INSTALLATION AND SERVICE INSTRUCTION
MYCRO 382
LOGIC AND SEQUENCE CONTROLLER

SD382
Issue: 2
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MOORE PRODUCTS CO., Spring House, PA 19477
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Section 1

1.0 INTRODUCTION

1.1 DOCUMENTATION

This Installation Instruction for the MYCRO 382 Logic and Sequence Controller is divided into three sections.

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, CALIBRATION, furnishes field calibration procedures for analog inputs and outputs plus those No. 3 input Boards that require calibration. Section 4, CIRCUIT DESCRIPTION, supplies general circuit descriptions of the Controller Board, Expander Board, No. 3 Input Boards, Link Interface Board, and the Display Assembly. Section 5, MAINTENANCE, furnishes preventive maintenance guidelines, troubleshooting, and subassembly replacement procedures. A Parts List is at the end of this section.

In addition, configuration literature is supplied with the shipment. This literature provides details and procedures for complete configuration.

IMPORTANT

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

1.2 PRODUCT DESCRIPTION

1.2.1 GENERAL

The MYCRO 382 Logic and Sequence Controller (LSC) is a microprocessor-based controller capable of performing continuous control and discontinuous (ON-OFF) control. Its design provides for user configuration of the desired station type and control strategy via software interconnection of function blocks. Once configured, the Controller can maintain a process variable at the desired operating value, generate setpoint profiles for continuous controllers, and position a number of ON-OFF devices based on logical conditions usually centered around a sequencing device.

The main difference between the models being offered is the number of I/O channels available. The Model 382B (basic version) contains 3 dedicated I/O channels and can be configured to control a simple batch process, whereas, the Model 382E (expanded version) contains 16 additional I/O channels which can be configured as either inputs or outputs and control more complex processes. In addition, the expanded model contains a configurable real-time clock, recipe storage, and an additional analog output.

Option boards allow for both versions to receive a pulse, analog voltage, thermocouple, RTD, or frequency input and when equipped with a link interface option board, to communicate with MOORE's MYCRO Distributed System or with other Controllers and/or devices on the Local Instrument Link (LIL). Option boards are plug-in assemblies which are added without LSC modification.

An LSC is shown in Figure 1-1. Front panel dimensions conform to DIN standards. The Display Assembly contains the controls, switches, and displays required for configuration and local operation. Hardware and software for a basic LSC 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.

1.2.2 CONFIGURATION

Configuration is basically user selection and interconnection of function blocks to establish the station type and control strategy. Configuration data is stored in non-volatile 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 LSC Display Assembly. A link interface equipped LSC may be configured through a personal computer via a Model 320 Independent Computer Interface.

1.2.3 LEGEND CARD

A status light legend card is supplied. The card is snapped into slots in the Display Assembly bezel and places a white block adjacent to each status light. The user can write a word or phrase in the block to describe the active state of an adjacent status light. Sample entries are: START, RUN, STOP, HEAT, COOL, DRAIN, TO 170 DEG., ENZYME, STARCH, and WATER.
FIGURE 1-1 Logic and Sequence Controller
### 1.3 MODEL DESIGNATION

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**Power Requirement**
- A — 120 Vac (+10%, -15%) 47 to 63 Hz
- B — 24 Vac (+10%, -15%) 47 to 63 Hz
- C — 24 Vdc (+20%, -15%)
- E — 220/240 Vac (+10%, -15%) 47 to 63 Hz

**Rear Connections**
- 1 — Screw Terminals, 20
- 2 — Screw Terminals, 40 (Required on 382E)

**Operator's Panel**
- 1 — Analog and Digital Displays
- N — Not Required (Blank Panel)

**Third Input Options**
- V — Voltage (Additional 1 to 5 Vdc)
- T — Thermocouple (J, K, T, E, S, R, B) and Millivolt
- D — RTD (DIN curve, US curve)
- F — Frequency
- C — Computer (Dual Pulse and Pulse Direction)
- N — Not Required

**Link Interface**
- 1 — Local Instrument Link (RS422, Half-Duplex)
- N — Not Required

**Electrical Classification**
- C — CSA
- F — FM
- N — Not Available
1.4 SPECIFICATIONS

1.4.1 MECHANICAL

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

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

1.4.2 ELECTRICAL

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

TWO-WIRE TRANSMITTER POWER ...... 26 Vdc (±7.5%); 80 mA maximum, short circuit protected

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 ........ 6 dB @ 2 Hz, 60 dB @ 60 Hz
                          (2-pole filter with breakpoing frequency @ 2 Hz)
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

NOTE
> greater than
< less than
= equal to

THERMOCOUPLE INPUTS
Reference Junction Compensation ...... Automatic
Input Impedance .................. >200,000 Ohms
Input Overvoltage Protection ...... ±30 Vdc
Thermocouple Burnout Protection .... Field selectable using jumper-plug

Type "J" T/C
Range Limits .................. -300°F to 2000°F (-185°C to 1095°C)
Zero (configurable) ........ -300°F to 1000°F (-185°C to 540°C)
Span (configurable) ........ 125°F to 2000°F (70°C to 1110°C)
Accuracy ........................ ±0.7°F for span < 700°F
                           ±0.1% of span for span > 700°F
Burnout Drive Rate ............. 30°F/sec.

Type "K" T/C
Range Limits .................. -300°F to 2500°F (-185°C to 1370°C)
Zero (configurable) ........ -300°F to 1300°F (-185°C to 700°C)
Span (configurable) ........ 175°F to 2500°F (95°C to 1390°C)
Accuracy ........................ ±0.9°F for span < 900°F
                           ±0.1% of span for span > 900°F
Burnout Drive Rate ............. 45°F/sec.
Type “T” T/C
Range Limits .......................... -300°F to 750°F (-185°C to 400°C)
Zero (configurable) ................. -300°F to 600°F (-185°C to 315°C)
Span (configurable) ................. 150°F to 900°F (85°C to 500°C)
Accuracy ............................. ±0.6°F
Burnout Drive Rate ................... 40°F/sec.

Type “E” T/C
Range Limits .......................... -300°F to 1800°F (-185°C to 980°C)
Zero (configurable) ................. -300°F to 800°F (-185°C to 430°C)
Span (configurable) ................. 100°F to 1500°F (55°C to 835°C)
Accuracy ............................. ±0.6°F for span < 600°F
 ..................................... ±0.1% of span for span > 600°F
Burnout Drive Rate ................... 24°F/sec.

Type “S” T/C
Range Limits .......................... 0°F to 3000°F (-18°C to 1650°C)
Zero (configurable) ................. 0°F to 2400°F (-18°C to 1320°C)
Span (configurable) ................. 600°F to 3000°F (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 (-18°C to 1760°C)
Zero (configurable) ................. 0°F to 2600°F (-18°C to 1430°C)
Span (configurable) ................. 600°F to 3200°F (330°C to 1780°C)
Accuracy ............................. ±3°F
Burnout Drive Rate ................... 140°F/sec.

Type “B” T/C
Range Limits .......................... 0°F to 3300°F (-18°C to 1815°C)
Zero (configurable) ................. 0°F to 1800°F (-18°C to 980°C)
Span (configurable) ................. 150°F to 3300°F (830°C to 1830°C)
Accuracy ............................. ±2.5°F for span < 2500°F
 ..................................... ±0.1% of span for span > 2500°F
Burnout Drive Rate ................... 180°F/sec.

MILLIVOLT INPUTS*
Input Impedance ...................... > 1 Megohm
Input Overvoltage Protection ....... ±30 Vdc
Digital Filter Range ................. 0.001 to 10 Hz (breakpoint frequency)

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 17 mVdc
Span (configurable) ................. 3 to 40 mVdc
Accuracy ............................. ±5 microvolts for span < 10 mV
 ..................................... ±0.01% of span for span > 10 mV

VOLTAGE INPUT** ..................... Same as Analog Input

* Thermocouple/Millivolt Input Board
**Voltage Input Board
RTD INPUT
Type ........................................ 100 Ohms, Platinum, Din or US
Range Limits .................................. 300°F to 1200°F (-185°C to 650°C)
Zero (Configurable) .......................... 300°F to 800°F (-185°C to 425°C)
Span (Configurable) .......................... 25°F to 1500°F (14°C to 650°C)
Lead Resistance Effect ...................... 0.01°F/Ohm
Accuracy ...................................... ±0.1% of span for a > 100°F;
.............................................. ±0.1°F for a span < 100°F

FREQUENCY INPUT
Minimum Operating Frequency ............. 0.05 Hz
Range .......................................... 1.0 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 usec. minimum
Debounce Time
Fast ........................................... 11 usec. ±15%
Slow ........................................... 4 usec. ±15%
Hysteresis ..................................... 55% ±3%

Note: Specified percentage is of the difference between CIPV and CIVV
Input Impedance .............................. 450K Ohms, minimum

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 ................................. 20.5 mA, ± 0.1 mA
Output Load ................................... 0-800 Ohms
Ambient Temperature Effect ............... < ±0.5% of span for a 100°F temperature change

COMPUTER INPUTS***
Types .......................................... Pulse-direction and dual-pulse; selectable with on-board jumper
Input Voltage .................................. "ON" range: 5 to 30 Vdc
.............................................. "OFF" range: 0 to 0.5 Vdc
Maximum Frequency .......................... 5000 Hz
Minimum Pulse Width ......................... "ON" and "OFF" time: 100 usec.
Isolation ...................................... Input circuit isolated up to 100 Vdc from station common
Input Overvoltage Protection ............... ±30 Vdc
Input Range ................................... 1000 to 4000 pulses full scale
Ambient Temperature Effect ............... < ±0.5% for a 100°F ambient temperature change

DIGITAL INPUT
Logic "1" Range ............................... 15 to 30 Vdc
Logic "0" Range ............................... 0 to 1 Vdc
Overvoltage .................................. ±30 Vdc
Current Draw at 24 Vdc ..................... 10 mA maximum
Isolation ...................................... 100 Vdc
Minimum "On Time" .......................... 500 msec.
Minimum "Off Time" .......................... 500 msec.

***Pulse Input Board
DIGITAL OUTPUTS
Output type .................................................. Open collector transistor (emitter tied to station common)
Load Voltage ................................................. 30 Vdc maximum
Load Current .................................................. 100 mA maximum
Transistor "ON" Voltage ................................. 0.3V @ 0 mA load
.......................................................... 0.6V @ 100 mA load

CONFIGURABLE I/O
INPUTS
Type ................................................................. Non-isolated, 5 to 26 Vdc logic input
   Off Threshold ........................................... < 0.7 Vdc
   On Threshold ............................................ > 2.0 Vdc
   Overvoltage .............................................. ±30 Vdc
   Current Drawn at 24 Vdc .............................. < 1 mA
   Minimum On/Off Time .................................. 200 msec.

OUTPUTS
Type ................................................................. Open collector transistor
   (emitter tied to station common)
Load Voltage ................................................. 30 Vdc maximum
Load Current .................................................. 100 mAADC
Transistor "ON" Voltage ................................. 0.4V maximum @ 0 mA load
.......................................................... 1.0V maximum @ 100 mA load

LOCAL INSTRUMENT LINK ................................. Twincable cable Belden 860 or equivalent
(See SD15492 for details)

1.4.3 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

1.4.4 ELECTRICAL CLASSIFICATION
FOR INSTALLATION IN ......................... Class I, Division 2, Groups A, B, C and D
2.0 INSTALLATION

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

2.1 INSTALLATION CONSIDERATIONS

The LSC is intended for flush panel mounting in a vibration-free instrument panel or rack. It is also intended that the LSC be operated in an indoor or sheltered location. It can be mounted either 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 LSC 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 LSC should be mounted either horizontally or with a backward tilt (i.e., the front of the case higher than the rear). If the LSC 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 LSC 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, the LSC must have a Thermocouple/Millivolt Input Board and a Reference Junction Temperature Sensor Board. Thermocouple calibration includes both boards; therefore, to preserve the factory calibration, keep the Thermocouple/Millivolt Input Board and its Sensor Board together. When an LSC is shipped completely assembled, the Sensor Board is mounted on the case rear terminals. Be careful handling this LSC to avoid damaging the Sensor Board. When the circuit boards and Display Assembly are shipped separately, the Sensor Board is housed in a bag attached to the circuit boards.

2.2 ENVIRONMENTAL CONSIDERATIONS

Refer to section 1.4.3 for LSC operating temperature limits and operating humidity and maximum moisture content.

Note that the air surrounding all operating LSCs must be kept below 50°C (122°F).

CAUTION

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

Forced air ventilation is recommended when LSCs are mounted in a partially or completely enclosed panel. Figure 2-3 provides guidelines for forced air ventilation. 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 changed or cleaned periodically.

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

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 contact in connectors associated with circuit subassemblies. A layer of dust on circuit boards will interfere with semiconductor heat dissipation. Liquid and gaseous contaminants can have a corrosive effect on metal, plastic and circuit board components. Extended exposure to these contaminants may result in equipment malfunctions. To reduce contaminant related equipment malfunctions:

1. Identify contaminants and implement methods to reduce their presence.
2. When cleaning equipment and surrounding areas, 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**

Panel Cutout Dimensions: Tolerances

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>Inches</td>
<td>$\frac{5.44}{138}$</td>
</tr>
<tr>
<td>Width</td>
<td>Inches</td>
<td>$(2.84 \times A) + (5.67 \times B) - .16$</td>
</tr>
<tr>
<td></td>
<td>MM</td>
<td>$(72.0 \times A) + (144.0 \times B) - .41$</td>
</tr>
</tbody>
</table>

Where:

A = Number of 352, 372, and 382 Stations
B = Number of 362 Recorders

Alternate (DIN Standard) Cutout

For Individually Mounted 362 Recorders Only

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>Inches</td>
<td>$\frac{5.44}{138}$</td>
</tr>
<tr>
<td>Width</td>
<td>Inches</td>
<td>$\frac{5.44}{138}$</td>
</tr>
</tbody>
</table>

Note: Alternate cutout does not allow for possible future substitution of 2 Model 352, 372, or 382 stations due to width limitations.

**FIGURE 2-2 Station Dimensions**
GUIDELINES

FAN:  PAMOTOR TYPE 4600X SHADED POLE FAN WITH 5504 FINGER GUARD OR EQUIVALENT.

NO. OF FANS:  ONE FOR EACH 16 STATIONS OR 3 FT. OF PANEL WIDTH.

AIR INLET:  30 IN² FOR EACH FAN. IF FILTERS ARE USED, THEY MUST BE CHANGED PERIODICALLY (INCREASE INLET TO 50 IN²).

PA-0659-1

FIGURE 2-3 Forced Air Ventilation for Enclosed Panels
2.3 MOUNTING GUIDELINES

The following paragraphs provide guidelines and practices for mounting and connecting LSCs in a panel or rack.

The panel face should provide a flat and rigid mounting surface. Stiffeners should be welded to the back of the panel if there is a possibility that the panel face will bow. 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.

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

2.4 WIRING GUIDELINES

All electrical connections are made to the terminals located at the rear of the LSC. Rear terminals are shown in Figure 2-4 and their assignments in Table 2.1. The recommended wire size for signal wiring is 18 gauge (AWG), power wiring is 14 gauge (AWG). The terminals have #6 screws and pressure plates.

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

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.

LSC analog input terminals A4, A5, and A6 accept voltage signals. When a current signal (e.g., 4 to 20 mA) is to be applied, 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 20 mA inputs.

Station rear terminal A5 is station common. It should be connected by the installer to the user’s instrument bus common. Within the LSC, 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, configurable I/O common, and all analog input and analog output commons. Station common is isolated from case ground, terminal AG. Digital input common is isolated from station common and case ground.

Station rear terminals AH and AN, used for power input, are isolated from case ground and from station common in all models. Terminal AG is case (safety) ground.

Each configurable I/O circuit employs over-current protection in both input and output modes of operation. Most miswirings that would cause an unprotected I/O circuit to sink excessive current will cause a configurable I/O circuit to merely limit current at approximately 0.4 amperes. When the miswiring is removed, the circuit will resume normal operation.

2.5 STATION MOUNTING

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

2.5.1 SINGLE STATION MOUNTING

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

1. Loosen and remove mounting brackets. See Figure 2-2.
2. Insert LSC into panel cutout.
3. Install and partially tighten mounting brackets.
4. Square LSC with panel.
5. Square mounting brackets with panel.
6. Alternately tighten mounting brackets until LSC is secured to panel. Do not over tighten.

2.5.2 MULTIPLE STATION ROW MOUNTING

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

1. Loosen and remove mounting brackets from all LSCs. See Figure 2-2.
2. Insert an end of row LSC into panel cutout; install and partially tighten mounting brackets.
3. Insert remaining LSCs into panel cutout; install and partially tighten mounting brackets.
4. Square and space the LSCs in cutout.
5. Alternately tighten mounting brackets on each LSC until all are secured to panel. Do not over tighten.
ASSIGNMENTS

ROW "A"
AH - AC SUPPLY, HOT, OR DC (+)
AN - AC SUPPLY, NEUTRAL, OR DC (-)
AG - CASE (SAFETY) GROUND
A4 - ANALOG INPUT 1 (+)
A5 - ANALOG INPUT COMMON (-)
A6 - ANALOG INPUT 2 (+)
A7 - ANALOG OUTPUT 1 (+)
A8 - ANALOG OUTPUT COMMON (-)
A9 - OPTIONAL No. 3 INPUT (SEE NOTE 2)
A10 - OPTIONAL No. 3 INPUT

ROW "B"
B1 - LINK (+)
B2 - LINK (-)
B3 - NO CONNECTION
B4 - DIGITAL OUTPUT 1 (+)
B5 - 26 VDC TRANSMITTER SUPPLY
B6 - DIGITAL OUTPUT 2 (+)
B7 - DIGITAL OUTPUT COMMON (-)
B8 - DIGITAL INPUT 1 (+)
B9 - DIGITAL INPUT 1 (-)
B10 - OPTIONAL No. 3 INPUT

ROW "C"
C1 - CONFIGURABLE I/O COMMON (-)
C2 - CONFIGURABLE I/O 1 (+)
C3 - CONFIGURABLE I/O 1/0 3 (+)
C4 - CONFIGURABLE I/O 5 (+)
C5 - CONFIGURABLE I/O 7 (+)
C6 - CONFIGURABLE I/O 9 (+)
C7 - CONFIGURABLE I/O 11 (+)
C8 - CONFIGURABLE I/O 13 (+)
C9 - CONFIGURABLE I/O 15 (+)
C10 - ANALOG OUTPUT 2 (+)

ROW "D"
D1 - CONFIGURABLE I/O COMMON (-)
D2 - CONFIGURABLE I/O 2 (+)
D3 - CONFIGURABLE I/O 4 (+)
D4 - CONFIGURABLE I/O 6 (+)
D5 - CONFIGURABLE I/O 8 (+)
D6 - CONFIGURABLE I/O 10 (+)
D7 - CONFIGURABLE I/O 12 (+)
D8 - CONFIGURABLE I/O 14 (+)
D9 - CONFIGURABLE I/O 16 (+)
D10 - ANALOG OUTPUT COMMON (-)

NOTES:
1. Terminal rows "A" and "B" are provided on 20 terminal case for Model 382B. Terminal rows "A", "B", "C", AND "D" are provided on 40 terminal case for Models 382B and 382E.
2. Refer to Table 2.1 for No. 3 Input Connections.

FIGURE 2-4 Rear Terminals
### 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 2-4 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></td>
</tr>
<tr>
<td>AH</td>
<td>HOT</td>
<td>AC Hot or DC (+)</td>
</tr>
<tr>
<td>AN</td>
<td>NEUTRAL</td>
<td>AC Neutral or DC (-)</td>
</tr>
<tr>
<td>AG</td>
<td>GROUND</td>
<td>Case Ground</td>
</tr>
<tr>
<td></td>
<td></td>
<td>See Model Designation section for voltage input.</td>
</tr>
</tbody>
</table>

| **ANALOG INPUTS** | | |
| A4              | A11+                | Each analog input is connected between an A1(#)+ terminal and an A1C- terminal. All analog inputs must be 1 to 5 Vdc. For mA inputs, a range resistor must be connected across the analog input terminals. This precision (0.1%) resistor should be metal film, 1/2 W. Two 250 ohm range resistors are supplied. Terminal A5 (station common) to be connected to user's instrument bus common. |
| A5              | A1C-                | |
| A6              | A12+                | |

| **OPTIONAL NO. 3 INPUT** | | |
| A9              | A13e                | For Pulse Input Board — pulse-direction or dual-pulse inputs accepted; either input type selectable with Pulse Input Board jumper. Refer to Figure 2-5 for jumper position. |
| A10             | A13+                | |
| B10             | A13-                | Terminal A10 is Pulse or Up. Terminal B10 is Direction or Down. Figure 2-6 illustrates typical pulse input connections. |

| **Thermocouple/Millivolt Input Board** | | |
| A10             | A13+                | 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 2-4. |
| B10             | A13-                | |
| A8              | SENS. BD.           | |
| A9              | SENS. BD.           | |

| **Voltage Input Board** | | |
| A9              | A13-                | Analog input, 1 to 5 Vdc. For mA input, a range resistor must be connected across the input terminals. |
| A10             | A13+                | |

| **RTD Input Board** | | |
| A9              | A13e                | Refer to Figure 2-7 for input connections. |
| A10             | A13+                | |
| B10             | A13-                | |

| **Frequency Input Board** | | |
| A10             | A13+                | Frequency input source is connected to terminals A10 and B10. |
| B10             | A13-                | |

| **DIGITAL INPUT** | | |
| B8              | DI1+                | Digital input source is connected between terminals B8 and B9. Terminal B9 is isolated from station common and case ground. An inductive source must be shunted by a transient suppression diode to prevent damage to the LSC input circuit. Protection required is similar to that shown in Figure 2-8 for digital outputs. |
| B9              | DI1-                | |

| **LOCAL INSTRUMENT LINK** | | |
| B1              | LK+                 | Refer to Figure 2-9 for typical link connections and to SD15492 for LIL cable and Tap Box installation. |
| B2              | LK-                 | |

*Option board required to use these terminals.*
<table>
<thead>
<tr>
<th>REAR TERMINAL</th>
<th>TERMINAL ASSIGNMENT</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ANALOG OUTPUTS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A7</td>
<td>AO1+</td>
<td>Each analog output is connected between an AO(#)+ terminal and an AOC- terminal. Standard output is 4 to 20 mA dc referenced to station common.</td>
</tr>
<tr>
<td>A8</td>
<td>AOC-</td>
<td></td>
</tr>
<tr>
<td>C10</td>
<td>AO2+</td>
<td></td>
</tr>
<tr>
<td>D10</td>
<td>AOC-</td>
<td></td>
</tr>
<tr>
<td><strong>DIGITAL OUTPUTS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>DO1+</td>
<td>Each digital output is connected between a DO(#)+ terminal and a DOC- terminal. Output circuits use open collector NPN transistors referenced to station common. Voltage source to external load can be +26 Vdc at rear terminal B5 or a separate power supply. Load must limit current to 100 mA or less. An inductive load must be shunted by a transient suppression diode to prevent damage to an LSC output circuit. Refer to Figure 2-8.</td>
</tr>
<tr>
<td>B6</td>
<td>DO2+</td>
<td></td>
</tr>
<tr>
<td>B7</td>
<td>DOC-</td>
<td></td>
</tr>
<tr>
<td><strong>CONFIGURABLE I/O</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>DC-</td>
<td>These terminals are for function blocks 61 through 76 on the Expander Board. Each may be configured as either an input or an output. Each input or output is connected between a D(#)+ terminal and a DC- terminal.</td>
</tr>
<tr>
<td>C2</td>
<td>D1+</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>D3+</td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>D5+</td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td>D7+</td>
<td></td>
</tr>
<tr>
<td>C6</td>
<td>D9+</td>
<td></td>
</tr>
<tr>
<td>C7</td>
<td>D11+</td>
<td></td>
</tr>
<tr>
<td>C8</td>
<td>D13+</td>
<td></td>
</tr>
<tr>
<td>C9</td>
<td>D15+</td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>DC-</td>
<td>A user supplied bus bar can be connected to expand DC- “station common” connections to/from the field.</td>
</tr>
<tr>
<td>D2</td>
<td>D2+</td>
<td></td>
</tr>
<tr>
<td>D3</td>
<td>D4+</td>
<td></td>
</tr>
<tr>
<td>D4</td>
<td>D6+</td>
<td>Digital output circuits use open collector transistors referenced to station common. Load must limit current to 100 mA or less.</td>
</tr>
<tr>
<td>D5</td>
<td>D8+</td>
<td></td>
</tr>
<tr>
<td>D6</td>
<td>D10+</td>
<td>Typical input and output connections are shown in Figures 2-10 and 2-11. An inductive input or output load must be shunted by a transient suppression diode to prevent damage to LSC circuits.</td>
</tr>
<tr>
<td>D7</td>
<td>D12+</td>
<td></td>
</tr>
<tr>
<td>D8</td>
<td>D14+</td>
<td></td>
</tr>
<tr>
<td>D9</td>
<td>D16+</td>
<td></td>
</tr>
<tr>
<td><strong>TWO-WIRE TRANSMITTER POWER</strong></td>
<td></td>
<td>Supply to power up to four process transmitters; 26 Vdc (±7.5%) @ 80 mA maximum, referenced to station common.</td>
</tr>
<tr>
<td>B5</td>
<td>+26V</td>
<td></td>
</tr>
<tr>
<td><strong>NO CONNECTION</strong></td>
<td></td>
<td>No connection.</td>
</tr>
</tbody>
</table>
PULSE MODE JUMPER-PLUG SHOWN IN DUAL-PULSE POSITION (SEE DETAIL)

JUMPER-PLUG DETAIL

PULSE INPUT BOARD

CONTROLLER BOARD

DUAL-PULSE

PULSE-DIRECTION

NOTES:
1. ASSEMBLY VIEWED FROM BOTTOM
2. JUMPER PLUG COLORS MUST RUN PARALLEL TO CIRCUIT BOARD. DO NOT ROTATE JUMPER PLUG SO COLORS ARE PERPENDICULAR TO CIRCUIT BOARD.

FIGURE 2-5 Pulse Input Board, Physical Layout
A. POSITIVE GOING PULSES

B. NEGATIVE GOING PULSES

FIGURE 2-6 Typical Pulse Input Connections
FIGURE 2-7 RTD Connections
A. SOLID STATE LOADS (E.G., ALARM ANNUNCIATOR)

B. RELAY LOAD AND USER SUPPLIED POWER SUPPLY

C. RELAY LOAD AND STATION +26V POWER SUPPLY

NOTE: DIGITAL OUTPUT 2 (FB05) BETWEEN B6(+) AND B7(−) IS WIRED SIMILARLY

FIGURE 2-8 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 OF LSC.
2. DRAIN WIRE OF SHIELD IS CUT BACK AND INSULATED.
3. \(\uparrow\) \(\downarrow\) DENOTES 18 AWG TWISTED PAIR CONDUCTORS.
4. TWISTED PAIR WIRING IS USED TO INTERCONNECT LSCs 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.

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FIGURE 2-9 Link Connections
A. MECHANICAL CONTACT INPUT

B. TRANSISTOR SWITCH INPUT

C. TRANSISTOR SWITCH INPUT WITH EXTERNAL PULL-UP

FIGURE 2-10 Typical Inputs to Configurable I/O
A. SOLID STATE LOADS (E.G., ALARM ANNUNCIATOR)

B. RELAY LOAD AND USER SUPPLIED POWER SUPPLY

C. RELAY LOAD AND STATION +26V POWER SUPPLY

FIGURE 2-11 Typical Output Loads for Configurable I/O
2.6 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. Station calibration and configuration may be needed when circuit boards are added.

Since 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, special handling is required. Handling guidelines and installation procedures are provided in the following sections.

2.6.1 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.
   The bags are 8" x 12" (20.3 cm x 30.5 cm), P/N X6080.
   The Controller Board uses a larger bag, P/N Z74A.

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.
   Maintenance Kit, P/N 15545-110, contains a wrist strap and a conductive mat and is available from Moore Products Co.

2.6.2 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 ground clip where shown in Figure 2-12.
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 2-12.
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 2-12, must be in place whenever the Controller Board is installed in the case.

2.6.3 NO. 3 INPUT BOARD

A No. 3 Input Board can be field-installed in a Basic Station (Model 382B) or an Expanded Station (Model 382E).

Only one No. 3 Input Board can be added per Station. The No. 3 Input Board plugs into connector J2 of the Controller Board and 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 2.6.2.
2. Place Controller Board on a grounded conductive mat, component side up.
3. Model 382E 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 2-5
   Thermocouple/Millivolt Input Board - See Figure 2-13
   Frequency Input Board - See Figure 2-14
   RTD Input Board - None to be set; See Figure 2-15
   Voltage Input Board - None to be set; See Figure 2-16
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. Use two, 4-40 x 3/8 lg. pan head screws with lockwashers at each corner to secure the Board.
7. Model 382E only - install Expander Board.
8. Install Controller Board and Display Assembly in case according to instructions in section 2.6.2.
9. For a Thermocouple/Millivolt Input Board jumpered for thermocouple input, install Sensor Board on case terminals A8 and A9. See Figure 2-4.
FIGURE 2-12 Controller Board and Display Assembly Installation
<table>
<thead>
<tr>
<th>THERMOCOUPLE INPUTS</th>
<th>MILLIVOLT INPUTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>J, K, OR E, T, R, S, OR B</td>
<td>-20 TO -20mV, 75 TO +75mV</td>
</tr>
<tr>
<td>J1 SPAN</td>
<td>WIDE, NARROW</td>
</tr>
<tr>
<td>J2 DIRECTION</td>
<td>UP OR DOWN</td>
</tr>
</tbody>
</table>

J3 CONNECTOR TO CONTROLLER BOARD CONNECTOR J2

BOARD EDGE VIEW OF J1 AND J2

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 2-13 Sensor Board and Thermocouple/Millivolt Input Board, Physical Layout
NOTE: BOARD SHIPPED WITH W1 IN "FAST" DEBOUNCE POSITION AS SHOWN. ALTERNATE POSITION IS "SLOW" DEBOUNCE. SEE INPUT SPECIFICATIONS.

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FIGURE 2-14 Frequency Input Board, Physical Layout
J1 CONNECTOR TO CONTROLLER BOARD CONNECTOR J2

NO USER SETTABLE JUMPER-PLUGS
J1 CONNECTOR TO CONTROLLER BOARD CONNECTOR J2

REF. DRAWING NO. 15824-20, ISS. 2

NO USER SETTABLE JUMPER-PLUGS

FIGURE 2-16 Voltage Input Board, Physical Layout
2.6.4 EXPANDER BOARD

This section covers the installation of an Expander Board in a Model 382B 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. Follow the below procedure to install an Expander Board.

1. If Controller Board is installed in case, reverse procedure in section 2.6.2 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 2.6.2. Adding an Expander Board requires station calibration.

2.6.5 LINK INTERFACE BOARD

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 2.6.1, 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 2.6.2 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 AD382-20 for additional instructions.

2.6.5.1 Setting Link Address

An LSC equipped with a Link Interface Board 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 AD382-30, MYCRO 382 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.
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. [Station must be in 'L' (Local mode)].
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 AD382-30. (If ESN unavailable, set Pulser Knob to any value in order to continue with this procedure.)
10. Press STORE button to store 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 5-digit display.)

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

19. Press STORE button to store 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 locally.

### 2.7 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
- Thermocouple/Millivolt input
  - Board Thermocouple ............. Type J, Upscale Break
  - Voltage Input Board .................... 1 to 5 Vdc

Section 3 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 LSC will require recalibration.
Section 3

3.0 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
FB04 Analog Output 2
FB99 No. 3 Input
Voltage Input 3 - Refer to section 3.1
T/C or Millivolt Input - Refer to section 3.2
RTD Input - Refer to section 3.3
Frequency Input Board - Refer to section 3.4

Calibration and verification should be performed under any of the following circumstances:

— To check or change the calibration of a new LSC
— When an Expander Board, Thermocouple/Millivolt Input Board or Voltage 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 or choice of upscale or downscale break
— After replacing a Reference Junction Temperature Sensor Board
— As part of a troubleshooting or failure confirmation routine.

* IMPORTANT

Configuration is also necessary.
Be sure to set or confirm all configuration parameters.

Factory calibrations are provided in section 2.7. 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.

The LSC is equipped with lockout switches on the front edge of the Controller Board. 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 the lockout switch, simply flip down the front panel ID plate to reveal the captive bezel retaining screw. Loosen the screw and separate the Display Assembly from the case by five inches (12 cm). Support the Assembly so it doesn’t hang by the ribbon cable. From this point, the switch is readily accessible. Refer to Figure 3-1 for location of lockout switch.

After setting the lockout switch, reinstall the Display Assembly.

Calibration and calibration verification are described in the following procedures.

Display Assembly pushbuttons use a dome switch mechanism and wear resistant materials to provide tactile feedback and reliability. Pushbuttons should be pressed by a finger. Use of a hard implement, such as the cap end of a pen or a blunt tool, can deform the dome causing failure of the pushbutton. Use of a sharp or pointed implement, such as a pencil point, can puncture the surface material leading to eventual pushbutton failure.
3.1 ANALOG INPUTS AND OUTPUTS AND VOLTAGE INPUT BOARD

The LSC 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 3.1.
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 'Z01' zero output 1). Parameter is indicated on alphanumeric display. See Table 3.1.
9. Press STEP DOWN button to enter VALUE level ('CAL' appears on 5-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).
      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) To verify calibration, proceed to step 11.

---

**TABLE 3.1 Calibration Chart**

<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>CZI1</td>
<td>A4+; A5-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CF11</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CV11</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>2</td>
<td>—</td>
<td>CZI2</td>
<td>A6+; A5-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CF12</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CV12</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>—</td>
<td>1</td>
<td>CZO1</td>
<td>A7+; A8-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CFO1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CV01</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>—</td>
<td>2</td>
<td>CZO2</td>
<td>C10+; D10-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CFO2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CV02</td>
<td></td>
</tr>
<tr>
<td>99</td>
<td>3</td>
<td>—</td>
<td>C13T</td>
<td>A10+; B10- (T/C -mV input)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CZ13</td>
<td>A10+; A9- (Voltage Input)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CF13</td>
<td>A9e; A10+; B10- (RTD Input)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CV13</td>
<td>A10+; B10- (Frequency Input)</td>
</tr>
</tbody>
</table>

C = Calibration
Z1 = Zero input
F1 = Full Scale Input
Z0 = Zero Output
VO = Verify Output

FL = Full Scale Output
VI = Verify Input
3.2 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 LSC in which it will be used and, for a thermocouple input, the Sensor Board which will remain with the LSC. Tables 3.2 and 3.3 list the values for calibration parameters C13T, C213 and CF13. Table 3.2 is for a Thermocouple Input and Table 3.3 for a Millivolt Input. The Thermocouple/Millivolt Input Board is configured under function block 99.

3.2.1 REQUIRED EQUIPMENT

Calibration of a Thermocouple/Millivolt Input Board requires the use of some or all of the following equipment:

1. Model 382B 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.


3.2.2 PRELIMINARY ADJUSTMENTS

Refer to Figure 2-13 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.

3.2.3 PROCEDURE

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

3.2.3.1 Thermocouple Input

The calibration procedure prepares the LSC 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 3.2 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 3-2. Method 1 is the
TABLE 3.2 Calibration Parameters - Thermocouple Inputs

<table>
<thead>
<tr>
<th>TYPE T/C</th>
<th>NO. 3 INPUT TABLE (C/3T)</th>
<th>ZERO INPUT (CZ3) mV °F</th>
<th>FULL SCALE INPUT (CF3) mV °F</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>2</td>
<td>-0.885</td>
<td>53.525 1700</td>
</tr>
<tr>
<td>K</td>
<td>3</td>
<td>-0.692</td>
<td>52.939 2400</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>-1.026</td>
<td>70.821 1700</td>
</tr>
<tr>
<td>T</td>
<td>6</td>
<td>-5.341</td>
<td>19.086 700</td>
</tr>
<tr>
<td>R</td>
<td>7</td>
<td>2.017</td>
<td>19.518 3000</td>
</tr>
<tr>
<td>S</td>
<td>8</td>
<td>1.962</td>
<td>17.347 3000</td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>3.274</td>
<td>11.829 3000</td>
</tr>
</tbody>
</table>

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 3-2 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 2-4 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 5-digit display.
   F. Press STORE button to store value.
   G. Press EXIT button.
   H. Press ENTER CONF button to enter configuration mode at MENU level.
   I. Rotate Pulser Knob to select 'C' (calibration) on alphanumeric display.
   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 'C/3T' appears in the alphanumeric display.
   M. Refer to Table 3.2 and locate value under C/3T column for the desired type T/C.
   N. Press STEP DOWN button and rotate Pulser Knob until the desired value appears in the 5-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 store 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'.

3-5
**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 3-2 Typical Calibration Hook-Up Diagrams — Thermocouple Input
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 5-digit display.)

E. Refer to Table 3.2 and obtain value in millivolts under Zero Input (CZ13) column for type T/C selected.

F. For Method 1, verify that ice baths are at 32°F (0°C). 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 3.2 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 °F to Zero Input value listed in Table 3.2.
   Method 3 - The value obtained for CZ13 from Table 3.2 must be compensated to 32°F (0°C) 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 3.2 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 store desired value. ('CAL' blinks.)

I. Press STEP UP button once.

10. Rotate Piuier Knob to select 'CF13' on alphanumeric display.

11. To set-in Full Scale Input value:
   A. Press STEP DOWN button. ('CAL' appears.)
   B. Refer to Table 3.2 and obtain value in millivolts from Full Scale Input (CF13) column for type T/C selected.
   C. For Method 1, verify that ice baths are at 32°F (0°C).

D. Set calibration source as follows:
   Method 1 - Adjust calibration source to millivolts value (CF13) from Table 3.2 and step B above.
   Method 2 - Refer to calibrator instruction manual for detailed calibrator adjustment. Set calibrator temperature in °F to Full Scale Input value listed in Table 3.2.
   Method 3 - The value obtained for CF13 from Table 3.2 must be compensated to 32°F (0°C) 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 3.2 for step B.
      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 store desired value. ('CAL' blinks.)

12. To verify calibration:
   A. Press STEP UP button.
   B. Rotate Piuier Knob to select 'CV13' on alphanumeric display.
   C. Press STEP DOWN button. (100.00% should appear in 5-digit display since calibration source is set to Full Scale Input value.)
   D. Adjust calibration source to Zero Input value. (0.00% should appear in 5-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 from the Station.)

15. Remove power from Station.


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.
3.2.3.2 Millivolt Input

Refer to Figure 2-13 for jumper-plug settings and to Table 3.3 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 3-3 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 5-digit display.
   F. Press STORE button to store value.
   G. Press EXIT button.
   H. Press ENTER CONF button to enter configuration mode at MENU level.
   I. Rotate Pulser Knob to select 'C' (calibration) on alphanumeric display.
   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 'C313' appears in the alphanumeric display.
   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 store 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. ('C313' appears in alphanumeric display.)
   D. Press STEP DOWN button to enter VALUE level. ('CAL' appears in 5-digit display.)
   E. Refer to Table 3.3 and locate 0.000mV in Zero Input (C313) 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 store desired value. ('CAL' blinks.)
   9. Press STEP UP button and rotate Pulser Knob to select 'C313' on alphanumeric display.

**TABLE 3.3 Calibration Parameters - Millivolt Inputs**

<table>
<thead>
<tr>
<th>MILLIVOLT INPUT RANGE</th>
<th>NO. 3 INPUT TABLE (C313)</th>
<th>ZERO INPUT (C313)</th>
<th>FULL SCALE INPUT (C313)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-75mV</td>
<td>1</td>
<td>0.000mV</td>
<td>75.000mV</td>
</tr>
<tr>
<td>0-20mV</td>
<td>5</td>
<td>0.000mV</td>
<td>20.000mV</td>
</tr>
</tbody>
</table>
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 3.3 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 store 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. (100.00% should appear in 5-digit display since calibration source is set to Full Scale Input value.)
    D. Adjust calibration source to Zero Input value. (0.00% should appear in 5-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 from 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.
3.3 RTD INPUT BOARD

An RTD Input Board, is configured under function block (FB) 99. Calibration must be performed with the Board installed in the LSC in which it will be used. Recalibration should not be required unless the RTD Input Board or the Controller Board is replaced. Periodic recalibration is not necessary.

An RTD Input Board is calibrated to accept low level input voltages representing a range from -300°F to 1200°F (-185°C to 650°C) from a 100 ohm platinum resistance temperature detector. The engineering units (°F or °C), the type of curve (DIN or US), and actual operating temperature range are entered as soft ('S') configuration parameters after calibration is completed. Refer to Configuration Handbook AD382-20 for the configuration procedure.

IMPORTANT
When setting the soft ('S') configuration parameter SFB3, rotate the Pulser Knob to select 10.00 Hz for the shortest response time.

Calibration parameters and related values are shown in Table 3.4

### TABLE 3.4 Calibration Parameters - RTD Inputs

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>DESCRIPTION</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CZI3</td>
<td>Zero Input</td>
<td>100.00 Ohms</td>
</tr>
<tr>
<td>CFI3</td>
<td>Full Scale Input</td>
<td>200.00 Ohms</td>
</tr>
<tr>
<td>CVI3</td>
<td>Verify Input</td>
<td>-3.34 to 103.30%</td>
</tr>
</tbody>
</table>

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 ($0080-$0F80) represents a specific operating range.

3.3.1 REQUIRED EQUIPMENT

Calibration of an RTD Input Board requires the use of the following equipment:

1. Model 382B or 382E Station and an installed RTD Input Board.
2. Two precision resistors (100 ohms, ±0.1%, ¼w and 200 ohms, ±0.01%, ¼w) 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) wire must be used as in a 3-wire RTD connection.

3.3.2 PROCEDURE

The calibration procedure involves storing the Zero Input value (CZI3 = 100.00 ohms) and the Full Scale Input value (CFI3 = 200.00 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 are used and there is good electrical contact with the resistor leads. 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 LSC as shown in Figure 2-7, 3-wire connection.

IMPORTANT
DO NOT use alligator clips. If alligator clips are used to make the connections, contact resistance may be present decreasing calibration accuracy.

Proceed as follows:
1. With power off at Station, verify that 'C' (calibration) lockout switch is enabled.
2. Perform either A or B.
   A. Set resistance decade box to 100.00 ohms and connect as shown for 3-wire in Figure 2-7.
   B. Connect 100.00 ohm precision resistor to rear terminals as shown for 3-wire in Figure 2-7.
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 function block '99'.
   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 5-digit display).
   E. Allow at least 15 seconds before proceeding to next step. This is to allow the hardware filter voltage time to stabilize.
   F. Press STORE button to store desired value. ('CAL' blinks.)
G. Press STEP UP button once.
7. Rotate Pulser Knob to select 'CF13' on alphanumeric display.
8. To set-in Full Scale Input value:
   A. Press STEP DOWN button. ('CAL' appears.)
   B. Refer to Table 3.4 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 2-7 for 3-wire RTD.
   C. Allow at least 15 seconds before proceeding to next step.
   D. Press STORE button to store desired value. ('CAL' blinks.)
9. To verify calibration:
   A. Press STEP UP button.
   B. Rotate Pulser Knob to select 'CV13' on alphanumeric display.
   C. Press STEP DOWN button. 100.00 should appear in 5-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 5-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.

3.4 FREQUENCY INPUT BOARD

The Frequency Input Board is configured and calibrated under function block 99. Calibration must be performed with the Board installed in the LSC in which it will be used.

The following subsections contain procedures which:
1. Configure the LSC for the soft ('S') configuration parameters that establish the operating frequency range, and
2. Calibrate the LSC either automatically or manually for the input signal's peak and valley voltages.

3.4.1 CONFIGURATION

It is recommended that the actual operating range of frequency inputs be entered in an LSC equipped with a Frequency Input Board prior to calibration. This will ensure proper operation of the automatic (learn mode) calibration feature.

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

Refer to the MYCRO 382 Configuration Handbook AD382-20 and the Configuration Documentation AD382-30 for additional information.

Perform the following procedure to set-in the operating frequency range:
1. With power off at Station, verify that H/T/FR and S lockout switches are enabled.
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.)
5. Press STEP DOWN button to enter FUNCTION BLOCK level.
6. Rotate Pulser Knob to select function block '99'.
7. Press STEP DOWN button to enter PARAMETER level. ('TEN' appears in alphanumeric display.)
8. Press STEP DOWN button to enter VALUE level. Rotate Pulser Knob to ESN for FB99 listed in AD382-30. If unassigned and if it is desirable to continue with this procedure, rotate Pulser Knob to any number except 00 in 5-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.)
   B. Press STEP DOWN button to enter FUNCTION BLOCK level.
   C. Rotate Pulser Knob to select function block '99' on right side digits of alphanumeric display.
   D. Press STEP DOWN button to enter PARAMETER level. ('SMIN' appears in alphanumeric display.)
   E. Refer to Documentation Booklet for minimum frequency of input signals.
   F. Press STEP DOWN button to enter value level. Rotate Pulser Knob to minimum frequency. (Example: Enter 4.0 in 5-digit display if minimum frequency is 4.0 Hz.)
   G. Press STORE button to store desired value. (Value blinks.)
   H. Press STEP UP button and rotate Pulser Knob to SMAX. (Refer to AD380-30 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 5-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 configuration procedure for FB99, ex-
cept for parameter SZDO, which can be entered and
stored at user’s convenience. It has no effect on the cali-
bration procedure that follows.

3.4.2 CALIBRATION

An LSC ordered with the Frequency Input Board option
(Model 382— F — — ) will require user calibration.
This procedure allows the user to adjust the parameters of
the Board so that operation is within specific require-
ments.

Likewise, if the user installs a Frequency Input Board in an
existing Model 382B or 382E Station, initial calibration is
necessary. However, periodic recalibration is not neces-
sary.

Although it is possible to manually enter the peak and
valley voltages of the frequency input signals during cali-
bration, it is recommended that the automatic (learn) meth-
od be utilized. This eliminates the need to obtain the
values from manufacturer’s specifications or measure the
signal’s peak and valley voltages with an oscilloscope.

The calibration parameters listed in Table 3.5 are set-in
during this procedure.

3.4.2.1 Required Equipment

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

— Model 382B or 382E Station and an installed Frequency
Input Board.

— Manual method may require an oscilloscope.

3.4.2.2 Procedure

This section contains procedures for two different calibra-
tion methods: automatic (learn mode) and manual. The
automatic is the recommended online method requiring
no external equipment and the fewest number of steps.
The manual method requires the use of an oscilloscope to
measure the peak and valley voltages of the input signal if
the manufacturer’s specifications are unavailable, and is
more complex than the automatic method.

**IMPORTANT**

Perform either the automatic meth-
_od or the manual method, not both.

**AUTOMATIC METHOD**

1. Follow prescribed maintenance and operation proce-
dures to install the LSC equipped with Frequency
Input Board on-line.

2. With power off at Station, verify that ‘C’ (calibration)
lockout switch is enabled.

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

4. Verify Station’s model number and input power re-
quirements. Apply power to Station.

---

**TABLE 3.5 Calibration Parameters - Frequency Inputs**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>CALIBRATION METHOD</th>
<th>DESCRIPTION</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIPV</td>
<td>MANUAL</td>
<td>INPUT PEAK VOLTAGE</td>
<td>-30.0V to +30.0V</td>
</tr>
<tr>
<td>CIVV</td>
<td>MANUAL</td>
<td>INPUT VALLEY VOLTAGE</td>
<td>-30.0V to +30.0V</td>
</tr>
<tr>
<td>CIL</td>
<td>AUTOMATIC</td>
<td>INPUT VOLTAGE LEARN</td>
<td>learn</td>
</tr>
</tbody>
</table>
5. Verify that process is generating frequency input signals to the LSC.

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

7. 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.)

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

9. Rotate Pulser Knob to select function block ‘99’ on right side digits of alphanumeric display.

10. Press STEP DOWN button and rotate Pulser Knob until CIL appears in alphanumeric display.

11. Press STEP DOWN button to enter VALUE level. (‘1000’ appears in 5-digit display.)

12. Press STORE button to activate automatic calibration. (Depending on the operating frequency range entered as parameters SMIN and SMAX, the 5-digit display will either count down from a fixed number of seconds to 1 second, then ‘DONE’ appears followed by ‘1000’ or indicate ‘1000’ - (blank) - ‘DONE’ - (blank) - ‘1000’. This time is needed to sample the input signal’s peak and valley voltages.)

13. Press EXIT button. (The calibration parameters CIPV and CIVV 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. Lockout the ‘C’ (calibration) mode on Controller Board, if desired.

MANUAL METHOD

This method can be used to calibrate an LSC 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.

1. With power off at Station, verify that ‘C’ (calibration) lockout switch is enabled.

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 ‘C’ (calibration) mode on left digit position of alphanumeric display.

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

6. Rotate Pulser Knob to select function block ‘99’ on right side digits of alphanumeric display.

7. Press STEP DOWN button to enter PARAMETER level. (‘CIPV’ appears in alphanumeric display.)

8. Press STEP DOWN button to enter VALUE level and rotate Pulser Knob to input peak voltage (CIPV) listed in Documentation Booklet and appearing on 5-digit display. (This value is normally obtained from manufacturer’s specifications or by oscilloscope measurement.)

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

10. Press STEP UP button and rotate Pulser Knob to ‘CIVV’ in alphanumeric display.

11. Press STEP DOWN button and rotate Pulser Knob to input valley voltage (CIVV) listed in AD382-30 and appearing on 5-digit display. (This value is also obtained from manufacturer’s specifications or by oscilloscope measurement.)

NOTE

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

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

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

This completes the manual calibration procedure. Lockout the ‘C’ (calibration) mode on Controller Board, if desired.
Section 4

4.0 CIRCUIT DESCRIPTION

This section contains circuit descriptions of the various boards that collectively form the 'Hardware Architecture' of the Logic and Sequence Controller. Figure 4-1 illustrates how the boards are interconnected when a full complement is present.

All major plug-in assemblies interact with the Controller Board. The MPU-based Controller Board performs many of the Station's signal processing and batch control functions in addition to overseeing many other internal operations. It controls the Expander Board, Link Interface Board, Display Assembly and any of the various No. 3 Input Boards. The on-board power supply provides the power for all plug-in assemblies.

The Expander Board contains the hardware which adds configurable discrete I/O and an additional analog output to the I/O capacity of the Controller Board.

The Display Assembly provides 20 status LED indicators that can be configured to meet user requirements and two station operating mode LED indicators. A 5-digit display and a 4-digit alphanumeric display provide indications of operation and configuration parameters. The Display Assembly accepts operator entered commands and data via the assembly's front panel controls.

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

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

4.1 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 4-2, 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 LSC. 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 382B. It also stores the general operating programs for the onboard 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
*16 CONFIGURABLE DISCRETE I/O CHANNELS. EACH IS CONFIGURABLE AS EITHER AN INPUT OR OUTPUT.
FIGURE 4-2  Hardware Block Diagram, Controller Board
circuit. 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 LSC 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 3-1 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.

4.2 EXPANDER BOARD

The Expander Board contains the following circuitry:

- Digital and analog circuitry for analog output 2 (AO2), Function Block 6; used to provide continuous control (4-20 mA).
- Configurable I/O circuitry for up to either 16 digital inputs, 16 digital outputs, or a combination of inputs and outputs; configurable under Function Blocks 61-76; used to provide discontinuous control (ON or OFF).
- Real-Time Clock/Recipe Storage; configurable under Function Block 77 for setting up to 4 tripoints and for storing up to 6 recipes in battery backed-up RAM. (The battery is an integral part of U8, the RAM/RTC integrated circuit.)
- Also included in Function Block 77 is a power up selection. When this feature is configured, process data such as controller output, timers, and sequencer will be automatically stored when power is removed from the station. Reapplying power before the configured time (HPUT) expires will allow the station to resume operation at the point prior to power interruption. Default values will replace stored values should the configured time expire before power is reapplied.

The block diagram of the Expander Board in Figure 4-3 shows that 16 Configurable I/O circuits (configurable as either inputs or outputs) connect to the near terminals of the Station. Also on-board and available at the output terminals is Analog Output 2 (AO2).

The Expander Board operates under the control of the MPU-based Controller Board. A ribbon cable assembly interconnects the boards and extends the Data Bus, Address Bus, and Control Lines (R/W, E, and Reset) to the Expander Board.

The UVEPROM, which is addressable by the Controller Board’s MPU, is factory-programmed with the operating programs for the function blocks associated with the Expander Board. The inputs and outputs on the Expander Board are updated every controller cycle, which occurs every 100 milliseconds during normal control.

As shown in Table 4.1, either a read or write cycle at the listed hardware locations - as executed by the Controller Board’s MPU - controls the updating of the Station’s inputs and outputs.

For example, a typical read cycle would include the following sequence of events.

1. The Controller Board’s MPU loads the Expander Board’s Address Bus with address $7FF0. (See Table 4.1.)
2. Decoders 1, 2 and 4 accept address $7FF0 at their inputs.
3. Decoders 1 and 4 issue Enable signals to Data Transceivers 1 and 2.
4. If configurable discrete I/O are configured as inputs, the ON and OFF states are present at the outputs of Comparators 1 and 2.
5. A Read (R) signal from the MPU to Decoder 2 causes an Enable signal to move the discrete inputs at Comparator 2 through Input Driver 2. Simultaneously, the Read signal to Decoders 1 and 4 sets the Direction of Data Transceivers 1 and 2 so that the discrete inputs can travel along the Data Bus to P1 and then to the Controller Board and the MPU.

Input Driver 1 will be enabled in a similar fashion when address $7FF1 is sent to the Expander Board.

**TABLE 4.1 I/O Addressing**

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>CYCLE</th>
<th>STATE ADDRESSED</th>
<th>RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$7FF0</td>
<td>READ (R)</td>
<td>Input Driver 2</td>
<td>Inputs up to 8 Digital Inputs</td>
</tr>
<tr>
<td>$7FF0</td>
<td>WRITE (W)</td>
<td>Output Latch 2</td>
<td>Latches up to 8 Digital Outputs</td>
</tr>
<tr>
<td>$7FF1</td>
<td>READ (R)</td>
<td>Input Driver 1</td>
<td>Inputs up to 8 Digital Inputs</td>
</tr>
<tr>
<td>$7FF1</td>
<td>WRITE (W)</td>
<td>Output Latch 1</td>
<td>Latches up to 8 Digital Outputs</td>
</tr>
<tr>
<td>$7FF2</td>
<td>WRITE (W)</td>
<td>Control Latch</td>
<td>Enables Output Drivers 1 and 2, RTD, and AO2</td>
</tr>
<tr>
<td>$7FF3</td>
<td>WRITE (W)</td>
<td>A/D Converter</td>
<td>Outputs 4-20mA as Analog Output 2 (AO2)</td>
</tr>
<tr>
<td>$7FF4</td>
<td>WRITE (W)</td>
<td>A/D Converter</td>
<td>Outputs 4-20mA as Analog Output 2 (AO2)</td>
</tr>
</tbody>
</table>
A typical write cycle would include the following sequence of events:

1. When the LSC is powered-up, the Control Latch is initialized to produce Enable logic levels which activate the RTC, Output Amplifier, and Output Drivers 1 and 2.

2. The Controller Board’s MPU loads the Expander Board’s Address Bus with address $7FF0. (See Table 4.1.)

3. Decoders 1, 3 and 4 accept address $7FF0 at their inputs.

4. Decoders 1 and 4 issue Enable signals to Data Transceivers 1 and 2.

5. A Write (W) signal from the MPU to Decoders 1 and 4 sets the Direction of Data Transceivers 1 and 2 so that up to 8 digital outputs from the Control Board can travel along the Data Bus on the Expander Board. Simultaneously, the Write signal from the MPU to Decoder 3 produces an Enable signal that clocks the digital outputs into Output Latch 2 updating the previous scan.

6. Because Output Driver 2 is enabled (step 1), the ON and OFF states of Output Latch 2 also appear at the outputs of Output Driver 2 and are applied to the output terminals.

Output Latch 1 will be enabled in a similar fashion when address $7FF1 is sent to the Expander Board.

Analog Output AO2 is updated during a write cycle as listed in Table 4.1. When an LSC is powered-up and FB60 is configured, a control bit maintained in the Control Latch produces an output control logic level that turns on the Output Amplifier so that the output of the D/A Converter can drive the Output Amplifier within its range (4-20 mA).

The digital data to the D/A Converter is updated when the MPU addresses Decoder 3 at $7FF3 and $7FF4. Two write cycles (as described above) are executed to update the D/A Converter. The D/A Converter outputs an analog value that drives the Output Amplifier.

If FB77 is configured, the MPU on the Controller Board performs a read routine on the Expander Board to obtain time information from the battery backed-up Real-Time Clock. This time is obtained from the RTC every 100 milliseconds. User setting of the Real-Time Clock is accomplished by the MPU performing a write routine on the Expander Board. In this way the user can “force” the time to whatever they desire.

A physical layout of the Expander Board is shown in Figure 4-4.
4.3 DISPLAY ASSEMBLY

The Display Assembly shown in Figure 4-5 consists of three interconnected subassemblies: Display Interface Board, Display/Driver Board, and Keyboard.

The Display Assembly functions under the direction of the Station's MPU-based Controller Board. Using LEDs, it provides 5-digit numeric and 4-digit alphanumeric indications of station operation, operator entered data during hard or soft configuration procedures, and station error codes. Keyboard pushbuttons and the pulser knob comprise the front panel operator controls.

4.3.1 DISPLAY INTERFACE BOARD

The Display Interface Board performs four main functions:
- Interfaces the Display Assembly to the Controller Board
- Supports the operation of the front panel Pulser Knob
- Scans the keyboard for operator initiated keystrokes
- Routes display data to the Display/Driver Board

Refer to the Display Interface Board area of Figure 4-5 while reading the following description.

The Dual Optical Switch functions in conjunction with the front panel Pulser Knob to produce two pulse trains whenever the knob is rotated. Direction pulse will either lead or lag step pulses by 90° depending upon the direction of Pulser Knob rotation. Since their lead-lag relationship is dependent on the direction of knob rotation, as illustrated in Figure 4-6, the Up/Down Binary Counter (via the Dual Flip-Flop) knows whether to increment or decrement (direction pulses) and by how much (step pulses).

The number of pulses generated is counted by the Up/Down Binary Counter. The final count is placed on the Pulser Data Bus where it can be retrieved and used by the Controller Board to adjust the levels of process signals (e.g., setpoint or value) or adjust configuration parameters.

The Keyboard Scanner circuit uses its built-in oscillator to scan the Keyboard at regular time intervals to sense a completed keystroke. If a keystroke is detected, data identifying the key is placed on the Keyboard 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 Data and Control Buses of the Controller Board to the Display/Driver Board.

4.3.2 DISPLAY/Driver BOARD

The Display/Driver Board performs three main functions:
- Decodes display data received from the MPU-based Controller Board (via the Display Interface Board) to drive the 5-digit display and the 4-digit alphanumeric display
- Provides 20 configurable Status LEDs for ON/OFF indications of Controller function blocks
- Provides an LED indication of Console (C)/Local (L) operating mode

Refer to the Display/Driver Board area of Figure 4-5. Control signals and data are routed by the MPU on the Controller Board (via the Display Interface Board) to the LED Driver System U1 which multiplexes the data intended for the red, 7-segment, 5-digit numeric display. When the information is sent to the display, the Colon Driver on the Display Interface Board is activated and the colon in the display is turned-on.

Control signals and data are also routed to the 4-digit alphanumeric display. DL11 contains memory, decoder and driver capabilities to activate the red, 17-segment, encapsulated 4-digit alphanumeric display.

The LED Driver System U2 operates similar to U1 except that the multiplexed output is capable of driving up to 20 configurable Status LEDs. C(Concole)/L (Local) LEDs are also driven by U2.

4.3.3 KEYBOARD

The Keyboard is a membrane keypad which contains 15 pushbutton switches. The layout of the switches is shown in the Keyboard section of Figure 4-5. Each switch has tactile feedback. The nine configuration switches, located at the bottom of the keypad, are reached 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 (1K ohm closed resistance) are arranged in a matrix fashion.
FiGURE 4-5 Hardware Block Diagram And Front Panel Display Assembly
FIGURE 4-6  Pulse Train Phase Relationship

FIGURE 4-7  Hardware Block Diagram, Pulse Input Board
4.4 NO.3 INPUT BOARD

Each following subsection describes a signal processing board which plugs into the LSC's Controller Board. No. 3 Input Boards permit a variety of process related signals to be handled by the LSC. Function block 99, INPUT 3, must be configured to use a No. 3 input feature.

4.4.1 PULSE INPUT BOARD

The Pulse Input Board provides the LSC 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 4-7. 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 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 2-5, 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 4-7, the on-board memory consists of a factory prepared ultraviolet EPROM. It is used to store operating program information including Factory Configuration 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.
4.4.2 THERMOCUPLE/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 4-8 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 juncture 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 juncture 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 2-13) 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 75 mV 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 20 mV or T/C type T, R, S or B. The filter circuits remove noise appearing at the input of the Gain Block.

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.
FIGURE 4-8 Hardware Block Diagram, Thermocouple/Millivolt Input Board
4.4.3 VOLTAGE INPUT BOARD

The Voltage Input Board is an optional No. 3 Input Board (FB99) that adds an additional 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 analog inputs (FB01 and 02). 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 4-9 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 2-16.

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**FIGURE 4-9** Hardware Block Diagram, Voltage Input Board
4.4.4 LINK INTERFACE BOARD

The Link Interface Board can be installed in either a Model 382B or E Station. It is configured under Function Block (FB) 98 to provide communications over the Local Instrument Link (LIL) between LSCs 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 4-10 while reading the following circuit descriptions. The physical layout of the Board is shown in Figure 4-11.

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 from 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.
4.4.5 RTD INPUT BOARD

The RTD Input Board provides excitation to and accepts a low level input voltage representing a temperature from a 100 ohm platinum resistance temperature detector (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 LSC data base as a No. 3 Input under function block FB 99. 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 4-12 while reading the following circuit description. The physical layout of the Board is shown in Figure 2-15.

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 temperature changes over its operating range of -300°F to 1200°F, the RTD resistance varies to produce voltages from 7 mV to 170 mV. The Gain & Offset stage conditions this analog voltage to meet the input requirements of the A/D Converter. The range of voltages is from -2.5 Vdc to +2.5 Vdc. 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 $4FFX signal is produced that enables the Multiplexer to gate 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.

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 $4FFX 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 products +V and +1.2V outputs for onboard use.
FIGURE 4-12 Hardware Block Diagram, RTD Input Board
4.4.6 FREQUENCY INPUT BOARD

The Frequency Input Board is capable of converting 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 LSC data base as a No. 3 Input under function block 99.

Refer to the block diagram of the Frequency Input Board in Figure 4-13 while reading the following circuit description. Figure 2-14 shows a physical layout of the Board.

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 Board through the Data Bus Buffer which buffers the data and reduces loading on the MPU Data Bus. The on-board devices which are accessed from the Internal Data Bus are:

- An 8K X 8 UVPEPROM that contains the MPU instructions or programming to operate the Frequency Input Board.

- A 12-Bit D/A Converter (DAC) that is 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 switches" located in the Signal Conditioner.

- A Data Latch that enables the software to read back the control status from the Board.

- A Programmable Timer that converts the frequency input signals to an equivalent 12-bit digital output for application to the LSC's data base.

The Address Decoder assures orderly accessing of the various devices available to 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 zeros, and negative and positive gain coefficients, are derived and stored in the data base. 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 signal 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 display is decrementing) and the values obtained during the learn process will be 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 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.
Section 5

5.0 MAINTENANCE

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

5.1 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 ±0.1% 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.

5.2 PREVENTIVE MAINTENANCE

5.2.1 GENERAL

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.

5.2.2 ENVIRONMENTAL CONSIDERATIONS

The Station 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.

5.2.3 VISUAL INSPECTION

As part of a periodic maintenance program the Station 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.

5.2.4 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.

5.2.5 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.

5.3 FUSE LOCATION

A power input fuse is located on the rear of the Controller Board as shown in Figure 3-1. This is the 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 5.5 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.

5.4 TROUBLESHOOTING

In the event a malfunction within the Station 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 5.1 as a service reference.

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

Factory repaired Stations must also be configured.

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 LSC. Table 5.2 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 LSC'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 2-4 of this Instruction for rear terminal assignments.

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 5.4.1 provides a quick reference to the identification of these codes. Section 5.4.2 discusses each code with respect to the type of test or error check, station response, problem configuration, and corrective action.

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>COMMENT</th>
<th>POSSIBLE CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>No 5-digit display indication, no alphanumeric indication, no LEDs turned on, 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, Display Assembly.</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>Status LED fails to turn on. Other LEDs function normally.</td>
<td>Status LED configured.</td>
<td>Display Assembly.</td>
</tr>
<tr>
<td>No Pulser Knob response. All other indications normal.</td>
<td>All applicable conditions.</td>
<td>Display Assembly.</td>
</tr>
<tr>
<td>Fluctuating analog output signal V (Valve) as viewed on 5-digit display.</td>
<td>Seemingly abnormally fluctuating process signal on display.</td>
<td>Faulty process signal P from external transmitter, turbulent process conditions, Controller Board.</td>
</tr>
<tr>
<td>Certain configuration parameters (S, H, C, etc.) 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>
</tbody>
</table>
If troubleshooting indicates a station failure, the failed board should be removed and returned for repair to one of the addresses in the warranty statement.

**IMPORTANT**

During the warranty period, it is recommended that the entire circuit board cluster (Controller, Expander, No. 3 Input and Link Interface Boards) or entire Display Assembly be returned for repair even though the failed board can be identified.

### TABLE 5.2 Function Block Allocation

<table>
<thead>
<tr>
<th>CONTROLLER BOARD</th>
<th>NO. 3 INPUT BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB01 ANALOG INPUT 1</td>
<td>FB99 NO. 3 INPUT OPTIONS</td>
</tr>
<tr>
<td>FB02 ANALOG INPUT 2</td>
<td></td>
</tr>
<tr>
<td>FB03 ANALOG OUTPUT 1</td>
<td></td>
</tr>
<tr>
<td>FB04 DIGITAL OUTPUT 1</td>
<td></td>
</tr>
<tr>
<td>FB05 DIGITAL OUTPUT 2</td>
<td></td>
</tr>
<tr>
<td>FB06 DIGITAL INPUT 1</td>
<td></td>
</tr>
<tr>
<td>FB07 PROGRAMMER</td>
<td></td>
</tr>
<tr>
<td>FB08 REPEAT CYCLE TIMER 1</td>
<td></td>
</tr>
<tr>
<td>FB09 HI/LO LIMIT</td>
<td></td>
</tr>
<tr>
<td>FB10 BATCH TOTALIZER 1</td>
<td></td>
</tr>
<tr>
<td>FB11 SEQUENCER</td>
<td></td>
</tr>
<tr>
<td>FB12 ALARM</td>
<td></td>
</tr>
<tr>
<td>FB13 CONTROLLER</td>
<td></td>
</tr>
<tr>
<td>FB14 A/M TRANSFER</td>
<td></td>
</tr>
<tr>
<td>FB15 OPERATOR DISPLAY</td>
<td></td>
</tr>
<tr>
<td>FB17 SETPOINT TRACK &amp; HOLD</td>
<td></td>
</tr>
<tr>
<td>FB18 GENERAL PURPOSE TRACK &amp; HOLD</td>
<td></td>
</tr>
<tr>
<td>FB20 TO FB31 QUAD LOGIC BLOCKS 1 TO 12</td>
<td></td>
</tr>
<tr>
<td>FB32 DEVIATION AMPLIFIER 1</td>
<td></td>
</tr>
<tr>
<td>FB33 DUAL TRANSFER SWITCH 1</td>
<td></td>
</tr>
<tr>
<td>FB34 QUAD COMPARATOR</td>
<td></td>
</tr>
<tr>
<td>FB35 QUAD DELAY TIMER 1</td>
<td></td>
</tr>
<tr>
<td>FB36 QUAD DELAY TIMER 2</td>
<td></td>
</tr>
<tr>
<td>FB37 QUAD DIVIDE BY N COUNTER 1</td>
<td></td>
</tr>
<tr>
<td>FB38 QUAD DIVIDE BY N COUNTER 2</td>
<td></td>
</tr>
<tr>
<td>FB39 QUAD ONE-SHOT 1</td>
<td></td>
</tr>
<tr>
<td>FB40 QUAD ONE-SHOT 2</td>
<td></td>
</tr>
<tr>
<td>FB41 QUAD FLIP-FLOP 1</td>
<td></td>
</tr>
<tr>
<td>FB42 QUAD FLIP-FLOP 2</td>
<td></td>
</tr>
<tr>
<td>FB44 REPEAT CYCLE TIMER 2</td>
<td></td>
</tr>
<tr>
<td>FB45 BATCH TOTALIZER 2</td>
<td></td>
</tr>
<tr>
<td>FB46 MULTIPLIER/DIVIDER 1</td>
<td></td>
</tr>
<tr>
<td>FB47 MULTIPLIER/DIVIDER 2</td>
<td></td>
</tr>
<tr>
<td>FB48 ADDER/SUBTRACTOR 1</td>
<td></td>
</tr>
<tr>
<td>FB49 ADDER/SUBTRACTOR 2</td>
<td></td>
</tr>
<tr>
<td>FB50 DEVIATION AMPLIFIER 2</td>
<td></td>
</tr>
<tr>
<td>FB51 SQUARE ROOT EXTRACTOR</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EXPANDER BOARD</th>
<th>LINK BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB90 ANALOG OUTPUT 2</td>
<td>FB98 LINK INTERFACE OPTION</td>
</tr>
<tr>
<td>FB81 TO FB76 DIGITAL I/O 1 TO 16</td>
<td></td>
</tr>
<tr>
<td>FB77 RECIPE STORAGE AND REAL TIME CLOCK</td>
<td></td>
</tr>
</tbody>
</table>
5.4.1 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.

5.4.1.1 Power-Up Error Code Designation

Sample Error Code
Error Indicator
Error Type
1 — Hardware
2 — Database
Board Type
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 — Controller - EEPROM Transient Data CRC
— Expander - Board Type
— No. 3 Input - Board type
7 — Power-Down
8 — EEPROM Constant/Calibration Data CRC

5.4.1.2 Power-Up Error Codes
Table 5.3 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.

5.4.1.3 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
Error Indicator
Error Type
1 — Controller Board A/D
2 — Expander Board Real Time Clock Error
3 — No. 3 Input Board
4 — Link Interface Board
5 — Watchdog Time Out - Controller Board
6 — EEPROM Stores Exceeds 10,000
— Controller Board
7 — EEPROM Activity Did Not Verify
— Controller Board
Alarm (Configured through FB12)
* — Uncleared
Blank — Cleared
Number of On-Line Errors

5.4.1.4 On-Line Error Codes
Table 5.4 gives the definition and affected board for each on-line error code.

5.4.2 ERROR CODE DISCUSSION
This section discusses the diagnostic test or error check, station response, problem confirmation, and corrective action for each error code. Tables 5.5, 5.6, and 5.7 are for power-up codes; Table 5.8 is for on-line codes.

Error codes related to recipe data are presented in Table 5.9. To view these error codes it is necessary to enter configuration, step down to the recipe (R) value level and then use the pulser knob to select each recipe. An error code example follows: Er 15. The first number is the error code number that also appears in Table 5.9. The second number is the recipe slot number (location).
### TABLE 5.3 Power-Up Error Codes

<table>
<thead>
<tr>
<th>ERROR CODES</th>
<th>DEFINITION/TEST</th>
<th>AFFECTED BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>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>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>E225</td>
<td>FB77 CONFIGURED IN EST BUT RAM NOT INSTALLED</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>

EST - Execution Sequence Table

### TABLE 5.4 On-Line Error Codes

<table>
<thead>
<tr>
<th>LINK CODE</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>RAM/REAL TIME CLOCK 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>04</td>
<td>E4</td>
<td>BOARD ERROR</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>05</td>
<td>E5</td>
<td>WATCHDOG TIME OUT</td>
<td>ANY</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</td>
<td>EEPROM ACTIVITY DID NOT VERIFY</td>
<td>CONTROLLER</td>
</tr>
<tr>
<td>14</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 200</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>15</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 201</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>16</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 202</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>17</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 203</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>18</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 204</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>19</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 205</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>1A</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 206</td>
<td>LINK INTERFACE</td>
</tr>
<tr>
<td>1B</td>
<td>NONE</td>
<td>NON-UPDATING INPUT 207</td>
<td>LINK INTERFACE</td>
</tr>
</tbody>
</table>
### TABLE 5.5 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. 5-Digit display blank</td>
<td>Remove and reapply station power</td>
<td>Replace Controller Board</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Operator controls inoperative</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Outputs failsafed:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A. Analog set to -3.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>B. Digital nonconducting</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C. Configurable I/O nonconducting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E111</td>
<td>ROM CRC - Verifies factory entered data and that it can be read</td>
<td>1. 5-Digit display blank</td>
<td>Remove and reapply station power</td>
<td>Replace Board:</td>
</tr>
<tr>
<td>E121</td>
<td></td>
<td>2. Operator controls inoperative</td>
<td></td>
<td>E111 - Controller</td>
</tr>
<tr>
<td>E131</td>
<td></td>
<td>3. Outputs failsafed:</td>
<td></td>
<td>E121 - Expander</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A. Analog set to -3.3%</td>
<td></td>
<td>E131 - No. 3 Input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B. Digital nonconducting</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C. Configurable I/O nonconducting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E122</td>
<td>Compatibility - Checks for software compatibility between boards</td>
<td>1. 5-Digit display blank</td>
<td>Remove and reapply station power</td>
<td>Install software compatible board(s):</td>
</tr>
<tr>
<td>E132</td>
<td></td>
<td>2. Operator controls inoperative</td>
<td></td>
<td>E122 - Expander</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Outputs failsafed:</td>
<td></td>
<td>E132 - No. 3 Input</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A. Analog set to -3.3%</td>
<td></td>
<td>Refer to section 5.7 for software</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B. Digital nonconducting</td>
<td></td>
<td>compatibility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C. Configurable I/O nonconducting</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 5.6 E213, E223, E233 - Power-Up Database ID Error Codes

<table>
<thead>
<tr>
<th>LINK CODE</th>
<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>D5</td>
<td>E213</td>
<td>ID - Checks for correctness of configuration for boards installed</td>
<td>1. 5-Digit displays blank; Displays active for configuration only</td>
<td>Remove and reapply station power</td>
<td>Before pressing a keyboard button, check the following:</td>
</tr>
<tr>
<td>DF</td>
<td>E223</td>
<td></td>
<td>2. Operator controls operative for configuration only</td>
<td></td>
<td>1. Expander Board not plugged-in or not installed</td>
</tr>
<tr>
<td>E9</td>
<td>E233</td>
<td></td>
<td>3. Outputs failsafed:</td>
<td></td>
<td>2. Wrong No. 3 Input Board installed for present configuration</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A. Analog to -3.3%</td>
<td></td>
<td>If correct boards are installed, press ENTER CONF and re-enter configuration or download new data base via Local Instrument Link</td>
</tr>
<tr>
<td>LINK CODE</td>
<td>DISPLAY 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>
<tr>
<td>D6</td>
<td>E214</td>
<td>EEPROM CRC - Verified transient data.</td>
<td>1. 5-Digit display active for configuration only. 2. Operator controls operative for configuration only 3. Outputs failed: A. Analog to -3.3% B. Digital nonconducting C. Configurable I/O nonconducting</td>
<td>Remove and reapply station power.</td>
<td>Press ENTER CONF button. (Station loads default transient data.) Re-enter configuration or download new data base via Local Instrument Link. Replace Controller Board.</td>
</tr>
<tr>
<td>D9</td>
<td>E217</td>
<td>Controller Board Power-Down</td>
<td>1. 5-Digit display active for configuration only 2. Operator controls operative for configuration only 3. Outputs failed: A. Analog to -3.3% B. Digital nonconducting C. Configurable I/O nonconducting</td>
<td>Remove and reapply station power default calibration data</td>
<td>Press ENTER CONF button. (Station loads, and clears Execution Sequence Table.) Re-enter configuration or download new data base via Local Instrument Link. Recalibrate. Replace Controller Board.</td>
</tr>
<tr>
<td>DA</td>
<td>E218</td>
<td>EEPROM CRC - Verifies constant and calibration data</td>
<td>1. 5-Digit display active for configuration only 2. Operator controls operative for configuration only 3. Outputs failed: A. Analog to -3.3% B. Digital nonconducting C. Configurable I/O nonconducting</td>
<td>Remove and reapply station power default calibration data</td>
<td>Press ENTER CONF button. (Station clears Execution Sequence Table.) Re-enter configuration or download new data base via Local Instrument Link. Recalibrate. Replace Controller Board.</td>
</tr>
<tr>
<td>EO</td>
<td>E224</td>
<td>Expander Board - Type</td>
<td>1. Display active for configuration only 2. Operator controls operative for configuration only</td>
<td>Remove and reapply station power</td>
<td>Press ENTER CONF button. (Station clears Execution Sequence Table.) Re-enter configuration or download new data base via Local Instrument Link. Recalibrate. Replace Controller Board.</td>
</tr>
<tr>
<td>EA</td>
<td>E234</td>
<td>No. 3 Input Board - type</td>
<td>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. Configurable I/O nonconducting</td>
<td>Remove and reapply station power</td>
<td>Press ENTER CONF button. (Station clears Execution Sequence Table.) Re-enter configuration or download new data base via Local Instrument Link. Recalibrate. Replace Controller Board.</td>
</tr>
<tr>
<td>LINK CODE</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>
<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 Controller Board.</td>
</tr>
<tr>
<td>02</td>
<td>E2</td>
<td>Checks operation of RAM, Real-Time clock and battery on Expander Board.</td>
<td>Time is set to 12:00A. Outputs of FB77 set to 0.0%.</td>
<td>Force time to new value. If time sets to 12:00A, the RTC IC is faulty.</td>
<td>Replace Expander Board.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Last process data checksum test; performed only on power-up.</td>
<td>Station does not resume operation at point established prior to power interruption.</td>
<td>Reestablish operating point then remove and reapply power within HPUT configured time. If error code reappears and station operating point is wrong, proceed to corrective action column.</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>Thermocouple/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 Thermocouple/ Millivolt Input Board.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RTD Input</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>4. Replace RTD Input Board.</td>
</tr>
<tr>
<td>LINK CODE</td>
<td>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>
<tr>
<td>04</td>
<td>E4</td>
<td>Link Interface Board: Dual Port RAM (Off-Line) and Board 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 corrective action column.*</td>
<td>Replace Link Interface Board.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Link Interface Board: Dual Port RAM (On-Line) and Board 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, exit configuration. If error code remains or reappears, proceed to corrective action column.*</td>
<td>Replace Link Interface Board.</td>
</tr>
<tr>
<td>05</td>
<td>E5</td>
<td>MPU - Check to determine if program has been executed in required time.</td>
<td>Station executes power-up diagnostic test routines (4 seconds). 1. Display blank except for alphanumeric display (4 seconds). 2. Controls inoperative (4 seconds).</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 Controller Board.</td>
</tr>
<tr>
<td>06</td>
<td>E6</td>
<td>EEPROM - Check to determine if number of EEPROM stores (writes) has exceeded 10,000.</td>
<td>Normal operation.</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 Controller Board at next convenient periodic maintenance check. 2. Check power supply for erratic output (can be indicated by momentary display blanking).</td>
</tr>
<tr>
<td>07</td>
<td>E7</td>
<td>EEPROM activity did not verify.</td>
<td>Normal operation.</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 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 a momentary display blanking).</td>
</tr>
</tbody>
</table>

*If error code does not reappear, an environmental problem (e.g., excessive power input voltage or out-of-specified operating temperature) can exist or an intermittent electrical problem can be present, see corrective action column.
### TABLE 5.9 Recipe Related Error Codes

<table>
<thead>
<tr>
<th>DISPLAY ERROR CODE</th>
<th>DIAGNOSTIC TEST</th>
<th>PROBLEM CONFIRMATION</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Er 1</td>
<td>RAM CRC</td>
<td>Exit configuration, remove and reapply power, re-enter configuration, and check for error code.</td>
<td>Replace Expander Board.</td>
</tr>
<tr>
<td>Er 2</td>
<td>Incomplete recipe data</td>
<td></td>
<td>Re-enter recipe; If error code reappears, replace Expander Board.</td>
</tr>
<tr>
<td>Er 3</td>
<td>Expander Board ID</td>
<td></td>
<td>Re-enter recipe</td>
</tr>
<tr>
<td>Er 4</td>
<td>Expander Board ROM</td>
<td></td>
<td>Re-enter recipe</td>
</tr>
<tr>
<td>Er 5</td>
<td>No. 3 Input Board ID</td>
<td></td>
<td>Re-enter recipe</td>
</tr>
<tr>
<td>Er 6</td>
<td>Wrong or no No. 3 Input Board</td>
<td></td>
<td>Install proper Board or alter configuration</td>
</tr>
<tr>
<td>Er 7</td>
<td>Link Interface Board not installed (when needed by configuration)</td>
<td></td>
<td>Install Link Interface Board</td>
</tr>
</tbody>
</table>

### 5.5 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 LSC. Refer to section 5.7 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 (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 2-8, notice how a wrist strap can be 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 274A.

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, Frequency Input, RTD Input, or Voltage Input. Recipes must be reentered after replacing an Expander Board.

### 5.5.1 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 cm); support the Assembly so it doesn’t hang by the ribbon cable
3. Ground the 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 retaining 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.

5.5.2 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 5.5.1.
3. Remove board retainer by extracting board retainer screw (see Figure 2-12)
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
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 shielding bag
3. Set lockout switches as on removed Board (see Figure 3-1)
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 2-12)
8. Install Display Assembly as described in section 5.5.1

NOTE
Station must be configured when Controller Board is replaced

5.5.3 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 5.5.1
2. Remove Controller Board as described in section 5.5.2
3. On a grounded conductive mat, remove retaining screws and washers which hold board to be removed to Controller Board
4. Carefully remove Board. Be 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 2-5.
   - Thermocouple/Millivolt Input Board — See Figure 2-13.
   - Frequency Input Board — See Figure 2-14.
   - Expander, Voltage Input, RTD, 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 5.10.

<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>Frequency Input, J1</td>
<td>J2</td>
</tr>
<tr>
<td>Pulse Input, J1</td>
<td>J2</td>
</tr>
<tr>
<td>RTD Input, J1</td>
<td>J2</td>
</tr>
<tr>
<td>Thermocouple/Millivolt Input, J3</td>
<td>J2</td>
</tr>
<tr>
<td>Voltage Input, J1</td>
<td>J2</td>
</tr>
<tr>
<td>Link Interface, P1</td>
<td>J3</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 5.5.2 and 5.5.1 to install Controller Board and Display Assembly.
5.6 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.

5.7 SOFTWARE COMPATIBILITY IDENTIFICATION

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

Sample Marking: 14728-1000-A B C

System Part Number
Station

EPROM Revision

The System code letter applies to software which defines and formats communications between LSCs (and other stations) connected to the Local Instrument Link. This letter must be the same on all boards within an LSC, 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 LSC. This letter must be the same on Controller, Expander and No. 3 Input Boards within an LSC — The Link Interface Board’s station code letter does not need to be the same. However, the second letter on all Link Interface Boards in stations connected to the LIL must be the same.

**IMPORTANT**
All Local Instrument Link connected LSCs 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.

5.8 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.

---

**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, i.e., 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, guarantees, 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.
  - Summertown Pike
  - Spring House, PA 19477
- Equipment manufactured or sold by MOORE INSTRUMENT CO.
  - MOORE INSTRUMENTS LTD/TEE
  - 2KM West of Mississauga Rd. Hwy. 7
  - Brampton, Ontario, Canada
- Equipment manufactured or sold by MOORE PRODUCTS CO. (U.K.) LTD.
  - MOORE PRODUCTS CO. (U.K.) LTD
  - Central Avenue
  - East Molesey, Surry KT8 OSL
  - England

The warranty will be null and void if repair is attempted without prior authorization by a member of the MOORE PRODUCTS CO. Service Department.
<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Req’d</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16942-15</td>
<td>Display Assembly (incl. items 2-11, 36)</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>6757-9</td>
<td>Retaining Ring</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>16973-44</td>
<td>Bezel Screw</td>
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</tr>
<tr>
<td>5</td>
<td>16973-55</td>
<td>Keeper Spring</td>
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</tr>
<tr>
<td>6</td>
<td>16973-57</td>
<td>Keyboard Cover</td>
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</tr>
<tr>
<td>7</td>
<td>16973-69</td>
<td>Knob Cap</td>
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<tr>
<td>8</td>
<td>16973-20</td>
<td>Knob</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>16942-20</td>
<td>Spacer</td>
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</tr>
<tr>
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<td>16942-18</td>
<td>Cylinder &amp; Shaft Assy</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>16973-88</td>
<td>I.D. Card</td>
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</tr>
<tr>
<td>12</td>
<td>16973-79</td>
<td>Card Guide</td>
<td>2</td>
</tr>
<tr>
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<td>Spacer (Model 382E — — — only)</td>
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<td>14</td>
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<td>Spacer (No. 3 Input Board &amp; Link Interface)</td>
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<td>15</td>
<td>See Table No. 3 Input Board</td>
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<td>16</td>
<td>See Table Expander Board</td>
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<td></td>
<td>17</td>
<td>See Table Controller Board</td>
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<td>19</td>
<td>See Table Link Interface</td>
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<td>Board Retainer (incl. items 31, 32 &amp; 33)</td>
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<td>16942-26</td>
<td>Case-40 Terminal - 120 Vac</td>
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</tr>
<tr>
<td>20b</td>
<td>16942-27</td>
<td>Case-40 Terminal - 24 Vdc</td>
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</tr>
<tr>
<td>20c</td>
<td>16942-28</td>
<td>Case-40 Terminal - 24 Vac</td>
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</tr>
<tr>
<td>20d</td>
<td>16942-29</td>
<td>Case-40 Terminal - 120/240 Vac</td>
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</tr>
<tr>
<td>20e</td>
<td>16942-30</td>
<td>Case-20 Terminal - 120 Vac</td>
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</tr>
<tr>
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<td>16942-31</td>
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</tr>
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<td>16973-49</td>
<td>Case</td>
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<td>Mounting Bracket (incl. items 22 &amp; 23)</td>
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<td>Stud</td>
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<td>Alignment Screw</td>
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<td>25</td>
<td>7418-341</td>
<td>Cover Plate</td>
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<th>Req’d</th>
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<td>Terminal Block Barrier (40 Term only)</td>
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<td>Power Terminal Cover (For 120V or 220V only)</td>
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<td>Receptacle</td>
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<td>16942-54</td>
<td>20 Terminal</td>
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<td>40 Terminal</td>
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<td>30b</td>
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<td>Controller Board (240 Vac)</td>
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<td>39c</td>
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<td>39d</td>
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<td>16942-75</td>
<td>Controller Board (220/240 Vac)</td>
<td>1</td>
</tr>
<tr>
<td>48</td>
<td>16942-76</td>
<td>Controller Board (120 Vac)</td>
<td>1</td>
</tr>
<tr>
<td>49</td>
<td>16942-77</td>
<td>Controller Board (240 Vac)</td>
<td>1</td>
</tr>
<tr>
<td>50</td>
<td>16942-78</td>
<td>Controller Board (24 Vdc)</td>
<td>1</td>
</tr>
<tr>
<td>51</td>
<td>16942-79</td>
<td>Controller Board (220/240 Vac)</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.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Req’d</th>
</tr>
</thead>
<tbody>
<tr>
<td>15a</td>
<td>16942-101</td>
<td>Pulse Input Board</td>
<td>1</td>
</tr>
<tr>
<td>15b</td>
<td>16942-112</td>
<td>Voltage Input Board</td>
<td>1</td>
</tr>
<tr>
<td>15c</td>
<td>16942-123</td>
<td>Thermocouple/Multivolt Input Board</td>
<td>1</td>
</tr>
<tr>
<td>15d</td>
<td>16942-134</td>
<td>Frequency Input Board</td>
<td>1</td>
</tr>
<tr>
<td>15e</td>
<td>16942-145</td>
<td>RTD Input Board</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>16942-156</td>
<td>Expander Board</td>
<td>1</td>
</tr>
<tr>
<td>17a</td>
<td>16942-167</td>
<td>Controller Board (120 Vac)</td>
<td>1</td>
</tr>
<tr>
<td>17b</td>
<td>16942-178</td>
<td>Controller Board (24 Vac)</td>
<td>1</td>
</tr>
<tr>
<td>17c</td>
<td>16942-189</td>
<td>Controller Board (240 Vac)</td>
<td>1</td>
</tr>
<tr>
<td>17d</td>
<td>16942-190</td>
<td>Controller Board (220/240 Vac)</td>
<td>1</td>
</tr>
<tr>
<td>17e</td>
<td>16942-191</td>
<td>Controller Board (120 Vac)</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>16942-192</td>
<td>Expander Board</td>
<td>1</td>
</tr>
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</table>

### Circuit Board Table

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Req’d</th>
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</thead>
<tbody>
<tr>
<td>15a</td>
<td>16942-101</td>
<td>Pulse Input Board</td>
<td>1</td>
</tr>
<tr>
<td>15b</td>
<td>16942-112</td>
<td>Voltage Input Board</td>
<td>1</td>
</tr>
<tr>
<td>15c</td>
<td>16942-123</td>
<td>Thermocouple/Multivolt Input Board</td>
<td>1</td>
</tr>
<tr>
<td>15d</td>
<td>16942-134</td>
<td>Frequency Input Board</td>
<td>1</td>
</tr>
<tr>
<td>15e</td>
<td>16942-145</td>
<td>RTD Input Board</td>
<td>1</td>
</tr>
<tr>
<td>15f</td>
<td>16942-156</td>
<td>Expander Board</td>
<td>1</td>
</tr>
<tr>
<td>15g</td>
<td>16942-167</td>
<td>Controller Board (120 Vac)</td>
<td>1</td>
</tr>
<tr>
<td>15h</td>
<td>16942-178</td>
<td>Controller Board (24 Vac)</td>
<td>1</td>
</tr>
<tr>
<td>15i</td>
<td>16942-189</td>
<td>Controller Board (240 Vac)</td>
<td>1</td>
</tr>
<tr>
<td>15j</td>
<td>16942-190</td>
<td>Controller Board (220/240 Vac)</td>
<td>1</td>
</tr>
<tr>
<td>15k</td>
<td>16942-191</td>
<td>Controller Board (120 Vac)</td>
<td>1</td>
</tr>
</tbody>
</table>

### IMPORTANT

When ordering a spare or replacement circuit board, provide the following:

- part number
- software compatibility code
- serial number

---

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

Model 382 Logic And Sequence Controller Installation And Service Instruction, Issue 2

SUBJECT

Rear terminal connections

DISCUSSION

The case rear terminal screws must be tightened to make electrical contact. When a terminal screw is loosened, the circuit may be broken due to the construction of the connector.

As shown in the Figure, a terminal screw threads into a threaded insert. But the insert is electrically isolated from the socket that is engaged by the pin on the mating circuit board connector. The spring plate is connected to the socket. This is done so that the spring plate and socket can be replaced.

When a wire is placed under the pressure plate and the screw tightened, the wire is clamped between the pressure plate and the spring plate providing a direct electrical path to the socket.

When the terminal screw is loosened and a DVM probe (for example) is touching it, the terminal screw is often not in contact with the spring plate because of the screw clearance hole in the plate and the circuit may appear open. If the screw is wiggled the circuit may appear intermittent.
RECOMMENDATIONS

When a permanent connection is made, the terminal screw must be tightened clamping the wire or crimp-on connector between the pressure plate and spring plate to insure electrical contact.

If a temporary connection must be made, such as measuring the +26 Vdc at the connector with a DVM, either tighten the terminal screw before performing the measurement or be sure to contact the spring plate with the probe. Alternatively, use a short length of wire clamped at one end by the pressure plate and connect the test instrument to the free end of the wire.

JNR

Service Publications Group
INSTRUCTION INVOLVED

SD382, Model 382 Logic And Sequence Controller Installation And Service Instruction, issue 2

SUBJECT

Wiring Guidelines

DISCUSSION

This addendum provides additional information concerning the wiring of the case rear terminals. The material in this addendum supplements that in section 2.4 Wiring Guidelines.

- The terminals at the rear of the case contain #6 screws and pressure plates. They are for use with stranded wire or with spring spade tongue or ring tongue crimp-on terminals with insulated barrels.
- Refer to section 2.4 for wire gauge recommendations. Also, consult the wire vendor and the National Electrical Code for additional recommendations and suggestions when selecting wire.

Some wire 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

- Strip wire end 1/4" to 5/16" or as recommended by the crimp-on terminal manufacturer.

  When stripping stranded wire, do not nick or cut away conductor strands.

- When using crimp-on terminals, 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; the screw must be tightened for a reliable electrical connection; if a crimp-on terminal is not used, wire insulation should butt against the connector, conductor should not be visible.

**CAUTION**

- Before applying power, carefully inspect and test for the following:

  Correct connection to each terminal; each wire should be clearly marked (e.g., color or wire marker)

  An exposed conductor or stray wire strand that could be contacted by installation or maintenance personnel, or short to another wire or terminal possibly damaging equipment

  Mechanically strong crimp-on connections

  Terminal screws are tight ensuring good electrical contact

  Wires are properly supported throughout their runs (e.g., clamps, trays).

Service Publications Group
INSTRUCTION INVOLVED

MYCRO 382 Logic And Sequence Controller Installation And Service Instruction SD382

SUBJECT

Thermocouple/Millivolt Input Board P/N16005-51

INTRODUCTION

The subject board is now in production. Installation, calibration, circuit description, and maintenance data in sections 1 through 6 are applicable. Board layout and SPAN and INPUT BREAK jumper settings are shown in the accompanying figure.

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<table>
<thead>
<tr>
<th>THERMOCOUPLE INPUTS</th>
<th>MILLIVOLT INPUTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>J,K OR E</td>
<td>T.R.S. OR B</td>
</tr>
<tr>
<td>-20 mV TO +20 mV</td>
<td>-75 mV TO +75 mV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SPAN AND JUMPER INSTALLED</th>
<th>WIDE J2</th>
<th>NARROW J3</th>
<th>NARROW J3</th>
<th>WIDE J2</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT BREAK DIRECTION AND JUMPER</td>
<td>UP OR DOWN J4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
1. AS SHOWN: NARROW SPAN, UPSCALE BREAK.
2. OPERATION IS POSSIBLE WITH JUMPER–PLUG J2 REMOVED; HOWEVER, THE "INPUT BREAK" FEATURE IS DISABLED.
3. RECALIBRATION IS REQUIRED IF JUMPER–PLUGS ARE CHANGED IN ANY WAY.

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

MYCRO 382 Logic and Sequence Controller Installation And Service Instruction
SD382, issue 2

SUBJECT

Thermocouple Wiring Guidelines

DISCUSSION

This addendum provides information concerning the wiring of thermocouples, and other devices connected with solid wire, to the case rear terminals. The material in this addendum supplements that in section 2.4 Wiring Guidelines.

A solid wire should be formed and clamped as described below:

- Strip wire end 3/8" to 7/16".

- Form a gradual bend in the stripped wire end that will hook behind the terminal screw. See the figure on the next page.

- Loosen the screw and insert the formed wire end under the pressure plate and behind the screw so that the screw tightens the pressure plate on the wire. Tighten the terminal screw. Wire insulation should be touching, but not under, the pressure plate.

CAUTION

- Before applying power, carefully inspect and test for the following:

  1. Correct connection to each terminal; each wire should be clearly marked (e.g., color or wire marker)

  2. There are no exposed conductors that could be contacted by installation or maintenance personnel, or short to another wire or terminal possibly damaging equipment

  3. Terminal screws are tight ensuring good electrical contact

  4. Wires are properly supported throughout their runs (e.g., clamps, trays).
FIGURE  Solid Conductor Installation on Rear Connectors
CONTROLLER BOARD PLUG-IN POWER SUPPLY
MYCRO 382 LOGIC AND SEQUENCE CONTROLLER

INSTRUCTION INVOLVED

MYCRO 382 Logic and Sequence Controller (LSC), Installation and Service Instruction SD382, Issue 2

SUBJECT

Model 382_A Controller Board plug-in power supply enhancement

DISCUSSION

Starting in August, 1992, all MYCRO 382_A LSCs will be produced with a revised Controller Board. This board includes a plug-in power supply and minor circuit changes. Figure 1 shows the Controller Board.

These enhancements improve serviceablility and do not affect functionality. A revised LSC is fully compatible with a previous LSC.

The plug-in power supply accepts a wide range of AC input voltages. Therefore, Model 382_E will no longer be offered; it will be merged with Model 382_A. Models 382_B and 382_C will continue to use the soldered-in power supply. Refer to the following model designation list.

MODEL DESIGNATION CHANGES

Sample Model Number ___________ 382 B A 11 V I F

Model Series _______________________________________

Type ____________________________________________
B - Basic
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.
PLUG-IN POWER SUPPLY SERVICING

This section supplements the troubleshooting and assembly replacement information in section 5, 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 5.5.1.

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 5.5 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 5.5 to reassemble the station.

**PART NUMBER CHANGES**

The following part numbers pertain to the updated Controller Board and amend Parts List Drawing 15942-8PL dated 3/87.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>17a</td>
<td>15958-1</td>
<td>Controller Board with Plug-In Power Supply 120/240 Vac</td>
</tr>
<tr>
<td>17e</td>
<td>15942-16</td>
<td>Controller Board with Plug-In Power Supply and Expander Board, 120/240 Vac</td>
</tr>
<tr>
<td></td>
<td>14755-123</td>
<td>Plug-In Power Supply, 120/240 Vac</td>
</tr>
</tbody>
</table>

Service Publications Group
## MODEL 382 LOGIC AND SEQUENCE CONTROLLER
### DECLARATION OF CONFORMITY

### INVOLVED MANUAL
SD382, Model 382 Logic and Sequence Controller Installation And Service Instruction, Issue 2, September 1987; this addendum supersedes SDA382-6, Issue 1, February 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>1.3 MODEL DESIGNATION</td>
<td>Compliant stations will contain an ‘E’ in the Electrical Classification portion of the model designation.</td>
</tr>
<tr>
<td>1.4.4 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. Environmental Conditions, Per IEC 664: Installation Category II Pollution Degree 2</td>
</tr>
<tr>
<td>1.4 SPECIFICATIONS</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. When the Local Instrument Link twinaxial cable is to be grounded to the Model 382’s rear terminals: 1. Install a jumper between terminals AG (earth ground) and B3; order Jumper Kit PN 16105-98. 2. Connect the twinaxial cable shield to terminal B3.</td>
</tr>
<tr>
<td>2.4 WIRING GUIDELINES</td>
<td></td>
</tr>
</tbody>
</table>

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MOORE PRODUCTS CO., Spring House, PA 19477-0900
An ISO 9001 registered company.
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 382xxxxxE Logic and Sequence 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

James O. Moore
General Manager
Measurement and Control Division
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 bulletin board 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 calling 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 software title and version

- If there is a problem with a product’s operation:
  - Is the problem intermittent or constant?
  - What steps were performed before the problem occurred?
  - What steps have been performed since the problem occurred?
  - What symptoms accompany the problem? Is an error message displayed?
  - What is the installation environment? For example:
    - type of plant and process, involved loop, control strategy, and related equipment.
    - workstation or personal computer manufacturer and model, amount of memory, and operating system.

For product support outside of North America, contact your nearest Moore Products Co. subsidiary. Subsidiary addresses and telephone and FAX numbers can be found at www.mooreproducts.com.

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 or outside of North America go to www.mooreproducts.com for the address and telephone and FAX numbers of your nearest Moore Products Co. subsidiary. Ask for an RMA (Return Material Authorization) number and be sure to mark the RMA number prominently on the outside of the shipment.
When calling for an RMA number, provide the reason for the return. If returning equipment for repair, failure information (e.g., error code, failure symptom, installation environment) will be requested. A purchase order number will also be needed.

MATERIAL SAFETY DATA SHEET

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

PACKAGING

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

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

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 and any attached documents or for the application and use of information included in this and any attached documents. The information herein is subject to change without notice.