic “1” Range ......................... 15 to 30 Vdc
Logic “0” Range ......................... 0 to 1 Vdc
Overshoot ............................. ±30 Vdc
Current Draw at 24 Vdc ............... 10mA maximum
Isolation ................................ 100 Vdc
Minimum “On Time” .................. 500 msec
Minimum “Off Time” ................ 500 msec

1.3.6 COMPUTER PULSE INPUT BOARD

Types .................................. Pulse-direction and dual-pulse; selectable with on-board jumper
Input Voltage ......................... “ON” range: 5 to 30 Vdc
........................................ “OFF” range: = or < 0.5 Vdc
Maximum Frequency .................. 5000Hz
Minimum Pulse Width .................. “ON” and “OFF” time: 100 usec
Isolation ............................. Input circuit isolated up to 100 Vdc from station common
Maximum Continuous Input .......... ±30 Vdc
Input Range ......................... 1000 to 4000 pulses full scale
Ambient Temperature Effect .......... < ±0.5% for a 100°F ambient temperature change
1.3.7 THERMOCOUPLE INPUT BOARD

Reference Junction Compensation .......... Automatic
Input Impedance .......................... >200,000 ohms
Maximum Continuous Input ................. ±30 Vdc
Thermocouple Burnout Protection .......... Field selectable using jumper-plug

Type "J" T/C
Range Limits .............................. -300°F to 2000°F or -185°C to 1095°C
Zero (configurable) ....................... -300°F to 1000°F or -185°C to 540°C
Span (configurable) ....................... 125°F to 2000°F or 70°C to 1110°C
Accuracy ................................ ±0.7°F for span 700°F
Burnout Drive Rate ....................... 30°F/sec.

Type "K" T/C
Range Limits .............................. -300°F to 2500°F or -185°C to 1370°C
Zero (configurable) ....................... -300°F to 1300°F or -185°C to 700°C
Span (configurable) ....................... 175°F to 2500°F or 95°C to 1390°C
Accuracy ................................ ±0.9°F for span 900°F
Burnout Drive Rate ....................... 45°F/sec.

Type "T" T/C
Range Limits .............................. -300°F to 750°F or -185°C to 400°C
Zero (configurable) ....................... -300°F to 600°F or -185°C to 315°C
Span (configurable) ....................... 150°F to 900°F or 85°C to 500°C
Accuracy ................................ ±8°F
Burnout Drive Rate ....................... 40°F/sec.

Type "E" T/C
Range Limits .............................. -300°F to 1800°F or -185°C to 980°C
Zero (configurable) ....................... -300°F to 800°F or -185°C to 430°C
Span (configurable) ....................... 100°F to 1500°F or 55°C to 835°C
Accuracy ................................ ±0.6°F for span 600°F
Burnout Drive Rate ....................... 24°F/sec.

Type "S" T/C
Range Limits .............................. 0°F to 3000°F or -18°C to 1650°C
Zero (configurable) ....................... 0°F to 2400°F or -18°C to 1320°C
Span (configurable) ....................... 600°F to 3000°F or 330°C to 1670°C
Accuracy ................................ ±3°F
Burnout Drive Rate ....................... 160°F/sec.

Type "R" T/C
Range Limits .............................. 0°F to 3200°F or -18°C to 1760°C
Zero (configurable) ....................... 0°F to 2600°F or -18°C to 1430°C
Span (configurable) ....................... 600°F to 3200°F or 330°C to 1778°C
Accuracy ................................ ±3°F
Burnout Drive Rate ....................... 140°F/sec.

Type "B" T/C
Range Limits .............................. 0°F to 3300°F or -18°C to 1815°C
Zero (configurable) ....................... 0°F to 1800°F or -18°C to 980°C
Span (configurable) ....................... 1500°F to 3300°F or 830°C to 1830°C
Accuracy ................................ ±2.5°F for span < 2500°F
Burnout Drive Rate ....................... 180°F/sec.

1.3.8 MILLIVOLT INPUT BOARD

Input Impedance .......................... > 1 Megohm
Maximum Continuous Input ................. ±30 Vdc
Digital Filter Range ...................... 0.001 to 10Hz (breakpoint frequency)

*Thermocouple/Millivolt Input Board
WIDE RANGE
Range Limits ........................................ -75 mVdc to +75 mVdc
Zero (configurable) ............................ -75 to 70 mVdc
Span (configurable) ......................... 5 to 150 mVdc
Accuracy ............................................ ±5 microvolts for span < 10 mV
............................................ ±0.05% of span for span > 10 mV

NARROW RANGE
Range Limits ........................................ -20 mVdc to +20 mVdc
Zero (configurable) ............................ -20 to 19 mVdc
Span (configurable) ......................... 1 to 40 mVdc
Accuracy ............................................ ±5 microvolts for span < 10 mV
............................................ ±0.01% of span for span > 10 mV

1.3.9 VOLTAGE INPUT BOARD  Same as Analog Input, see section 1.3.4.

1.3.10 RTD INPUT BOARD
PARAMETERS
SF63-Filter Breakpoint Freq. ....................... 0.001 to 10 Hz
SRT-Range Type .................................. DIN/US
SRU-Range Units ................................ °F/°C
SRL-Range Low ...................................... -300 to 800°F (-185 to 425°C)
SRH-Range High ...................................... -275 to 1200°F (-171 to 650°C)
C213-Zero Input .................................. 100.00 Ohms
CF13-Full Scale Input ............................. 200.00 Ohms
CVI3-Verify Input ................................ 3.3 to 103.3%
HINT-Input T ..................................... 00 to 99
HINC-Input C ..................................... 00 to 99
LEAD RESISTANCE EFFECT ..................... 0.01°F/Ohm
ACCURACY ............................................ ±0.1°F for a span less than 100°F
............................................ ±0.1% of span for span greater than 100°F

1.3.11 FREQUENCY INPUT BOARD
PARAMETERS
SMIN-Frequency Range, Min. .................... 0.0 Hz to 12.50 kHz
SMAX-Frequency Range, Max .................... 1.0 Hz to 25.00 kHz
SZDO-Zero Drop Out .............................. 0.0 to 100% (% of Range)
CIPV-Input Peak Voltage ......................... -30.0V to +30.0V
CIVV-Input Valley Voltage ....................... -30.0V to +30.0V
CIL-Input Voltage Learn .......................... learn
CALIBRATION
Input Peak Voltage (CIPV) ...................... ±30.0V
Input Valley Voltage (CIVV) ................... ±30.0V, CIVV must be less than or equal to CIPV
Learn Mode CIL
Conversion Time ................................... 20 seconds maximum
Accuracy ............................................ ±2% V peak ±0.1V
Frequency Inputs Less Than 25 Hz
Pulse Width ....................................... 25 Milliseconds minimum
INPUTS
Frequency Range ................................ 0.05 Hz minimum
............................................ 25.00 kHz Maximum
Amplitude ......................................... 4.00V peak-to-peak minimum
............................................ 60.00V peak-to-peak maximum
Note: The DC offset plus 1/2 the peak-to-peak voltage cannot exceed 30V.
Signal Types ...................................... Sine, square, pulse, triangle, contact
Pulse Width ....................................... 20.00 μsec. minimum
Debounce Time
Fast ........................................... 11 μsec. ±15%
Slow ........................................... 4 μsec. ±15%
Hysteresis ....................................... 55% ±3% (difference between CIPV and CIVV)
Input Impedance .................................. 450k Ohms minimum
CONFIGURATION PARAMETERS
0% Frequency Range .................................. 0.0 Hz minimum
12.5 KHz maximum
100% Frequency Range ................................. 1.0 Hz minimum
25.00 KHz maximum
Minimum Span ........................................... >0% Frequency Range Value
Resolution ............................................. 12 bits
Accuracy ............................................... ±0.01% ±1 LSB over the specified temperature range
Zero Drop Out ......................................... 0.0% of span minimum
100.0% span maximum

1.3.12 ANALOG OUTPUTS
Standard Calibration .................................. 4 to 20 mAdc
Zero .................................................... 4 mAdc ± trim
Span .................................................... 16 mAdc ± trim
Signal Reference ..................................... Negative (-) output terminal is station common
Accuracy ............................................... ±0.1% of span
Current Limit ......................................... 20.5mA, ± 0.1mA
Output Load ........................................... 0-800 Ohms
Ambient Temperature Effect .......................... < ±0.5% of span for a 100°F temperature change

1.3.13 DIGITAL OUTPUTS
Output Type ........................................... Open collector transistor
(emitter tied to station common)
Load Voltage .......................................... 30 Vdc maximum
Load Current ......................................... 100mA maximum
Transistor “ON” Voltage ............................... 0.3V @ 0mA load
0.6V @ 100mA load

1.3.14 RELAY OUTPUTS
Type ..................................................... Hermetically sealed
Contact Configuration ................................ SPDT
Contact Rating ........................................ 1A @ 115 Vac
Action .................................................. Direct or reverse

1.3.15 LOCAL INSTRUMENT LINK
CABLE TYPE .......................................... Twinaxial Cable, Belden 9860 or 9182 or equivalent
(See SD15492 for details)

1.3.16 ENVIRONMENTAL
IEC LOCATION CLASSIFICATION .................... B (IEC 654-1)
OPERATING TEMPERATURE LIMITS ........... 0°C to +50°C (+32°F to +122°F)
See Section 2.2 for forced air ventilation statement.
OPERATING HUMIDITY AND MAXIMUM
MOISTURE CONTENT ................................. 5 to 95% RH; 0.028 pounds water/pound dry air
TRANSPORTATION AND STORAGE
TEMPERATURE LIMITS .............................. -40°C to +85°C (-40°F to +185°F)
TRANSPORTATION AND STORAGE
HUMIDITY LIMITS .................................... 0 to 100% RH, Non-Condensing

1.3.17 ELECTRICAL CLASSIFICATION
APPROVALS ........................................... FM and CSA approval as non-incendive for Class 1, Division 2 service in
Groups A, B, C & D.
See Section 1.2 Model Designation for station nameplate information.
2.0 INSTALLATION

This section provides general information such as installation considerations and mounting and wiring guidelines. It also provides specific information on SLDC mounting and electrical connections.

2.1 INSTALLATION CONSIDERATIONS

The SLDC is intended for flush panel mounting in a vibration-free instrument panel or rack. Install the SLDC in an indoor or sheltered location, either mounted singly or row mounted in a single panel cutout. Panel cutout dimensions are shown in Figure 2-1 and overall Station dimensions are shown in Figure 2-2.

Do not mount the SLDC where direct sunlight can strike the Display Assembly or case. Direct sunlight can make the displays difficult to read and will interfere with heat dissipation.

The SLDC should be mounted either horizontally or with a backward tilt (i.e., the front of the case higher than the rear). If the SLDC is to be mounted with electronic recorders, pneumatic recorders, or pneumatic stations, tilt back restrictions for these units may have a bearing on panel design or layout.

An SLDC is usually shipped with the circuit boards installed in the case and a Display Assembly attached to the front of the case. In some instances, the case is shipped separately and the circuit boards and Display Assembly are cartoned together for installation by the user.

For thermocouple inputs, a Thermocouple/Millivolt Input Board and a Reference Junction Temperature Sensor Board are needed. Thermocouple calibration includes both boards; therefore, to preserve the factory calibration, keep the Thermocouple/Millivolt Input Board and its Sensor Board together. When an SLDC is shipped completely assembled, the Sensor Board is mounted on the case rear terminals. When the Boards are shipped separately, the Sensor Board is housed in a bag attached to the circuit boards.

2.2 ENVIRONMENTAL CONSIDERATIONS

Refer to section 1.3.16 for SLDC operating temperature limits, operating humidity, and maximum moisture content. The air surrounding any operating SLDC must be kept below 50°C (122°F). The temperature of the air should be checked to ensure that this specification is not being exceeded.

CAUTION

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

Forced air ventilation is recommended when SLDCs are mounted in a partially or completely enclosed panel or cabinet (e.g., NEMA 1); see Figure 2-3. When clean air is present, exhaust fans are often mounted across the top of a panel and louvers formed in the panel bottom. Air is then drawn upward between the station cases. When air contains particulate matter, fans and filters are generally located at the panel bottom and louvers at the top. Filtered air is now forced upward between the station cases. Filters must be serviced periodically.

Only high quality, quiet running fans should be used. Also, the fans should not generate electrical noise which could interfere with electronic instruments.

A sealed cabinet (e.g., NEMA 12) containing equipment that does not generate significant heat should contain a recirculating fan for forcing air flow around equipment and throughout the cabinet preventing hot spots from developing.

Forced air conditioning may be required in very high density panels or consoles. Periodically change or clean air filters.

Industrial environments often contain particulate, liquid, and gaseous contaminants. Particulate matter, usually dust and dirt, is abrasive and can cause intermittent connections. A layer of dust on circuit boards can interfere with semiconductor heat dissipation. Liquid and gaseous contaminants can have a corrosive effect on metal, rubber, plastic and circuit board components. Extended exposure to these contaminants may result in malfunctions.

To reduce contaminant related equipment malfunctions:

1. Identify contaminants and implement methods to reduce their presence.

2. When cleaning equipment and surrounding area, especially the floor, either vacuum away all dust and dirt or use a dampened rag or mop. Sweeping or dry dusting recirculates dust and dirt.

3. Clean or replace all air conditioning filters, room air filters, and equipment filters regularly.

4. Inform all personnel with access to the equipment of the need for cleanliness.
**FIGURE 2-1 Panel Cutout Dimensions**

**ALTERNATE (DIN STANDARD) CUTOUT**

FOR INDIVIDUALLY MOUNTED 362 RECORDERS ONLY

\[
\text{HEIGHT} = \frac{5.44}{138} \\
\text{WIDTH: INCHES} = \frac{(2.84 \times A) + (5.67 \times B) - 16}{72.0 \times A} \\
\text{MM} = \frac{(144.0 \times A) + (144.0 \times B) - 4.1}{138} \\
\]

WHERE: 
A = NUMBER OF 352 AND 372 STATIONS
B = NUMBER OF 362 RECORDERS

NOTE: ALTERNATE CUTOUT DOES NOT ALLOW FOR POSSIBLE FUTURE SUBSTITUTION OF 2 MODEL 352 OR 372 STATIONS DUE TO WIDTH LIMITATIONS.

**FIGURE 2-2 Station Dimensions**

**NOTE:** 15" (381MM) MINIMUM FRONT OF PANEL CLEARANCE REQUIRED FOR BOARD ASSEMBLY REMOVAL.
Rear support is recommended where panel cutout density is high, and where panel face distortion may occur. Rear supports can be square stock, angle iron, metal channel, etc. The panel cutout should be square and flat, especially the bottom edge. Uneven cutting of the bottom edge can cause the station case(s) to cock and detract from front panel appearance.

An optional Analog Module Rack (AMR) can be used to mount up to six stations without cases. The AMR accepts circuit board modules, fits standard 19’’ rails and, since the top and bottom covers are perforated, must be mounted in an enclosure. Screw terminals like those on the standard case are located at the rear of the AMR for electrical connections.

Raceways, conduit, and wiring should not interfere with the removal or accessibility of the instruments, control devices, alarms, and related equipment.

2.3.2 STATION MOUNTING

This section provides procedures for single station mounting and multiple station row mounting of the SLDC.

2.3.2.1 Single Station Mounting

Single station mounting consists of mounting one SLDC in a single panel cutout.

1. Loosen and remove mounting brackets. See Figure 2-2.

2. Insert SLDC into panel cutout.

3. Install and partially tighten mounting brackets.

4. Square SLDC with panel.

5. Square mounting brackets with panel.

6. Alternately tighten mounting brackets until SLDC is secured to panel. Do not over tighten.

2.3.2.2 Multiple Station Row Mounting

Multiple station row mounting consists of grouping a number of SLDCs side by side within a single panel cutout.

1. Loosen and remove mounting brackets from all SLDCs. See Figure 2-2.

2. Insert an end of row SLDC into panel cutout; install and partially tighten mounting brackets.

3. Insert remaining SLDCs into panel cutout; install and partially tighten mounting brackets.

4. Square and space the SLDCs in cutout.

5. Alternately tighten mounting brackets on each SLDC until all are secured to panel. Do not over tighten.
2.4 ELECTRICAL INSTALLATION

The following sections describe wiring guidelines that should be followed when wiring an SLDC installation and define the purpose of each station rear terminal.

WARNING
Remove power from all involved wires and terminals to eliminate electrical shock hazard.

2.4.1 WIRING GUIDELINES

All wiring must conform to the National Electrical Code and local codes. DC wiring should be separated from AC wiring, and away from AC powered pushbuttons, alarms, annunciators, motors, solenoids, and similar devices. Metallic and non-metallic raceway and conduit are commonly used for routing panel wiring. Wiring not installed in raceways or conduit should be clamped or supported approximately every 12 inches.

Stranded wire is recommended, however, solid wire is typically used for thermocouple extension wire. Carefully select the wire size, conductor material, and appropriate insulation. Some selection considerations are:
- Current and voltage to be carried
- Total length of each wire run
- Whether wire will be bundled or run singly
- Indoor or outdoor installation
- Temperature extremes
- Exposure to sunlight
- Vibration
- Types of contaminants

Electrical connections are made to the screw terminals on the rear of the case. To make a connection, insert a stripped wire end or crimp-on terminal under the pressure plate at a screw terminal and tighten the screw. When preparing wire ends and making connections, refer to Figure 2-4 and the following:

- Stranded Conductor: Strip wire end 1/4" to 5/16" or as recommended by the crimp-on terminal manufacturer
- Solid Conductor: Strip wire 3/8" to 7/16" and form a gradual bend that will hook behind the terminal screw
- Do not nick conductor or cut away conductor strands when stripping insulation
- Crimp-on terminals must have insulated barrels; use a high quality crimping tool recommended by the terminal manufacturer
- Carefully inspect the crimped connection for mechanical strength and stray strands of wire that could short to an adjacent screw terminal; conductor should not be visible outside the crimp-on terminal body
- Insert the stripped wire end or crimp-on terminal under the pressure plate and tighten the terminal screw for a reliable electrical connection. If a crimp-on terminal is not used, wire insulation should butt against the pressure plate and the conductor should not be visible; it is not necessary to wrap wire conductor around terminal screw.
- Inspect each connection completed for strands of wire that could short to an adjacent terminal, for connection to the correct terminal, and for tightness of the terminal screw. Pay particular attention to the braided shield of twinaxial cable for the Local Instrument Link.

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FIGURE 2-4 Conductor Installation on Rear Terminals

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PA-1780-1
2.4.2 REAR TERMINAL CONNECTIONS

All electrical connections are made to the terminals located at the rear of the SLDC. Rear terminals are designated by a column letter and a row number (e.g., A1, D8) as shown in Figure 2-5 and Table 2.1. Recommended wire size for signal wiring is 18 gauge (AWG), power wiring 14 gauge (AWG).

WARNING

Remove power from all involved wires and terminals to eliminate electrical shock hazard.

Rear terminals have #6 screws and pressure plates. They accept stranded wire, solid wire, and spring spade tongue and ring tongue crimp-on terminals with insulated barrels. See Figure 2-4. For an electrical connection to be made, a terminal screw must be tightened clamping the wire or crimp-on connector between the pressure plate and spring plate to insure electrical contact.

Station common is at rear terminal A5. It should be connected to the user’s instrument bus common. Within the SLDC, station common is connected to a common reference point which in turn is connected to the two-wire power supply common, the digital output common, and all analog input and analog output commons. Station common is isolated from case ground, terminal AG. Digital input commons are isolated from the station common and case ground.

The SLDC accepts voltage inputs. When a current input (e.g., 4 to 20mA) is to be applied to the SLDC, a precision range resistor must be placed across the input terminals. A range resistor may not be required if the input is wired in parallel with other 1 to 5 Vdc receiving instruments. Refer to loop diagrams and determine if a range resistor is required. Supplied range resistors are 250 ohms for 4 to 20mA inputs.

ASSIGNMENTS

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<tr>
<th>COLUMN “A”</th>
<th>COLUMN “B”</th>
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<tr>
<td>AH - AC SUPPLY, HOT. OR DC (+)</td>
<td>B1 - LINK (+)</td>
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<tr>
<td>AN - AC SUPPLY, NEUTRAL. OR DC (-)</td>
<td>B2 - LINK (-)</td>
</tr>
<tr>
<td>AG - CASE (SAFETY) GROUND</td>
<td>B3 - NO CONNECTION</td>
</tr>
<tr>
<td>A4 - ANALOG INPUT 1 (+)</td>
<td>B4 - DIGITAL OUTPUT 1 (+)</td>
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<tr>
<td>A5 - ANALOG INPUT</td>
<td>B5 - 426 VDC</td>
</tr>
<tr>
<td>COMMON (+)</td>
<td>B6 - TRANSMITTER SUPPLY</td>
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<tr>
<td>A6 - ANALOG INPUT 2 (+)</td>
<td>B7 - DIGITAL OUTPUT 2 (+)</td>
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<td>A7 - ANALOG OUTPUT 1 (+)</td>
<td>B8 - DIGITAL OUTPUT 1 (+)</td>
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<td>A8 - ANALOG OUTPUT</td>
<td>B9 - DIGITAL OUTPUT 1 (+)</td>
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<tr>
<td>COMMON (+)</td>
<td>B10 - OPTIONAL No. 3 INPUT</td>
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<td>A9 - OPTIONAL No. 3 INPUT</td>
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<td>C4 - NO CONNECTION</td>
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<td>C5 - ANALOG OUTPUT 2 (+) (SEE NOTE 3)</td>
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<td>C6 - ANALOG OUTPUT 3 COMMON (+)</td>
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<td>C7 - DIGITAL INPUT 2 (+)</td>
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<td>C8 - DIGITAL INPUT 2 (+)</td>
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<td>C10 - DIGITAL INPUT 3 (+)</td>
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</tr>
<tr>
<td>COMMON (+)</td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
1. Terminal columns “A” and “B” are provided on 20 terminal case for model 352B. Terminal columns “A”, “B”, “C”, and “D” are provided on 40 terminal case for models 352B and 352E.
2. Refer to Table 2.1 for No. 3 Input Connections.

3. Terminal C5 and C6 are NO CONNECTION in stations with A 0 software or Expander Board PN 15770-1.
### TABLE 2.1 Rear Terminal Assignments

This table lists rear terminal designations, assignments, and comments in groups according to the type of input or output. Input/output specifications are contained in section 1.4. Figure 2-5 shows the case rear terminals.

<table>
<thead>
<tr>
<th>REAR TERMINAL</th>
<th>TERMINAL ASSIGNMENT</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POWER INPUT</strong></td>
<td></td>
<td>See Model Designation</td>
</tr>
<tr>
<td>AH</td>
<td>AC Hot or DC (+)</td>
<td>section and station name-plate for voltage input.</td>
</tr>
<tr>
<td>AN</td>
<td>AC Neutral or DC (-)</td>
<td></td>
</tr>
<tr>
<td>AG</td>
<td>Case (Safety) Ground</td>
<td></td>
</tr>
<tr>
<td><strong>ANALOG INPUTS</strong></td>
<td></td>
<td>Each analog input is connected between an Al(#)+ terminal and an AlC- terminal. All analog inputs must be 1 to 5 Vdc. For mA inputs, a range resistor must be connected across the analog input terminals.</td>
</tr>
<tr>
<td>A4</td>
<td>A11+</td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td>A1C-</td>
<td></td>
</tr>
<tr>
<td>A6</td>
<td>A12+</td>
<td></td>
</tr>
<tr>
<td>D4</td>
<td>A14+</td>
<td></td>
</tr>
<tr>
<td>D5</td>
<td>A1C-</td>
<td></td>
</tr>
<tr>
<td>D6</td>
<td>A15+</td>
<td></td>
</tr>
<tr>
<td>D7</td>
<td>A16+</td>
<td></td>
</tr>
<tr>
<td>D8</td>
<td>A1C-</td>
<td></td>
</tr>
<tr>
<td><strong>OPTIONAL NO. 3 INPUT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer Pulse Input Board</td>
<td></td>
<td>Option board required to use these terminals. For Pulse Input Board, pulse direction and dual pulse inputs accepted; either input type selectable with pulse input board jumper. Refer to Figure 2-8 for jumper position. “ON” range, 5 to 30 Vdc; “OFF” range, 0 to 0.5 Vdc. Max. frequency, 5000Hz. Minimum ON and OFF time, 100 usec. Terminal A9 is source common, may be at ground or up to 30 Vdc. Terminal A10 is Pulse or Up. Terminal B10 is Direction or Down.</td>
</tr>
<tr>
<td>A9</td>
<td>A13e</td>
<td></td>
</tr>
<tr>
<td>A10</td>
<td>A13+</td>
<td></td>
</tr>
<tr>
<td>B10</td>
<td>A13-</td>
<td></td>
</tr>
<tr>
<td>Thermocouple/Millivolt Input Board</td>
<td></td>
<td>Thermocouple or millivolt inputs are applied across A10 and B10. Reference junction Temperature Sensor Board is connected across A8 and A9 for T/C inputs; See Figure 2-5.</td>
</tr>
<tr>
<td>A10</td>
<td>A13+</td>
<td>Refer to Calibration, section 4.2 for jumper-plug positions.</td>
</tr>
<tr>
<td>B10</td>
<td>A13-</td>
<td></td>
</tr>
<tr>
<td>A8</td>
<td>SENS. BD.</td>
<td></td>
</tr>
<tr>
<td>A9</td>
<td>SENS. BD.</td>
<td></td>
</tr>
<tr>
<td><strong>Voltage Input Board</strong></td>
<td></td>
<td>Analog input, 1 to 5 Vdc. For mA input, a range resistor must be connected across the input terminals.</td>
</tr>
<tr>
<td>A9</td>
<td>A13-</td>
<td></td>
</tr>
<tr>
<td>A10</td>
<td>A13+</td>
<td></td>
</tr>
<tr>
<td><strong>Frequency Input Board</strong></td>
<td></td>
<td>Refer to section 1.3.11 for specifications and Figure 2-10 for jumper-plug settings.</td>
</tr>
<tr>
<td>A10</td>
<td>A13+</td>
<td></td>
</tr>
<tr>
<td>B10</td>
<td>A13-</td>
<td></td>
</tr>
<tr>
<td><strong>RTD Input Board</strong></td>
<td></td>
<td>RTD connections for 2-wire, 3-wire, and 4-wire devices.</td>
</tr>
<tr>
<td>A9</td>
<td>A13 Power</td>
<td>See Figure 2-11 for connections.</td>
</tr>
<tr>
<td>A10</td>
<td>A13+</td>
<td></td>
</tr>
<tr>
<td>B10</td>
<td>A13-</td>
<td></td>
</tr>
<tr>
<td><strong>DIGITAL INPUTS</strong></td>
<td></td>
<td>Each digital input is connected between a DI(#)+ terminal and a DI(#) terminal. Logic “1” is 15 to 30 Vdc, Logic “0” is 0 to 1 Vdc; minimum on and off time 500 msec. An inductive source must be shunted by a transient suppression diode to prevent damage to an SLDC input circuit. Protection required is similar to that shown in Figure 2-12 for digital outputs.</td>
</tr>
<tr>
<td>B8</td>
<td>DI1+</td>
<td></td>
</tr>
<tr>
<td>B9</td>
<td>DI1-</td>
<td></td>
</tr>
<tr>
<td>C7</td>
<td>DI2+</td>
<td></td>
</tr>
<tr>
<td>C8</td>
<td>DI2-</td>
<td></td>
</tr>
<tr>
<td>C9</td>
<td>DI3+</td>
<td></td>
</tr>
<tr>
<td>C10</td>
<td>DI3-</td>
<td></td>
</tr>
</tbody>
</table>

*Continued*
<table>
<thead>
<tr>
<th>TABLE 2.1 (Cont'd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>REAR TERMINAL</td>
</tr>
<tr>
<td>LOCAL INSTRUMENT LINK</td>
</tr>
<tr>
<td>B1</td>
</tr>
<tr>
<td>B2</td>
</tr>
<tr>
<td>ANALOG OUTPUTS</td>
</tr>
<tr>
<td>A7</td>
</tr>
<tr>
<td>A8</td>
</tr>
<tr>
<td>D9</td>
</tr>
<tr>
<td>D10</td>
</tr>
<tr>
<td>C5</td>
</tr>
<tr>
<td>C6</td>
</tr>
<tr>
<td>DIGITAL OUTPUTS</td>
</tr>
<tr>
<td>B4</td>
</tr>
<tr>
<td>B6</td>
</tr>
<tr>
<td>B7</td>
</tr>
<tr>
<td>RELAY OUTPUTS</td>
</tr>
<tr>
<td>C1</td>
</tr>
<tr>
<td>C2</td>
</tr>
<tr>
<td>C3</td>
</tr>
<tr>
<td>D1</td>
</tr>
<tr>
<td>D2</td>
</tr>
<tr>
<td>D3</td>
</tr>
<tr>
<td>TWO-WIRE TRANSMITTER POWER</td>
</tr>
<tr>
<td>B5</td>
</tr>
<tr>
<td>NO CONNECTION</td>
</tr>
<tr>
<td>B3</td>
</tr>
<tr>
<td>C4</td>
</tr>
</tbody>
</table>
FIGURE 2-6 Single-Loop System, 2-Wire I/O

FIGURE 2-7 Single-Loop System, 4-Wire I/O
Figure 2-8 Pulse Input Board, Physical Layout
WIRING RECOMMENDATIONS FOR ISOLATED COMPUTER OUTPUTS USING AN ALTERNATE POWER SUPPLY

ON/OFF = TWISTED PAIR CONDUCTOR

WIRING RECOMMENDATIONS FOR ISOLATED COMPUTER OUTPUTS USING THE STATION POWER SUPPLY

ON/OFF = TWISTED PAIR CONDUCTOR

WIRING RECOMMENDATION FOR NON-ISOLATED COMPUTER OUTPUTS USING AN ALTERNATE POWER SUPPLY

ON/OFF = TWISTED PAIR CONDUCTOR

FIGURE 2-9 Typical Pulse Input Connections
NOTE:
UVEPROM (ULTRAVIOLET ERASABLE ELECTRICALLY PROGRAMMABLE READ-ONLY MEMORY)
DAC (DIGITAL/ANALOG CONVERTER)
BOARD SHIPPED WITH W1 IN "FAST" DEBOUNCE POSITION AS SHOWN. ALTERNATE POSITION IS "SLOW" DEBOUNCE. SEE INPUT SPECIFICATIONS.

FIGURE 2-10 Frequency Input Board, Physical Layout

FIGURE 2-11 RTD Connections
A. Relay Load and User Supplied Power Supply

B. Relay Load and Station +26V Power Supply

C. Solid State Loads (e.g., Alarm Annunciator)

FIGURE 2-12 Digital Outputs to Typical Loads
A. Row to Row Connections, Twinaxial Cable

---

B. Row Mounted Station Connections, Twisted Pair Wiring

NOTES:
1. DRAIN WIRE OF SHIELD CONNECTS TO TERMINAL SG. A SHORT JUMPER OF 16 AWG, INSULATED WIRE GROUNDS SHIELD TO TERMINAL AG.
2. DRAIN WIRE OF SHIELD IS CUT BACK AND INSULATED.
3. \( \uparrow \) DENOTES 18 AWG TWISTED PAIR CONDUCTORS.
4. TWISTED PAIR WIRING IS USED TO INTERCONNECT STATIONS SEPARATED BY UP TO 2 FT. (0.6 METERS) EITHER WITHIN A ROW OR ROW-TO-ROW. TWINAXIAL CABLE IS USED FOR DISTANCES GREATER THAN 2 FT. THE MAXIMUM TWISTED PAIR LENGTH IS 10 FT. (3 METERS).

SEE SD15492 FOR COMPLETE INFORMATION ON LOCAL INSTRUMENT LINK WIRING.

PA-1285-2

FIGURE 2-13 Link Connections
2.5 CIRCUIT BOARD INSTALLATION

This section describes field installation of circuit boards and the Display Assembly. Some shipments are made with the Controller Board and Display Assembly separated from the case. They are installed in the case by the user. Also, the user can add circuit boards to a previously acquired station to increase its usefulness. Added boards must be software compatible with those previously installed; see section 6.7. Station calibration and configuration may be needed when circuit boards are added.

The Controller Board, Expander Board, No.3 Input Boards, Link Interface Board, and Display Assembly contain integrated circuits which can be damaged by electrostatic discharge, therefore, special handling is required. Handling guidelines and installation procedures are provided in the following sections.

2.5.1 HANDLING GUIDELINES

1. Each circuit board and Display Assembly is shipped in a static shielding bag. Keep each item in its bag until time of installation.

2. A grounding wrist strap must be used when handling a circuit board and is highly recommended when handling the Display Assembly. The display assembly bezel is made of plastic so the Display Assembly can be installed without touching the boards inside.

3. Moore Products Co. part numbers for a Grounding Wrist Strap and Mat Kit and Static Shielding Bags are given in the Maintenance section of this Instruction.

2.5.2 CONTROLLER BOARD AND DISPLAY ASSEMBLY

Additional circuit boards may be mounted on the Controller Board, depending upon model designation.

1. Remove board retainer.

2. Snap grounding wrist strap around wrist and attach clip to ground.

3. Remove Controller Board from static shielding bag and insert Board into card guides.

4. Push on top and bottom of board with equal force to slide Board into case.

5. Install board retainer as shown in Figure 2-14.

6. Remove Display Assembly from static shielding bag. Handle Assembly by bezel.

7. Connect Controller Board ribbon cable to Display Assembly.

8. Detach ground clip from case.


10. Secure Assembly by tightening captive screw behind ID plate.

IMPORTANT

The board retainer, shown in Figure 2-14, must be in place whenever the Controller Board is installed in the case.

2.5.3 NO.3 INPUT BOARD

A No.3 Input Board can be field-installed in a Basic Station (Model 352B) or an Expanded Station (Model 352E).

Only one No.3 Input Board can be added per Station. The Parts List at the back of this Instruction shows that the No.3 Input Board plugs into connector J2 of the Controller Board and that it is positioned and secured by four spacers and eight screws.

1. If Controller Board is installed in a case, remove the Board and Display Assembly by reversing the steps in section 2.5.2.

2. Place Controller Board on a grounded conductive mat, component side up.

3. Model 352E only - remove Expander Board by:

   A. Removing four screws and lockwashers securing Expander Board to spacers.

   B. Disconnecting Expander Board ribbon cable connector from J1 on Controller Board.

4. Remove No.3 Input Board from static shielding bag and set jumper-plugs as follows:

   Pulse Input Board — See Figure 2-8

   Thermocouple/Millivolt Input Board — See Figure 4-1 or Figure 4-2

   Voltage Input Board — None to be set.

   RTD Input Board — None to be set.

   Frequency Input Board — See Figure 2-10

5. Align 40 pin connector on No.3 Input Board with connector J2 on Controller Board, and while applying equal force to both ends of the No.3 Input Board connector, carefully mate the connectors.

6. Install a spacer between the No.3 Input Board and the Controller Board at each corner of the No.3 Input Board. The two, 4-40 x 3/8 lg. pan head screws with lockwashers at each corner.

7. Model 352E only - install Expander Board.

8. Install Controller Board and Display Assembly in case according to instructions in section 2.5.2.

9. For a Thermocouple/Millivolt Input Board jumpered for thermocouple input, install Sensor Board on case terminals A8 and A9. See Figure 2-5.

2.5.4 EXPANDER BOARD

This section covers the installation of an Expander Board in a Model 352B Station. The addition of an Expander Board requires a case with a rear plate having 40 screw terminals. A case with 20 screw terminals will require modification. Consult the factory for information on case modification.

The Expander Board must be mounted on the component side of the Controller Board with 4 spacers and secured by 8 screws and washers, as shown in the Parts List at the back of this Instruction. Follow the below procedure to install an Expander Board.

1. If Controller Board is installed in case, reverse procedure in section 2.5.2 and remove Display Assembly and Controller Board; otherwise, continue this procedure.
2. Place Controller Board on a grounded conductive mat, component side up.

3. Line-up P1 of the Expander Board with J1 of the Controller Board and note positions which the 4 spacers will occupy - directly under the 4 screw holes in the Expander Board. Do not plug Expander Board into Controller Board at this time.

4. Mount 4 spacers on Controller Board with #8-32 x 3/8 lg. round head screws and washers.

5. Plug P1 of Expander Board into J1 of Controller Board. Secure Expander Board to 4 spacers with four #8-32 x 3/8 lg. round head screws and washers.

6. Installation is complete. Reinstall Controller Board and Display Assembly in case according to instructions in section 2.5.2 Adding an Expander Board requires station calibration.

2.5.5 LINK INTERFACE BOARD

Figure 5-2 and the Parts List at the back of this instruction indicate that the Link Interface Board must be connected to J3 of the Controller Board and secured with four spacers and eight screws. Follow the below procedure to install a Link Interface Board.

1. Refer to Handling Guidelines, section 2.5.1, prior to removing a Link Interface Board from its static shielding bag or removing Controller Board from case.

2. If Controller Board is installed in case, reverse procedure in section 2.5.2 and remove Display Assembly and Controller Board; otherwise, continue this procedure.

3. Place Controller Board on a grounded conductive mat - component side up.
4. Line-up P1 of Link Interface Board with J3 of Controller Board and note positions which the 4 spacers will occupy directly under the 4 corner screw holes in the Link Interface Board. Do not plug Link Interface Board into Controller Board at this time.

5. Mount 4 spacers on Controller Board and secure with four #4-40 x 3/8 lg. pan head screws.

6. Plug P1 of Link Interface Board into J3 of Controller Board. Secure Link Interface Board to 4 spacers with four #4-40 x 3/8 lg. pan head screws.

7. Installation is complete. Reinstall Controller Board and Display Assembly in case according to instructions in section 2.6.2.

NOTE
The Link Interface Board requires no jumper-plug settings or calibration; however, the Station's link address must be set and it must be configured under Function Block (FB)98 prior to placing it into operation. Refer to the Configuration Handbook AD352-20 for additional instructions.

2.5.5.1 Setting Link Address

An SLDC equipped with a Link Interface Board and B - - software can communicate with other link-connected stations and/or devices providing that FB98 has been configured and the assigned station address set into the Station by the user.

The following information will be required prior to setting a Station's address:

1. Assigned Station address. (Refer to System Drawing or other applicable documentation.)

2. Execution Sequence Number (ESN) assigned to FB98. (Refer to AD352-30, MYCRO 352 Configuration Documentation Booklet.)

Use the following procedure to set the address of a Station:

1. With power off at Station, verify that 'H/T/F' lockout switch is enabled. (Refer to Figure 5-3 for switch location.)

2. Verify the Station's model number and input power requirement. The Station's nameplate is on the Controller Board; refer to section 1.2 Model Designation to decode the model number. Figure 2-14 shows the color coded extractor tab that also indicates power input requirement. Apply power to Station.

3. Press ENTER CONF button to enter configuration mode at MENU level. [Station must be in 'L' (Local mode). Refer to section 3.5.]

4. Rotate Pulser Knob to select 'T' (table) on left digit position of alphanumeric display. (If 'TX' appears in the display, the lockout switch on the Controller Board must be enabled.)

5. Press STEP DOWN button to enter FUNCTION BLOCK level.

6. Rotate Pulser Knob to select function block '98'.

7. Press STEP DOWN button to enter PARAMETER level. ('TESN' appears in alphanumeric display.)

8. Press STEP DOWN button to enter VALUE level.

9. Rotate Pulser Knob to ESN assigned to FB98 in user's Configuration Documentation Booklet AD352-30. (If ESN unavailable, set Pulser Knob to any value in order to continue with this procedure.)

10. Press STORE button to lock-in value.

11. Press EXIT button.

12. Press ENTER CONF button to enter configuration mode at MENU level.

13. Rotate Pulser Knob to select 'H' (hard configuration) mode on left digit position of alphanumeric display.

14. Press STEP DOWN button to enter FUNCTION BLOCK level.

15. Rotate Pulser Knob to select function block '98' on right side digits of alphanumeric display. (FB '98 will not be available if ESN set to 00 or not stored in accordance with steps 9 and 10.)

16. Press STEP DOWN button. ('HLSA' appears in alphanumeric display.)

17. Press STEP DOWN button. (Station address 0 to 64 appears in 4-1/2 digit display.)

18. Rotate Pulser Knob to assigned Station address. (Refer to System Drawing or other applicable documentation.)

19. Press STORE button to lock-in desired value.

20. Press EXIT button.

This completes the procedure. Refer to SD15492, Installation and Service Instruction, Local Instrument Link, for additional information.

IMPORTANT
A Station connected to the LIL will not be capable of link communications unless the Station address is set.
2.6 FACTORY CALIBRATION

Unless a special calibration is ordered, the factory calibration is as follows:

Analog input function blocks ................. 1 to 5 Vdc
Analog output function blocks ............... 4 to 20mA
Frequency Input Board ..................... SMIN - 0.0 Hz
.................................... SMAX - 25.000 Hz
.................................... SZDO - 0%

Pulse Input Board ...................... Refer to section 1.3.6

RTD Input Board ....................... CZI3 - 100 Ohms
.................................... CFI3 - 200 Ohms
.................................... CVI3 - -3.3 to 103.3%

Thermocouple/Milliamp Input Board

Thermocouple ....................... Type J. Upscale Break
Voltage Input Board ...................... 1 to 5 Vdc

Section 4 provides calibration procedures which may be used to check or change factory calibration.

IMPORTANT

Thermocouple calibration includes the Sensor Board. Changing the Sensor Board from that supplied with the SLDC will require recalibration.

2.7 CONFIGURATION

The station must be configured, which includes entering values for loop tuning, before controlling a process. For configuration procedures, refer to either AD352-10 Model 352 User's Manual or AD352-20 Model 352 Configuration Handbook. For tuning guidelines, refer to AM-35. Digital Controller Tuning.

Unless otherwise specified on the order, the factory configuration is FC01.
Section 3

3.0 OPERATION

This section describes the controls and signal displays used for SLDC operation. Since the SLDC is user configured, the information provided in this section is considered typical. Refer to Configuration Handbook AD352-20 for configuration procedure.

Some displays and controls are used during both configuration and operation. The use of displays and controls for station operation is explained in this section; refer to the supplemental configuration literature for their use during configuration.

Refer to Figure 3-1 for each of the following sections.

3.1 4-1/2 DIGIT DISPLAY

The 4-1/2 digit, display is used to indicate a selected variable from the display select group. Any number of variables in this group [i.e., (P) process, (S) setpoint, (V) valve, (X) user defined variable, and (Y) user defined variable] can be selected for display.

The "D" display select pushbutton is used to change the displayed variable. Pressing this pushbutton steps the display one position in the sequence P, S, V, X, and Y from any starting point within the display select group. This pushbutton is inactive during configuration modes and all variables in the display select group are off.

The SLDC is configured for power-up in either an automatic or manual operating mode. The display will show the appropriate variable upon power-up: setpoint for automatic, valve for manual.

The process, setpoint, and user defined variables can be configured for display in scaled process units (such as pressure, temperature, GPM) or for 0 to 100%. A positive range value is indicated with a (+) sign and a (-) sign indicates a negative range value.

---

![Operator Controls and Signal Displays](image)

**FIGURE 3-1 Operator Controls and Signal Displays**
3.2 ALPHANUMERIC DISPLAY

This display shows an activated status when a specified condition is met.

A1 — Absolute alarm #1; function block FB12
A2 — Absolute alarm #2; function block FB12
Ad — Deviation alarm; function block FB12
H1 — Hi/Lo limit input equal to or higher than high limit setting; function block FB09
L1 — Hi/Lo limit input equal to or lower than low limit setting; function block FB09
H2 — Hi/Lo limit input equal to or higher than high limit setting; function block FB51
L2 — Hi/Lo limit input equal to or lower than low limit setting; function block FB51
OR — Override selector status output indicates normal “A” input being overridden by “B” or “C” input; function block FB10
SS — A/M transfer block in standby synchronization mode; function block FB14
EM — A/M transfer block in emergency manual mode; function block FB14
U1 — User defined Input #1; function block FB15
U2 — User defined Input #2; function block FB15
EI — Emergency Internal; function block 11
EL — Emergency Local; function block 98
NU — Non-Updating input; function block 98
E* — Station error; specific error code

During normal operation, the alphanumeric display is blank. When a single status condition is activated, the status indicator is displayed and followed by an asterisk (A1, A2 & Ad only) and the number 1, e.g., “A1*1”. When multiple status conditions are activated, either simultaneously or additionally with others, one of the statuses is displayed followed by an asterisk (if, A1, A2, or Ad is in alarm) and the total number of activated status conditions e.g., “A1*3”.

A maximum of three status indicators may be selected to trigger the flashing of the process and setpoint bargraphs when a status indication is activated. Acknowledgment of the bargraphs can be configured to be self-clearing and the flashing of the bargraphs will cease when the status condition no longer exists. A local operator can always clear the flashing by pressing the “ACK” acknowledge pushbutton.

The “ACK” pushbutton is also used to step through activated status conditions. Each time this pushbutton is pressed, the remaining active status indicators are stepped through for display.

3.3 BARGRAPH DISPLAYS

Three, multi-segmented, red LED bargraph displays are typically used to indicate the setpoint, process, and valve signals. The vertical setpoint and process bargraphs each contain 64 LEDs and indicate from 0% to 100%. The horizontal valve bargraph contains 40 LEDs and indicates the valve signal from 0% to 100% of the valve opening.

The valve bargraph indicates the valve signal with respect to percent of valve opening from 0% to 100%. Note that the valve bargraph has the words CLOSE at 0% and OPEN at 100%. If a valve signal increases to move the valve in the open direction, the valve bargraph is configured so that a 0% valve signal is shown as 0% (CLOSE) and a 100% valve signal is shown as 100% (OPEN). If a valve signal decreases to move the valve in the open direction, the valve bargraph is configured so that a 0% valve signal is shown as 100% (OPEN) and a 100% valve signal is shown as 0% (CLOSE).

All signals must be configured by the user unless a Factory Configured Option is used. Typically, control stations (i.e., an SLDC configured with a control function) have the setpoint displayed on the left, “S” bargraph, the process displayed on the right, “P” bargraph, and the valve signal on the valve bargraph. A non-control station (i.e., an SLDC configured without a control function) typically has the station input displayed on the “P” bargraph and the valve signal on the valve bargraph.

In addition, the process and setpoint bargraphs can be configured to flashed on and off in response to an activated status condition; see section 3.2.

3.4 PULSER KNOB

The pulser knob is normally used to adjust the local setpoint and manual output. The setpoint is adjusted during automatic modes and the manual output is adjusted during manual modes.

The pulser knob action is determined during configuration. It can be set for either direct action (i.e., clockwise turning increases the manual output) or for reverse action (i.e., clockwise turning decreases the manual output). Note that the pulser knob action applies only to manual output adjustment and is typically configured so that clockwise turning increases the process signal.

3.5 OPERATING MODES

The operating modes required for any SLDC operation are dependent upon the user configuration of the station type and control strategy. All typical operating modes for standard industrial controller types can be configured for use by the SLDC.

The A/M (Automatic/Manual), E/I (External/Internal), and C/L (Console/Local) pushbutton mode switches are used to establish the operating modes locally. Any combination of these switches can be configured for use. Each mode switch has a corresponding function block from which the switch function or functions are selected. The following paragraphs describe the typical function selections of the three mode switches.

The A/M switch may be used to select either automatic or manual control. Each mode has a corresponding LE indication: a green LED is lighted to indicate automatic and a red LED is lighted to indicate manual.
The E/I switch may be used to select either an external or internal setpoint for the controller setpoint. Each mode has a corresponding LED indication; a green LED is lighted to indicate external setpoint and a red LED is lighted to indicate internal setpoint.

The C/L switch may be used to establish the origin of station control for a link interface equipped SLDC. Console control can be by a MYCRO Operator Console or an independent computer via an Independent Computer Interface. Local control is maintained by an operator locally. Each mode has a corresponding LED indication; a green LED is lighted to indicate console control and a red LED is lighted to indicate local control. When this switch is not configured for use, local control is assumed and no LED indication is shown.

The functions of the three mode switches can be combined to accommodate the desired station type.

Used alone, the A/M switch provides for control with a local operator adjusted setpoint in automatic or valve signal in manual. A link interface equipped SLDC can use the C/L switch in conjunction with the A/M switch to allow for either non-local or local control. Non-local control (Console mode) allows a MYCRO Operator Console or independent computer via an Independent Computer Interface to adjust the controller setpoint or valve signal and to switch between non-local and local control. The E/I switch can be used together with the A/M or C/L switch or with both switches. This switch allows for an external setpoint only or a choice of an external or internal setpoint for the controller. When configured so that an external or internal setpoint may be chosen, both non-local and local selection can be performed in the applicable console or local mode.

The SLDC is configured for power-up in the desired operating mode. Switching between modes can be user configured to be bumpless and procedureless.

3.6 DISPLAY TEST

Pushing the EXIT configuration button will light all display segments and LEDs. A three step test is automatically performed on the alphanumeric display to light all its segments. The Station must be in an operating mode for display test to function. If the Station is in a configuration mode when the EXIT button is pressed, the Station will exit configuration without performing a display test.

3.7 PUSHBUTTON CARE

Pushbuttons should be pressed by a finger, an unused eraser on a pencil, or a stick eraser. Use of a hard implement, such as the cap end of a pen, a blunt tool, or a fingernail, may deform the dome switch and result in pushbutton failure.
Section 4

4.0 CALIBRATION

This section describes calibration and calibration verification of the following function blocks:

FB01 Analog Input 1
FB02 Analog Input 2
FB03 Analog Output 1
FB05 Analog Input 4
FB06 Analog Input 5
FB07 Analog Input 6
FB09 Analog Output 2
FB61 Analog Output 3
FB99 No. 3 Input

| Voltage Input 3 - Refer to section 4.1 |
| T/C or mV Input - Refer to section 4.2 |
| RTD Input - Refer to section 4.3 |
| Frequency Input - Refer to section 4.4 |

Stations calibrated at the factory will not need to be recalibrated for most applications. However, for critical applications, consider the following during recalibration:

- If the input is a current signal (e.g., 4-20 mA), calibrate the input with a precision current source. The 250 ohm precision resistor installed across a pair of terminals for calibration should remain with the station, connected across that set of terminals, to eliminate the voltage drop variation due to resistor tolerance.

- Allow the Station to warm-up for an hour prior to calibrating. The ambient temperature should be close to normal operating conditions.

Periodic calibration is not necessary. However, calibration and verification should be performed under any of the following circumstances:

- To check or change the calibration of a new or in-service SLDC

- When an Expander Board or No. 3 Input Board is added by the user

- Upon replacing one of the following Boards - Controller, Expander, Thermocouple/Millivolt Input, Voltage input, RTD input, or Frequency Input

- After changing the type of No. 3 Input Board, or for a Thermocouple/Millivolt Input Board, changing the selection of T/C or mV

- After replacing a Reference Junction Temperature Sensor Board

- As part of a troubleshooting or failure confirmation routine.

Factory calibrations are provided in section 2.8. Function blocks which are not configured can also be calibrated. In this way, calibration will not be required in the event configuration is changed at a future date. The Station must be off-line during calibration.

Lockout switches are located on the front edge of the Controller Board as shown in Figure 5-3. The 'C' (calibration) lockout switch is factory set to lockout the calibration mode. This prevents inadvertent changing of calibration parameters from the front panel Keyboard. However, the calibration mode may be left in an enabled condition, if desired. To gain access to and set the lockout switch:

1. Flip down the front panel ID plate to reveal the captive bezel retaining screw.
2. Loosen the screw and separate the Display Assembly from the case. Support the Assembly so it doesn’t hang by the ribbon cable.
3. Refer to Figure 5-3 to locate and set the 'C' configuration lockout switch.
4. After setting the lockout switch, reinstall the Display Assembly.

The bargraphs on the Display Assembly are not used during the calibration procedure. Ignore any bargraph indications during calibration.

Calibration and calibration verification are described in the following procedures. The calibration portion of each procedure is used for all software versions. The verification portion of each procedure is used for B_ software only. For verification with A_ software, the SLDC must be in an operational mode, not the calibration mode, and a voltage input to current output relationship must be established and tested.

* Configuration is also necessary

4-1
4.1 ANALOG INPUTS AND OUTPUTS AND VOLTAGE INPUT BOARD

The SLDC analog input and analog output function blocks have been factory calibrated for 1 to 5 Vdc inputs and 4-20 mADC outputs. Likewise, the Voltage Input Board has been calibrated as an analog input under function block 99 for a 1-5 Vdc input. Recalibration should not be required unless calibration parameters are to be changed, or the Station's Controller Board or Voltage Input Board is replaced. Periodic recalibration is not necessary.

If calibration of any of the above mentioned function blocks is necessary, use the following procedures.

1. If applicable, enable the 'C' (calibration) lockout switch.
2. Press ENTER CONF button to enter configuration mode at the MENU level.
3. Rotate Pulser Knob to select 'C' (calibration) on left digit position of alphanumeric display. (If 'CX' appears in the display, the lockout switch on the Controller Board must be enabled.)
4. Press STEP DOWN button to enter FUNCTION BLOCK level.
5. Rotate Pulser Knob to select desired input or output function block number on right side digits of alphanumeric display. Refer to Table 4.1.

6. At Station's rear terminals connect either:
   A. For analog input or Voltage Input Board
      Electronic calibrator or a precision reference source capable of supplying a voltage between 0.000 and 5.000 Vdc connected to selected input terminals for calibrating analog input function blocks. (Ensure that terminal screws are tight.)
   B. For analog output
      Electronic calibrator or digital multimeter capable of displaying a current between 4.00 and 20.00 mA DC to selected output terminals for calibrating analog output function blocks. (Ensure that terminal screws are tight.)
7. Press STEP DOWN button to enter PARAMETER level.
8. Rotate Pulser Knob to select desired parameter (e.g., 'Z1' zero input 1 or 'Z0' zero output 1). Parameter is indicated on alphanumeric display. See Table 4.1.
9. Press STEP DOWN button to enter VALUE level ('CAL' appears on 4-1/2 digit display).
10. For calibration, perform either A or B depending upon function block selected in step 5.
   A. Analog Input
      1) Set precision voltage source to zero input value (0.000 to 1.000 Vdc).

<table>
<thead>
<tr>
<th>FUNCTION BLOCK NUMBER</th>
<th>ANALOG INPUT NUMBER</th>
<th>ANALOG OUTPUT NUMBER</th>
<th>CALIBRATION PARAMETERS</th>
<th>REAR TERMINAL CONNECTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>1</td>
<td>-</td>
<td>C11</td>
<td>A4+; A5-</td>
</tr>
<tr>
<td>02</td>
<td>2</td>
<td>-</td>
<td>C12</td>
<td>A6+; A5-</td>
</tr>
<tr>
<td>03</td>
<td>-</td>
<td>1</td>
<td>C01</td>
<td>A7+; A8-</td>
</tr>
<tr>
<td>25</td>
<td>4</td>
<td>-</td>
<td>C14</td>
<td>D4+; D5-</td>
</tr>
<tr>
<td>26</td>
<td>5</td>
<td>-</td>
<td>C15</td>
<td>D6+; D5-</td>
</tr>
<tr>
<td>27</td>
<td>6</td>
<td>-</td>
<td>C16</td>
<td>D7+; D8-</td>
</tr>
<tr>
<td>29</td>
<td>-</td>
<td>2</td>
<td>C02</td>
<td>D9+; D10-</td>
</tr>
<tr>
<td>61</td>
<td>-</td>
<td>3</td>
<td>C03</td>
<td>C5+; C6-</td>
</tr>
<tr>
<td>99</td>
<td>3</td>
<td>-</td>
<td>C13</td>
<td>A10+; B10- (T/C - mV Input)</td>
</tr>
</tbody>
</table>

C = Calibration
Z1 = Zero input
F1 = Full Scale Input
Z0 = Zero Output
F0 = Full Scale Output
V1 = Verify Input
VO = Verify Output
2) Press STORE to lock-in desired value.
3) Press STEP UP button.
4) Rotate Pulser Knob to select full scale parameter (FI_).
5) Press STEP DOWN button.
6) Set voltage source to full scale input value (4,000 to 5,000 Vdc).
7) Press STORE
8) For A -- software only - Press STEP UP, rotate Pulser Knob to Z1 parameter and set voltage source to zero input value, press STEP DOWN then press STORE.
9) Proceed to step 11.

B. Analog Output
1) Rotate Pulser Knob to set zero output to 4.00 mA on digital multimeter or electronic calibrator.
2) Press STORE button to lock-in desired value.
3) Press STEP UP button.
4) Rotate Pulser Knob to select full scale parameter (FO_).
5) Press STEP DOWN button to enter Value level (‘CAL’ appears on 4-1/2 digit display).
6) Rotate Pulser Knob to set full scale output to 20.00 mA.
7) Press STORE

11. Perform one of the following depending upon SLDC software and need to verify calibration.
   A -- software - Proceed to step 13.
   B -- software - To verify calibration, proceed to step 12. If verification is not needed, proceed to step 13.

12. For verification, perform either A or B depending upon function selected in step 5.
   A. Analog Input
      1) Press STEP UP button.
      2) Rotate Pulser Knob to select verification parameter (e.g., CV11 verify input 1). Parameter is shown on alphanumeric display. See Table 4.1.
      3) Press STEP DOWN button to enter VALUE level.
      4) Set precision voltage source to zero input voltage. The 4-1/2 digit display should read 0.0%.
      5) Set source to full scale voltage. The 4-1/2 digit display should read 100.0%.
      6) Proceed to step 13.
   B. Analog Output
      1) Press STEP UP button.
      2) Rotate Pulser Knob to select verification parameter (e.g., CV01 verify output 1). See Table 4.1.
      3) Press STEP DOWN button to enter VALUE level.
      4) Rotate Pulser Knob to set 4-1/2 digit display to 0.0%. Output current should be 4.00 mA.
      5) Rotate Pulser Knob to set 100.0%. Output current should be 20.00 mA.
      6) Proceed to step 13.

13. Select one of the following:
   If all points have been calibrated and verified, press EXIT button to leave calibration mode and enter operation mode.
   If additional function blocks are to be calibrated and verified, press STEP UP button twice to enter FUNCTION BLOCK level. Perform steps 5 through 13 for each function block.

14. Lock out the Station's calibration mode via the Controller Board's 'C' lockout switch.

This step is recommended.

4.2 THERMOCOUPLE/MILLIVOLT INPUT BOARD

The following provides calibration procedures for the Thermocouple/Millivolt Input Board. Calibration must be performed with the Board installed in the SLDC in which it will be used and, for a thermocouple input, the Sensor Board which will remain with the SLDC. Tables 4.2 and 4.3 list the values for hard configuration parameter Hi3T and for calibration parameters CI3T, C213 and CF3T. Table 4.2 is for a Thermocouple Input and Table 4.3 for a Millivolt Input. The Thermocouple/Millivolt Input Board is configured under function block 99.

4.2.1 REQUIRED EQUIPMENT

Calibration of a Thermocouple/Millivolt Input Board requires the use of some or all of the following equipment:
1. Model 352B or E Station with Input Board installed. For thermocouple input, Sensor Board must be installed on station rear terminals.
2. Precision millivolt or thermocouple calibration source for required millivolt calibration range or thermocouple type and calibration range. The signal source must be adjustable to an accuracy of ±0.01% or better and provide a source resistance of 100 ohms or less.
3. Two small containers of crushed ice and water and a laboratory bulb thermometer or a commercially produced ice bath reference.
4. Two foot length of appropriate T/C extension wire.

IMPORTANT
Use the same gauge of wire that will be used when the Station is on-line.
5. Two 2-foot lengths of #18 gauge, insulated copper wire.
4.2.2 PRELIMINARY ADJUSTMENTS

Refer to either Figure 4-1 or Figure 4-2 for the location of jumper-plugs J1 and J2 used to select the desired operating modes. Set the jumper-plugs as shown in the Figure.

4.2.3 PROCEDURE

Presented first is a thermocouple calibration procedure. A millivolt calibration procedure follows.

4.2.3.1 Thermocouple Input

The calibration procedure prepares the SLDC for the type thermocouple and the zero and full scale calibration input values in millivolts or °F for a specific thermocouple temperature range (calibration parameters). Refer to Table 4.2 for the required calibration input values while calibrating a Thermocouple/Millivolt Input Board for a thermocouple input. Actual operating engineering units (°F) and temperature range are entered as soft (‘S’) configuration parameters after calibration is completed.

Three different “off-line” methods for calibrating thermocouple inputs are illustrated in Figure 4-3. Method 1 is the most accurate and recommended. Methods 2 and 3 are provided as alternatives should circumstances prevent the use of Method 1.

Select a method from Figure 4-3 and proceed as follows:

1. With power off at Station, verify that ‘C’ (calibration) and ‘T’ (table) lockout switches are enabled.
2. Place T/C extension wires (if possible, the actual gauge wire that will be used in final installation) under rear terminals A10 (+) and B10 (-) and tighten screws. Do not use alligator or similar clips for connections.
3. Connect as follows:
   Method 1 - Connect each end of the extension wires to separate 2-foot lengths of insulated copper wire (solder or twist ends), and insert junction points into separate ice baths. Connect opposite ends of copper wires to calibration source. (Power off at calibration source.)
   Methods 2 and 3 - Connect T/C extension wires to calibration source. Observe polarity as indicated. (Power off at calibration source.)
4. Refer to Figure 2-5 and connect Sensor Board between rear terminals A8 and A9 as shown. (Component side of Board faces case.)
5. Verify Station’s model number and input power requirement. Apply power to Station.
   IMPORTANT
   Allow at least 1 hour for warm up before proceeding.
6. Press ENTER CONF button to enter configuration mode at MENU level.
7. To set-in T/C type or check Station’s configured T/C type:
   A. Rotate Pulser Knob to select ‘T’ (table) on left digit position of alphanumeric display. (If ‘TX’ appears in the display, the lockout switch on the Controller Board must be enabled.)
   B. Press STEP DOWN button to enter FUNCTION BLOCK level.
   C. Rotate Pulser Knob to select function block ‘99’.
   D. Press STEP DOWN button to enter PARAMETER level. (‘ESN’ appears in alphanumeric display.)
   E. Press STEP DOWN button to enter VALUE level. Rotate Pulser Knob to any number except 00 in 4-1/2 digit display.
   F. Press STORE button to lock-in value.
   G. Press EXIT button.
   H. Press ENTER CONF button to enter configuration mode at MENU level.
   I. Rotate Pulser Knob to select on alphanumeric display, left hand digit, one of the following:
      A. _ _ software - ‘H’ (hard configuration)
      B. _ _ software - ‘C’ (calibration)
   J. Press STEP DOWN button to enter FUNCTION BLOCK level.
   K. Rotate Pulser Knob to select function block number ‘99’ on right side digits of alphanumeric display.
   L. Press STEP DOWN button and rotate Pulser Knob until one of the following appears in the alphanumeric display:
      A. _ _ software - ‘HI3T’
      B. _ _ software - ‘CI3T’
   M. Refer to Table 4.2 and locate value under proper INPUT 3 TYPE column for the software and desired type T/C.
   N. Press STEP DOWN button and rotate Pulser Knob until the desired value appears in the 4-1/2 digit display.
      (For example, a 2 must be displayed for a type J T/C. If desired value will not appear, check position of J1.)
   O. Press STORE button to lock-in desired value.
   P. Press EXIT button.
   Q. Press ENTER CONF button.
8. Rotate Pulser Knob to select ‘C’ (calibration) mode on left digit position of alphanumeric display.
9. To set-in Zero Input value:
   A. Press STEP DOWN button to enter FUNCTION BLOCK level.
   B. Rotate Pulser Knob to select function block number ‘99’.
### Table: Thermocouple Inputs vs Millivolt Inputs

<table>
<thead>
<tr>
<th>Thermocouple Inputs</th>
<th>Millivolt Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>J, X OR E</td>
<td>-20 mV to +20 mV</td>
</tr>
<tr>
<td>T, R, S, OR B</td>
<td>-75 mV to +75 mV</td>
</tr>
</tbody>
</table>

#### Span and Jumper

- **Wide J2**
- **Narrow J3**

#### Input Break Direction and Jumper

- **Up or Down J4**

#### Notes:
1. As shown: Narrow Span, Upscale Break.
2. Operation is possible with jumper-plug J4 removed; however, the "Input Break" feature is disabled.
3. Recalibration is required if jumper-plugs are changed in any way.
4. EPROM (erasable programmable read only memory).
5. Hi Common Mode Rejection TC/mV Input Board includes additional shielding.

---

**Figure 4-1 TC/mV Input Board, Series P/N 16005**
NOTES:
1. OPERATION IS POSSIBLE WITH JUMPER-PLUG J2 REMOVED; HOWEVER, THE "INPUT BREAK" FEATURE IS DISABLED.
2. RECALIBRATION IS REQUIRED IF JUMPER-PLUGS ARE CHANGED IN ANY WAY.

FIGURE 4-2 TC/mV Input Board, Series P/N 15819
**COMMERCIAL AVAILABLE ICE BATH REFERENCES ELIMINATE NEED FOR CONTAINERS ICE WATER AND THERMOMETER**

**METHOD 1**

**METHOD 2**

**METHOD 3**

NOTE WHERE THERMOCOUPLE EXTENSION WIRES ARE SHOWN IT IS ADVISABLE TO CALIBRATE WITH THE SAME GAUGE OF WIRE USED IN THE ACTUAL OPERATING INSTALLATION

**FIGURE 4-3 Typical Calibration Hook-Up Diagrams — Thermocouple Input**
TABLE 4.2 Hard Configuration And Calibration Parameters, Thermocouple Inputs

<table>
<thead>
<tr>
<th>TYPE T/C</th>
<th>INPUT 3 TYPE</th>
<th>ZERO INPUT (CZI3)</th>
<th>FULL SCALE INPUT (CFI3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A = HIST</td>
<td>B = CI3T</td>
<td>mV</td>
</tr>
<tr>
<td>J</td>
<td>2</td>
<td>2</td>
<td>-0.885</td>
</tr>
<tr>
<td>K</td>
<td>3</td>
<td>3</td>
<td>-0.892</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>4</td>
<td>-1.026</td>
</tr>
<tr>
<td>T</td>
<td>6</td>
<td>6</td>
<td>-5.341</td>
</tr>
<tr>
<td>R</td>
<td>7</td>
<td>7</td>
<td>2.017</td>
</tr>
<tr>
<td>S</td>
<td>8</td>
<td>8</td>
<td>1.962</td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>9</td>
<td>3.274</td>
</tr>
</tbody>
</table>

C. Press STEP DOWN button to enter PARAMETER level. ('CZI3' appears in alphanumeric display.)

D. Press STEP DOWN button to enter VALUE level. ('CAL' appears in 4-1/2 digit display.)

E. Refer to Table 4.2 and obtain value in millivolts under Zero Input (CZI3) column for type T/C selected.

F. For Method 1, verify that ice baths are at 32ºF (0ºC). Periodically, stir slurry gently with thermometer and monitor temperature. Add crushed ice as required.

G. Set calibration source as follows:
   Method 1 - Apply power to calibration source and adjust output to millivolt value from Table 4.2 and step E.
   Method 2 - A T/C calibrator with direct temperature readout and cold junction compensation is used. Refer to calibrator instruction manual for detailed calibrator operation. Apply power and set temperature in ºF to Zero input value listed in Table 4.2.
   Method 3 - The value obtained for CZI3 from Table 4.2 must be compensated to 32ºF (0ºC) as follows:
      a) Touch bulb end of thermometer to one of the input terminals. Allow reading to stabilize before recording temperature.
      b) In the appropriate T/C Table, look up the equivalent millivolts.
      c) Subtract the millivolts of step b) above from the millivolts obtained in Table 4.2 for step E.
      d) Apply power to calibration source and adjust output to value obtained in step c) above.
   For all methods, allow at least 10 seconds after changing applied input voltage before proceeding to next step. This is to allow the hardware filter voltage time to stabilize.

H. Press STORE button to lock-in desired value. ('CAL' blinks.)

I. Press STEP UP button once.

10. Rotate Pulser Knob to select 'CFI3' on alphanumeric display.

11. To set-in Full Scale Input value:
   A. Press STEP DOWN button. ('CAL' appears.)
   B. Refer to Table 4.2 and obtain value in millivolts from Full Scale Input (CFI3) column for type T/C selected.
   C. For Method 1, verify that ice baths are at 32ºF (0ºC).
   D. Set calibration source as follows:
      Method 1 - Adjust calibration source to millivolts value (CFI3) from Table 4.2 and step B above.
      Method 2 - Refer to calibrator instruction manual for detailed calibrator adjustment. Set calibrator temperature in ºF to Full Scale Input value listed in Table 4.2.
      Method 3 - The value obtained for CFI3 from Table 4.2 must be compensated to 32ºF (0ºC) as follows:
         a) Touch bulb end of thermometer to one of the input terminals.
         b) In the appropriate T/C Table, look up the equivalent millivolts.
         c) Subtract the millivolts of step b) above from the millivolts obtained in Table 4.2 for step E.
         d) Adjust output to value obtained in step c) above.
      For all methods, allow at least 10 seconds after changing applied input voltage before proceeding to next step. This is to allow the hardware filter voltage time to stabilize.
   E. Press STORE button to lock-in desired value. ('CAL' blinks.)

12. To verify calibration:
   A. Press STEP UP button.
   B. Rotate Pulser Knob to select 'CVI3' on alphanumeric display.
   C. Press STEP DOWN button. (100% should appear in 4-1/2 digital display since calibration source is set to Full Scale Input value.)
D. Adjust calibration source to Zero Input value. (0% should appear in 4-1/2 digit display.)

13. Repeat steps 9 through 12 if Station fails calibration verification; otherwise, continue this procedure.

14. Press EXIT button. (The calibration parameters are transferred to the nonvolatile EEPROM and will remain indefinitely even if power is disconnected to the Station.)

15. To simulate a T/C break:
   A. Turn off power to calibration source.
   B. Simulate an open T/C by disconnecting calibration source. Observe Station bargraphs for required output signal reaction. (Example: If process (P) bargraph is configured to indicate output of FB99, it will increase if J1 is in "UP" position.) If Station calibration and configuration is complete, the valve bargraph (station output) will respond for fail-safe operation.
   C. Remove power from Station.
   D. Disconnect wires from terminals A10 and B10.

NOTE
The Sensor Board between terminals A8 and A9 must remain in place for on-line operation. DO NOT disconnect.

This completes the calibration procedure. Lockout the ‘C’ (calibration) mode on Controller Board.

4.2.3.2 Millivolt Input

Refer to either Figure 4-1 or Figure 4-2 for jumper-plug settings and to Table 4.3 for the required calibration input values while calibrating the Thermocouple/Millivolt Input Board for a millivolt input.

The calibration procedure sets the Board for one of two fixed ranges and the zero and full scale input values in millivolts for the range selected (calibration parameters). Actual operating engineering units (zero and full scale in millivolts) are entered as soft (‘S’) configuration parameters after calibration is completed. Refer to Figure 4-4 for a typical calibration hook-up diagram and perform the following procedure:

1. With power off at Station, verify that ‘C’ (calibration) and ‘T’ (table) lockout switches are enabled.
2. Connect the calibration source to the Station’s rear terminals: A10 (+) and B10 (-).
3. Turn on power to calibration source and adjust for 0.000 Vdc.
4. Verify Station’s model number and power input requirement. Apply power to Station.

IMPORTANT
Allow at least 1 hour for warm up before proceeding.

5. Press ENTER CONF button to enter configuration mode at MENU level.

6. To set-in range or check Station’s configured range:
   A. Rotate Pulser Knob to select ‘T’ (table) on left digit position of alphanumeric display. (If ‘TX’ appears in the display, the lockout switch on the Controller Board must be enabled.)
   B. Press STEP DOWN button to enter FUNCTION BLOCK level.
   C. Rotate Pulser Knob to select function block ‘99’.
   D. Press STEP DOWN button to enter PARAMETER level. (‘ESN’ appears in alphanumeric display.)
   E. Press STEP DOWN button to enter VALUE level. Rotate Pulser Knob to any number except 00 in 4-1/2 digit display.
   F. Press STORE button to lock-in value.
   G. Press EXIT button.
   H. Press ENTER CONF button to enter configuration mode at MENU level.
   I. Rotate Pulser Knob to select on alphanumeric display, left hand digit, one of the following:

---

**FIGURE 4-4** Typical Calibration Hook-Up Diagram — Millivolt Input

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4-9
A. Press STEP DOWN button to enter FUNCTION BLOCK level.
B. Rotate Pulser Knob to select function block number ‘99’ on right side digits of alphanumeric display.

L. Press STEP DOWN button and rotate Pulser Knob until one of the following appears in the alphanumeric display:
   A. ___ software - ‘H13T’
   B. ___ software - ‘C13T’

M. Press STEP DOWN button and rotate Pulser Knob to 1 for 0 to 75mV range or to 5 for 0 to 20mV range.

N. Press STORE button to lock-in desired value.
O. Press EXIT button.
P. Press ENTER CONF button.

7. Rotate Pulser Knob to select ‘C’ (calibration) mode on left digit position of alphanumeric display.

8. To set-in Zero Input value:
   A. Press STEP DOWN button to enter FUNCTION BLOCK level.
   B. Rotate Pulser Knob to select function block number ‘99’ on right side digits of alphanumeric display.
   C. Press STEP DOWN to enter PARAMETER level. (‘CZI3’ appears in alphanumeric display.)
   D. Press STEP DOWN button to enter VALUE level. (‘CAL’ appears in 4-1/2 digit display.)
   E. Refer to Table 4.3 and locate 0.000mV in Zero Input (CZI3) column for either range.
   F. Verify that calibration source is still at 0.000mV. Allow at least 10 seconds after changing applied input voltage before proceeding to next step. This is to allow the hardware filter voltage time to stabilize.
   G. Press STORE button to lock-in desired value. (‘CAL’ blinks.)

9. Press STEP UP button and rotate Pulser Knob to select ‘CFI3’ on alphanumeric display.
10. To set-in Full Scale Input value:
    A. Press STEP DOWN button. (‘CAL’ appears.)
    B. Refer to Full Scale Input (CFI3) column in Table 4.3 and note that either 20.000mV or 75.000mV appears.
    C. Adjust calibration source to either 20.000mV or 75.000mV. Allow at least 10 seconds after changing applied voltage before proceeding to next step.
    D. Press STORE button to lock-in desired value. (‘CAL’ blinks.)

11. To verify calibration:
    A. Press STEP UP button.
    B. Rotate Pulser Knob to select ‘CVI3’ or alphanumeric display.
    C. Press STEP DOWN button. (100% should appear in 4-1/2 digit display since calibration source is set to Full Scale Input value.)
    D. Adjust calibration source to Zero Input value. (0% should appear in 4-1/2 digit display.)

12. Repeat steps 8 through 11 if Station fails calibration verification; otherwise, continue this procedure.

13. Press EXIT button. (The calibration parameters are transferred to the nonvolatile EEPROM and will remain indefinitely even if power is disconnected to Station.)

14. Turn off power to calibration source.
15. Turn off power to Station.

This completes calibration procedure. Lockout the ‘C’ (calibration) mode on Controller Board.

### TABLE 4.3 Hard Configuration And Calibration Parameters, Millivolt Inputs

<table>
<thead>
<tr>
<th>MILLIVOLT INPUT RANGE</th>
<th>INPUT 3 TYPE</th>
<th>ZERO INPUT (CZI3)</th>
<th>FULL SCALE INPUT (CFI3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A - -</td>
<td>B - -</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HI3T</td>
<td>CI3T</td>
<td></td>
</tr>
<tr>
<td>0-75mV</td>
<td>1</td>
<td>1</td>
<td>0.000mV</td>
</tr>
<tr>
<td>0-20mV</td>
<td>5</td>
<td>5</td>
<td>0.000mV</td>
</tr>
</tbody>
</table>
4.3 RTD INPUT BOARD

This section contains a list of required equipment and the procedure for calibrating an RTD Input Board to accept low level input voltages over a range from -300°F to 1200°F (-185°C to 650°C) from a 100 ohm platinum resistance temperature detector. Engineering units (F or C), type of curve (DIN or US), and actual operating temperature range are entered as soft ('S') configuration parameters after calibration is completed. Refer to the Configuration Handbook AD352-20 for configuration procedure.

The RTD Input Board is a No. 3 Input Board calibrated under function block FB99. Rear terminal connections are shown in Figure 2-11 and calibration parameters and related values are shown in Table 4.4.

Once the Board is calibrated, FB99 Block Output 33 is a scaled and linearized signal using the values entered in configuration (SRT, SRU, SRL, SRH) so that the 0-100% signal represents a specific operating range.

4.3.1 REQUIRED EQUIPMENT

Calibration of an RTD Input Board requires the following equipment:

1. Model 352 Station with software and an RTD Input Board installed.
2. Two precision resistors (100 ohms, ±0.01%, 1/4 W and 200 ohms, ±0.01%, 1/4 W) or a resistance decade box capable of providing the two values specified.
3. Three, 2-foot lengths of 18 gauge (AWG), insulated copper wire.

**IMPORTANT**

To obtain proper lead resistance compensation during calibration, equal lengths of 18 gauge (AWG) must be used as in a 3-wire RTD connection.

4.3.2 PROCEDURE

The calibration procedure involves storing the Zero Input value (CZ13 = 100.00 ohms) and the Full Scale Input value (CF13 = 200.0 ohms) into Controller Board memory.

If a resistance decade box is used to provide the required input resistance, ensure that the connections to the box minimize contact resistance. Three equal lengths of 18 gauge (AWG) wire provide equal resistance in each lead.

If two precision resistors are used (100.00 and 200.00 ohms) instead of the resistance decade box, ensure that equal lead lengths make good electrical contact with the resistors. It is recommended that the wires be soldered to the resistor leads.

Install crimp-on ring or spring spade terminals on the end of each lead that connects to the terminal screws of the SLDC as shown in Figures 2-4 and 2-11, 3-wire connection.

**IMPORTANT**

DO NOT use alligator clips. If alligator clips are used to make the connections on either end, contact resistance may be present and alter the calibration accuracy.

Proceed as follows:

1. With power off at Station, verify that the 'C' (calibration) lockout switch is enabled. See Figure 5-3 for location of switches on Controller Board.
2. Perform either A or B.
   
   A. Set resistance decade box to 100.00 ohms and connect as shown for 3-wire in Figure 2-11.
   
   B. Connect 100.00 ohm precision resistor to rear terminals as shown for 3-wire in Figure 2-11.
3. Verify Station's model number and input power requirement. Apply power to Station.

**IMPORTANT**

Allow at least 1 hour for warm up before proceeding.

4. Press ENTER CONF button to enter configuration at MENU level.
5. Rotate Pulser Knob to select 'C' (calibration mode on left digit position of alphanumeric display).
6. To set-in Zero Input value:
   
   A. Press STEP DOWN button to enter FUNCTION BLOCK level.
   
   B. Rotate Pulser Knob to select FB99.
   
   C. Press STEP DOWN button to enter PARAMETER level ('CZ13' appears in alphanumeric display).
   
   D. Press STEP DOWN button to enter VALUE level. ('CAL' appears in 4-1/2 digit display).

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>DESCRIPTION</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CZ13</td>
<td>Zero Input</td>
<td>100.0 Ohms</td>
</tr>
<tr>
<td>CF13</td>
<td>Full Scale Input</td>
<td>200.0 Ohms</td>
</tr>
<tr>
<td>CV13</td>
<td>Verify Input</td>
<td>-3.3 to 103.3%</td>
</tr>
</tbody>
</table>
E. Allow at least 15 seconds before proceeding to next step. This will allow the hardware filter voltage to stabilize.

F. Press STORE button to lock-in desired value. ('CAL' blinks.)

G. Press STEP UP button once.

7. Rotate Pulser Knob to select 'CFl3' on alphanumeric display.

8. To set-in Full Scale Input value:
   A. Press STEP DOWN button. ('CAL' appears.)
   B. Refer to Table 4.4 and perform either 1) or 2):
      1) Set Resistance decade box to 200.00 ohms.
      2) Connect 200.00 ohm precision resistor to rear terminals as shown in Figure 2-11 or 3-wire RTD.
   C. Allow at least 15 seconds before proceeding to next step.
   D. Press STORE button to lock-in desired value. ('CAL' blinks.)

9. To verify calibration:
   A. Press STEP UP button.
   B. Rotate Pulser Knob to select 'CVi3' on alphanumeric display.
   C. Press STEP DOWN button. 100.00% should appear in 4-1/2 digit display since input resistance is set to Full Scale Input value.
   D. Set input resistance to Zero Input Value (100.00 ohms). (0.00% should appear in 4-1/2 digit display.)

10. Repeat steps 6 through 8 if Station fails calibration verification; otherwise, the procedure is completed.

11. Remove power from Station.

12. Disconnect wires from terminals A9, A10 and B10.

13. Lockout the 'C' (calibration) mode on Controller Board.

4.4 FREQUENCY INPUT BOARD

The Frequency Input Board may be calibrated using either the automatic (learn) mode or the manual mode; procedures for these mutually exclusive calibration methods are explained in section 4.4.2.

Before calibration is performed, the steps in section 4.4.1 should be performed to enter the actual operation range of frequency inputs into an SLDC equipped with a Frequency Input Board. This will ensure proper operation of the automatic (learn mode) calibration feature.

4.4.1 FREQUENCY CONFIGURATION

In this section, the actual operating range of frequency inputs will be entered into an SLDC equipped with a Frequency Input Board prior to calibration.

Minimum and maximum frequencies are entered as soft ('S') configuration parameters SMIN and SMAX.

Perform the following procedure to set-in the operating frequency range:

1. With power off at Station, verify the 'H/T/F' and 'S' lockout switches are enabled. Refer to Figure 5-3 for switch locations.

2. Verify Station's model number and input power requirement. Apply power to Station.

3. Press ENTER CONF button to enter configuration mode at MENU level.

4. Rotate Pulser Knob to select 'T' (table) on left digit position of alphanumeric display. (If 'TX' appears in the display, the lockout switch on the Controller Board must be enabled. Refer to Figure 5-3 for switch location.)

5. Press STEP DOWN button to enter FUNCTION BLOCK level.


7. Press STEP DOWN button to enter PARAMETER level. ('TESN' appears in alphanumeric display.)

8. Press STEP DOWN button to enter VALUE level. Rotate Pulser Knob to ESN for FB99 listed in Documentation Booklet. If a value has not been assigned and configuration will continue, rotate Pulser Knob to any number except 00 in 4-1/2 digit display.

9. Press STORE button to store value in memory.

10. Press EXIT button.

11. To set-in minimum and maximum values:

   A. Press ENTER CONF button to enter configuration mode at MENU level. ('S'-soft appears on left digit position of alphanumeric display. If 'SX' appears, the lockout switch labeled S on the Controller Board must be enabled. Refer to Figure 5-3 for switch location.)

   B. Press STEP DOWN button to enter FUNCTION BLOCK level.

   C. Rotate Pulser Knob to select FB99 on right side digits of alphanumeric display.

   D. Press STEP DOWN button to enter PARAMETER level. ('SMIN' appears in alphanumeric display.)

   E. Refer to AD351-20, Configuration Handbook, for input signal minimum frequency.

   F. Press STEP DOWN button to enter value level. Rotate Pulser Knob to minimum frequency value.

   G. Press STORE button to store desired value. (Value blinks.)

   H. Press STEP UP button and rotate Pulser Knob to SMAX value. (Refer to Documentation Booklet for maximum frequency of input signals.)

NOTE
The lowest value obtainable for SMAX is limited by software in order to comply with the minimum span listed in the specifications.
I. Press STEP DOWN button and rotate Pulser Knob to maximum frequency. (Example: Enter 48.0 in 4-1/2 digit display if maximum frequency is 48.0 Hz.)

J. Press STORE button to store desired value. (Value blinks.)

K. Press Exit button.

This completes the frequency configuration procedure for FB99, except for parameter S2D0. S2D0 will not affect the calibration procedure that follows.

4.4.2 CALIBRATION

Although it is possible to manually enter the peak and valley voltages of the frequency input signals during calibration, it is recommended that the automatic (learn) method be utilized. This eliminates the need to check manufacturer’s specifications or measure the signal’s peak and valley voltages with an oscilloscope.

The calibration parameters listed in Table 4.5 are set-in during this procedure.

4.4.2.1 Required Equipment

Calibration of the Frequency Input Board requires the use of the following equipment:

— Model 352 Station with a Frequency Input Board installed.

4.4.2.2 Procedure

There are two different calibration methods: automatic (learn mode) and manual. The automatic method is the recommended on-line procedure, since it requires no external equipment and the fewest number of steps. The manual method may require the use of an oscilloscope to measure the peak and valley voltages of the input signal, if manufacturer’s specifications are unavailable, and is more complex than the automatic method.

4.4.2.3 Automatic Calibration (LEARN) Method

A. Follow prescribed installation procedures to install the SLDC equipped with Frequency Input Board on-line.

B. With power off at Station, verify that ‘C’ (calibration) lockout switch is enabled. Refer to Figure 5-3 for switch location.

C. Connect frequency input wires under rear terminals A10 (+) and B10 (-) and tighten screws.

D. Verify Station’s model number and input power requirements in section 1.2. Apply power to Station.

E. Verify that process is generating frequency input signals to the SLDC.

F. Press ENTER CONF button to enter configuration mode at MENU level.

G. Rotate Pulser Knob to select ‘C’ (calibration) mode on left digit position of alphanumeric display. (If ‘CX’ appears in display, the ‘C’ (calibration) lockout switch must be enabled. Refer to Figure 5-3 for switch location.)

H. Press STEP DOWN button to enter FUNCTION BLOCK level.

I. Rotate Pulser Knob to select FB99 on right side digits of alphanumeric display.

J. Press STEP DOWN button and rotate Pulser Knob until CI appears in alphanumeric display.

K. Press STEP DOWN button to enter VALUE level. (‘LEArn’ appears in 4-1/2 digit display.)

L. Press STORE button to activate automatic calibration.

Depending on the operating frequency range entered as parameters SMIN and SMAX, the 4-1/2 digit display will either count down from a fixed number of seconds to 1 second, then ‘dONE’ appears followed by ‘LEArn’ or indicate ‘LEArn’ (blank) ‘dONE’ (blank) ‘LEArn’. This time is needed to sample the input signal’s peak and valley voltages.

M. Press EXIT button. (The calibration parameters CIIPV and CIIV obtained automatically from the input signal are transferred to the nonvolatile EEPROM and will remain indefinitely even if power is disconnected to Station.)

This completes the automatic calibration procedure. Disable the ‘C’ (calibration) lockout switch on Controller Board, if desired.

<table>
<thead>
<tr>
<th>TABLE 4.5 Calibration Parameters, Frequency Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARAMETER</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>CIIPV</td>
</tr>
<tr>
<td>CIIV</td>
</tr>
<tr>
<td>CIL</td>
</tr>
</tbody>
</table>
4.4.2.4 Manual Calibration Method

NOTE
This method can be used to calibrate an SLDC in the shop providing that the peak and valley voltages of the frequency input signals are known and the Controller Board and Frequency Input Board remain together after calibration.

A. With power off at Station, verify the 'C' (calibration) lockout switch is enabled. Refer to Figure 5.3 for switch location.

B. Verify Station’s model number and input power requirement in section 1.2. Apply power to Station.

C. Press ENTER CQNF button to enter configuration mode at MENU level.

D. Rotate Pulser Knob to select 'C' (calibration) mode on left digit position of alphanumeric display.

E. Press STEP DOWN button to enter FUNCTION BLOCK level.

F. Rotate Pulser Knob to select function block '99' on right side digits of alphanumeric display.

G. Press STEP DOWN button to enter PARAMETER level. ('CIPV' appears in alphanumeric display.)

H. Press STEP DOWN button to enter VALUE level and rotate Pulser Knob to input peak voltage (CIPV) listed in Documentation booklet. This value can be obtained from manufacturer's specifications or by making an oscilloscope measurement.

I. Press STORE button to store desired value. (Value blinks.)

J. Press STEP UP button and rotate Pulser Knob to 'CIVV' in alphanumeric display.

K. Press STEP DOWN button and rotate Pulser Knob to input valley voltage (CIVV) listed in Documentation Booklet. This value can be obtained from manufacturer's specifications or by making an oscilloscope measurement.

NOTE
The maximum value obtainable for CIVV is limited by software to be less than or equal to CIPV.

L. Press STORE button to store desired value. (Value blinks.)

M. Press EXIT button. (The calibration parameters CIPV and CIVV manually entered are transferred to the nonvolatile EEPROM and will remain indefinitely even if power is disconnected to Station.)

This completes the manual calibration procedure. Disable the 'C' (calibration) lockout switch on Controller Board, if desired.
Section 5

5.0 CIRCUIT DESCRIPTION

The Single Loop Digital Controller's hardware architecture is shown in Figure 5-1. Notice that all major plug-in assemblies interact with the Controller Board.

The MPU-based Controller Board performs many of the Station's signal processing and process control functions in addition to overseeing other Station internal operations. It controls the Expander Board, Link Interface Board, Display Assembly and No. 3 Input Board (e.g., Pulse Input Board). The Controller Board's on-board power supply furnishes DC operating voltages to all plug-in assemblies and to external process transmitters connected to the rear terminal block.

The Expander Board contains hardware which extends the signal I/O and signal processing capacity of the Controller Board.

The Display Assembly provides LED indication of process related signals, station operating mode and configuration parameters. It also accepts operator entered commands and data via the Assembly's front panel controls.

A functional description, a hardware block diagram and a physical layout drawing are provided for each of the following circuit areas:

Controller and Expander Board Assembly
Display Assembly
No. 3 Input Boards
Link Interface Board

FIGURE 5-1 SLDC Hardware Architecture
5.1 CONTROLLER BOARD

The Controller Board's hardware is supported by a large array of software based function blocks. During Station configuration, a group of function blocks are linked together to meet the control requirements of the Station's process application. While many configurations are possible, the Board is typically configured to regulate a controlled variable by working to eliminate any difference between the Station's process and setpoint signals.

As shown in Figure 5-2, the Controller Board has two analog inputs, one optional third analog input, one digital input and one optional bidirectional serial port which passes Local Instrument Link signals. The Board also has two digital outputs and one analog output. The actual inputs and outputs which are active during station operation depend on its configuration. For example, a Station configured to accept an external setpoint signal will require the Controller Board to accept at least two analog input signals (i.e., the external setpoint and process signals). To determine the actual I/O arrangement, refer to the appropriate configuration documentation.

The Controller Board is a hybrid assembly in that it contains analog and digital circuits. The analog circuitry operates in real time while the microprocessor based digital circuitry operates at high speed under program control.

The MPU (microprocessor unit) is a single integrated circuit capable of arithmetical, logical and support circuit control functions. It directly or indirectly interacts with surrounding on-board and off-board circuitry to control the internal operation of the SLDC. To operate under program control, the MPU systematically fetches instructions from the PROM area and executes them to control data flow and organize support circuit activities.

The Clock circuit contains a precision square wave oscillator which operates at 8 MHz. It also contains a flip-flop type of frequency divider network to down count the oscillator frequency to the value required by the MPU. Timing pulses from the clock are used to synchronize the MPU's computing activities.

The Watchdog Timer circuit is a dual "one-shot" interval timer that will automatically reset the MPU in the event it does not complete executing its programs within a predetermined time.

On-board memory consists of ultraviolet erasable PROM (UVEPROM), electrically erasable PROM (EEPROM), and RAM. The UVEPROM stores the operating programs for the function blocks and Factory Configured Options associated with a Model 352B. It also stores the general operating programs for the on-board microprocessor. The EEPROM stores hard configuration, the table of function blocks, soft configuration, calibration data, and transient data. The RAM stores configuration and transient data.

During configuration and calibration, data is entered into RAM when the STORE button is pressed. Data is transferred to the EEPROM when the EXIT button is pushed. Transient data (process, station status, alarm, and error code data) is also stored in RAM. It is transferred to the EEPROM when power is removed from the Station.

The MPU's three bus lines are the address bus, control bus and data bus. They interconnect the MPU and the support circuits. The address bus is unidirectional while the control and data buses are bidirectional.

The Signal Selector circuit operates under MPU control to select an analog signal and feed it to the A/D Converter. It is essentially a solid state switch.

The A/D Converter circuit converts an analog input signal into a digital value. Once digitized, the signal value can easily be manipulated and/or stored in memory by the MPU.

The D/A Converter circuit converts a digital value into an analog signal.

The Reference Voltage Source circuit provides a precision analog reference for the D/A Converter.

The Amplifier circuit provides gain and drive capability to the analog signal output of the D/A Converter.

The Opto-Coupler circuit provides signal isolation of the digital input signal.

The on-board Power Supply circuit provides the power sources necessary for SLDC circuit components. It also provides a ±26 Vdc output to power up to four process transmitters.

The physical layout of the Controller Board is illustrated in Figure 5-3 for reference purposes. It's helpful to know the location of the Board's connectors (i.e., J1 thru J5), power fuse and lockout switches. The lockout switches can be set to prevent unauthorized changes to selected configuration modes.
FIGURE 5-2 Controller Board, Hardware Block Diagram
Figure 5-3 Controller Board, Physical Layout

**NOTES**
EEPROM (ELECTRICALLY ERASABLE PROGRAMMABLE READ-ONLY MEMORY)
MPU (MULTI-PROCESSING UNIT)
UVEPROM (ULTRAVIOLET ERASABLE ELECTRICALLY PROGRAMMABLE READ-ONLY MEMORY)

<table>
<thead>
<tr>
<th>SUPPLY VOLTAGE</th>
<th>RATING/TYPE</th>
<th>MPCO PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 VAC</td>
<td>0.5A, 3AG, SLOW BLOW</td>
<td>7447-54</td>
</tr>
<tr>
<td>24 VDC</td>
<td>1A, 3AG, SLOW BLOW</td>
<td>7447-123</td>
</tr>
<tr>
<td>220-240 VAC</td>
<td>0.35A, 3AG, SLOW BLOW</td>
<td>7447-52</td>
</tr>
</tbody>
</table>

POWER FUSE

PA-1067-2
5.2 EXPANDER BOARD

The Expander Board's hardware is supported by a large array of software based function blocks. These blocks are in addition to those associated with the Controller Board. During station configuration, a group of function blocks are linked together to meet the control requirements of the Station's process application. While many configurations are possible, the Expander Board greatly increases (i.e., expands) the signal I/O capacity of the SLDC.

As shown in Figure 5-4, the Expander Board has three analog inputs and two digital inputs. The Board also has two relay outputs and one or two analog outputs. The actual Expander Board inputs and outputs which are active during station operation depend upon station configuration.

The Expander Board's circuitry operates under the control of the MPU based Controller Board. The Expander Board, like the Controller Board, is a hybrid assembly. The analog circuitry operates in real time while the microprocessor controlled digital circuitry operates at high speed under program control.

Many signal processing circuits on the Expander Board are very similar to those of the Controller Board. This may be observed by comparing block diagrams in Figures 5-2 and 5-4.

The on-board memory consists of ultraviolet EPROM circuitry. It stores operating programs for the function blocks associated with the Expander Board. This UVEPROM is addressable by the Controller Board's MPU.

The on-board bus lines interconnect the Expander Board's circuits and the Controller Board MPU. The address bus is unidirectional while the data and control buses are bidirectional.

The Signal Selector circuit operates under the direction of the off-board MPU. It selects an analog input signal, depending upon the control operation at the time, and feeds it to the input of the A/D Converter circuit. It is essentially a solid state switch.

The A/D Converter circuit converts an analog input signal into an equivalent digital value. Once digitized, the signal value can easily be manipulated or stored in memory by the off-board MPU.

The D/A Converter circuits convert a digital value to analog signals.

The Amplifier circuits provide gain and drive capability to the analog output signals of the D/A Converters.

Relay 1 and Relay 2 are triggered by the off-board MPU to provide relay contact type outputs to the rear terminals of the SLDC. Each SPDT relay output can be connected in a normally open or normally closed contact state.

The Opto-Coupler circuits provide signal isolation for digital input signals.

The physical layout of the Expander Board is provided in Figure 5-5 for reference purposes. It's helpful to know the location of the Board's main connectors which connect to the rear terminals and the Controller Board. There are no user adjustments on the Expander Board.

*One analog output with A— software or board PN 15770-1
Two analog outputs with B— software and board PN 15770-101
FIGURE 5-4 Expander Board, Hardware Block Diagram
5.3 DISPLAY ASSEMBLY

The Display Assembly consists of the following interconnected subassemblies:

- Display Interface Board
- Display Driver Board
- Display Board
- Keyboard

The Display Assembly functions under the direction of the Station's MPU based Controller Board. It provides LED indication (both analog and digital) of process signals, accepts operator entered data during hard or soft configuration procedures, and supports the front panel operator controls. Refer to the hardware block diagram, Figure 5-6.

5.3.1 DISPLAY INTERFACE BOARD

The Display Interface Board performs several functions. It interfaces the Display Assembly to the Controller Board, supports the operation of the front panel Pulser Knob, scans the Keyboard for operator initiated keystrokes and forwards display data to the Display Driver Board.

Refer to the Display Interface Board section of Figure 5-6. Notice that the Board has three major circuit areas.

The Dual Optical Switch functions in conjunction with the front panel Pulser Knob to produce two pulse trains whenever the knob is rotated. The pulse trains are phase shifted by 90°. Since their lead-lag relationship is dependent on the direction of knob rotation, as illustrated in Figure 5-7, the Digital Up/Down Counter knows whether to increment or decrement (direction pulses) and by how much (step pulses).

The number of pulses generated is counted by the Digital Up-Down Counter which places binary pulse counts on the data bus where they can be retrieved and used by the Controller Board to adjust the levels of process signals (e.g., setpoint or valve) and/or adjust configuration settings.

The Keyboard Scanner circuit uses its built-in oscillator to scan the Keyboard at regular time intervals to sense a complete keystroke. If a keystroke is detected, data identifying that key is placed on the data bus where it can be interpreted by the Controller Board's MPU. The Display Interface Board also acts as a bus feed through by connecting the address and data busses of the Controller Board to the Display Driver Board.

5.3.2 DISPLAY DRIVER BOARD

The Display Driver Board performs three main functions. It decodes display data received from the MPU based Controller Board (via the Display Interface Board), forwards decoded display data to the Display Board, and provides LED indication of the active switching state for three front panel mode selector switches (i.e., C/L, E/I, and A/M).

Refer to the Display Driver Board area of Figure 5-6. There are six LEDs mounted on this Board. These LEDs are grouped into three pairs. Notice the data path between the Display Driver Board and the Display Board. Display data is sent to the Display Board via this route.

The Segment And Digit Driver circuitry uses standard digital decoding and latching techniques. The circuit accepts encoded display data from the Display Interface Board and forwards decoded segment and digit/bar graph signals to the Display Board. It also decodes display data for the six on-board switch-state indicator LEDs.

The six LEDs are arranged in three pairs with each pair consisting of one green (top) and one red (bottom) LED. Each pair is associated with a front panel mode selector switch. Only one LED in each pair may be lit at any one time, however, the associated mode selector switch must either have been configured or be activated by a station option. The C/L switch is active when the optional Link Interface is present. The E/I switch is active when the EXTERNAL/INTERNAL function block is used and the A/M switch is active when the AUTO/MANUAL TRANSFER function block is used. Switches that have not been configured or do not have an associated option will have the corresponding LEDs off at all times.

5.3.3 DISPLAY BOARD

The Display Board contains the various LED devices used to display process and configuration information.

Refer to the Display Board area of Figure 5-6. This illustration shows the layout and types of LED devices. These devices consist of arrays, bargraphs and alphanumeric readouts. All on-board LED devices are red.

The Display Board accepts decoded display drive signals from the Display Driver Board.

5.3.4 KEYBOARD

The Keyboard is a membrane keypad which contains 14 switches. The layout of these switches is shown in the Keyboard section of Figure 5-6. Each switch has tactile feel. The nine configuration switches, located at the bottom of the keypad, are accessible by opening the front panel flip-down door. Operator initiated keystrokes are sensed by circuitry on the Display Interface Board. The Keyboard has a built-in shield to prevent false triggering from static or EMI (electromagnetic interference). The switch contacts (1 Kohm closed resistance) are arranged in a matrix fashion.
FIGURE 5-6 Display Assembly, Hardware Block Diagram
FIGURE 5-7  Pulse Train Phase Relationship
5.4 NO. 3 INPUT BOARD

Each following subsection describes a signal processing board which plugs into the SLDC's Controller Board. No. 3 Input Boards permit a variety of process related signals to be handled by the SLDC. Function block 98, INPUT 3, must be configured to use a No. 3 input feature.

5.4.1 COMPUTER PULSE INPUT BOARD

The Pulse Input Board provides the SLDC with the capability of accepting computer pulse inputs. Typically, these pulses are used to increment or decrement a configuration defined signal within the Station. One application is the computer adjustment of the Station's setpoint signal. The on-board circuitry operates under the control of the Controller Board's MPU.

Refer to the hardware block diagram in Figure 5-8. Note that the Pulse Input Board plugs into the Controller Board. Therefore, the two pulse inputs are routed from the station's rear terminals through the Controller Board to the Pulse Input Board. There are two modes of operation associated with the Pulse Input Board: the Dual-Pulse mode and the Pulse-Direction mode.

The Dual-Pulse mode of operation requires the application of a pulse train to Pulse Input 1 to increment a configuration defined signal or a pulse train to Pulse Input 2 to decrement the signal. Pulse characteristics are listed in the Specifications section of this Instruction. The Pulse-Direction mode of operation requires the application of a pulse train to Pulse Input 1 and a logic level voltage (high or low) applied to Pulse Input 2. The pulse train will change the magnitude of a configuration defined signal while the logic level voltage determines if the signal is to be incremented or decremented. Pulse details are listed in the Specifications section of this Instruction.

As indicated in Figure 2-8, the pulse mode is selected by the position of the Board's Pulse Mode jumper-plug P1. The jumper-plug is factory positioned in the Dual-Pulse mode before shipment.

As shown in Figure 5-8, the on-board memory consists of a factory prepared ultraviolet EPROM. It is used to store operating program information including Factory Configured Options associated with the Pulse Input Board. This information is required by the Controller Board's MPU for configuration and to operate the Pulse Input Board.

The Pulse Rectifier circuit delivers positive going pulses to the Opto-Coupler circuit regardless of the input pulse polarity.

The Opto-Coupler circuit isolates incoming pulses to prevent circuit loading and ground loop signal interference. The Up/Down Counter circuit is a 12 bit binary counter. It incrementally changes its output state (either up or down) in response to incoming pulses.

The Buffer circuit buffers the Up/Down Counter's output to prevent loading the data bus.

---

**FIGURE 5-8 Pulse Input Board, Hardware Block Diagram**
5.4.2 THERMOCOUPLE/MILLIVOLT INPUT BOARD

The Thermocouple/Millivolt Input Board (FB99) can be configured to accept an input signal from one of the below sources:

- Millivolt source, -20 to 20 mVdc
- Millivolt source, -75 to 75 mVdc
- T/C type J, K, or E
- T/C type, T, R, S, or B

The hardware block diagram in Figure 5-9 indicates that the Board plugs into the Controller Board. Therefore, either the thermocouple signal and Sensor Board current input or the millivolt signal input is routed from the station's rear terminals through the Controller Board to the Thermocouple/Millivolt Input Board*.

A thermocouple input requires a Sensor Board. The Board contains a reference junction temperature sensing transistor that inputs a current proportional to temperature. The Current To Voltage Converter accepts this current and outputs a voltage (IN3) to the Controller Board for automatic reference junction temperature compensation.

DC operating voltages (+12V and -12V) are supplied from the Controller Board. The remaining circuitry on the Board is powered by 5V from the Controller Board; although, the stages in the thermocouple/millivolt signal path are powered by an isolated 5V supply from the isolated DC-DC Converter.

The thermocouple or millivolt input signal appears at the Overvoltage Protection And Open T/C Detection stage. The components in this stage function as transient suppressors and protect the input circuitry from accidental application of excessive plus or minus voltages. The stage contains jumper-plugs J1 and J2 (see Figure 4-2)* for selecting Span (Narrow or Wide) and Direction (Up or Down) and the components which function to detect and respond to a T/C break or an open in the input wiring or terminal connections. The setting of J1 determines the gain of the Gain Block And Filter stage. When J1 is in the "Wide" position, the gain of the stage is set to process either a millivolt input between -75 and 75mV or T/C type J, K, or E. When J1 is in the "Narrow" position, the gain of the stage is set to process either a millivolt input between -20 and 20mV or T/C type T, R, S or B. The filter circuits remove noise appearing at the input of the Gain Block. Refer to either Figure 4-1 or Figure 4-2 for the physical layout of the Board.

The amplified and filtered analog signal representing the thermocouple or millivolt signal appears at the input to the A/D Converter. The Converter produces a digital output consisting of a train of pulses whose count is proportional to the amplitude of the analog input. This output is routed through the Opto-Coupler to the serial count line. The Converter also outputs a logic level based upon whether the number undergoing conversion is plus or minus. This is called the sign line. A logic level from the Control Interface to the A/D Converter on the conv./stop line allows the Controller Board's MPU to control the action of the Converter.

The digital and sign inputs to the Control Interface circuitry are under the control of the Controller Board's MPU and exit via separate lines of the data bus. The MPU can also initiate a read operation and access the configuration information stored in the UV EPROM Memory. The address and data buses serve to transmit the request and respond with the required data.

* Description is for Board series P/N 15819. Figure 4-1 shows series P/N 18005 which functions similarly.
FIGURE 5-9 Thermocouple/Millivolt Input Board, Hardware Block Diagram
5.4.3 VOLTAGE INPUT BOARD

The Voltage Input Board is an optional No.3 Input Board (FB99) that adds an additional analog input to a Basic or an Expanded Station. It is capable of processing signals (non-isolated) between 1 and 5 Vdc similar to the other five analog inputs (FB01, 02, 25, 26 and 27). This third analog input is applied to the rear terminals of the Station and routed through the Controller Board before being processed by the Voltage Input Board.

The block diagram in Figure 5-10 shows that the voltage input signal is filtered and buffered by U1 before its output is returned to the Controller Board. The on-board memory U3 is a factory programmed ultraviolet erasable PROM (UVEPROM). It is used to store the operating program and the Factory Configured Options (FCO) associated with the Voltage Input Board. This information is required by the Controller Board's MPU for configuration and operation of the Voltage Input Board.

When the Controller Board's MPU addresses the Voltage Input Board, Memory chip U3 and Decoder U2 are enabled, placing the contents of Memory on the data bus. A "Read" signal (R) from the MPU to the Decoder produces an output signal that gates the contents of Memory through Buffer U4 to the Controller Board via the data bus. A physical layout of the Voltage Input Board is illustrated in Figure 5-11.

---

**FIGURE 5-10 Voltage Input Board, Hardware Block Diagram**
FIGURE 5-11 Voltage Input Board Variations, Physical Layout
5.4.4 RTD INPUT BOARD

The RTD Input Board is capable of processing a low level voltage from a 100 ohm platinum resistance temperature detector (RTD) exposed to a temperature range of -300°F to 1200°F (-185°C to 650°C).

The RTD Input Board provides excitation to and accepts a low level input voltage representing a temperature from an RTD. This analog input voltage is converted to a 16-bit digital value for application to the MPU on the Controller Board. The value is stored in the Station's data base as a No. 3 Input under function block FB99. Twice a second, the MPU reads the digital value from the Board and updates the data base.

Refer to the block diagram of the RTD Input Board shown in Figure 5-12 while reading the following circuit description. The physical layout of the Board is shown in Figure 5-13.

A constant current of 0.5 mA is established through the field-connected RTD by the action of the 1 mA Current Source and the 0.5 mA Current Sink. As a result, when the measured temperature changes, the RTD resistance varies to produce an equivalent millivolt DC signal. The Gain & Offset stage conditions this analog voltage to meet the input requirements of the A/D Converter. The A/D Converter outputs a 16-bit value onto the Data Bus every 500 ms or twice a second.

When a conversion from analog to digital is completed, the Data Valid line to the MPU goes low. The MPU addresses the Decoder and a Read signal is produced that enables the Multiplexer and gates the high byte from the output of the Converter through the Multiplexer. Simultaneously, a Read signal gates the high byte through the Buffer to the Data Bus.

---

**FIGURE 5-12 RTD Input Board, Hardware Block**
A timer on the Controller Board produces an initiate conversion signal that disables the high byte, and through the Control stage, enables the low byte. For approximately 10 ms, the low byte input is enabled and the output of the Converter contains the low byte. During this time, another Read signal is produced and the low byte is gated from the output of the Converter through the Multiplexer. Simultaneously, a Read signal gates the low byte through the Buffer to the Data Bus. This completes one conversion and data transfer.

Operating programs stored in the UVEPROM permit the MPU on the Controller Board to perform the following functions:
1. Linearization
2. Calibration
3. Filtering
4. Output Scaling

The Reference Voltage circuitry accepts $-V$, +12V and -12V inputs and produces +V and +1.2 outputs for on-board use.
5.4.5 FREQUENCY INPUT BOARD

The Frequency Input Board is capable of accepting sine, square, pulse or triangle waves at a frequency between 0.05 Hz and 25.00 KHz and at an amplitude from 4.00V to 60.00V peak-to-peak. It can also accept contact closure inputs at a maximum frequency of 100 Hz.

The Frequency Input Board converts a frequency input signal to a 12-bit digital value for application to the MPU on the Controller Board. The value is stored in the SLDC data base as a No. 3 input under FB89. Refer to the block diagram of the Frequency Input Board in Figure 5-14 while reading the following circuit description. The physical layout of the Board is shown in Figure 2-10.

The Controller Board communicates with the Frequency Input Board via the MPU Data Bus and the Address Bus. Data is transferred to and from the Controller Board through the Data Bus Buffer which buffers the data and reduces loading on the MPU Data Bus. The on-board devices accessed from the Internal Data Bus are:
- An 8K X 8 UVEPROM that contains the MPU instructions, or programming, to operate the Frequency Input Board
- A 12-bit D/A Converter (DAC) used during the learn mode to calibrate the Controller Board's A/D Converter and, during normal operation, to update or refresh the analog voltages of the peak and valley sample and hold circuits located in the Signal Conditioner
- A Control Latch, whose TTL signal lines are used to control various "soft", or program-controlled, switches located in the Signal Conditioner
- A Data Latch which enables the software to read back the control status from the Frequency Input Board
- A Programmable Timer that converts the frequency input signals to an equivalent 12-bit digital output for application to the SLDC's data base

The Address Decoder assures orderly accessing of the various devices which interface with the internal Data Bus.

Automatic calibration of the Frequency Input Board is made possible by the learn mode (CIL). Under program control, negative and positive zeroes, and negative and positive gain coefficients, are derived and stored in a data base in the Controller Boards' RAM. In addition, peak and valley voltages are obtained automatically from the frequency input signals entering the Signal Conditioner. These voltages are conditioned and applied via the Absolute Value line labeled IN3 to the Controller Board's A/D Converter. The resulting digital values, labeled calibration parameters CIPV and CIVV and representing the input's peak and valley voltage levels, are then stored in the data base for later use.

The automatic calibration described above takes place in the learn mode (CIL) after the STORE button is pressed. Depending on the configured values of SMIN and SMAX (minimum and maximum input frequency), the entire calibration sequence can occur instantaneously or take as long as 20 seconds. Any value greater than 1 second will be displayed on the 4-1/2 digit display and decremented at about once a second to give the operator an indication that the learn mode is in progress. The learn mode can be aborted at any time by pressing the EXIT button (while the display is decrementing); any values obtained during the learn process are discarded.

During normal operation and under program control, the line labeled Peak & Valley Voltages to the Signal Conditioner is refreshed about 12 times a minute with the values held in the peak and valley sample and hold circuit. These voltages, representing data base parameters CIPV and CIVV, establish a hysteresis band in hardware that yields a TTL level output from the Signal Conditioner. Automatic calibration in the learn mode assures that the input signal is capable of traversing around the hysteresis band to produce an output. In the manual calibration mode, an accurate oscilloscope measurement of the peak and valley voltages is required prior to storing the CIPV and CIVV values or the Board will fail to function properly.

The actual conversion from frequency input to 12-bit digital output takes place in the Programmable Timer. During normal operation, a command to Begin Conversion starts the process. At the prescribed time, the MPU commands the Timer to End Conversion and the digital value, equivalent to the frequency input, is read from the Board via the Data Bus Buffer.
FIGURE 5-14 Frequency Input Board, Hardware Block Diagram
5.5 LINK INTERFACE BOARD

The Link Interface Board can be installed in either a Model 352B or E Station. It is configured under Function Block (FB) 98 to provide communications over the Local Instrument Link (LIL) between SLDCs and various other link-connected devices such as a Model 320 Independent Computer Interface or a Model 322 Configuration Terminal.

Refer to the block diagram of the Link Interface Board shown in Figure 5-15 while reading the following circuit description. The physical layout of the Board is shown in Figure 5-16.

Operating programs stored in the UVEPROM permit the Link Interface Board to communicate on the LIL. These programs perform the following functions:

1. Receive messages containing commands or data from other Stations and devices on the LIL.
2. Send commands or data to other Stations and devices on the LIL.
3. Perform error checking on the messages.
4. Handle link protocol (token-passing).

When the Link Interface Board is receiving a message from the LIL, encoded data (Manchester II) is received by the LIL Modem and separated into clock and data for the Data-Link Controller. The Link Status Receiver recognizes the presence of link data and sends status signals to the Link MPU. The Data-Link Controller converts serial data into parallel and calculates an error code check (Cyclic Redundancy Check (CRC)) on the message. The Link MPU transfers, via Data Transceiver U3, data from the Data-Link Controller to a temporary receive message buffer located in the Dual Port RAM. After the message is verified and found to be error free, data is transferred to another area in the Dual Port RAM and made available, via Data Transceiver U1, for the Controller Board MPU to read and process. The Link MPU executes an EPROM-stored program that sends an acknowledge message to the sending station indicating that the message was received. This message is routed by the Link MPU to the LIL through the Data-Link Controller and the LIL Modem. If the original incoming message contained an error, the Link MPU would not acknowledge but would wait for the sending station to retry sending the message.

Data to be transmitted is placed in the Dual Port RAM by the Controller Board's MPU. When the MPU addresses the RAM through the Multiplexer And Decoder, data is transferred from the MPU to the RAM over the data bus and Data Transceiver U1. The Link MPU then executes an EPROM-stored program that reads the data from the Dual Port RAM. The Address Decoder enables the Data-Link Controller allowing the data to be stored by the MPU in the Controller. The Data-Link Controller converts the parallel data to serial form and sends it to the LIL Modem. The LIL Modem combines the transmit clock and data to produce encoded data (Manchester II). Within the Modem, the encoded data is sent to a differential driver producing RS-422 signals. These signals pass through a station isolation transformer and a station disconnect relay, operated by the Relay Latch, also contained in the LIL Modem. After transmitting a message on the LIL, the Link MPU waits for an acknowledge from the receiving station. If one is not received, the Link MPU will try to transmit the message up to three times.
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NOTE:
UVEPROM (ULTRAVIOLET ERASEABLE ELECTRICALLY PROGRAMMABLE READ-ONLY MEMORY)
MPU (MULTI-PROCESSING UNIT)

FIGURE 5-16 Link Interface Board, Physical Layout
6.0 MAINTENANCE

SLDC maintenance requirements are minimal. Activities such as cleaning and visual inspection should be performed at regular intervals. The severity of the SLDC’s operating environment will determine the frequency of maintenance. Additional topics including troubleshooting, assembly replacement, and software compatibility are also covered.

6.1 TOOL AND EQUIPMENT REQUIREMENTS

The following tools and equipment are necessary for servicing:

A. Common electronic hand tools
B. Digital Multimeter (DMM)
   Voltmeter section . . . Accuracy ± .01% of reading
   Resolution 1.0 millivolt Input Impedance 10 Megohms
   Ammeter section . . . Accuracy ± 0.1% of reading
   Resolution 100 microamperes
C. Maintenance Kit, P/N 15545-110, containing wrist strap and conductive mat. This kit, or an equivalent, is required when a circuit board assembly is handled for any reason.

6.2 PREVENTIVE MAINTENANCE

The objective for establishing a preventive maintenance program is to provide maximum operating efficiency. Every preventive maintenance operation should assist in realizing this objective. Unless a preventive measure reduces a Station’s down time, it is unnecessary.

6.2.1 ENVIRONMENTAL CONSIDERATIONS

The SLDC has been designed to operate within specified environmental parameters (temperature and humidity). These parameters are listed in the Specifications section of this Instruction. Additional information concerning environmental contaminants is covered in the Installation section.

6.2.2 VISUAL INSPECTION

As part of a periodic maintenance program the SLDC must be visually inspected. When viewing the assembly, scan for abnormalities such as loose, broken or stressed ribbon cables. Look for damaged circuitry and heat stressed parts. Check for excessive dirt or dust build-up which may impede air flow and inhibit proper heat dissipation.

6.2.3 CLEANING

Circuit boards should not be cleaned unless accumulated foreign material is causing a problem. The enclosed station design should prevent particulate material from building up. If cleaning becomes necessary, remove debris with either a soft brush or low velocity deionized air. The bezel is cleaned with a mild, nonabrasive liquid cleaner and a soft, lint-free cloth - do not use a paper towel.

6.2.4 CIRCUIT BOARD HANDLING

Special handling procedures are required whenever a circuit board assembly is removed, tested, repaired, adjusted or installed in the Station’s case. These procedures are required to prevent component damage from the electrostatic discharge hazard to which most semiconductors are vulnerable. When handling an assembly, follow the procedures outlined in the Assembly Replacement section of this Instruction.

6.3 FUSE LOCATION

A power input fuse is located on the rear of the Controller Board as shown in Figure 5-3. This is the SLDC’s main power fuse. A replacement fuse may be obtained from any local electronics supplier or may be ordered from the factory. See the Parts List at the back of this Instruction for fuse part number and description.

To replace the fuse, refer to section 6.5 for removal and installation of the Display Assembly and Controller Board. While Station is disassembled, visually inspect the assemblies. After inserting a new fuse and assembling the Station, apply power. Operate the Station off-line for several minutes to be sure that a condition does not exist which will cause the replacement fuse to fail.

6.4 TROUBLESHOOTING

Troubleshooting the SLDC is primarily done by error codes. Refer to Table 6.4 through 6.9 for information on a particular error code.

Error codes are indicated on the alphanumeric display in response to a failed power-up diagnostic test or to an
on-line station error. Section 6.4.1 provides a quick reference to the identification of these codes. Section 6.4.2 discusses each code with respect to the type of test or error check, station response, problem confirmation, and corrective action.

In the event a malfunction within the SLDC is suspected, troubleshooting by assembly substitution is recommended to get the Station back on-line in the shortest possible time. The plug-in design of station assemblies permits rapid removal and replacement to isolate a defect.

If a problem develops upon initial installation of the Station, a check should be made of the installation wiring and the Station's hard and soft configuration parameters. In addition, check the wiring of any associated external process devices (e.g., as a process transmitter). Field servicing experience indicates that most initial service incidents are of this nature. A troubleshooting guide is provided in Table 6.1 as a service reference.

**NOTE**
When replacing a Controller Board, the SLDC's configuration and calibration parameters must be re-entered. Refer to the Configuration Handbook, Configuration Documentation Booklet, and the Calibration section of this Instruction.

Factory repaired Stations must also be configured.

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>COMMENT</th>
<th>POSSIBLE CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>No station output signal, no bargraph indications, no alphanumeric indications, and no Pulser Knob response.</td>
<td>Completely inoperative station.</td>
<td>Station fuse (F1), power not applied, Controller Board unseated from rear terminal connector, Controller Board.</td>
</tr>
<tr>
<td>No front panel displays, switch action or Pulser Knob response.</td>
<td>Station operates normally otherwise.</td>
<td>Display Assembly unplugged or failed.</td>
</tr>
<tr>
<td>Missing segments from one or more front panel displays.</td>
<td>Station operates normally otherwise.</td>
<td>Display Assembly, Controller Board.</td>
</tr>
<tr>
<td>No Pulser Knob response.</td>
<td>All applicable conditions.</td>
<td>Display Assembly</td>
</tr>
<tr>
<td>Fluctuating station output signal.</td>
<td>Seemingly abnormal fluctuating process signal on bargraph.</td>
<td>Faulty process signal from external transmitter, turbulent process conditions, Controller Board.</td>
</tr>
<tr>
<td>Certain soft/hard configuration and/or calibration parameters cannot be adjusted or reset.</td>
<td>&quot;X&quot; appears on alphanumeric display when attempting to make adjustments.</td>
<td>Lockout switch on Controller Board is set to prevent changes.</td>
</tr>
<tr>
<td>Station will not operate properly after editing existing hard or soft configuration.</td>
<td>Conditions depend on application.</td>
<td>Configuration error (refer to Configuration Handbook).</td>
</tr>
<tr>
<td>No response from &quot;A/M&quot; switch on front panel.</td>
<td>Both associated LEDs off.</td>
<td>Auto/Manual Transfer Block not configured, Display Assembly.</td>
</tr>
<tr>
<td>Erratic Station operation.</td>
<td>Fluctuating displays on output signals.</td>
<td>Controller Board, Expander Board, very low supply voltage.</td>
</tr>
<tr>
<td>Relay output(s) will not change state.</td>
<td>Station operates normally otherwise.</td>
<td>Expander Board.</td>
</tr>
<tr>
<td>No response from &quot;E/I&quot; switch on front panel.</td>
<td>Both associated LEDs off.</td>
<td>External/Internal Transfer Block not configured.</td>
</tr>
</tbody>
</table>
Additional troubleshooting avenues are also possible. For example, a series of test configurations may be generated and implemented to 'exercise' different function block areas within the SLDC. Table 6.2 is provided to indicate which function blocks are associated with a particular assembly. This type of troubleshooting analysis is intended to be implemented in an off-line test bench situation.

On-line checks of the SLDC's input and output signals (i.e., analog and digital) can be performed without affecting station operation. However, this type of signal tracing is usually carried out behind an instrument panel. Refer to Figure 2-5 of this Instruction for rear terminal assignments.

### TABLE 6.2 Function Block Allocation

<table>
<thead>
<tr>
<th>CONTROLLER BOARD</th>
<th>EXPANDER BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB01 ANALOG INPUT 1</td>
<td>FB24 SQUARE ROOT EXTRACTOR</td>
</tr>
<tr>
<td>FB02 ANALOG INPUT 2</td>
<td>FB25 ANALOG INPUT 4</td>
</tr>
<tr>
<td>FB03 ANALOG OUTPUT 1</td>
<td>FB26 ANALOG INPUT 5</td>
</tr>
<tr>
<td>FB04 DIGITAL OUTPUT 1</td>
<td>FB27 ANALOG INPUT 6</td>
</tr>
<tr>
<td>FB05 DIGITAL OUTPUT 2</td>
<td>FB29 ANALOG OUTPUT 2</td>
</tr>
<tr>
<td>FB06 DIGITAL INPUT 1</td>
<td>FB30 DIGITAL INPUT 2</td>
</tr>
<tr>
<td>FB07 RATIO</td>
<td>FB31 DIGITAL INPUT 3</td>
</tr>
<tr>
<td>FB08 BIAS</td>
<td>FB32 RELAY OUTPUT 1</td>
</tr>
<tr>
<td>FB09 HI/LO LIMIT 1</td>
<td>FB33 RELAY OUTPUT 2</td>
</tr>
<tr>
<td>FB10 OVERRIDE SELECTOR</td>
<td>FB34 MULTIPLIER/DIVIDER 1</td>
</tr>
<tr>
<td>FB11 EXTERNAL/INTERNAL TRANSFER</td>
<td>FB35 MULTIPLIER/DIVIDER 2</td>
</tr>
<tr>
<td>FB12 ALARMS</td>
<td>FB36 ADDER/SUBTRACTOR 1</td>
</tr>
<tr>
<td>FB13 CONTROLLER 1</td>
<td>FB37 ADDER/SUBTRACTOR 2</td>
</tr>
<tr>
<td>FB14 AUTOMATIC/MANUAL TRANSFER</td>
<td>FB38 GAIN &amp; BIAS 1</td>
</tr>
<tr>
<td>FB15 OPERATOR'S DISPLAY</td>
<td>FB39 GAIN &amp; BIAS 2</td>
</tr>
<tr>
<td>FB16 INTEGRATOR/TOTALIZER [B]</td>
<td>FB40 LAG</td>
</tr>
<tr>
<td>FB17 SETPOINT TRACK &amp; HOLD</td>
<td>FB41 LEAD</td>
</tr>
<tr>
<td>FB18 GENERAL PURPOSE TRACK &amp; HOLD</td>
<td>FB42 RATE LIMITER</td>
</tr>
<tr>
<td>FB19 GENERAL PURPOSE HOLD</td>
<td>FB43 DEAD TIME TABLE</td>
</tr>
<tr>
<td>FB20 AND/NAND LOGIC 1</td>
<td>FB44 5-SEGMENT CHARACTERIZER</td>
</tr>
<tr>
<td>FB21 OR/NOR LOGIC 1</td>
<td>FB45 CONTROLLER 2</td>
</tr>
<tr>
<td>FB22 DEVIATION AMPLIFIER 1 [B]</td>
<td>FB46 SETPOINT TRACK &amp; HOLD 2</td>
</tr>
<tr>
<td>FB23 DUAL TRANSFER SWITCH [B]</td>
<td>FB47 REPEAT CYCLE TIMER</td>
</tr>
<tr>
<td>FB98 LINK INTERFACE OPTION [B]</td>
<td>FB48 AND/NAND LOGIC 2</td>
</tr>
<tr>
<td>FB99 NO. 3 INPUT OPTIONS</td>
<td>FB49 GENERAL PURPOSE TRANSFER 1</td>
</tr>
<tr>
<td></td>
<td>FB50 OR/NOR LOGIC 2</td>
</tr>
<tr>
<td></td>
<td>FB51 HI/LO LIMIT 1</td>
</tr>
<tr>
<td></td>
<td>FB52 HI/LO LIMIT 2</td>
</tr>
<tr>
<td></td>
<td>FB53 BATCH SWITCH</td>
</tr>
<tr>
<td></td>
<td>FB54 HI/LO SIGNAL SELECTOR</td>
</tr>
<tr>
<td></td>
<td>FB55 GENERAL PURPOSE TRANSFER 2</td>
</tr>
<tr>
<td></td>
<td>FB56 AND/NAND LOGIC 3</td>
</tr>
<tr>
<td></td>
<td>FB57 OR/NOR LOGIC 3</td>
</tr>
<tr>
<td></td>
<td>FB58 DEVIATION AMPLIFIER 2 [B]</td>
</tr>
<tr>
<td></td>
<td>FB59 INVERTER 1 [B]</td>
</tr>
<tr>
<td></td>
<td>FB60 INVERTER 2 [B]</td>
</tr>
<tr>
<td></td>
<td>FB61 ANALOG OUTPUT 3 [B]</td>
</tr>
<tr>
<td></td>
<td>FB62 GENERAL PURPOSE HOLD 2 [B]</td>
</tr>
<tr>
<td></td>
<td>FB63 GENERAL PURPOSE TRACK &amp; HOLD 2 [B]</td>
</tr>
<tr>
<td></td>
<td>FB64 COMPARATOR [B]</td>
</tr>
<tr>
<td></td>
<td>FB65 DELAY TIMER [B]</td>
</tr>
<tr>
<td></td>
<td>FB66 BINARY COUNTER [B]</td>
</tr>
<tr>
<td></td>
<td>FB67 ONE-SHOT TIMER [B]</td>
</tr>
<tr>
<td></td>
<td>FB68 FLIP-FLOP [B]</td>
</tr>
<tr>
<td></td>
<td>FB69 AND/NAND LOGIC 4 [B]</td>
</tr>
<tr>
<td></td>
<td>FB70 OR/NOR LOGIC 4 [B]</td>
</tr>
</tbody>
</table>

[B] = B -- software only; not available in A -- software.
6.4.1 ERROR CODE QUICK REFERENCE

An error code is indicated on the alphanumeric display in response to a power-up test failure or an on-line error. This section serves as a quick reference for error code identification.

6.4.1.1 Power-Up Error Code Designation

Sample Error Code

<table>
<thead>
<tr>
<th>Error Indicator</th>
<th>Error Type</th>
<th>Board Type</th>
<th>Test Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>E 1 1 0</td>
<td>1 — Hardware</td>
<td>1 — Controller</td>
<td>0 — RAM</td>
</tr>
<tr>
<td></td>
<td>2 — Database</td>
<td>2 — Expander</td>
<td>1 — ROM CRC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 — No.3 Input</td>
<td>2 — Software ID</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 — Link Interface</td>
<td>3 — Database ID</td>
</tr>
</tbody>
</table>

6.4.1.2 Power-Up Error Codes

Table 6.3 gives the definition and affected board for each power-up error code. The codes are grouped by error type and listed in the sequence in which diagnostic tests are run.

Multiple database errors can occur. Pressing ENTER CONF button will display additional errors before configuration mode can be entered.

6.4.1.3 On-Line Error Code Designation

An on-line error code is treated as a status change incrementing the alphanumeric display's right-most digit.

Sample Error Code

<table>
<thead>
<tr>
<th>Error Indicator</th>
<th>Error Type</th>
<th>Board Type</th>
<th>Test Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>E 1 1 0</td>
<td>1 — Controller Board A/D</td>
<td>1 — Controller</td>
<td>0 — RAM</td>
</tr>
<tr>
<td></td>
<td>2 — Expander Board A/D</td>
<td>2 — Expander</td>
<td>1 — ROM CRC</td>
</tr>
<tr>
<td></td>
<td>3 — No.3 Input Board</td>
<td>3 — No.3 Input</td>
<td>2 — Software ID</td>
</tr>
<tr>
<td></td>
<td>4 — Link Interface Board</td>
<td>4 — Link Interface</td>
<td>3 — Database ID</td>
</tr>
<tr>
<td></td>
<td>5 — Watch Dog Time Out - Controller Board</td>
<td>5 — Watch Dog Time Out - Controller Board</td>
<td>4 — Link Interface</td>
</tr>
<tr>
<td></td>
<td>6 — EEPROM Stores Exceeds 10,000 - Controller Board</td>
<td>6 — EEPROM Stores Exceeds 10,000 - Controller Board</td>
<td>5 — Watch Dog Time Out - Controller Board</td>
</tr>
<tr>
<td></td>
<td>7 — EEPROM Activity Did Not Verify - Controller Board</td>
<td>7 — EEPROM Activity Did Not Verify - Controller Board</td>
<td>6 — EEPROM Stores Exceeds 10,000 - Controller Board</td>
</tr>
<tr>
<td></td>
<td>Alarm (Configured through FB12)</td>
<td>Alarm (Configured through FB12)</td>
<td>7 — EEPROM Activity Did Not Verify - Controller Board</td>
</tr>
<tr>
<td></td>
<td>* — Uncleared</td>
<td>* — Uncleared</td>
<td>Alarm (Configured through FB12)</td>
</tr>
<tr>
<td></td>
<td>Blank - Cleared</td>
<td>Blank - Cleared</td>
<td>* — Uncleared</td>
</tr>
</tbody>
</table>

Number of Statuses On Stack

6.4.1.4 On-Line Error Codes

Table 6.4 gives the definition and affected board for each on-line error code.

6.4.2 ERROR CODE DISCUSSION

This section discusses the diagnostic test or error check, station response, problem confirmation, and corrective action for each error code. Tables 6.5, 6.6, and 6.7 are for power-up codes; Table 6.8 is for on-line codes.

---

**TABLE 6.3 Power-Up Error Codes**

<table>
<thead>
<tr>
<th>ERROR CODES</th>
<th>DEFINITION/TEST</th>
<th>AFFECTED BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HARDWARE</td>
<td></td>
</tr>
<tr>
<td>E110</td>
<td>RAM</td>
<td>CONTROLLER</td>
</tr>
<tr>
<td>E111</td>
<td>ROM CRC</td>
<td>CONTROLLER</td>
</tr>
<tr>
<td>E121</td>
<td>ROM CRC</td>
<td>EXPANDER</td>
</tr>
<tr>
<td>E122</td>
<td>COMPATIBILITY</td>
<td>EXPANDER</td>
</tr>
<tr>
<td>E131</td>
<td>ROM CRC</td>
<td>NO. 3 INPUT</td>
</tr>
<tr>
<td>E132</td>
<td>COMPATIBILITY</td>
<td>NO. 3 INPUT</td>
</tr>
<tr>
<td></td>
<td>DATABASE</td>
<td></td>
</tr>
<tr>
<td>E213</td>
<td>DATABASE ID</td>
<td>CONTROLLER</td>
</tr>
<tr>
<td>E214</td>
<td>EEPROM TRANSIENT DATA CRC</td>
<td>CONTROLLER</td>
</tr>
<tr>
<td>E215</td>
<td>EEPROM CONSTANT DATA CRC</td>
<td>CONTROLLER</td>
</tr>
<tr>
<td>E216</td>
<td>EEPROM CALIBRATION DATA CRC</td>
<td>CONTROLLER</td>
</tr>
<tr>
<td>E217</td>
<td>POWER-DOWN</td>
<td>CONTROLLER</td>
</tr>
<tr>
<td>E223</td>
<td>DATABASE ID</td>
<td>EXPANDER</td>
</tr>
<tr>
<td>E224</td>
<td>BOARD TYPE ID</td>
<td>EXPANDER</td>
</tr>
<tr>
<td>E233</td>
<td>DATABASE ID</td>
<td>NO. 3 INPUT</td>
</tr>
<tr>
<td>E234</td>
<td>BOARD TYPE ID</td>
<td>NO. 3 INPUT</td>
</tr>
</tbody>
</table>

6-4
### TABLE 6.4 On-Line Error Codes

<table>
<thead>
<tr>
<th>LINK CODE [B]</th>
<th>DISPLAY ERROR CODE</th>
<th>DEFINITION</th>
<th>AFFECTED BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>E1</td>
<td>A/D ERROR</td>
<td>CONTROLLER</td>
</tr>
<tr>
<td>02</td>
<td>E2</td>
<td>A/D ERROR</td>
<td>EXPANDER</td>
</tr>
<tr>
<td>03</td>
<td>E3</td>
<td>BOARD ERROR</td>
<td>NO. 3 INPUT</td>
</tr>
<tr>
<td>-</td>
<td>E4 [B]</td>
<td>BOARD ERROR</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>05</td>
<td>E5</td>
<td>WATCHDOG TIME OUT</td>
<td>ALL</td>
</tr>
<tr>
<td>06</td>
<td>E6</td>
<td>EEPROM STORES EXCEEDS 10,000</td>
<td>CONTROLLER</td>
</tr>
<tr>
<td>07</td>
<td>E7 [B]</td>
<td>EEPROM ACTIVITY DID NOT VERIFY</td>
<td>CONTROLLER</td>
</tr>
<tr>
<td>46</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 70</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>47</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 71</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>48</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 72</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>49</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 73</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>4A</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 74</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>4B</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 75</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>4C</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 76</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>4D</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 77</td>
<td>LINK INTERFACE</td>
</tr>
</tbody>
</table>

[B] = B ... software only; not available on A ... software.

### TABLE 6.5 E110 Through E132 - Power-Up Hardware Error Codes

<table>
<thead>
<tr>
<th>ERROR CODE</th>
<th>DIAGNOSTIC TEST</th>
<th>STATION RESPONSE</th>
<th>PROBLEM CONFIRMATION</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>E110</td>
<td>RAM - Verifies that each memory location can be written to and read from</td>
<td>1. Display blank except for alphanumeric display 2. Operator controls inoperative 3. Outputs failed: A. Analog set to -3.3% B. Digital nonconducting C. Relay de-energized</td>
<td>Remove and reapply station power</td>
<td>Replace Controller Board</td>
</tr>
<tr>
<td>E111</td>
<td>ROM CRC - Verifies factory enterd data and that it can be read</td>
<td>1. Display blank except for alphanumeric display 2. Operator controls inoperative 3. Outputs failed: A. Analog set to -3.3% B. Digital nonconducting C. Relays de-energized</td>
<td>Remove and reapply station power</td>
<td>Replace Board: E111 - Controller E121 - Expander E131 - No. 3 Input</td>
</tr>
<tr>
<td>E121</td>
<td>3. Outputs failed: A. Analog set to -3.3% B. Digital nonconducting C. Relays de-energized</td>
<td>Remove and reapply station power</td>
<td>Replace Board: E111 - Controller E121 - Expander E131 - No. 3 Input</td>
<td></td>
</tr>
<tr>
<td>E131</td>
<td>Compatibility - Checks for software compatibility between boards</td>
<td>1. Display blank except for alphanumeric display 2. Operator controls inoperative 3. Outputs failed: A. Analog set to -3.3% B. Digital nonconducting C. Relays de-energized</td>
<td>Remove and reapply station power</td>
<td>Install software compatible board(s): Refer to section 6.7 for software compatibility</td>
</tr>
<tr>
<td>LINK CODE</td>
<td>ERROR CODE</td>
<td>DIAGNOSTIC TEST</td>
<td>STATION RESPONSE</td>
<td>PROBLEM CONFIRMATION</td>
</tr>
<tr>
<td>-----------</td>
<td>------------</td>
<td>----------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>D5</td>
<td>E213</td>
<td>ID - Checks for correctness of configuration for boards</td>
<td>1. Displays blank except for alphanumeric. Displays active for configuration only</td>
<td>Remove and reapply station power</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Operator controls operative for configuration only</td>
<td></td>
</tr>
<tr>
<td>DF</td>
<td>E223</td>
<td></td>
<td>3. A -- software only - Station clears all execution sequence numbers (ESNs)</td>
<td></td>
</tr>
<tr>
<td>E9</td>
<td>E233</td>
<td></td>
<td>4. Outputs failed:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A. Analog to -3.3%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>B. Digital nonconducting</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C. Relays de-energized</td>
<td></td>
</tr>
<tr>
<td>LINK CODE [B]</td>
<td>DISPLAY CODE</td>
<td>ERR CODE</td>
<td>DIAGNOSTIC TEST</td>
<td>STATION RESPONSE</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
<td>----------</td>
<td>-----------------</td>
<td>------------------</td>
</tr>
</tbody>
</table>
| D6           | E214         |          | EEPROM CRC - Verifies transient data. | 1. Display active for configuration only.  
2. Operator controls operative for configuration only.  
3. Outputs failed:  
A. Analog to -3.3%  
B. Digital nonconducting  
C. Relays de-energized | Remove and reapply station power. | A _ _ software - Step through soft configuration to verify or correct parameter values.  
If values are correct, remove and reapply station power.  
B _ _ software - Press ENTER CONF button. Re-enter configuration or download new database via Local Instrument Link. |
| D7           | E215         |          | EEPROM CRC - Verifies constant data. | 1. Displays blank except for alphanumeric; Displays active for configuration only.  
2. Operator controls operative for configuration only.  
3. A _ _ software only - Station clears all execution sequence numbers (ESNs).  
4. Outputs failed:  
A. Analog to -3.3%  
B. Digital nonconducting  
C. Relays de-energized | Remove and reapply station power. | A _ _ software - If correct Boards are installed, re-enter configuration.  
B _ _ software - If correct Boards are installed, press ENTER CONF button and re-enter configuration or download database via Local Instrument Link. |
| D8           | E216         |          | EEPROM CRC - Verifies calibration data. | 1. Display active for configuration only.  
2. Operator controls operative for configuration only.  
3. Outputs failed:  
A. Analog to -3.3%  
B. Digital nonconducting  
C. Relays de-energized | Remove and reapply station power. | A _ _ software - Recalibrate all inputs and outputs.  
If error code remains, remove and reapply station power.  
B _ _ software - Press ENTER CONF button. (Station loads default calibration data and enters normal mode.) At earliest convenience, recalibrate all inputs and outputs. |
| D9           | E217 [B]     |          | Controller Board - Power-Down | 1. Display active for configuration only.  
2. Operator controls operative for configuration only.  
3. Outputs failed:  
A. Analog to -3.3%  
B. Digital nonconducting  
C. Relays de-energized | Remove and reapply station power. | B _ _ software - Press ENTER CONF button. Re-enter configuration or download new database via Local Instrument Link. |
| EO           | E224 [B]     |          | Expander Board - Type | 1. Display active for configuration only.  
2. Operator controls operative for configuration only.  
3. Outputs failed:  
A. Analog to -3.3%  
B. Digital nonconducting  
C. Relays de-energized | Remove and reapply station power. |  |
| EA           | E234 [B]     |          | No. 3 Input Board - Type | 1. Display active for configuration only.  
2. Operator controls operative for configuration only.  
3. Outputs failed:  
A. Analog to -3.3%  
B. Digital nonconducting  
C. Relays de-energized | Remove and reapply station power. |  |

[B] = B _ _ software only; not available in A _ _ software.
<table>
<thead>
<tr>
<th>LINK CODE [B]</th>
<th>DISPLAY CODE</th>
<th>DIAGNOSTIC TEST</th>
<th>STATION RESPONSE</th>
<th>PROBLEM CONFIRMATION</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>E1</td>
<td>A/D Converter - determines if conversion is completed in required time.</td>
<td>Apparent normal operation. Since A/D converter is not functioning properly, some displays may not change even though process is changing.</td>
<td>Enter configuration mode (T) or (H), step to value level push store, then exit configuration. If error code remains or reappears, proceed to corrective action column.*</td>
<td>Replace Board: E1 - Controller E2 - Expander</td>
</tr>
<tr>
<td>02</td>
<td>E2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>E3</td>
<td>Pulse Input Board - Check for abnormal condition of input.</td>
<td>Apparent normal operation. Since pulse input is incorrect or being improperly processed, signal input display may not be correct or respond to changing input signal.</td>
<td>Enter configuration mode (T) or (H), step to value level push store, then exit configuration. If error code remains or reappears, proceed to corrective action column.*</td>
<td>1. Check input signal for excessive noise or out of frequency range. 2. Replace Pulse Input Board.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thermo couple/Millivolt Input Board - A/D Converter - determines if conversion is completed in required time.</td>
<td>Apparent normal operation. Since A/D converter is not functioning properly, some displays may not change even though process is changing.</td>
<td>Enter configuration mode (T) or (H), step to value level push store, then exit configuration. If error code remains or reappears, proceed to corrective action column.*</td>
<td>3. Replace Thermo couple/Millivolt Input Board.</td>
</tr>
<tr>
<td></td>
<td>E4 [B]</td>
<td>Link Interface Board: Dual Port RAM (Off-Line) Power-Up</td>
<td>Extended power-up condition, then apparent normal operation. Since Link Interface Board is not operating, some displays may not change.</td>
<td>Enable H/T/F lockout switch. Enter configuration mode (T) or (H), step to value level push store, then exit configuration. If error code remains or reappears, proceed to correction action column.*</td>
<td>Replace Link Interface Board.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dual Port RAM (On-Line) Operation</td>
<td>Apparent normal operation. Since Link Interface Board is not operating, some displays may not change.</td>
<td>Enable H/T/F lockout switch. Enter configuration mode (T) or (H), step to value level push store, then exit configuration. If error code remains or reappears, proceed to corrective action column.*</td>
<td>Replace Link Interface Board.</td>
</tr>
<tr>
<td>LINK CODE [B]</td>
<td>DISPLAY ERROR CODE</td>
<td>DIAGNOSTIC TEST</td>
<td>STATION RESPONSE</td>
<td>PROBLEM CONFIRMATION</td>
<td>CORRECTIVE ACTION</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------</td>
<td>-----------------</td>
<td>------------------</td>
<td>----------------------</td>
<td>-------------------</td>
</tr>
</tbody>
</table>
| 05            | E5                | MPU - Check to determine if program has been executed in required time. | Station executes power-up diagnostic test routines (4 seconds).  
1. Display blank except for alphanumeric display (4 seconds).  
2. Controls inoperative (4 seconds). | Enable H/T/F lockout switch. Enter configuration mode (T) or (H), step to value level, push store, then exit configuration. If error code remains or reappears, proceed to corrective action column.* | Replace Controller Board. |
| 06            | E6                | EEPROM - Check to determine if number of EEPROM stores (writes) has exceeded 10,000. | Normal operation. | Enable H/T/F lockout switch. Enter configuration mode (T) or (H), step to value level, push store, then exit configuration. If error code remains or reappears, proceed to corrective action column.* | 1. Replace Controller Board at next convenient periodic maintenance check.  
2. Check power supply for erratic output (can be indicated by momentary display blanking). |
| 07            | E7 [B]            | EEPROM activity did not verify. | Normal operation. | Enable H/T/F lockout switch. Enter configuration mode (T) or (H), step to value level, push store, then exit configuration. If error code remains or reappears, proceed to corrective action column.* | 1. Replace Controller Board at next convenient periodic maintenance check. (If not replaced, next power cycle will result in a 200 series error and the Station will go off-line.)  
2. Check power supply for erratic output (can be indicated by momentary display blanking). |

*[B] = B - software only; not available in A - software.

*If error code does not reappear, an environmental problem (e.g., excessive power input voltage excursion or out-of-specification operating temperature) can exist or an intermittent electrical problem can be present, see corrective action column.
6.5 ASSEMBLY REPLACEMENT

Controller, Expander, Link Interface and No. 3 Input Boards contain software. The software on a replacement board must be compatible with the software on other boards in an SLDC. Refer to section 6.7 for software compatibility guidelines.

As is the case with most electronic assemblies populated with semiconductor components, precautions must be observed to prevent component damage from ESD (i.e., electrostatic discharge). Accordingly, a maintenance kit containing a wrist strap and a conductive mat must be used whenever an assembly, such as a Controller Board, is removed from or installed in the station case. Refer to Figure 2-14, notice how a wrist strap can be conveniently grounded by clipping it to the bezel screw retainer block.

Whenever an assembly is not installed in a Station, it must be stored in a static shielding bag. These bags are 8" x 12" (20.3 cm x 30.5 cm) and are available from the factory under material code X6080. The Controller Board requires a larger bag (30.4 cm x 45.7 cm) under material code Z74A.

When unplugging ribbon cables from assemblies be sure to grip the connector, not the ribbon wire. Do not let the Display Assembly hang by the connecting ribbon cable. Care should be exercised when seating and unseating circuit boards.

Station calibration will be necessary after replacing any of the following circuit boards: Controller, Expander, Thermocouple/Millivolt Input or Voltage Input.

6.5.1 DISPLAY ASSEMBLY

To replace the Display Assembly use the following procedure:

REMOVAL:
1. Flip down bezel ID plate and loosen captive bezel retaining screw
2. Separate Assembly from station case by five inches (12.7 cm); support the Assembly so it doesn't hang by the ribbon cable
3. Ground wrist strap to bezel screw retainer block
4. Disconnect ribbon cable from Assembly
5. Place Assembly in static shielding bag
6. Disconnect wrist strap from block.

INSTALLATION:
1. Ground wrist strap to screw retainer block
2. Remove Assembly from static shielding bag
3. Connect ribbon cable to Assembly

NOTE
When changing a Display Assembly with the Station powered-up and an error code present, the displays will light in a random pattern except for the alphanumeric display which will show the error code. Clear the error to clear the displays.

4. Disconnect wrist strap from block
5. Position Assembly in front of case and line up captive bezel screw
6. Make sure ribbon cable is not pinched
7. Tighten screw and flip up ID plate.

6.5.2 CONTROLLER BOARD

To replace the Controller Board or the station fuse use the following procedure:

REMOVAL:
1. In a hazardous area, remove input power from Station
2. Remove Display Assembly as described in section 6.5.1
3. Remove board retainer by extracting board retainer screw (see Figure 2-14)
4. Ground wrist strap to bezel screw retainer block
5. Pivot the Controller Board's extractor tab to unseat the Board from the rear terminal connection block (refer to Figure 5-3)
6. Slide the Board from the Station case
7. Place the Board in a static shielding bag
8. Disconnect wrist strap from block.

INSTALLATION:
1. Ground wrist strap to bezel screw retainer block
2. Remove Board from static shield bag
3. Set lockout switches as on removed Board (see Figure 5-3)
4. Position end of Board into top and bottom card guide channels
5. Push top and bottom of Board with equal force and slide it into case
6. Disconnect wrist strap
7. Install board retainer (see Figure 2-14)
8. Install Display Assembly as described in section 6.5.1.

NOTE
Station must be configured when Controller Board is replaced.

6.5.3 EXPANDER, No.3 INPUT, AND LINK INTERFACE BOARDS

These board types are removed and installed in a similar manner. Refer to the Parts List at the back of this Instruction for location of boards and mounting hardware. Note that the Expander Board must be removed before a No.3 Input Board can be removed.

REMOVAL:
1. Remove Display Assembly as described in section 6.5.1.
2. Remove Controller Board as described in section 6.5.2.
3. On a grounded conductive mat, remove retaining screws and washers which hold board to be removed to Controller Board.
4. Carefully remove Board being sure not to bend connector pins.
5. Place Board in static shielding bag.
6. Repeat steps 3, 4 and 5 for each Board to be removed.

INSTALLATION:
1. Ground wrist strap to grounded conductive mat.
2. Remove Board from static shielding bag and set jumper plugs as on Board removed or as follows:
   Pulse Input Board - See Figure 2-8. Thermocouple/Millivolt Input Board - See Figure 4-1 or Figure 4-2.
   Expander, Voltage Input and Link Interface Boards - None to be set.
3. Position Board as shown in Parts List drawing; carefully align board connector with mating Controller Board connector and press connectors together; see Table 6.9.

<table>
<thead>
<tr>
<th>BOARD TO BE INSTALLED AND CONNECTOR</th>
<th>CONTROLLER BOARD CONNECTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expander, P1</td>
<td>J1</td>
</tr>
<tr>
<td>Pulse Input, J1</td>
<td>J2</td>
</tr>
<tr>
<td>Thermocouple/Millivolt Input, J3</td>
<td>J3</td>
</tr>
<tr>
<td>Voltage Input, J1</td>
<td>J2</td>
</tr>
<tr>
<td>Link Interface, P1</td>
<td>J3</td>
</tr>
<tr>
<td>RTD Input, J1</td>
<td>J2</td>
</tr>
<tr>
<td>Frequency Input, J1</td>
<td>J2</td>
</tr>
</tbody>
</table>

4. Install retaining screws and washers (and spacers, if necessary) to secure Board to Controller Board.
5. Repeat steps 2, 3 and 4 for each Board to be installed.
6. Perform sections 6.5.2 and 6.5.1 to install Controller Board and Display Assembly.

6.6 RECOMMENDED SPARE AND REPLACEMENT PARTS

It is recommended that one spare of each of the following items be stocked for every 1 to 10 units in service: Fuse, Display Assembly, Controller Board, Expander Board, No.3 Input Board, and Link Interface Board. Part numbers are provided in the Parts List at the back of this Instruction. Replacement circuit boards, assemblies and recommended spare parts are available from the factory. Part numbers are provided in the Parts List at the back of this Instruction.

IMPORTANT
When ordering a replacement or spare circuit board, provide the following data from the board to be replaced or spared:
- part number
- software compatibility code
- serial number.

An item being returned to the factory should be packaged in its original shipping container. Otherwise, package for safe shipment or contact the factory for shipping recommendations. Send package to one of the addresses given in the Warranty Statement.

IMPORTANT
A circuit board must be placed in a static shielding bag before it is packaged for shipment.

6.7 SOFTWARE COMPATIBILITY IDENTIFICATION

When adding or changing a circuit board, consideration must be given to the software compatibility of the boards. A three letter, alphabetic, software compatibility code is used to signify the compatibility and identity of SLDC software. This code is added to the end of an EPROM (UV EPROM) part number. Each EPROM carries a label with the EPROM part number and a code as follows:

Sample Marking 14728-1000-A B C

EPROM Part Number
System
Station
EPROM Revision

The System code letter applies to software which defines and formats communications between SLDCs (and other stations) connected to the Local Instrument Link. This letter must be the same on all boards within an SLDC, whether or not it is connected to a Local Instrument Link. The Station code letter applies to software which defines communications between boards within an SLDC. This letter must be the same on Controller, Expander and No.3 Input Boards within an SLDC - The Link Interface Board's station code letter does not need to be the same.

IMPORTANT
All Local Instrument Link connected SLDCs must have Link Interface Boards with the same System code letter and the same Station code letter.

The EPROM Revision Code letter indicates the software version. All EPROMs on a board must have the same code letter.

6.8 MAINTENANCE RECORDS

An accurate record keeping system for maintenance operations should be established and kept up to date. Data extracted from the record can serve as a basis for ordering supplies such as spare parts. In addition, it's useful as a troubleshooting tool by providing historical maintenance data. Scheduled and unscheduled maintenance should be recorded.
MODEL 352 WARRANTY

The Company warrants all equipment manufactured by it and bearing its nameplate, 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 herein described and sold by the Company, proves to be defective in material or workmanship and if such part is within thirty-six 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, f.o.b. Company's factory. The Company assumes no liability for the consequence of its use or misuse 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 renewed, repaired or replaced, operate to condemn 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 title are 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.
Sumneytown Pike
Spring House, PA 19477

Equipment manufactured or sold by MOORE PRODUCTS Co. (CANADA) INC.:

MOORE PRODUCTS Co. (CANADA) INC.: 2KM West of Mississauga Rd. Hwy. 7
Brampton, Ontario, Canada

Equipment manufactured or sold by MOORE PRODUCTS Co. (UK) LTD.:

MOORE PRODUCTS Co. (UK) LTD
Copse Road
Lufton, Yeovil,
Somerset, BA22 8RN, ENGLAND

The warranty will be null and void if repair is attempted without authorization by MOORE PRODUCTS Co.

* Twelve months on Model 352s shipped prior to January 1, 1995 and on all spare and replacement parts.
CONNECT KEYBOARD CABLE TO P2 ON INTERFACE BD.
CONNECT TO J1 ON INTERFACE BD.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
<th>QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6773-9</td>
<td>Retaining Ring</td>
<td>1</td>
</tr>
<tr>
<td>2a</td>
<td>16040-7</td>
<td>Keyboard/Bezel (Model 383)</td>
<td>1</td>
</tr>
<tr>
<td>2b</td>
<td>16100-27</td>
<td>Keyboard/Bezel (Model 351)</td>
<td>1</td>
</tr>
<tr>
<td>2c</td>
<td>16103-17</td>
<td>Keyboard/Bezel (Model 352)</td>
<td>1</td>
</tr>
<tr>
<td>2d</td>
<td>16151-5</td>
<td>Keyboard/Bezel (Model 385)</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>15738-96</td>
<td>Non-Metallic Washer</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>15738-45</td>
<td>Bezel Screw</td>
<td>1</td>
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<td>5</td>
<td>15738-44</td>
<td>Bracket</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>15738-66</td>
<td>Shaft Bearing</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>See Note</td>
<td>Display Board</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>See Note</td>
<td>Display Driver Board</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>See Note</td>
<td>Display Interface Board</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>15738-58</td>
<td>Keeper Spring</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>15738-69</td>
<td>Cylinder &amp; Shaft Assembly</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>15738-57</td>
<td>Keyboard Cover</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>15738-280</td>
<td>Knob</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>15738-297</td>
<td>Knob Cap</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>15738-88</td>
<td>1D Card</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>1-0390</td>
<td>2-56 x 1.88 Pan Hd.</td>
<td>2</td>
</tr>
<tr>
<td>17</td>
<td>1-7216</td>
<td>2 Medium Lockwash</td>
<td>2</td>
</tr>
<tr>
<td>18</td>
<td>1-0848</td>
<td>4-40 x 1.13 Bd</td>
<td>2</td>
</tr>
<tr>
<td>19</td>
<td>1-7228</td>
<td>4 Medium Lockwasher</td>
<td>2</td>
</tr>
</tbody>
</table>

NOTE: Shown for reference only.
**Mounting Case**

*(20 Terminals & 40 Terminals)*

**Models**: 320, 351, 352, 372, 382, 383, 385

---

**Warning:**

INSTALL ITEM 7 AT A3 WITH "G" EXPOSED.

---

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
<th>QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7418-339</td>
<td>Receptacle</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>15738-49</td>
<td>Case</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>15738-50</td>
<td>Card Guide Mdg.</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>15738-52</td>
<td>Mounting Bracket Assy. (Include the following 2 Items)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>12740-262</td>
<td>Mounting Screw</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>12740-263</td>
<td>Mounting Stud</td>
<td>2</td>
</tr>
<tr>
<td>5a</td>
<td>15738-54</td>
<td>Rear Plate (40 Terminal Case)</td>
<td>1</td>
</tr>
<tr>
<td>5b</td>
<td>15738-55</td>
<td>Rear Plate (20 Terminal Case)</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>15738-56</td>
<td>Power Terminal Cover</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>15738-60</td>
<td>Ground Strap</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>15738-61</td>
<td>Terminal Block Barrier (40 Terminal Case)</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>7418-341</td>
<td>Cover Plate</td>
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<tr>
<td>20a</td>
<td>15738-126</td>
<td>Range Resistor Kit (40 Terminal Case) (Not Shown)</td>
<td>1</td>
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<tr>
<td>20b</td>
<td>15738-125</td>
<td>Range Resistor Kit (20 Terminal Case) (Not Shown)</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>15738-62</td>
<td>Alignment Screw</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>1-0723</td>
<td>Screw</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>1-0832</td>
<td>4-40 X 0.875 Fill Hd.</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>3603-79</td>
<td>Flx Screw 4-20</td>
<td>6</td>
</tr>
<tr>
<td>15</td>
<td>1-7260</td>
<td>6 Intl Tooth Lwr</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>1-1174</td>
<td>6-32 x 1/4 Rd</td>
<td>1</td>
</tr>
<tr>
<td>26</td>
<td>1-7217</td>
<td>4 Int. Tooth Lwr</td>
<td>1</td>
</tr>
</tbody>
</table>

---

8/95 Supersedes 2/93
### Parts List

**Model 352**

Single Loop Digital Control Station

**Drawing No. 16100-8BPL**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>*201a</td>
<td>16105-19</td>
<td>Display Assy (See Parts Dwg. 15738-68PL)</td>
<td>1</td>
</tr>
<tr>
<td>*201b</td>
<td>15918-16</td>
<td>Blank Panel</td>
<td>1</td>
</tr>
<tr>
<td>202</td>
<td>15738-242</td>
<td>Board Retainer (Inc. next 4 items)</td>
<td>1</td>
</tr>
<tr>
<td>15738-111</td>
<td>Board Retainer (Inc. with item 202)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3175-149</td>
<td>Captive Screw (Inc. with item 202)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>15738-240</td>
<td>Washer (Inc. with item 202)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>12251-4</td>
<td>Tensile Ring (Inc. with item 202)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>*201</td>
<td>Plane Panel</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>*201</td>
<td>Mounting Case (See Parts Dwg. 15738-19PL)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>15942-48</td>
<td>Case Assy. 40 Terminal. (200/240 VAC)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>15942-27</td>
<td>Case Assy. 40 Terminal. 24 VDC</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>15942-28</td>
<td>Case Assy. 40 Terminal. 24 VAC</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>15942-49</td>
<td>Case Assy. 40 Terminal. 120/240 VAC</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>15942-31</td>
<td>Case Assy. 40 Terminal. 24 VDC</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>*302</td>
<td>15738-164</td>
<td>Stand Off</td>
<td>1</td>
</tr>
<tr>
<td>*303</td>
<td>L-0723</td>
<td>Screw 4-40</td>
<td>8</td>
</tr>
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</table>

### Obsolete Board

<table>
<thead>
<tr>
<th>Item</th>
<th>Obsolete Board</th>
<th>Obsolete Board</th>
<th>Current Kit</th>
<th>Circuit Board Assy</th>
<th>Req'd</th>
</tr>
</thead>
<tbody>
<tr>
<td>*301a</td>
<td>15768-112</td>
<td>15768-112</td>
<td>15768-115</td>
<td>Pulse Input Kit</td>
<td>1</td>
</tr>
<tr>
<td>*301b</td>
<td>15824-112</td>
<td>15824-112</td>
<td>15824-115</td>
<td>Voltage Input Kit</td>
<td>1</td>
</tr>
<tr>
<td>*301c</td>
<td>16005-51</td>
<td>16005-51</td>
<td>16005-53</td>
<td>T/CH/MV Input Kit</td>
<td>1</td>
</tr>
<tr>
<td>*305</td>
<td>15819-21</td>
<td>15819-21</td>
<td>15819-21</td>
<td>Thermocouple Input</td>
<td>1</td>
</tr>
<tr>
<td>*304d</td>
<td>15945-11</td>
<td>15945-11</td>
<td>15945-13</td>
<td>RTD Input Kit</td>
<td>1</td>
</tr>
<tr>
<td>*304e</td>
<td>15950-11</td>
<td>15950-11</td>
<td>15950-13</td>
<td>Frequency Input Kit</td>
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</tr>
<tr>
<td>*304f</td>
<td>N/A</td>
<td>N/A</td>
<td>16005-43</td>
<td>(With Common)</td>
<td>1</td>
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<tr>
<td>*304g</td>
<td>N/A</td>
<td>N/A</td>
<td>16105-46</td>
<td>Smart Interface Kit</td>
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<tr>
<td>*304h</td>
<td>16105-46</td>
<td>16105-46</td>
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<td>Expander Kit</td>
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<td>*304i</td>
<td>16105-39</td>
<td>16105-39</td>
<td>16105-42</td>
<td>Link Interface Kit</td>
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<td>*304j</td>
<td>15853-31</td>
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<td>15853-31</td>
<td></td>
<td>1</td>
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<tr>
<td>*304k</td>
<td>15853-31</td>
<td>15853-31</td>
<td>15853-31</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>*304l</td>
<td>11881</td>
<td>11881</td>
<td>11881</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>*304m</td>
<td>11881</td>
<td>11881</td>
<td>11881</td>
<td></td>
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<tr>
<td>*304n</td>
<td>16105-49</td>
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<td>16105-49</td>
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<td>1</td>
</tr>
<tr>
<td>*304o</td>
<td>11881</td>
<td>11881</td>
<td>11881</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>*304p</td>
<td>14155-122</td>
<td>14155-122</td>
<td>14155-122</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>*304q</td>
<td>14155-122</td>
<td>14155-122</td>
<td>14155-122</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>*304r</td>
<td>16105-18</td>
<td>16105-18</td>
<td>16105-18</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>*304s</td>
<td>16105-26</td>
<td>16105-26</td>
<td>16105-26</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

* Recommended on-hand spare parts. Always specify range, serial no., or other nameplate information when ordering spare parts.

---

### Important Note

When ordering a replacement or spare circuit board, provide the following data to ensure a compatible assembly:

- **Part Number**
- **Three-letter software compatibility code**
- **Serial number**

---

**Ref:** SD352-1
INSTRUCTION INVOLVED

Model 352 Single-Loop Digital Controller (SLDC), Installation and Service Instruction SD352, issues 6 and 7

INTRODUCTION

This addendum describes enhancements present in ‘C’ level software. Software compatibility, display assembly pushbuttons, function block allocation, error codes, and assembly part numbers are discussed in the following sections.

A station with either ‘A’ or ‘B’ level software (residing in UVEPROMs on each circuit board) can be converted to ‘C’ level by installing the appropriate Conversion Kits. Contact your local Moore Products representative for additional information.

NOTE

The above software levels are the second letter in the three-letter code (e.g., BCA is ‘C’ level software). The software level is printed on a label on each UVEPROM.

SOFTWARE COMPATIBILITY

Sections 2.5 Circuit Board Installation, 6.5 Assembly Replacement, 6.6 Recommended Spare And Replacement Parts, and 6.7 Software Compatibility Identification, and the Parts List refer to the need for software compatibility. Note the following exception to the guidelines stated in section 6.7:

- No. 3 Input Boards with ‘B’ level UVEPROMs are compatible with Controller and Expander Boards with ‘C’ level UVEPROMs. All Link Interface Boards are compatible with ‘C’ level.

No. 3 Input Boards with ‘A’ level UVEPROMs are not compatible with Controller and Expander Boards with ‘C’ level UVEPROMs. When updating Controller and Expander Boards to ‘C’ level, order software upgrade kits to install ‘B’ level UVEPROMs in No. 3 Input Boards and Link Interface Boards; specify board type and current software level.

Also note that a station must be upgraded to ‘C’ level software before installing a SMART Transmitter Interface for HART communication with an XTC™ Transmitter.

UVEPROM - Ultraviolet Erasable Programmable Read Only Memory
HART - Highway Addressable Remote Transducer; trademark of the HART Communication Foundation

MOORE PRODUCTS CO., Spring House, PA 19477-0900
An ISO 9001 registered company.
DISPLAY ASSEMBLY

Four Display Assembly pushbuttons that are used for configuration have additional functions. These functions are described in AD352-10 MYCRO 352 User's Manual and AD352-20 Configuration Handbook. Versions of these documents that describe 'C' level software are dated 5/91 or later.

FUNCTION BLOCK CHANGES

The following table amends information found in Table 6.2, Function Block Allocation. Function blocks listed in the first column have been enhanced in 'C' level software.

A station with 'B' level software and with any of the listed function blocks included in a configuration can be upgraded to 'C' level software without reconfiguring. Reconfiguration will be needed to take advantage of additional 'C' level functionality.

<table>
<thead>
<tr>
<th>FB Number</th>
<th>'B' Level Function Block</th>
<th>'C' Level Function Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB20</td>
<td>AND/NAND Logic 1</td>
<td>Logic Block 1</td>
</tr>
<tr>
<td>FB21</td>
<td>OR/NOR Logic 1</td>
<td>Logic Block 2</td>
</tr>
<tr>
<td>FB34</td>
<td>Multiplier/Divider 1</td>
<td>Math Block 1</td>
</tr>
<tr>
<td>FB35</td>
<td>Multiplier/Divider 2</td>
<td>Math Block 2</td>
</tr>
<tr>
<td>FB36</td>
<td>Adder/Subtractor 1</td>
<td>Math Block 3</td>
</tr>
<tr>
<td>FB37</td>
<td>Adder/Subtractor 2</td>
<td>Math Block 4</td>
</tr>
<tr>
<td>FB44</td>
<td>5-Segment Characterizer</td>
<td>10-Segment Characterizer</td>
</tr>
<tr>
<td>FB48</td>
<td>AND/NAND Logic 2</td>
<td>Logic Block 3</td>
</tr>
<tr>
<td>FB50</td>
<td>OR/NOR Logic 2</td>
<td>Logic Block 4</td>
</tr>
<tr>
<td>FB56</td>
<td>AND/NAND Logic 3</td>
<td>Logic Block 5</td>
</tr>
<tr>
<td>FB57</td>
<td>OR/NOR Logic 3</td>
<td>Logic Block 6</td>
</tr>
<tr>
<td>FB66</td>
<td>Binary Counter</td>
<td>Divide-by-N Counter</td>
</tr>
<tr>
<td>FB69</td>
<td>AND/NAND Logic 4</td>
<td>Logic Block 7</td>
</tr>
<tr>
<td>FB70</td>
<td>OR/NOR Logic 4</td>
<td>Logic Block 8</td>
</tr>
</tbody>
</table>
POWER-UP ERROR CODE DESIGNATION

The following amends information found in section 6.4.1.1, Power-Up Error Code Designation. The significant addition is the test for a ‘C’ level database.

Sample Error Code — E 110

Error Indicator

Error Type
1 - Fatal (Hardware)
2 - Non-Fatal (Database)

Board
1 - Controller
2 - Expander
3 - No.3 Input
4 - Link Interface

Test Type
0 - RAM
1 - ROM CRC
2 - Software ID
3 - Database ID
4 - EEPROM Transient Data CRC
5 - EEPROM Constant Data CRC
6 - EEPROM Calibration Data CRC
7 - Power-Down
9 - ‘C’ Level Database
## POWER-UP HARDWARE ERROR CODES

The following table amends information found in Table 6.5, E110 Through E132 - Power-up Error Codes. Four new error codes have been added.

<table>
<thead>
<tr>
<th>ERROR CODE</th>
<th>DIAGNOSTIC TEST</th>
<th>STATION RESPONSE</th>
<th>PROBLEM CONFIRMATION</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>E119</td>
<td>Compatibility - Checks for database compatibility</td>
<td>1. Display blank except for alpha-numeric display 2. Operator controls inoperative 3. Outputs failsafed: A. Analog set to -3.3%. B. Digital non-conducting C. Relays de-energized</td>
<td>Remove and reapply station power</td>
<td>Upgrade software to ‘C’ level; order upgrade kits</td>
</tr>
<tr>
<td>E124, E134</td>
<td>Compatibility - Checks for hardware compatibility between boards</td>
<td>1. Display blank except for alpha-numeric display 2. Operator controls inoperative 3. Outputs failsafed: A. Analog set to -3.3% B. Digital non-conducting C. Relays de-energized</td>
<td>Remove and reapply station power</td>
<td>Install hardware compatible board(s)</td>
</tr>
<tr>
<td>E130</td>
<td>RAM - Checks low level board for proper RAM</td>
<td>1. Display blank except for alphanumeric display 2. Operator controls inoperative 3. Outputs failsafed: A. Analog set to -3.3% B. Digital non-conducting C. Relays de-energized</td>
<td>Remove and reapply station power</td>
<td>Install a good SMART Transmitter Interface Board</td>
</tr>
</tbody>
</table>
SMART TRANSMITTER INTERFACE BOARD

INSTRUCTION INVOLVED

Model 352 Single-Loop Digital Controller, Installation and Service Instruction SD352, issues 6 and 7

SUBJECT

Smart Transmitter Interface Board

INTRODUCTION

The Smart Transmitter Interface Board is a No. 3 Input Board that is configured as function block 97. It is included in station Model 352 _ _ _ _ M _. The Interface Board can be added to an installed Model 352 station equipped with 'C' level software (i.e., BC_).

The Interface Board accepts up to three transmitter input signals.

CONFIGURATION PARAMETERS

M*TG - Tag Name, Eight ASCII Characters
M*ML - Measured Variable Lo, IEEE
M*MH - Measured Variable High, IEEE
M*MU - Measured Variable Units
M*DM - Damping, IEEE
M*SR - Square Root, Yes/No
M*TT - Moore Products Co. Transmitter Type
  1 - Pressure
  2 - Pressure/PID
  3 - Temperature
  4 - Temperature/PID
M*PL - Process Variable Lo
M*PH - Process Variable Hi
M*EU - Engineering Units, Four ASCII Characters
M*AR - Auto Re-Range, EN/DIS
C*ZI - Zero Input
C*FI - Full Scale Input
C*VI - Verify Input
S*FB - Filter Breakpoint Frequency, 0.001 to 10.00 Hz
H*TT - Transmitter Type
  1 - Conventional
  2 - Smart
  3 - Moore Products Co. Smart
  4 - Moore Products Co. Smart/PID
H*SR - Square Root Extractor, Yes/No
H4AC - Auto Configure
  0 - None
  1 - Process Range 1
  2 - Process Range 2
  3 - X
  4 - Y

* Replace with transmitter input A, B, or C

MOORE PRODUCTS CO., Spring House, PA 19477-0900
An ISO 9001 registered company.
HARDWARE SPECIFICATIONS

Transmitter Inputs .................. 3
Analog Input Range ............... 0 to 5 Vdc
Standard Calibration ............. 1 to 5 Vdc
Accuracy .......................... 0.05% of span
Zero .................................. 0 to 1 Vdc
Span .................................. 4 to 5 Vdc
Input Type .......................... Single-ended (non-isolated)
Normal Mode Rejection ............ 6 dB @ 2 Hz, 60 dB @ 60 Hz
Input Impedance .................... > 1 Megohm
Maximum Continuous Input ......... +/-30 Vdc
Update Rate .......................... 100 msec
Digital Communication Protocol ... HART*
Communication Topology .......... Point-to-Point only
Ambient Temperature Effect ...... < +/-0.5% of span for a 100°F ambient temperature change

INSTALLATION

Install a Smart Transmitter Interface Board in a Model 352 containing ‘C’ level software in accordance with sections 2.5, 2.5.1, and 2.5.3. The Interface Board mounts between the Expander Board, Link Interface Board, and Controller Board. Mount the Transmitter Interface Board using the standoffs supplied in the Interface Board Kit to properly space the circuit boards.

No jumper plugs or switches need to be set. Figure 1 shows the physical layout of the Interface Board.

CALIBRATION

A Smart Transmitter Interface Board is factory calibrated for 1 to 5 Vdc inputs. Recalibration should not be required unless:

- the Interface Board is field installed or its calibration parameters are to be changed
- the Station’s Controller Board is replaced

Periodic recalibration is not necessary.

Required Equipment

Calibration of an Interface Board requires use of the following equipment:

1. Model 352 SLDC with ‘C’ level software (i.e., BC_) and a Smart Transmitter Interface Board

2. Precision reference voltage source supplying 0.000 to 5.000 Vdc

*HART (Highway Addressable Remote Transducer) is a registered trademark of the HART Communication Foundation.
Procedure

The calibration procedure involves storing in Controller Board memory the Zero Input value and the Full Scale Input value. Calibration values should be the process range values, typically 1-5V.

1. With power off at the Station, set the 'C' (Calibration) and 'H/T/F/M' (transmitter) lockout switches to the enable position; see Figure 5-3.

2. Apply power to the Station and press ENTER CONF button to enter configuration mode at the MENU level.

3. Rotate Pulser Knob to select 'C' in left digit position of alphanumeric display. (If 'CX' appears in the display, perform step 1.)

4. Press STEP DOWN button to enter FUNCTION BLOCK level.

5. Rotate Pulser Knob to select function block 97 in the right-side digits of alphanumeric display.

6. At Station's rear terminals connect either an electronic calibrator or a precision reference source capable of supplying voltages from 0.000 to 5.000 Vdc. Refer to Table 1 for rear terminal connections for calibrating each analog input. (Ensure that terminal screws are tight.)

7. Press STEP DOWN button to enter PARAMETER level.

8. Rotate Pulser Knob to select desired parameter (e.g., 'CAZI' zero input A or 'CBZO' zero input B). Parameter is indicated on alphanumeric display.

### TABLE 1 FB97 Calibration

<table>
<thead>
<tr>
<th>TRANSMITTER INPUTS</th>
<th>REAR TERMINALS</th>
<th>FB OUTPUT NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>A9</td>
<td>97</td>
</tr>
<tr>
<td>B+</td>
<td>A10</td>
<td>98</td>
</tr>
<tr>
<td>C+</td>
<td>B10</td>
<td>99</td>
</tr>
<tr>
<td>Station Common</td>
<td>A5, D5, or D8</td>
<td>--</td>
</tr>
</tbody>
</table>

9. Press STEP DOWN button to enter VALUE level. ('CAL' appears on 4-1/2 digit display.)

10. Set precision voltage source to zero input value (0.000 to 1.000 Vdc).

11. Press STORE to lock-in desired value.

12. Press STEP UP button.

13. Rotate Pulser Knob to select full scale parameter (CAFI, CBFI, or CCFI).

14. Press STEP DOWN button.

15. Set voltage source to full scale input value (4.000 to 5.000 Vdc).

16. Press STORE.

17. To verify the calibration:
A) Press STEP UP button.

B) Rotate Pulser Knob to select verification parameter (e.g., CAVI to verify input A) shown on the alphanumeric display.

C) Press STEP DOWN button to enter VALUE level.

D) Set precision voltage source to zero input voltage; 4-1/2 digit display should read 0.0%.

E) Set source to full scale voltage; 4-1/2 digit display should read 100.0%.

18. Select one of the following:

If another transmitter input is to be calibrated, press STEP UP button once to enter the PARAMETER level. Turn the pulser knob to select the desired parameter. Perform steps 6 through 17 for each transmitter input.

If all points have been calibrated and verified, press EXIT button to leave calibration mode and enter operation mode.

19. Lock out the Station's Calibration and transMitter modes via the Controller Board's 'C' and 'H/T/F/M' lockout switches. This step is recommended.

HARDWARE DESCRIPTION

The Smart Transmitter Interface Board plugs into the Controller Board. Three inputs are routed from the Station's rear terminals through the Controller Board to the Interface Board (see Figure 2). Since the Interface Board has three identical channels for the three inputs, only input A will be described.

The transmitter input signal at J1-A9 has two components: a digital HART component and an analog DC component. The HART component of the transmitter input signal is passed by the bandpass filter and attenuated by the low pass filter. The bandpass filter passes signals between 500 Hz to 10 KHz.

A modern chip (U32) demodulates the signal into 0V and 5V logic pulses, according to the HART protocol which defines logic 1 as 1.2 KHz and logic 0 as 2.2 KHz. This digital signal is then stored in UART (U4) (Universal Asynchronous Receiver/Transmitter) until the station's microprocessor requests the information.

RAM and ROM (U8 and U13) store transient data for digital and analog signals and programming for the Interface Board.

The analog component of the transmitter input signal is passed by a two-pole, low pass filter with a breakpoint frequency of 2 Hz, which allows a slowly changing DC voltage (e.g., temperature inputs) to be passed. This signal is stored in the Buffer until polled by the multiplexer (U22 and U25) and sent to A/D Converter (U30). The Controller Board's MPU accesses each channel through Decoder U7.
FIGURE 2 Smart Transmitter Interface Board, Hardware Block Diagram
MAINTENANCE

Refer to section 6.0 for detailed maintenance instructions.

Troubleshooting the Smart Transmitter Interface Board, a No. 3 Input Board, is by error codes which appear on the Display Assembly alphanumeric display in response to either a failed power-up diagnostic test or an on-line station error. These error codes, including the type of test or error check, station response, problem confirmation, and corrective action are listed in the tables of SDA352-8.

If a No. 3 Input Board error code is displayed, refer to section 6.5 to replace the Smart Transmitter Interface Board. Return the Interface Board to the factory for repair.

The following three error codes identify either a transmitter fault or a communication error between the specified transmitter and the Station.

- EA - Transmitter A fault or communication error
- EB - Transmitter B fault or communication error
- EC - Transmitter C fault or communication error

RECOMMENDED SPARE AND REPLACEMENT BOARDS

One spare Smart Transmitter Interface Kit (P/N 16105-16) should be stocked for every 1 to 10 Smart Transmitter Interface Boards in service.

Refer to section 6.6 for ordering information and shipping instructions.
CONTROLLER BOARD PLUG-IN POWER SUPPLY
MODEL 352 SINGLE LOOP DIGITAL CONTROLLER

INSTRUCTION INVOLVED

Model 352 Single Loop Digital Controller (SLDC), Installation and Service Instruction SD352, Issues 6 and 7

SUBJECT

Model 352_A Controller Board plug-in power supply enhancement

DISCUSSION

Starting in August, 1992, all Model 352_A SLDCs with 'BC*' level software will be produced with a revised Controller Board. This board includes a plug-in power supply, a socketed non-volatile RAM (NVRAM), and other minor circuit changes. Figure 1 shows the Controller Board with 'BC*' level software. A Controller Board ordered with 'BB*' level software will not include NVRAM.

These enhancements improve serviceability and do not affect functionality. A revised SLDC is fully compatible with a previous SLDC, when software compatibility is maintained.

The plug-in power supply accepts a wide range of AC input voltages. Therefore, Model 352_E will no longer be offered; it will be merged with Model 352_A. Models 352_B and 352_C will continue to use the soldered-in power supply. Refer to the following model designation list.

MODEL DESIGNATION CHANGES

Sample Model Number ———————————————————— 352 B A 1 1 V 1 F

Model Series

Type
B -
E - Expanded

Power Requirement
A - 120/240 Vac (85 to 264 Vac) 47 to 63 Hz
B - 24 Vac (+10%, -15%) 47 to 63 Hz
C - 24 Vdc (+20%, -15%)
E - No longer offered; merged with ‘A’

The remaining model designations are as before.
CAUTION 85–264 VAC

14755-123

POWER FUSE
SUPPLY VOLTAGE   RATING/TYPE   PART NO.
120/240 VAC     0.5A, 3AG, SLO-BLO   7447-54
24 VDC          2A, 3AG, SLO-BLO   7447-123

SECURING SCREW

NOTES:
MPU (MULTIPROCESSING UNIT)
NVRAM (NON-VOLATILE RANDOM ACCESS MEMORY)
UVEPROM (ULTRAVIOLET ERASABLE ELECTRICALLY PROGRAMMABLE READ-ONLY MEMORY)
CONTROLLER BOARD SHOWN IS FOR 'BC* LEVEL SOFTWARE.

FIGURE 1 SLDC Controller Board with Plug-In Power Supply
PLUG-IN POWER SUPPLY SERVICING

This section supplements the troubleshooting and assembly replacement information in section 6, Maintenance.

A plug-in power supply failure may be indicated by one or more of the following symptoms:

• All Display Assembly displays are blank
• Fuse F1 blown
• E217 error code displayed
• No +26 Vdc at case rear terminal B5
• No +5 Vdc across VR7 (see procedure below)

A. +5 VDC TEST PROCEDURE

1. Temporarily loosen or remove the Display Assembly; see section 6.5.1.

2. Refer to Figure 1 and locate VR7 near the card ejector tab. Connect a digital voltmeter across VR7 as follows:
   Voltmeter positive lead - To banded end of VR7
   Voltmeter negative lead - To unbanded end of VR7

3. With power applied to station, voltmeter should read 4.75 to 5.25 Vdc.

   If incorrect voltage is present, replace Power Supply and retest.

   If correct voltage is present yet other symptoms listed above persist, replace Power Supply and retest. If replacing the Power Supply fails to remove the symptom(s), refer to the Troubleshooting section.

B. PLUG-IN POWER SUPPLY REPLACEMENT

REMOVAL:

1. Refer to section 6.5 Assembly Replacement and remove the Display Assembly, Controller Board, and Expander Board.

2. Remove the Power Supply Securing Screw. Lay the Controller Board on a static dissipative workmat Power Supply side up.

3. At the top of the Controller Board, carefully insert a small diameter screwdriver between the Controller Board and the Power Supply.

   Gently lift the screwdriver handle to raise the Power Supply approximately 1/4" above the Controller Board.

   IMPORTANT

   Do not lift the power supply more than 3/8" to avoid damaging the mounting pins.

4. At the bottom of the Controller Board, carefully insert a small diameter screwdriver between the Controller Board and the Power Supply, between the components along the edge of the Board.

   Gently lift the screwdriver handle to raise the Power Supply approximately 1/4" above the Controller Board.
5. Lift the Power Supply from the Controller Board pins.

INSTALLATION

1. Note the arrangement of Controller Board pins and Power Supply sockets for correct Power Supply orientation. Be sure all pins are straight.

2. At the top edge of the Controller Board, carefully align the top-most pins in the two headers with the corresponding sockets in the Power Supply. Then carefully lower the Power Supply onto the remaining pins.

   Check the alignment at the bottom of the Controller Board; adjust Power Supply placement as necessary.

3. Press the Power Supply onto the Controller Board pins.

4. Install the Securing Screw.

5. Refer again to section 6.5 to reassemble the station.

NVRAM DESCRIPTION AND ERROR CODES

The non-volatile RAM performs the functions previously assigned to the EEPROM. Its primary function is to store calibration, configuration, and transient data when power is removed from the station.

Error codes listed in section 6, Table 6.4 On-Line Error Codes are amended as follows:

<table>
<thead>
<tr>
<th>LINK CODE</th>
<th>DISPLAY CODE</th>
<th>ERROR CODE</th>
<th>DEFINITION</th>
<th>AFFECTED BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>05</td>
<td></td>
<td>E5</td>
<td>Watchdog Time Out</td>
<td>All (only with EEPROM)</td>
</tr>
<tr>
<td>06</td>
<td></td>
<td>E6</td>
<td>EEPROM Stores Exceed 10,000</td>
<td>Controller (only with EEPROM)</td>
</tr>
<tr>
<td>07</td>
<td></td>
<td>E7</td>
<td>EEPROM Activity Did Not Verify</td>
<td>Controller (only with EEPROM)</td>
</tr>
<tr>
<td>07</td>
<td></td>
<td>E7</td>
<td>NVRAM Write Did Not Verify</td>
<td>Controller (only with NVRAM)</td>
</tr>
</tbody>
</table>
MODEL 352 SINGLE-LOOP DIGITAL CONTROLLER
DECLARATION OF CONFORMITY

INVOLVED MANUAL

SD352, Model 352 Single-Loop Digital Controller Installation And Service Instruction, Issue 7, November 1995; this addendum supersedes SDA352-11, Issue 1, January 1996

DISCUSSION

As shown in the table below, the information in each affected section is amended by the statement in the right column.

<table>
<thead>
<tr>
<th>AFFECTED SECTION(S) IN SD</th>
<th>STATEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 MODEL DESIGNATION</td>
<td>Compliant stations will contain an ‘E’ in the Electrical Classification portion of the model designation.</td>
</tr>
<tr>
<td>1.3.17 Electrical Classification</td>
<td>CSA/FM electrical classification approval as non-incendive for Division 2 service applies to installations in North America and where recognized. Check local approval requirements.</td>
</tr>
<tr>
<td>SDA-CSA1</td>
<td>The next page contains a Declaration of Conformance with the standards or other normative documents stated on the certificate.</td>
</tr>
<tr>
<td>1.3 SPECIFICATIONS</td>
<td>Environmental Conditions, Per IEC 664: Installation Category II Pollution Degree 2</td>
</tr>
<tr>
<td>2.4 ELECTRICAL INSTALLATION</td>
<td>Route electrical power to the station through a clearly labeled circuit breaker or on-off switch that is located near the station and is accessible by the operator. The breaker or switch should be located in a non-explosive atmosphere unless suitable for use in an explosive atmosphere.</td>
</tr>
<tr>
<td></td>
<td>When the Local Instrument Link twinaxial cable is to be grounded to the Model 352’s rear terminals:</td>
</tr>
<tr>
<td></td>
<td>1. Install a jumper between terminals AG (earth ground) and B3; order Jumper Kit PN 16105-98.</td>
</tr>
<tr>
<td></td>
<td>2. Connect the twinaxial cable shield to terminal B3.</td>
</tr>
</tbody>
</table>
DECLARATION OF CONFORMITY
according to EN 45014

Moore Products Co.
Sumneytown Pike
Spring House, PA 19477

declares under its sole responsibility that the product:

Model 352xxxxxE Single-Loop Digital Controller,

to which this declaration relates is in conformity with the following standards or other normative documents listed below,

EN 61010-1, Safety Requirements for electrical equipment for measurement, control and laboratory use
EN 50081-2, Electromagnetic compatibility: Generic emission standard Industrial environment
EN 50082-1, Electromagnetic compatibility: Generic immunity standard, Residential, commercial, and light industrial environment
EN 50082-2, Electromagnetic compatibility: Generic immunity standard Industrial environment

following the provisions of the:

Manufactured in Spring House, PA, U. S. A.

Dated: 26 Nov 1996

[Signature]

James O. Moore
General Manager
Measurement and Control Division
DECLARATION OF CONFORMITY

We

Moore Products Co (UK) Ltd
Copse Road
Yeovil
Somerset BA22 8RN
United Kingdom

declare under our sole responsibility that the product:-

Model 352 Single Loop Digital Controller configured with EMC compliant version of the controller board
to which this declaration relates is in conformity with the following standards or other normative documents

EMC: EN50081-2 Emissions
EN50082-1 and EN50082-2 Immunity

following the provisions of the EMC directive

Manufactured in Yeovil Somerset United Kingdom.

J N Stansfield C Eng M I Mech E
Engineering Services Manager
Moore Products Co (UK) Ltd
Dated December 21st 1995
INSTRUCTION ADDENDUM

SUPPORT, REPAIR, AND WARRANTY INFORMATION

PRODUCT SUPPORT

Product support can be obtained from the Moore Products Co. Technical Information Center (TIC). TIC is a customer service center that provides direct phone support on technical issues related to the functionality, application, and integration of all products supplied by Moore Products Co.

To contact TIC for support, either call 215-646-7400, extension 4TIC (4842) or leave a message in the bulletinboard service (BBS) by calling 215-283-4968. The following information should be at hand when contacting TIC for support:

- Caller ID number, or name and company name
  
  When someone calls for support for the first time, a personal caller number is assigned. This number is mailed in the form of a caller card. 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’s operation:
  - Is problem intermittent
  - The steps performed before the problem occurred
  - Any error messages displayed
  - Installation environment

RETURN FOR REPAIR

Remove a failed instrument from service and proceed as follows to return it to the factory for repair.

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 to obtain an RMA (Return Material Authorization) number. 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.

WARRANTY

The Company warrants all equipment manufactured by it and bearing its nameplate, 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 herein 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, f.o.b. company's factory. The Company assumes no liability for the consequence of its use or misuse 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 renewed, repaired or replaced, operate to condemn 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 title, are hereby expressly negated and excluded.

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

1. Equipment manufactured or sold by MOORE PRODUCTS CO.

   MOORE PRODUCTS CO.
   Sumneytown Pike
   Spring House, PA 19477 USA

2. Equipment manufactured or sold by MOORE PRODUCTS CO. (CANADA) INC.

   MOORE PRODUCTS CO. (CANADA) INC.
   2KM West of Mississauga Rd. Hwy 7
   Brampton, Ontario Canada

3. Equipment manufactured or sold by MOORE PRODUCTS CO. (U.K.) LTD

   MOORE PRODUCTS CO. (U.K.) LTD
   Copse Road.
   Lufton, Yeovil.
   Somerset, BA22 8RN England

Warranty will be null and void if repair is attempted without authorization by Moore Products Co.

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

Cet addendum indique les précautions, relatives aux emplacements dangereux définis par la CSA, que doit prendre l'utilisateur lors de l'installation ou du dépannage de l'appareil décrit dans la notice ci-jointe. Ces directives complètent celles qui sont données dans la notice ci-jointe.

AVERTISSEMENT

Si les précautions suivantes ne sont pas prises, il pourrait résulter un danger d'explosion.

PRÉCAUTIONS

Emplacements dangereux de classe I, division 1 et classe I, division 2:

Les pièces de rechange doivent être autorisées par l'usine. Les substitutions peuvent rendre cet appareil impropre à l'utilisation dans les emplacements dangereux.

Emplacements dangereux de division 2:

Lorsque l'appareil décrit dans la notice ci-jointe est installé sans barrières de sécurité, on doit couper l'alimentation électrique à la source (hors de l'emplacement dangereux) avant d'effectuer les opérations suivantes:

- branchement ou débranchement d'un circuit de puissance, de signalisation ou autre.
- remplacement d'un fusible, d'une carte de circuit imprimé ou de tout autre élément connecté au circuit électrique.

Ceci termine la section Précautions.
INTRODUCTION
This addendum provides CSA hazardous location precautions that should be observed by the user when installing or servicing the equipment described in the accompanying Instruction. These statements supplement those given in the accompanying Instruction.

WARNING
Failure to observe the following precautions could result in an explosion hazard.

PRECAUTIONS
For Class I, Division 1 and Class I, Division 2 hazardous locations:
— Use only factory authorized replacement parts. Substitution of components can impair the suitability of this equipment for hazardous locations.
For Division 2 hazardous locations:
When the equipment described in the accompanying Instruction is installed without safety barriers, the following precautions should be observed. Switch off electrical power at its source (in non-hazardous location) before:
— Connecting or disconnecting power, signal, or other wiring
— Replacing a fuse, circuit board, or any other component connected to the electrical circuit.

This completes the precautions.

Service Publications Group