SELECTRONIX, INC.
WOODINVILLE, WA

SUPERSTEP SERIES 4000

SEQUENCING STEP

CONTROLLERS

INSTALLATION & OPERATING

MANUAL

1. **Models: SLC4000-xxx-yyy, SLC4024-xxx , SLC2170-xx**
2. **Relay Output**
3. **Integral Vernier Output**
4. **UL Recognized Component for U.S. and Canada File E124742**

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GENERAL INFORMATION

Introduction

The **SELECTRONIX, INC. SUPERSTEP SERIES 4000** controllers are all solid-state, microcontroller-based, proportional load controllers for use in staged electric heating, cooling, or other HVAC systems. It provides multi-stage relay contact closures in proportional response to a slidewire sensor, potentiometer, voltage, or current inputs. The controller is also suitable for many other general purpose control applications requiring proportional deadband closed-loop control.

- Units may be connected together to provide a maximum of 32 stages.
- A single board size accommodates from 1 to 8 relay stages, using on-board switches to configure the actual quantity of in-service relays. Standard models are SLC4000-4 which has 4 relays, while SLC4000-8 has 8 relays. SLC4000-x has 120V ac input power, while SLC4024-x is for 24V ac/ 28V dc power input.
- 3 relays have alternate functions and are enabled when they are not designated as in-service. See Section "Alternate Function Relays" for more information.
- The Master Unit is compatible with a number of different input signal types, including, 0-5VDC, 0-10VDC, 2-10VDC, 4-20 maDC, ohmic slidewire, and a user-defined input range. The input signal type is selected with on-board switches.
- Integral Load Limit Input provides for local or remote control of the maximum quantity of loads to energize, for control of peak demand charges. This input may also be used as a graceful shutdown control.
- Models are available with an integral 0-10 VDC vernier output, which provides a signal to control an SCR module or other proportional control devices. This provides a 0-100% fractional control between relay stages and also a "bumpless transfer" of applied power. See section "Integrated Vernier Output and Operation" for models which include the Vernier Output option..
- A 'Test Up' and 'Test Dn' Pushbutton provide for rapid startup and troubleshooting tests. The Operational Test Mode operates the relays for a short time interval before returning to the normal control mode, while the Dedicated Test Mode keeps the unit in a constant test configuration. The Test Mode is selected by an on-board switch.
- A multi-color LED indicates operational status, as well as annunciating several error conditions.
- All outputs are pilot relay contacts, intended to control interposing relays or contactors. Each output stage has an LED indicator to show output operation.
- Step timing is adjusted by a combination of on-board switches and a potentiometer for On-delay timing of up to 8 minutes. A single switch provides a selection between 2 and 5 second Off-delay.
- Range checking of offset input signals, detection of communication loss with expansion units, and many other built-in failsafe features are included in the SLC4000 family.
- The SLC4000 is provided with 4 swaged standoffs suitable for mounting to chassis panels using #6 machine screws.
- SLC4010 is a NEMA 4X enclosure is available as an option.
- The SLC4000 controllers are UL Recognized in accordance with UL873 Temperature Indicating and Regulating Equipment (CCN: XAPX2) and are intended for use by Original Equipment Manufacturers (OEM) who will seek overall UL approval for the end-item system. File Number The SLC4000 family have both US and Canadian UL recognition.
- SLC4000 may be used stand-alone or connected to the **Selectronix Building Management Interface System for BACnet and Modbus protocols**.
- References to SLC4000 models apply equally to SLC4024 models unless specified otherwise.

Warnings And Advisories

!!! WARNING !!!

THIS EQUIPMENT SHOULD BE INSTALLED, ADJUSTED, AND SERVICED BY QUALIFIED ELECTRICAL MAINTENANCE PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THE EQUIPMENT AND THE HAZARDS INVOLVED.

FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY!

THIS CONTROL IS AN OPERATING DEVICE, NOT A LIMITING DEVICE. IT IS THE RESPONSIBILITY OF THE USER TO INSTALL ALL LIMITING AND SAFETY DEVICES TO THE END-ITEM SYSTEM.

TYPICAL WIRING TO ENSURE ALL SLC4000 OUTPUTS ARE DE-ENERGISED IS TO DISCONNECT THE AC POWER FROM TERMINAL L1.

IMPORTANT NOTE FOR BUILDING MANAGEMENT INTERFACE WIRING

See Physical and Electrical Installation, Building Management Interface Limit Control Wiring

!!! WARNING !!!

THIS CIRCUITRY IN THIS EQUIPMENT CONTAINS STATIC SENSITIVE ELECTRONIC COMPONENTS. OBSERVE PROPER HANDLING PRECAUTIONS WHEN HANDLING THE PRINTED WIRING BOARDS. AVOID CONTACTING COMPONENTS WITHOUT FIRST DISCHARGING YOUR BODY TO GROUND. ALWAYS DISCONNECT POWER TO THE BOARDS BEFORE MAKING ELECTRICAL INTERCONNECT OR OUTPUT WIRING.

FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN DAMAGE TO THE CIRCUITRY!

Master and Expansion Units

The SLC4000 has 2 standard configurations, which contain either 4 or 8 relays.

Any quantity of the available relays may be designated as 'in-service' to match the sequencer to the actual quantity of system contactors.

The SLC4000 is compatible with the SLC2170-xx Remote Indicator Panel which provides for external indication of activated relay stages.

The SLC4000 may be configured as a Master Unit, and connected to other SLC4000s configured as Expansion Units, by using Cascading Cables. Up to 4 units may be cascaded together, to provide up to 32 stages. Dual-port cascading connectors are provided on the SLC4000, providing an easy method to interconnect additional units in a daisy-chained fashion. Either connector port may be used to connect to the next cascaded unit. This provides the OEM with the flexibility of purchasing a single unit which can be used individually or in multiples to accommodate larger systems.

Sequencing and output proportionality of the added stages are maintained automatically, without any additional adjustments or calibration of the additional units.

The Master Unit maintains independent communication with each Expansion Unit, such that if a single Expansion Unit were to fail, the other Expansion Units continue to operate. The Expansion Units continually verify communication with the Master Unit, so that in the event of a loss or communication, all outputs on the affected Expansion Unit sequence off.

Unit Configuration– DIP Switch Settings

Configuration Switch Operation – Master and BMI Expansion Relays

- **Turn switch ON by pressing down on the side of the switch closest to the legend number**.
- The logic state of all switches, except the ON DELAY MINUTES and the OFF DELAY SEC are changeable, ***only when all the relays are off***. This prevents inadvertent configuration changes during normal operation.

Table 1 Switch Settings for Various Command Input Types

Command Signal Type	SW1-1 Current Loop	SW1-2 Input Attn	SW1-3 Input Type	SW1-4 Input Type	SW1-5 Input Type	User-Defined Upper Lmt or Control Option	User-Defined Lower Lmt or Control Option	Used For
0-10 VDC (DEFAULT)	**Off**	**On**	**On**	**On**	**Off**	Unused	20% Load Limit Offset Note 3, 5	Master
2-10 VDC	Off	On	On	On	On	Unused	20% Load Limit Offset Note 3, 5	Master
0-5 VDC	Off	On	On	Off	Off	Unused	20% Load Limit Offset Note 3, 5	Master
4-20 ma	On	Off	On	Off	On	Unused	20% Load Limit Offset Note 3, 5	Master
Ohmic (Slidewire) or Contact Closure	Off	Off	On	Off	Off	Unused	20% Load Limit Offset Note 3, 5	Master
User-defined	Note 1	Note 2	Off	On	On	Upper Input Level Note 5	Lower Input Level Note 5	Master
Gen Purpose Set Point Controller	Note 7	Note 7	Off	On	Off	Deadband Width Note 5	Direct or Reverse Acting Control Note 5, 6	Master
Program User Input Range OR Control Options	Note 1	Note 2	Off	Off	Off	Pgm Upper Lmt value with Test Up	Pgm Lower Lmt value with Test Dn	Master
Expansion Units	Off	On	Off	Off	Off			Expansion
BMI XRlys	Off	On	Off	Off	On			BMI XRlys

Note 1: SW1-1 ON connects a 62 ohm resistor to circuit common, for use with current loop inputs.
Note 2: SW1-2 ON attenuates the input signal by 25%. Resistor divider of 5.9K and 2.0K.
Note 3: 20% Offset Option for Load Limit Input (Default is No Offset)
Note 5: See 'Programming The User-Defined Levels or Options'
Note 6: Direct Acting control is when the sensor level is above the set point, results in more stages added
Note 7: The sensor is connected to this input. See Table 2 for applicable settings

For General Purpose Set Point Controller applications, refer to SLC4000AddendumGenPurpSetPtCntl.doc available at www.selectronix.us

Table 2 Switch Position for Progressive or Linear

- *Effective for Master Only*

Description	SW1-6
Progressive Sequencing	**ON**
Linear Sequencing	Off

Progressive Sequencing is also referred to as First-On, First-Off sequencing. The first relay to turn on after all relays are off will be the next in sequence. After initial power-up, the first relay to turn on will be relay #1. When all relays are turned off when at zero demand, the first to turn on from increasing demand will be the next in sequence from the last relay turned off.

Linear Sequencing is First On, Last Off. The first relay to turn on will always be relay #1.

Table 3 Switch Combinations for Master and Expansion Unit Configuration

- *Effective for Master, Expansion and Expansion Relay Units*

Assign Expansion units in ascending order. For instance in a system with 2 Expansion Units, set the switches to use Expansion Unit 1 and Expansion Unit 2.

Description	SW1-7	SW1-8
Master	**Off**	**Off**
Expansion Unit 1	Off	On
Expansion Unit 2	On	Off
Expansion Unit 3	On	On

Table 4 Switch Position for the Operational and Test Mode

- *Effective for **Master** Only*

Description	SW2-1
Operational	**ON**
Dedicated Test	Off

Table 5 Switch Position for On Delay

- *Effective for Master Only*

Note: The total On Delay time is the total of the minute delay setting + the On Delay Seconds potentiometer setting.

Signal Type	SW2-2	SW2-3	SW2-4
0 Minutes	**OFF**	**OFF**	**OFF**
1 Minute	Off	Off	On
2 Minutes	Off	On	Off
3 Minutes	Off	On	On
4 Minutes	On	Off	Off
5 Minutes	On	Off	On
6 Minutes	On	On	Off
7 Minutes	On	On	On

Table 6 Switch Position for Off Delay

- *Effective for Master Only*

Description	SW2-5
2 Seconds	**ON**
5 Seconds	Off

Table 7 Switch Position for Defining Quantity of In-Service Relays

- *Effective for Master And Expansion Units*

Description	SW2-6	SW2-7	SW2-8
8 Relays or All Available	**OFF**	**OFF**	**OFF**
1 Relay	Off	Off	On
2 Relays	Off	On	Off
3 Relays	Off	On	On
4 Relays	On	Off	Off
5 Relays	On	Off	On
6 Relays	On	On	Off
7 Relays	On	On	On

- SW2-6 through SW2-8 are set to OFF as a default for both the 4 and 8 relay models. On the 4 relay model, all OFF, as well as any switch configuration greater than 4 is recognized as using 4 relays.

Alternate Function Relays

The last 3 relays on an 8 relay board have an alternate function, which is made available when the relay is not designated as in-service. The 'Quantity of In-Service Relays' must be set to a quantity that allows for the desired alternate function to operate.

The output of any of the Alternate Function relays is a closed contact to the 'RLYCOM' terminal tab #6 in all cases, which is typically connected to L1

For systems requiring additional output stages, simply cascade of up to 3 additional SLC4000 units. Be sure to observe the pilot rating of the relays.

Any On Alternate Function – Relay #8

This relay turns on whenever there is one or more operational relays on, and is available when the'Quantity of In-Service Relays' is 7 or less. See Table 7, above for 7 relay setting. This could be used to signal or operate a circulating pump or drive an external indicator, for instance.

All Off Alternate Function – Relay #7

This relay turns on whenever there are no operational relays on, and is available when the 'Quantity of In-Service Relays' is 6 or less. The AnyOn Alternate function for relay #8 is also enabled. . See Table 7, above for the 6 relay setting. This output could be used to signal a Building Automation System or to drive any external indicator or alarm.

System Fault Alternate Function – Relay #6

This relay turns on whenever there is a detected system fault. It is available when the 'Quantity of In-service Relays ' is 5 or less. See the on-board Status Led to determine the actual detected fault. The AnyOn and AllOff Alternate functions for relays #8 and #7, respectively, are also enabled. See Table 7, above for the 5 relay setting. This output could be used to signal a Building Automation System or to drive any external indicator or alarm.

Building Management Interface (BMI) Expansion Relays

Effective for firmware version V4.60 and above, a standard SLC4000 may be used in our Building Management Interface system to provide up to 8 additional relays. This special mode is set when the configuration switches are set for "BMI Expansion Relays" per Table 8 AND Table 3.

Compatible Input Signal Types

Standard Voltage Inputs

Standard Voltage Inputs are supported directly by a dedicated setting found in the Table 1 'Switch Combinations for Various Command Input Types'

- 0-5 VDC
- 0-10 VDC
- 2-10 VDC
- For other voltage inputs not listed, use the User-Defined Input Configuration

Standard Current Inputs

Standard Current Inputs are supported directly by a dedicated setting found in the Table 1 'Switch Combinations for Various Command Input Types'

- 4-20 ma DC
- For other current inputs not listed, use the User-Defined Input Configuration

Ohmic (Slidewire) Inputs

The ohmic input is for variable resistance devices, (including 0-135 ohm slidewire), with the following characteristics:

- Provides 3 wires for connection
- Has a total resistance from end point terminals between 100 and 5000 ohms.
- Has a resistance at the minimum setting that provides the desired output, at that setting.
- If the above requirements cannot be met, the User-Defined option may be used to provide the desired input span.

Contact Closure

A contact closure may be used to provide all-on/all-off operation.

Connect a 5K or less external resistor betweenTB2 and TB3 or connect DPST contacts with the NC contact between TB2 and TB3 and the NO contact between TB1 and TB2. SLC4040-1.50K is a suitable choice and contains a 'Y' quick connect terminal adapter for wiring ease.

User-Defined Input

Use this option for any inputs that do not match a Standard Input Configuration and meets the following requirements for the desired input type:

User-Defined - Voltage Inputs

- Any voltage between 0 and 20 VDC may be accommodated.
- Difference between upper and lower voltage is at least 2 VDC

User-Defined - Current Inputs

The current is developed across an internal 61.9 ohm resistor, when SW1-1 is ON.

- Maximum loop current is less than 80 ma DC.

User-Defined - Two-wire Resistance devices

2-wire devices, whose total resistance changes to indicate the desired proportional output, may be accommodated by adding an external resistor.

- Connect a 100 ohm resistor between TB1 and TB2.
- Connect 2-wire potentiometer between TB2 and TB3

Compatible Controllers and Sensors

The primary type of interface used with the Superstep Series 4000 is ***any*** which can provide a voltage, current, or an Ohmic Slide-Wire Resistance. This can be electronic controllers, temperature sensors, pressure sensors, or a manual potentiometer.

Suitable sensors are manufactured by Honeywell and other environmental control manufacturers.

Set the Input Configuration switches according to "Table 1 - Switch Combinations for Various Command Input Types".

- Honeywell Models T775E, T775F, T775M, T775R
  - **Use of 4-20 ma is recommended**
  - **Change the modulating output of the T775 to also be 4-20 ma**
- Honeywell Model T991A Temperature Sensor (Use Ohmic configuration)
- Honeywell Model L91 Pressure Sensor (Use Ohmic configuration)
  - Honeywell Model P7810B, Pressure Controller using 4-20ma output.
  - Resistance inputs provided by any potentiometer or slidewire device that has a total resistance of 135 to 5K ohms. All 3 wires must be connected.
  - Voltage Inputs of 0-5 VDC. 0-10VDC, 2-10VDC
  - Current Input of 4-20 ma
  - Dry Contact for All-On or All-Off operation
  - Voltage or Current compatible with the User-Defined Input Limits

Controllers NOT RECOMMENDED

Controllers which provide *simulated* 135 ohm outputs, which are usually used to control valve and damper motors ***are not*** recommended for use as the 135 ohm input to the Superstep Series 4000 controllers. Use a device which provides a compatible voltage or current output.

Proportional Load Limiting and Shutdown Function

- The Load Limiting feature limits the output to a proportional percentage of the full output capability. For instance if the load limit input signal is 75% on a 16 step system, then the maximum stages that will be energized with a maximum input signal will be ***4 steps***.

- The Load limiting input is 0 to 1.24V DC. An external potentiometer may also be used to set a proportional load limit. An integral 1.24V DC source is provided on-board to power an external potentiometer of 5K 1/2Watt or greater potentiometer.

- A normally open set of contacts may be used to command all in-service relay outputs to sequence off. A normally closed set of contacts may also be used and is described in the following paragraphs.

Table 9 Load Limit or Shutdown Function Wiring

Terminal	Alternate Designation	Signal Description	Potentiometer
TB4	B	1.24VDC Reference	CW terminal *1
TB5	X	Signal Input	Wiper
TB6	W	Control Circuit Common	CCW terminal *2

- *1 CW terminal measures 0 ohms between it and the wiper terminal, when the potentiometer knob is turned full clockwise
- *2 CCW terminal measures 0 ohms between it and the wiper terminal, when the potentiometer knob is turned full counterclockwise
- See Figure 4 Field Wiring Diagram
- Any signal between 0 and 1.24VDC may be used at TB5, referenced to TB6.
- For use with a 4-20 ma signal, connect a 61.9 Ohm 1% resistor between TB5 and TB6, and program the 20% offset option.. See '20% Offset (4-20ma) Option for Load Limit Input

The Load Limit Input may also be used as a **Shutdown Input or a Low Water Shutdown**.

- Connect a set of Normally Open contacts between TB4 to TB5.
- When the contacts close, all outputs will sequence off.

OR

- Connect a set of Normally Closed contacts between TB5 and TB6.
- Connect a resistor between TB4 and TB5. The resistor value may be any value between 100 and 5K ohms.
- SLC4040-1.50K resistor kit is a suitable choice.
- When the contacts open, all outputs will sequence off.

See "SLC4000Addendum_ LoadLimitCfgs.pdf" available at www.selectronix.us for additional instructions for

- 0-10 VDC
- 0-5 VDC
- 4-20 ma

Programming The User-Defined Levels or Options

There are 2 values that the user may store in non-volatile EEPROM. These values are interpreted differently, based on the Input Configuration switch settings.

General Steps To Program the User-Defined Levels

- Determine a method of producing the applicable voltage or current level.
- If it is not convenient to use the actual field-wired source to produce the appropriate levels, then a potentiometer or an alternate signal source may be temporarily substituted to produce the equivalent levels.
    - Turn the control power off, and disconnect any wires connected to TB1, TB2, and TB3.
    - Connect the signal source or potentiometer in place of the actual source.
- Set the Input Configuration switches to Program the User-Defined values

Table 10 Switch Position for Programming the User-Defined Values

Signal Source	SW1-1	SW1-2	SW1-3	SW1-4	SW1-5
Potentiometer	Off	Off	Off	Off	Off
Max voltage less than or equal to 5 VDC	Off	Off	Off	Off	Off
Max voltage greater than 5 VDC	Off	On	Off	Off	Off
Current less than 80 ma DC	On	Off	Off	Off	Off

- Apply control power, and verify the status LED is flashing Red, then Green, at 5 flashes in 10 secs, indicating the *programming mode.*
- Set the Input voltage, current, or other value for the User-Defined **Upper Limit**
- To Program an Upper Limit Value: Press and hold the **Test Up** pushbutton for greater than 1 second, until the status LED turns off, then cycles Grn, Org, and Red. It returns to flashing Red and Grn.
- Set the Input voltage, current, or other value for the User-Defined **Lower Limit**
- To Program an Lower Limit Value: Press and hold the **Test Dn** pushbutton for greater than 1 second, until the status LED turns off, then cycles Grn, Org, and Red. It returns to flashing Red and Grn.
- Turn off control power
- Set the Input Configuration switches to the desired setting.
- Re-connect the normal sensor inputs, as required.
- Test and verify the User-Defined levels or options are as desired

User-Defined Signal Input Details

- Use the applicable Input resistors, connected by SW1-1 and SW1-2 to produce a voltage between 0 and 5 VDC, as seen by the microcontroller.
- SW1-1 connects a 61.9 ohm resistor from TB2 to signal common. The voltage developed across this resistor is directly sensed by the microcontroller, and is typically used for current loop inputs. This allows a current range of up to 80 ma DC.
- SW1-2 connects a 2K ohm resistor to signal common. A series 5.9K resistor is in series

Integrated Vernier Output and Operation (Optional)

An optional integral vernier output of 0-10VDC into a minimum load of 5K ohms, is available to drive SCR or SSR power modules, providing full 0 to 100% modulation of the load. The output is proportional to the fractional unit-step load.

A load of up to **2 *times the unit-step*** load may be controlled by the vernier output. Potentiometer RV2 adjusts the vernier output to match the unit-step load when between steps, providing a 'bumpless' transition between steps. When all steps are on, the output modulates to full on.

When RV2 is full CCW, the setting is for a vernier load of 2 times the unit load, which corresponds to the Minimum gain.

For other vernier loads, adjust RV2 such that the interstep output of the vernier is equal to the unit-step load, just before the next relay stage is turned on. CW rotation increases the vernier output.

LED, DS9, illuminates in proportion to the vernier output.

The connections are TB7 (+), also labeled 'V' and TB8 (-), also labeled 'X'.

- **Order Part Number SLC40xx-8-01 for vernier output and standard Load Limit circuit**
- **Order Part Number SLC40xx-8-03 for vernier output with pre-programmed 4-20ma Load Limit input**
- **Where xx is 00 or 24**

Accessories and Cables

Cascading Cable - SLC4020-x (x is indicates length of cable in feet)

A separately ordered Cascading Cable is required to connect SLC4000 units, Process Gateway (SLC4060), and Touchscreen Gateway (SLC4075). Standard lengths are 1, 2, 3, 6, 10, 20, 1nd 35 feet. Alternately, a standard CAT-5 Ethernet patch cable may be used.

Remote Indicator Panel SLC2170-xx (x is quantity of LEDs between 01 to 12)

A Remote Indicator Panel provides LED indications of output stage status at a remote location.

The Panel consists of a printed wiring board and an acrylic plastic cover suitable for mounting behind a cutout on the control cabinet. The Panel is available with up to 8 LED's to match the quantity of stages located on the attached Control or Expansion Unit. A 6 foot flat cable is included with the Remote Indicator Panel.

Remote Indicator Panel Cable SLC2197

The Remote Indicator Panel Cable is a 6' 14-conductor flat cable with strain-relieved connectors at each end. It is used to connect the Remote Indicator Panel to a Master Unit. A 6' cable is included with the Remote Indicator Panel option.

Resistor Adapter Assemblies – SLC4040-xxx

Resistor adapter assemblies with different resistor values are available for applications that require an externally mounted resistor. The resistors are supplied with female quick-connect terminals and an insulated male quick-connect tab for the field connection. Also included are 2 quick-connect terminal adapters that provide 2 male connections for the single male tab, for a choice of field wiring preferences.

NEMA4X Enclosure – SLC4010

A NEMA4X enclosure which includes mounting studs to accept an SLC4000. The cover is transparent, so the relay and status indicators are readily visible. See SLC4000AddendumNEMA.pdf , available at www.selectronix.us for physical dimensions and other optional items.

Operating Modes

Operational - Normal Proportional Output Mode

- The Status LED on the Master Unit flashes:
- Green, at 5 flashes in 10 seconds to indicate that the system is in a balanced or quiescent state.
- Green, at 20 flashes in 10 seconds to indicate that the system is in the timing mode before changing the quantity of output stages.

Some features that apply when expansion units are used in a system:

- If the Expansion unit detects a loss of communications with the Master Unit, it sequences its own relays off in a graceful shutdown, turns on the flashing red status indication, then waits for resumption of Master Unit messages. If communications are restored, the Expansion Units will gracefully resume normal operation.
- Expansion Units detect loss of communications within approximately 10 seconds.

Operational – Transient Test Mode

The Master Unit may be put in a timed test mode by pressing either the Test Up or Test Dn pushbutton. Each time either the Test Up or Test Dn pushbutton is pressed, a one minute timer is started. For each press of the Test Up pushbutton, an additional stage is turned on, and for each press of the Test Dn pushbutton, a stage is turned off, until no stages remain on. When the Master Unit is in the Operational Test Mode, the status LED indicator blinks orange at a varying rate. The blink rate increases, as the time moves closer to the unit returning to the normal operating mode. Additional presses of either Test Up or Test Dn pushbuttons reloads the Test Mode timer.

Dedicated Test Mode

SW2-1 in the OFF position is used to select the Dedicated Test Mode. The dedicated test mode turns on an additional stage for each press of the applicable pushbutton. If the pushbutton is held down continuously for more than 2 seconds, the Master Unit enters an automatic Test Up mode, where the stages turn on sequentially, with no further pushbutton presses, until all the stages are on. Likewise if the Test Dn pushbutton is held continuously for more than 2 seconds, the Master Unit enters an automatic Test Dn mode, where the stages are sequentially turned off, until all the stages are off. When the Master Unit is in the Dedicated Test Mode, the status LED indicator blinks orange at a constant 5 flashes in 10 seconds.

Status LED Indications and Flash Rates

A single led capable of displaying green, orange, and red indicates various operating conditions.

Table 11 Status LED Indications and Flash Rates

Color	Flashes in 10 Sec	Flash Frequency	Description
Green	5	½ Hz	Quiescent Normal Operating condition – Master
Green/Orange	5	½ Hz	Quiescent Normal Operating condition – Expansion Unit
Green	20	2 Hz	Transient Normal Operating condition – System is in the OnDelay, or OffDelay timing prior to changing the quantity or relays activated.
Orange	5	½ Hz	Dedicated Test Mode
Orange	Slowly increases from 5 to 50	Between ½ and 5 Hz	Operational Test Mode. Higher flashing frequency indicates that the system is about to return to the Normal Operating Mode
Red	20	2 Hz	Unrecoverable Fault Condition
Red	10	1 Hz	Input is out-of-range (valid for 4-20ma, 2-10V, user-defined)
Red	5	½ Hz	RS485 Fault – Expansion Unit has not received a command from Master for over 10 seconds
Red/Green	5	½ Hz	***Programming*** User-Defined Limits
Off/Green/ Yellow/Orange	Sequence		Unit is performing an Auto-recovery reset sequence, which occurs when various faults are detected: • Expansion units perform auto-reset when communication with the master cannot be detected

Physical Dimensions and Component Identification

SLC4000 Board Dimensions and Component Identification

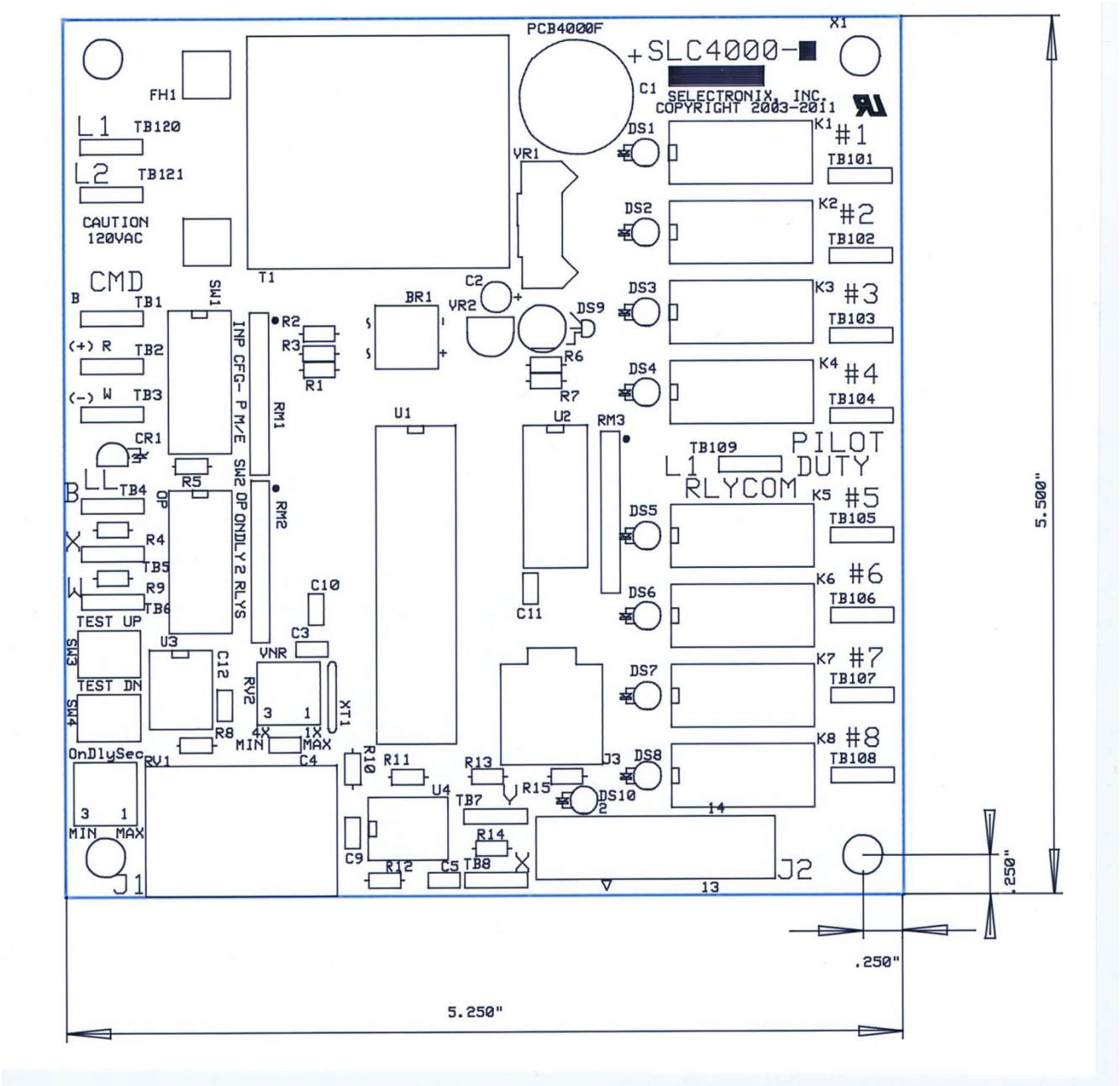

Figure 1 SLC4000 ASSEMBLY

APPLICABLE MODEL NUMBERS: SLC4000-x

SLC2170 Remote Indicator Panel Board Dimensions and Component Identification

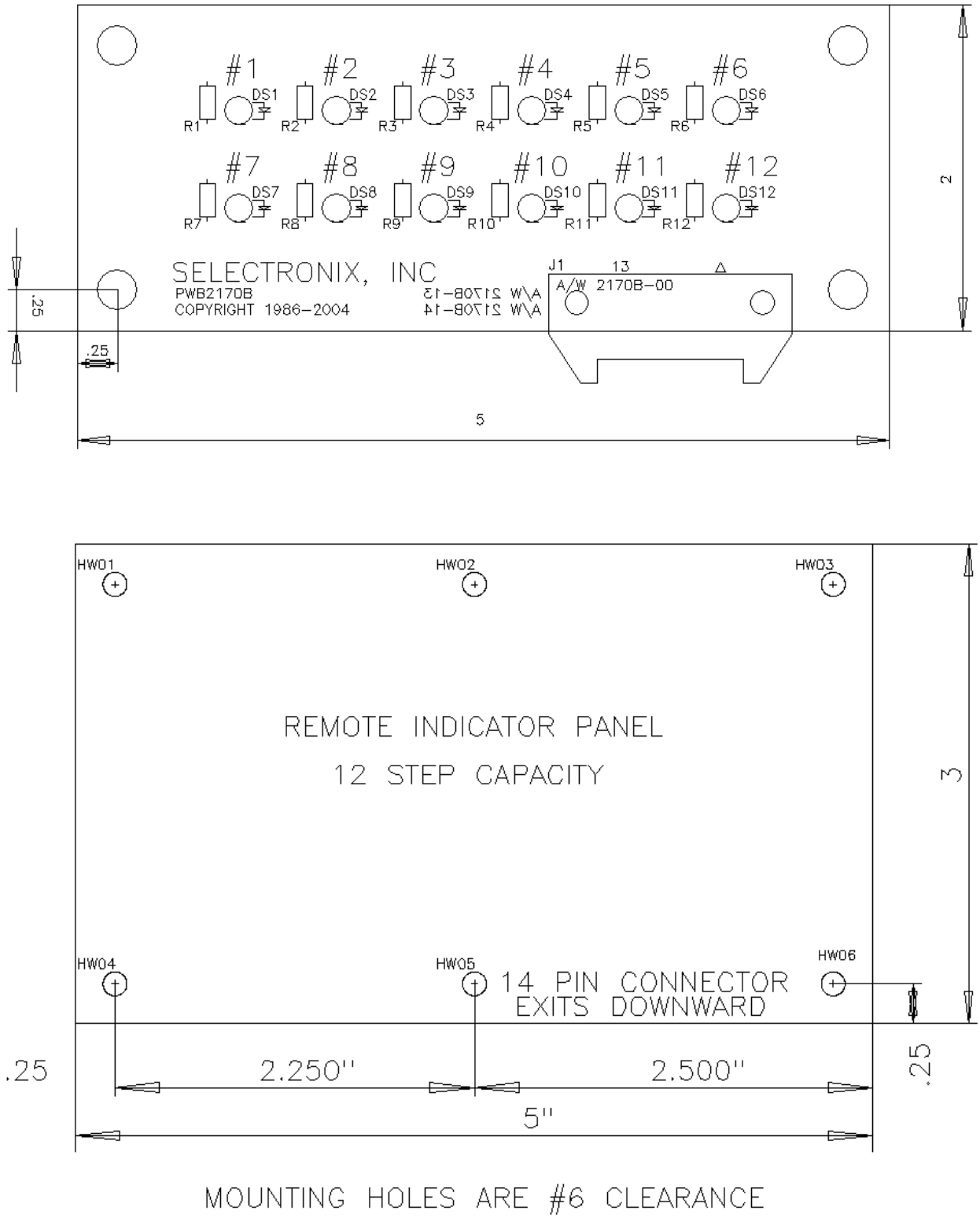

Figure 3 REMOTE INDICATOR PANEL MOUNTING HOLES

Physical and Electrical Installation

- Review all installation and wiring instructions thoroughly before proceeding.
- Inspect all SLC4000 units for any physical damage.
- Verify that the operating ambient temperatures will be within -40 to 80 degrees C. (32 to 176 degrees F).
- Mount the Master Unit by using 6-32 machine screws in the standoffs provided. See Figure 1 for the physical mounting dimensions.
- Mount the Remote Indicator Panel behind a 2" x 4" rectangular cutout, using the six #6 holes provided. See Figure 3 for the physical mounting dimensions.
- Verify the proper setting of all switches on the controller. See section 'Unit Configuration'
- Connect multiple units together using a Cascading Cable.
- **Verify that only 1 of the units is configured as a Master, and the remaining units are configured as Expansion Units. Each Expansion Unit must be configured with a unique unit number using the on-board configuration switches. Do not have line power applied, while configuring or connecting the units!**
- Verify that all interconnecting wiring is sized and installed in conformance with the National Electrical Code (NEC) and other applicable local codes.
- Connect the appropriate sensor or input signal to the Master unit per the wiring diagram shown in Figure 3 being careful to observe polarity.
- DO NOT route any of the low voltage signal wires that are connected to TB1 through TB8 or any cascading cables near the AC power lines, either incoming or especially the switched output from the relays.
- See the shielding and grounding considerations in the section 'Field Wiring'.
- Connect the Vernier Output (optional) to an SCR module, being careful to observe polarity and wire routing, as these are low voltage signal wires.
- Connect the cable from any Remote Indicator Panels, if used, and observe low voltage wiring precautions.
- **For multi-unit configurations, apply AC power and verify that the Master Unit status LED is flashing GRN, and that all Expansion Units are flashing GRN/ORG.**

Building Management Interface - Important Safety Limit Wiring Instructions

In order to provide for de-activation of relay outputs (SLC4000) and flame enable output (SLC4000-1)

- Provide continuous AC power to the master SLC4000 .
- On the master SLC4000, connect the AC power, switched by the limit string, to RLYCOM, TB109.
- On all expansion SLC4000s, connect the limit string AC power to the L1 terminal.
- The SLC4000 receives limit alarm status for GPDI inputs designated as Alarm inputs and rapidly sequences all outputs off.
- If an auxiliary controller is connected to the command input terminals of the master unit, ensure that its output is set to 0 on a limit alarm.
- The zero command ensures that all relays, vernier outputs, and flame-enable signals are de-energized for a zero-load restart when the limit alarm is resolved.

Field Wiring

Input Terminal Designations

The following 2 tables show the terminal designators and signal polarity for the input terminals.

Honeywell terminal references for their electronic controllers are NOT connected using the same lettered terminals, whereas their non-electronic controllers do match. Refer to the table to make the proper connections. Using the T775 4-20ma output provides the most accurate output.

Honeywell –Selectronix Terminal Designations

Table 12 Honeywell T775-Selectronix Terminal Designation Cross-Reference

Function	Honeywell Labels		Selectronix Labels	
Command Input (+)	1	W	TB2	R (+)
Command Input (-)	2	R	TB3	W (-)
No Connection	3	B	TB1	

Table 13 Honeywell Non-Electronic Controllers

Function	Honeywell Labels	Selectronix		
Reference Voltage	B	TB1	B	SLC2100 1.0VDC (+) TB3 (-) SLC4000 1.2VDC (+) TB3 (-)
Wiper Input	R	TB2	R	
Signal Common	W	TB3	W	

Shielding

Shielded twisted pair wire is recommended for wire runs which are in close proximity to power wiring or other sources of electromagnetic interference (EMI).

When using shielded wiring, the shield should only be terminated at one end to prevent ground loop currents. Preferably terminate the shield at the source end's signal common. 2nd choice is to terminate the source end to earth ground. 3rd choice is to leave both ends of the shield unterminated. EMI may originate from conducted, induced, or capacitive sources.

Route signal wires away from the AC control power and relays outputs.

Grounding

The low voltage circuit common on the Selectronix Superstep controllers is TB3, and TB6. It is isolated from the line control voltage and relay connections. Connecting the low voltage circuit common to earth ground is optional, however extreme care must be taken not to introduce ground loops. Verify that all field wiring is in accordance with local electrical codes.

Vernier Wiring

Connect the integral vernier output to a suitable SCR power module or any other device which accepts 0-10 VDC, being careful to observe correct polarity. Refer to Figure 4, Field Wiring Diagram.

Connecting Expansion Units

Master Units are connected to Expansion Units by using a cascading cable, SLC4020-x. (See section titled 'Cables') All connections between units should be done with AC power OFF. Either port on J1 may be used for interconnections.

Heating Versus Cooling Operation

The default operation for many temperature and pressure controllers is to provide an increasing signal when additional heat is required. The default operation of the SLC4000 is compatible with this default. For cooling operation, the opposite operation is required and can be easily accomplished.

1) For electronic controllers, set the mode to provide an increasing signal for increasing temperature.
2) For ohmic and 135 ohm slidewire devices, swap the connections to TB1 and TB3.

SLC4024 Versus SLC4000 Field Wiring

Substitute 24 V ac/ 28 V dc in place of 120V ac. Maintain the "common" side of the 24V ac for all controls. **The 24V ac common (L2) is connected directly to our signal common.**

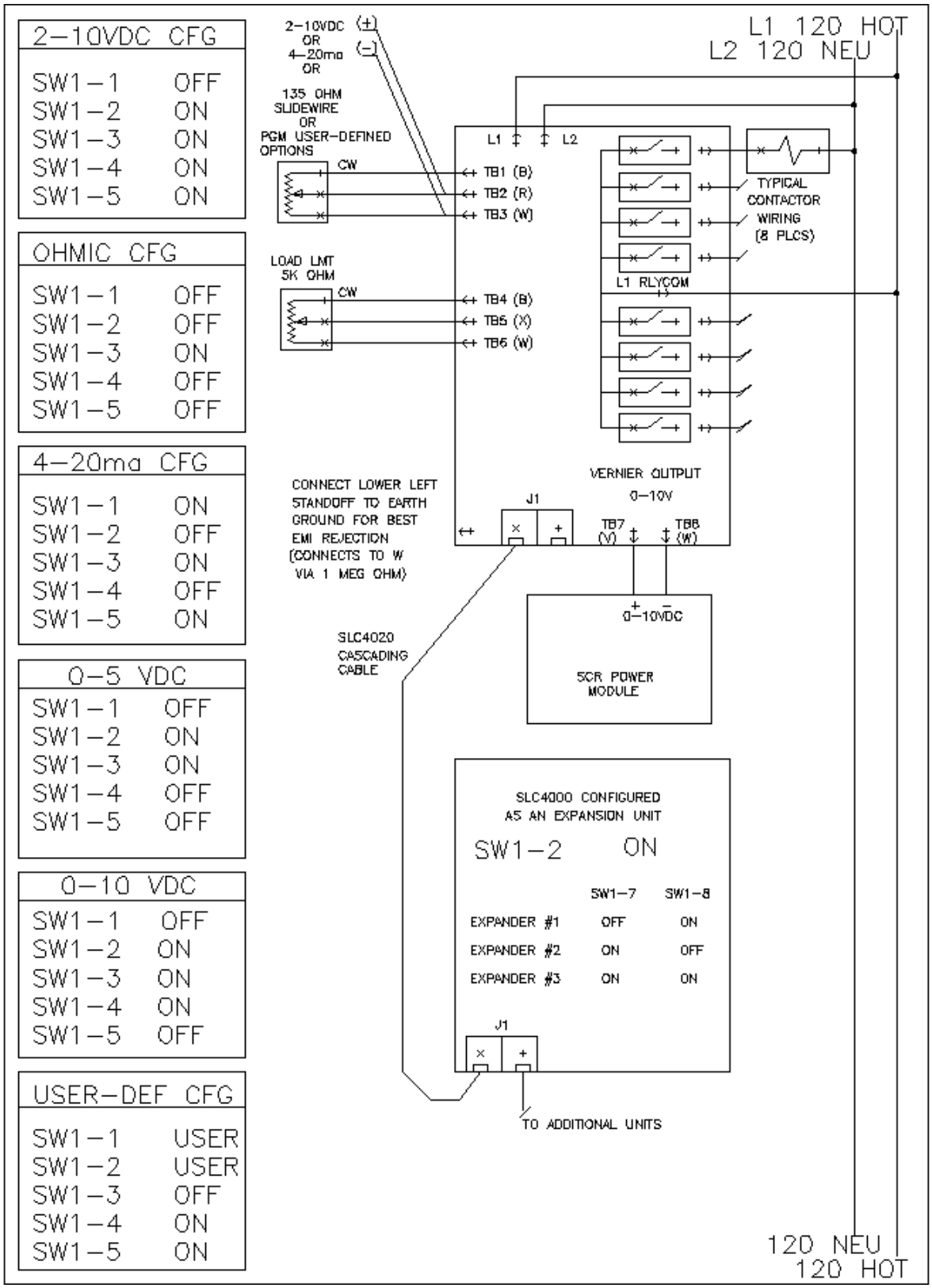

Figure 4 FIELD WIRING DIAGRAM

Startup and Adjustments

- Verify that all configuration switches are set as desired.
- Verify that the wiring is in accordance with Figure 4, Field Wiring Diagram.
- Verify that the On Delay Timing switches are set as desired, along with the OnDelaySeconds Adjustment RV1, and Off Delay Timing Switch.
- Make all RS-485 connections while the AC power is OFF.
- If Expansion Units are used in the system, verify that there is only 1 unit configured as the Master Unit and that each of the Expansion Units has a unique address, as set by the configuration switches.
- ***Verify the wiring in the remainder of the Control System before energizing the line power.***
- Apply line power to the Control System.
- If Expansion Units are used in the system, verify that the Master Unit's Status LED blinks Green/Off. Verify the Expansion Unit's status LED blinks Green/Orange.
- The Test Up pushbutton may be operated to turn on the relays, and the Test Dn pushbutton may be operated to turn off the relays.
- Verify the operation of the input signal by simulating the signal or by stimulating the transducer to produce a test output.
- Turn the line power off.

Fuses

- A single 2A fast-blow fuse is used on each Control or Expansion Unit. In the unlikely event one should fail, turn off the line power to the Control System and replace the failed fuse with an identical or equivalent type.
- A Littelfuse 312002 or Bussman AGC 2A are suitable replacements

TROUBLESHOOTING

Table 14 Troubleshooting

SYMPTOM	POSSIBLE CAUSE	REMEDY
Output stages do not turn on and Status LED not flashing	Fuse blown	Replace F1
Output stages do not turn on and Status LED flashes green at 20 flashes in 10 second.	Step command circuit latched.	Cycle power to the SLC4000. Check that step command input wires are routed away from AC power wires, especially the AC wires from the pilot relays to the contactors. Install SLC4042 Input protection diode on TB2 and TB3
	On Time delay set too long	Select the desired delay by setting the applicable switches for full On Delay Minutes and potentiometer RV1 for On Delay Seconds
	TB109 RLYCOM not connected	Connect to L1
Output stages do not turn on and Status LED flashing red at 10 flashes in 10 seconds.	Input is out-of-range for offset inputs, such as 4-20ma or 2-10VDC.	Verify that the step command source is providing a signal that matches the input configuration switch settings.
Output stages turn on, but the contactors do not energize.	No connection to TB109, which is the common terminal for all the relay contacts. It is normally connected to the coil voltage source.	Wire per Figure 4 verifying a matching contactor coil voltage.
All stages do not turn on at maximum command	Signal source is not producing the full range for the input configuration switch settings	Verify the desired input configuration switch settings
	A load limit signal is preventing the expected output.	Re-test with no load limit signal
All stages turn on before maximum command	Input configuration switches incorrectly set	Verify Set the configuration switches
Status LED periodically displays the sequence of Off/Green/Orange/Red. Unit is performing an auto-reset sequence in attempt to recover from various fault conditions. • An expansion unit performs an auto reset when it does not detect communication with the master	Communication with the master has been interrupted.	Cycle incoming power to all the SLC4000 units. If indication persists, disconnect the faulty unit's power and cascading cables. Re-connect cascading cables to any remaining good units. It is then possible to continue operating with the remaining units without any re-configuration, with a diminished temporary capacity.
Status LED is flashing red at 20 flashes in 10 seconds.	A fault has been detected.	Cycle incoming power to the SLC4000. If indication persists, the unit must be replaced.

Troubleshooting Tips

- Verify that the problem is not in the field wiring to the controller by verifying that the signal at the sensor is the same as at the controller terminals.

- Isolate the source of the problem to being either internal or external to the controller by disconnecting the external wiring, and driving the controller with a local input source.

- Temporarily change the Input Configuration switches for ohmic, if not already using this configuration.

- Connect a Test potentiometer with a total resistance value of between 100 and 5000 ohms, 1/2 watt or greater. Connect the CW terminal of the pot to TB1 (1.24 volt reference), the wiper to TB2, and the CCW terminal of the pot to TB3 (circuit common).

- Turn on the AC power. Rotate the potentiometer and monitor the quantity of relays and LEDs, which are activated. The quantity of LEDs should be proportional to the input signal. T2 may be monitored for a voltage between 0 and 1.24 VDC, which indicates the proportional amount of output stages to be activated.

- If the trouble appears to be in the controller or any attached expansion units, isolate the problem to being a Master or Expansion unit problem. **Turn off the power**, and then disconnect the cascading cable to the Expansion Units. Test the Master Unit as a stand-alone controller. If the unit operates normally, then the problem is in the communication link or in one of the Expansion Units.

- Connect a single Expansion unit to the Master, and retest. Repeat for all Expansion Units to isolate between individual units, and individual cables.

- If the problem is isolated to a specific cable or unit, re-configure the Master Controller for the applicable Input Configuration. Re-connect any functional Expansion Units. The system may still be operated in the stand-alone mode or with a partial amount of Expansion Units, until the defective parts are repaired or replaced.

- If the status LED shows the normal status, but the unit does not sequence up on demand, verify that the AC wiring is NOT routed near the low voltage command signal. Care must be taken when terminating the shield. The shield should be terminated using one of the following methods, in order of preference:
  - 1) the signal source's signal common
  - 2) earth ground
  - 3) left totally unterminated.

  The best choice is dependent on the characteristics of the individual installation.

SPECIFICATIONS

Table 15 Electrical and Physical Specifications

POWER:	SLC4000-xxx-yyy : yyy = 120 or none — 120 V ac +/- 10% @ 15 VA max.,50/ 60 Hz. yyy = 12 — 12V ac 15VA max 50/60 Hz 15V dc +/- 10% SLC4024-xxx yyy = 24 — 24V ac +/- 10% @ 15 VA max., 50/60 Hz 28V dc +/-10% @ 15 Watts
FUSE:	2A Fastblow, Littelfuse 312002 or equivalent. Bussman AGC 2A or equivalent
TEMPERATURE:	Storage: -55 to +150 Deg C Operating: -40 to +80 Deg C
INPUT:	**MASTER and EXPANSION UNITS:** • Slidewire Sensor, 0 ohms to anything between 100 to 5K ohms. Minimum resistance does not have to be 0 ohms. Output at minimum position is proportional to the total resistance ratio. • Potentiometer, 0 ohms to anything between 100 to 5K ohms • Voltage: 0-5VDC, 0-10VDC, 2-10VDC or User-defined between 0 and 20VDC • Current: 4-20 ma, or user-defined between a 0 and 80 ma DC through 62 ohms • Closed contact • Load Limiting from 0 to 100% See Table 10 for wiring details
RELAY OUTPUT:	Relay Contact, Pilot Duty • Contact Rating: 5A @ 250 VAC, 5A @ 30 VDC • Limit continuous load to 135VA per relay
VERNIER OUTPUT:	• 0 to 10 VDC into >=1K ohms • Potentiometer adjustable for 1 to 2X unit-step loads
FIELD WIRING:	• 1/4" quick-connect male terminals provided for all connections. • RJ-45 type connectors are used for interconnections between Master and Expansion Units.
STEP TIME:	• On Delay, Adjustable from 1 sec to 8 minutes, programmed by on-board switches for integral minutes from 0-7, and a potentiometer to provide the fine adjustment for seconds, which are added to the minutes delay. • Off Delay, selectable between either 2 or 5 seconds using an on-board switch.
SIZE:	Master Unit is: 5.50" height by 5.25" width by 2" max.