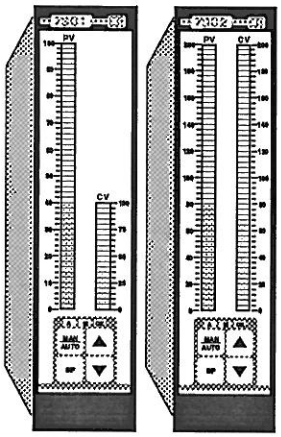
PRODUCT OVERVIEW
7300 Series Loopmate



Description

The 7300 LOOPMATE products are designed to provide automatic and hard manual back-up for process loop control systems. The LOOPMATE is a passive device which installs between the controller and the process loop. During normal operation, the LOOPMATE is transparent to the controller. Should the controller fail, the LOOPMATE maintains a stable control signal until the problem can be corrected. The user may select either of three manual modes, default to the last valid control variable output, ramp to a preset CV output value, or default to 4mA (1.0V).

Designed for versatility, the LOOPMATE can be configured for virtually any loop control system. Because the LOOPMATE may be used to manually control the loop, it is ideal for set-up, calibration, or batch operations.

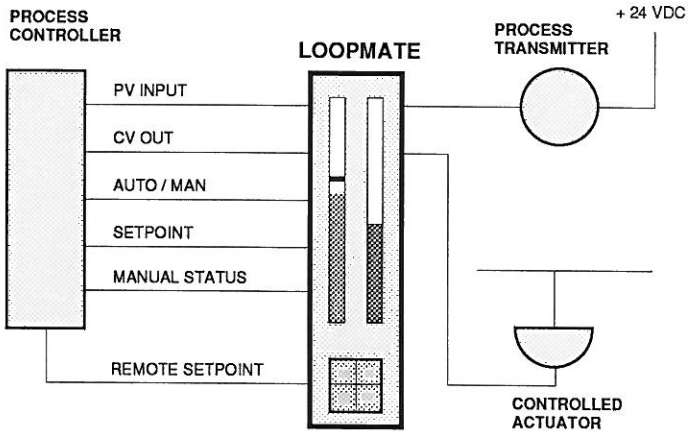
Dual front panel LED bargraphs display critical sensor and control signal variables. Options are available which allow remote setpoint change and display.

Features

- Highly visible bargraph displays
- Current or voltage mode (field configured)
- Isolated CV output in manual mode
- Low loop detect for CV input
- Variable slew rates for manual control
- Reverse acting CV output

Applications

The diagram below illustrates a typical installation of the LOOPMATE. The LOOPMATE is installed between the controller and the process loop. During normal operation, the LOOPMATE is transparent to the controller.



TYPICAL FIELD INSTALLATION

Options

Setpoint Display - Single LED bar on Process Variable Display.

Analog Setpoint Change - Accepts analog or discrete inputs and provides analog output.

Discrete Setpoint Change - Accepts analog or discrete inputs and provides discrete outputs.

Loop Integrity Block - Maintains circuit continuity when the LOOPMATE is removed from the loop.

Din Rail Block - Provides a convenient method of field wiring termination at a single point; includes loop integrity switch.

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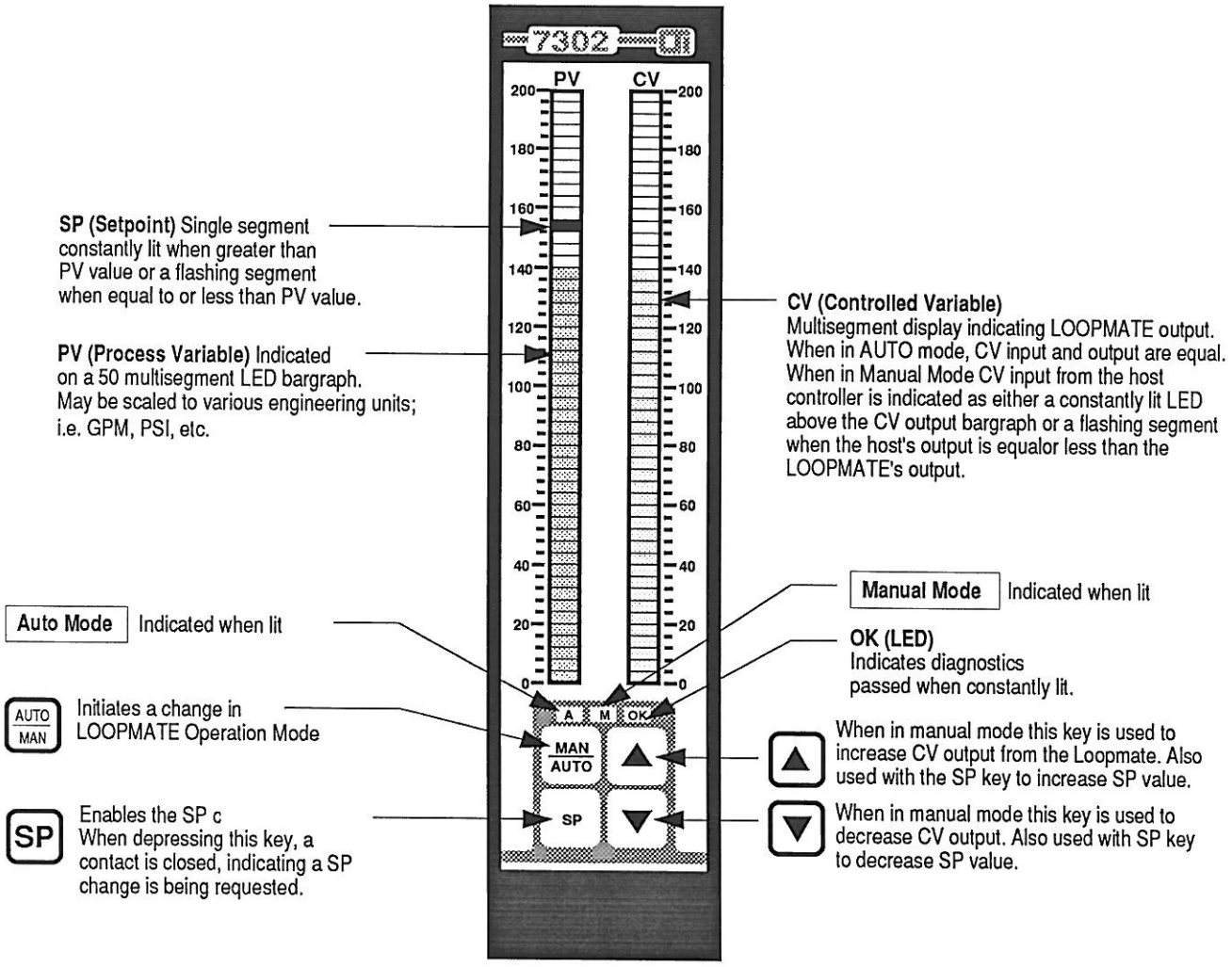
Front Panel Controls



Field Configurations (User-Selected)

The LOOPMATE may be user configured for a variety of operational modes by setting the position of internal switches and jumpers. These operational modes are summarized below:

Power Selection Switch - Power input to the LOOPMATE may be selected for 110 VAC @ 60 Hz or 220 VAC @ 50 Hz as indicated on the switch.

PV and CV Signal Current/Voltage Mode - Current or voltage mode for the PV and CV signals is selected by the placement of four internal jumper plugs. The mode selection for each signal may be set independently.

Manual Recovery - The LOOPMATE is configured so that the keypad MAN/AUTO pushbutton must be pressed to transfer from manual to automatic mode after a Hard Manual condition. The Auto/Man Select Input must be high before the pushbutton is pressed.

Automatic Recovery - The LOOPMATE automatically transfers to automatic mode after a Hard Manual condition. The Auto/Manual Select Input goes high.

Preset CV - The LOOPMATE automatically ramps the CV-Output to a preset CV value after transferring to manual mode due to a Hard Manual or Low Loop condition.

Last CV - The LOOPMATE CV-Output remains at the last valid CV-Input value monitored before a Hard Manual condition is encountered. Valid CV-Input values depend on a user selected signal range.

Signal Offset - The LOOPMATE PV and CV scales display "live zero" analog signal ranges (4-20mA or 1-5VDC). When the LOOPMATE is in manual mode, the CV-Output signal will not go below 4mA (1VDC) or above 20mA (5VDC). Current or voltage mode is user selected.

Signal Preset - The LOOPMATE PV and CV scales display analog signal ranges of 0-20mA or 0-5VDC. Current or voltage mode is user selected.

Reverse CV-Output Display - The CV scale display is reversed, i.e., a 20mA (5VDC) signal is displayed as 0% (no lighted segments). In manual mode, pressing the pushbutton actually ***decreases*** the CV-Output signal.

Normal CV-Output/Display - The CV scale display is direct-acting, i.e., a 20mA (5VDC) signal is displayed as 100% (all segments lighted).

Reverse Action PV Display - The PV scale display is reversed, i.e., a 20 mA (5VDC) signal is displayed as 0% (no lighted segments).

Normal PV Display - The PV scale display is direct-acting, i.e., a 20mA (5VDC) signal is displayed as 100% (all segments lighted).

Balance Disable - Transfer from manual to automatic mode is completed without regard to the CV-Output relative to the CV-Input. Care must be taken to manually balance the CV-Output with the CV-Input when conditions require a "bumpless" transfer. BALANCE DISABLE is primarily used when the controller performs the balancing function (usually when the controller requires a Tieback Input).

Balance Enable - The LOOPMATE will complete a manual to automatic mode transfer only if the CV-Output equals the CV-Input (plus or minus 2%). This results in a "bumpless" transfer into auto mode. BALANCE ENABLE is the normal operating mode.

Auto Balance - When a transfer from manual to automatic mode is initiated, the LOOPMATE automatically ramps the CV-Output to balance with the CV-Input before completing the mode change.

Manual Balance - CV-Output must be manually balanced with the CV-Input by using the ▲ or ▼ pushbuttons on the front panel keypad prior to a manual to automatic mode transfer.

CV Setup - This switch permits adjustment of the CV Value potentiometer for setting the Preset CV Value.

Normal CV - The CV scale displays the LOOPMATE CV-Output. This is the normal operating position.

Handshaking - Establishes a protocol for automatic-to-manual and manual-to-automatic mode transfers. This switch position enables a relay which provides a contact closure when the AUTO/MAN pushbutton on the front panel is pressed to initiate a mode transfer. Handshaking provides a means for the controller or host computer to monitor and control the operational mode of the LOOPMATE at all times. The LOOPMATE may be configured to prohibit unauthorized mode transfers from the LOOPMATE front panel and force all transfers to be "authorized" by the host.

Non-Handshaking - Permits immediate transfer to manual and automatic modes via the front panel keypad.

Hard Manual Disable - In this mode, the LOOPMATE ignores the the Auto/Manual Select Input. Mode transfers must be made via the front panel keypad. ***This mode should be used in applications where machine control over the LOOPMATE operating mode is NOT desired.***

Hard Manual Enable - The Auto/Manual Select Input is constantly monitored to determine the LOOPMATE operating mode. If the input is high, automatic mode is selected. If the input goes low, the LOOPMATE transfers to manual operation.

Slew Rate Selection - Shown inthe figure below is a table of the 4 selectable slew rates.

RATE	FULL SLEW SCALE	FULL SCALE BALANCE
RATE 1	14.12 SECONDS	32.07 SECONDS
RATE 2	12.05 SECONDS	15.49 SECONDS
RATE 3	9.09 SECONDS	5.43 SECONDS
RATE 4	6.90 SECONDS	3.52 SECONDS

Low Loop Detect Enable - The LOOPMATE is enabled to automatically transfer to manual mode and maintain a valid CV-Output signal to the controlled device when the CV-Input to the LOOPMATE falls below 3.2mA (0.8VDC). This would be the result of a failed controller output or an open CV current loop. The LOOPMATE indicates this condition by flashing the **OK** LED and illuminating the **M** on the front panel. It also signals the process controller of the mode change via relay contacts (Auto/Manual Status).

Upon transfer to manual mode, the LOOPMATE will react according to whether **Last CV Value**, or **Preset CV Value** has been selected.

After the controller output has returned to normal, transfer from manual to automatic mode may be configured for **Manual Recovery, Balance Enable**, or controlled from a remote location by selecting **Automatic Recovery**. In **Automatic Recovery** mode, the LOOPMATE will automatically balance CV-Output to CV-Input and transfer to automatic mode when the controller output returns to the valid range.

Low Loop Detect Disable - This configuration prohibits the LOOPMATE from transferring to manual mode based on the CV-Input value. If **Signal Offset** is selected, a CV-Input less than 3.2mA will cause the **OK** LED to blink indicating low CV loop current. However, the unit will remain in automatic mode. Transferring to manual mode via the front panel keypad will force the CV-Output to 4mA. This switch selection can be used with any combination of dip switch settings.

Preset CV Value - This configuration is selected when a specific controlled variable output is required during emergency or critical situations. Upon transfer to manual mode after a Hard Manual or Low Loop condition, the LOOPMATE will ramp the CV-Output to the value set by the Preset CV Potentiometer. One complete turn of the preset potentiometer changes the CV value approximately 0.8mA (0.25VDC). Settings can be verified by observing the CV bargraph or monitoring CV-Output.

Diagnostics - The LOOPMATE may be configured to run a diagnostic self test that checks for proper operation of the power supply, PV, CV-Input, and CV-Output circuitry.

7300 Series LOOPMATE Options:

Loop Integrity Block (LIB) - Allows removal of the LOOPMATE from the control circuit without interrupting loop continuity. The LIB consist of a six pole, double throw instrumentation grade switch to maintain process loop currents (PV, CV in, and CV out) when the LOOPMATE is removed.

DIN Rail Block (DIN) - Provides a convenient method of control wiring termination at a single point. Includes full-function DIN Rail Block and 3-foot ribbon cable.

Special Scales for PV/CV Bargraphs (SC) - Linear and/or non-linear Scotchcal scales in addition to those provided may be specially ordered for PV/CV displays.

19" Chassis (RCK) - Allows installation of eight (8) LOOPMATES in a standard 19" instrument rack.

Set Point Display (7300-DS) Option - This card allows the LOOPMATE to display the process controller setpoint. The LOOPMATE is furnished the process set point value via an analog signal from the controller.

Set Point Display and Change [Analog] (7300-AN) Option - This card allows the LOOPMATE to display the controller setpoint and permits an operator initiated change of this parameter from the front panel keypad. The LOOPMATE is furnished the process set point value via an analog signal from the controller. An additional analog output from the LOOPMATE indicates the current set point value as requested from the front panel keypad.

Set Point Display and Change [Discrete] (7300-DIS) Option - This card allows the LOOPMATE to display the controller set point and permits an operator initiated cahage of this parameter from the front panel keypad. The LOOPMATE is furnished the process set point value via an analog signal from the controller. Relay contacts provide indication of the status of the SP, and pushbuttons which can be used by the controller to modify its process set point.

The SET POINT DISPLAY AND CHANGE [DISCRETE] option is used primarily with Programmable Logic Controller (PLC) systems where discrete inputs are readily available and less costly than analog inputs. Although more programming support is required, this option permits flexibility in determining the rate of change of the set point value.

Multiplexed Analog Set Point Input Signals - LOOPMATES equipped with any set point option card use a "sample at strobe" technique for monitoring and displaying the process set point value via the Analog Set Point Input signal. This involves sampling the analog input only when the Set Point Strobe discrete input is high. This technique permits one analog output channel to be used as the Analog Set Point Input signal to multiple LOOPMATES, each using a separate discrete point for Set Point Strobe.

STANDARD INPUTS TO THE LOOPMATE

DESCRIPTION	ANALOG	DISCRETE
PV	X	
CV	X	
AUTO/MAN		X
FRONT PANEL LOCKOUT (not required)		X

STANDARD OUTPUTS FROM THE LOOPMATE

DESCRIPTION	ANALOG	DISCRETE
CV OUT	X	
MANUAL REQUEST (not required)		X
MANUAL MODE		X

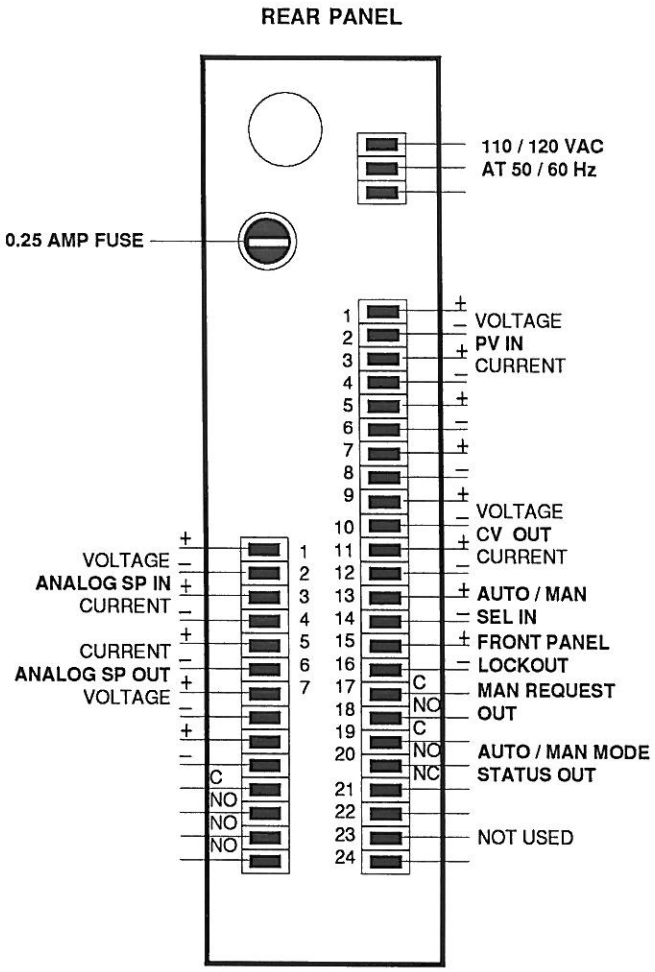
OPTIONAL INPUTS TO THE LOOPMATE

DESCRIPTION	ANALOG	DISCRETE
SP DISPLAY OPTION	1	1
SP DISCRETE OPTION	1	1
SP ANALOG OPTION	1	1

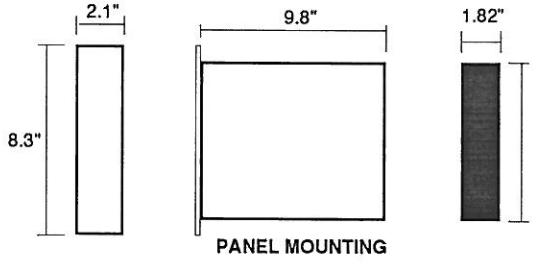
OPTIONAL OUTPUTS FROM THE LOOPMATE

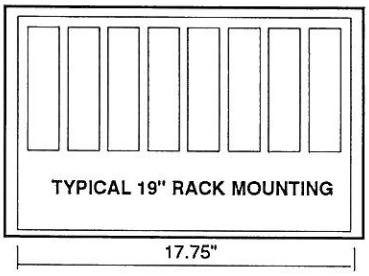
DESCRIPTION	ANALOG	DISCRETE
SP DISPLAY OPTION	0	0
SP DISCRETE OPTION	0	3
SP ANALOG OPTION	1	1

Field Wiring Connections



Mounting





Specifications

Displays

Multisegment Bargraph
- Process Variable (PV): 7301 (5"), 7302 (5")
- Controlled Variable (CV): 7301 (2"), 7302 (5")

Display Accuracy (to full scale)
- Process Variable (PV): (2%)
- Controlled Variable (CV): 7301 (5%), 7302 (2%)

Unit OK: (LED)
Automatic (A) Mode: (LED)
Manual (M) Mode: (LED)

Controls

Auto / Manual Mode: Front panel button
CV Increase / Decrease: Front panel button
Setpoint Change(optional): Front panel button
User Selectable Features: Internal dip switches
Variable Slew Rate: Internal dip switches
Power 115 / 230 VAC: Internally switched

Process Variable Input

Input Range: Current (0-20mA), Voltage (0-5 VDC)
Current (4-20mA), Voltage (1-5 VDC)
Input Impedance: Current (100 ohm ± 1%)
Voltage (500K ohm minimum)
CMRR (D.C.): Current (45 dB minimum)
Voltage (45 dB minimum)

Discrete Inputs

Range: 5 to 24 VDC
On-State Current: 24mA (maximum)
Off-State Leakage Current Allowed: 2mA

Controlled Output (Variable)

INPUT / OUTPUT
Input Range: Current (0-20mA), Voltage (0-5 VDC)
Current (4-20mA), Voltage (1-5 VDC)
Input Impedance: Current (100 ohm ± 1%)
Voltage (500K ohm minimum)
CMRR (D.C.): Current (45 dB minimum)
Voltage (45 dB minimum)

OUTPUT RANGE
Manual: Current (0-20mA), Voltage (0-5 VDC)
Current (4-20mA), Voltage (1-5 VDC)
Automatic: Same as output signal

LOAD IMPEDANCE
Manual: Current (800 ohm), Voltage (1K ohm)
Automatic: Same as input signal
Bumpless Transfer Accuracy: 1% (typical), 2% (maximum)

Manual Control

Slew Rate: Variable
Auto Balance Time: 24 Seconds (maximum)

Environment

Power Input: 15 Watts @ 115 / 230 VAC, 50 / 60 Hz
Temperature: Storage -40° to 85°C (-40° to 185°F)
Operating 0° to 60°C (32° to 140°F)
Humidity: 5% to 95% R.H. (non-condensing)
Front panel Seal: NEMA 12

CONTROL TECHNOLOGY INC. ● P.O. Box 59003 ● Knoxville, Tennessee 37950-9003 ● (615) 584-0440 ● **1-800-537-8398**

7300 SERIES LOOPMATE
USER'S GUIDE

CTI Part # 62-04-2.3

WP4.2-7300UG.23-052588

$25

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FEDERAL COMMUNICATIONS COMMISSION (FCC) STATEMENT

Warning: This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. Operation of this equipment in a residential area is likely to cause interference, in which case the user at the user's own expense will be required to take whatever measures may be required to correct the interference.

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TABLE OF FIGURES

USAGE CONVENTIONS

NOTE:

Notes alert the user to special features or procedures.

CAUTION:

Cautions alert the user to procedures which could damage equipment.

WARNING:

Warnings alert the user to procedures which could damage equipment and endanger the user.

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1. GENERAL DESCRIPTION

The 7300 Series LOOPMATE Analog Operator Interface Station provides operator monitoring and interaction that allows rapid response in routine and emergency situations. The LOOPMATE is installed between the analog process controller and the controlled field device as shown in Figure 1. When in automatic mode the LOOPMATE is transparent to the control loop, i.e., there is no degradation of the control signal generated by the process controller. When in manual mode the control signal is generated by the LOOPMATE.

The LOOPMATE's fail-safe design protects loop integrity regardless of its operational status. When no power is applied, the LOOPMATE is a totally passive device which maintains loop continuity.

The 7300 Series LOOPMATE is available in two models. The 7301 LOOPMATE has 5-inch Process Variable (PV) and 2-inch Controlled Variable (CV) bargraph displays. The 7302 has two 5-inch displays for PV and CV. Several options are available that allow tailoring to specific control applications. The LOOPMATE incorporates a splash-proof front panel with NEMA 12 rating and a slim-line enclosure that conserves panel or rack space.

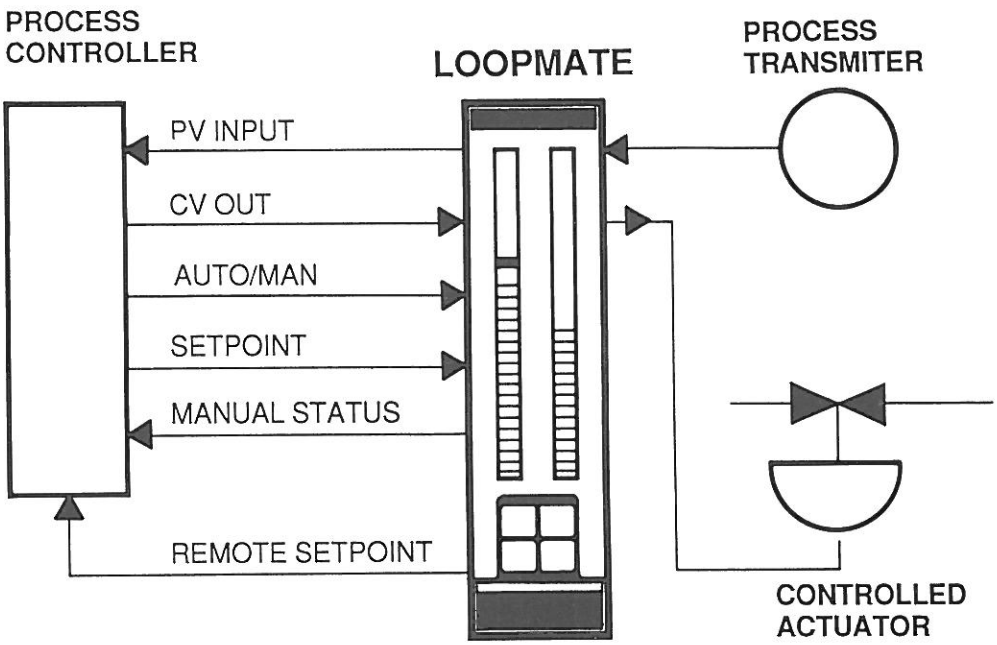

Figure 1. Typical Field Installation

2. OPTIONS

The following features are optionally available with the 7300 Series LOOPMATE:

2.1. Set Point Display (DS):

Displays set point (SP) value on the PV bargraph.

2.2. Analog Set Point Display and Change (AN):

Displays SP value on the PV bargraph and allows SP value changes to the host from the LOOPMATE's front panel using an additional analog signal.

2.3. Discrete Set Point Display and Change (DIS):

Displays SP value on the PV bargraph and allows SP value change to be initiated from the LOOPMATE's front panel using relay contacts.

2.4. Loop Integrity Block (LIB):

Allows removal of the LOOPMATE from the control circuit without interrupting loop continuity (see Figure 2). The LIB consists of a six pole, double throw instrumentation grade switch to maintain process loop currents (PV, CV in, and CV out) when the LOOPMATE is removed.

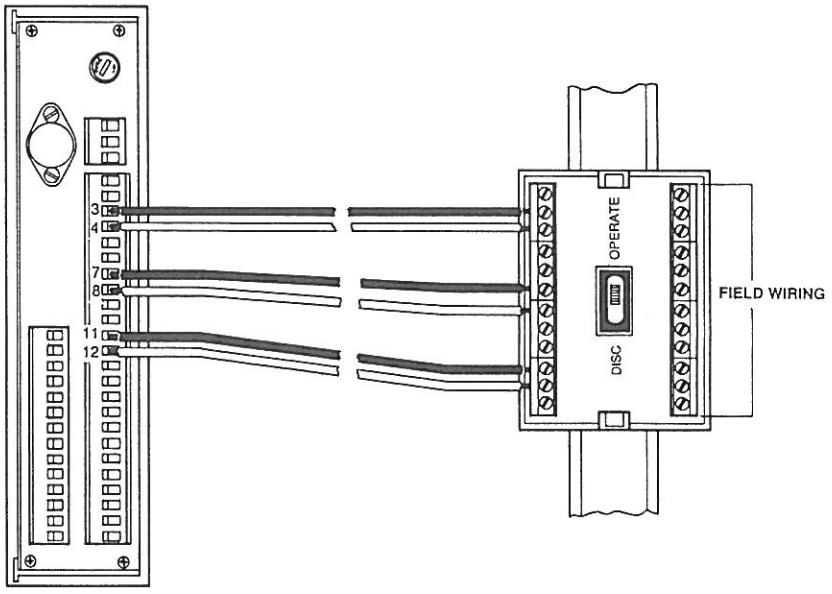

Figure 2. Loopmate Rear View with LIB

2.5. DIN Rail Block (DIN):

Provides a convenient method of control wiring termination at a single point. Includes full-function DIN Rail Block and 3-foot ribbon cable (see Figure 3).

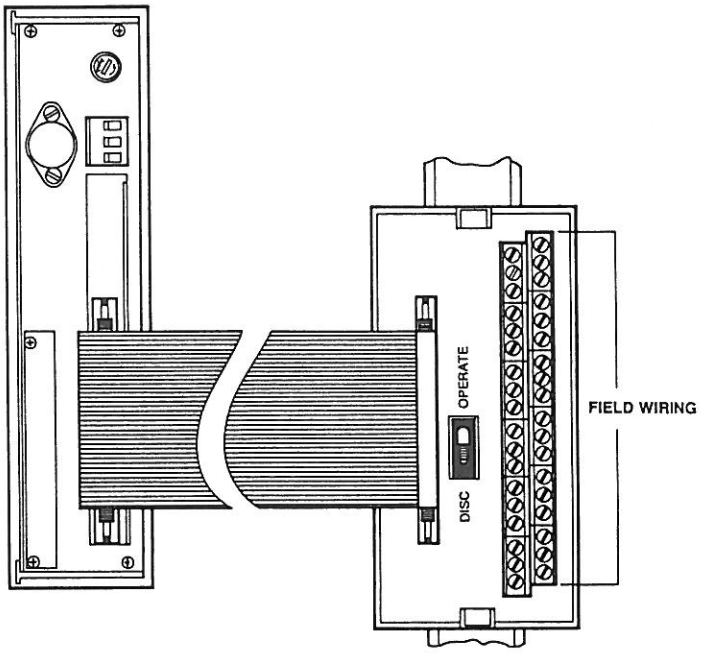

Figure 3. Loopmate Rear View with DIN Rail Connector, DIN Rail Block, and Ribbon Cable

2.6. Special Scales for PV/CV Bargraphs (SC):

Linear and/or non-linear scotchcal scales in addition to the 15 provided may be specially ordered for PV/CV displays.

2.7. 19" Chassis (RCK):

Allows installation of eight (8) LOOPMATES in a standard 19" instrument rack.

3. FRONT PANEL OPERATION

3.1. Displays

The process variable and optional set point values are displayed on the PV bargraph. The PV value is indicated by lighted segments on a 5-inch bargraph. A single segment lights steadily to indicate the SP value when it is above the PV value, and flashes when the PV value is greater or equal to the SP value. The PV value displayed represents 0-100% of the incoming PV signal from the field process transmitter. This display corresponds to 0-20 milliamps (0-5 volts d.c.), or the minimum value may be offset to represent 4 mA (1VDC). This display may be scaled in various engineering units to fit most applications; i.e., GPM, PSI, etc.

The CV bargraph displays the controlled variable input and controlled variable output signals. The CV value is indicated by lighted segments on a 5-inch (7302) or 2-inch (7301) bargraph. When the LOOPMATE is in automatic mode, the CV-Input equals the CV-Output and is displayed on the bargraph. When in manual mode the bargraph value is the CV signal generated by the LOOPMATE (CV-Output) and is operator-controlled from the front panel keypad. The CV-Input is displayed as a single LED segment. The CV value displayed represents 0-100% of the controller or LOOPMATE output signal to the controlled process. This display corresponds to 0-20 mA (0-5 VDC), or the minimum value may be offset to represent 4 mA (1VDC). This display may be scaled in various units of measurement.

The **OK** is lighted when power is applied, and the LOOPMATE internal self-diagnostic test has passed. This LED flashes to indicate an open CV loop (infinite resistance to current loop) or a microprocessor fault. If CV Signal Offset is selected (DS1 switch #3 - ON), the **OK** will flash to indicate a CV-Input less than 3.1 mA (0.78VDC), signifying an invalid signal range (see Section 5.4).

The **A** is lighted when the LOOPMATE is in automatic operation. It flashes if the internal diagnostics fail.

The **M** is lighted when the LOOPMATE is in manual mode. It flashes when the internal diagnostics fail.

3.2. Keys and Switches

The **MAN/AUTO** initiates a change in the LOOPMATE operational mode. Mode changes may be operator initiated at any time, but the actual man/auto transfer depends on dip switch settings which are user selected. See Section 5.3 for a description of switch settings and operating characteristics.

The **SP** enables the set point change option. Both analog and discrete SP change options are enabled with this key. Pressing and holding **SP** and simultaneously pressing the ∧ or ∨ key will alter the SP-Output value to the host. If no set point option is installed, **SP** has no function.

The ∧ or ∨ alters the CV-Output value when the LOOPMATE is in manual mode. If either of these two keys are depressed, the rate of change in CV-Output increases exponentially as the key is held. Small changes in CV-Output can be accomplished by toggling the ∧ or ∨ keys. Each key toggle equals about 0.125 mA (0.031VDC) so that eight toggles will light one bar on the 7301 and four toggles will light one bar on the 7302. Neither key has any effect when the LOOPMATE is in automatic mode.

4. LOOPMATE INPUTS / OUTPUTS

This section describes the LOOPMATE inputs and outputs associated with the standard units. If a set point option is included, see Section 7 for details of the additional inputs/outputs used with each specific card.

4.1. Inputs (see Figure 4)

LOOPMATE inputs provided with the standard units:

NOTE:

Discrete inputs into the LOOPMATE must be held in the range of 5-24VDC to be considered high (true). Leakage current less than 2mA is allowed from the controller outputs.

Analog input range is 0-5VDC, 1-5VDC, 0-20mA, or 4-20mA depending on dip switch and jumper position.

PV: 24-POS HEADER, POS 1-2 or 3-4
This analog signal from the user's field transmitting device indicates temperature, pressure, flow, or other process variables that must be held within certain operating parameters. This value is displayed on the PV bargraph. Wiring position selection depends on voltage/current signals (see Section 5.2).

CAUTION:

When current mode is selected for PV and/or CV-INPUT signals, the LOOPMATE input resistance is 100Ω. Excessive currents will result in damage to components and the circuit board.

<u>DO NOT</u> ALLOW THESE SIGNALS TO EXCEED 20 MILLIAMPS.

CV-INPUT: 24-POS HEADER, POS 5-6 or 7-8
This analog signal generated by the controller is monitored and displayed on the CV scale and becomes a LOOPMATE output (CV-Output) in automatic mode. Wiring position selection depends on current/voltage signals (see Section 5.2).

AUTO-MANUAL SELECT INPUT: 24-POS HEADER, POS 13-14
This discrete input to the LOOPMATE provides a means of determining controller failure and/or supervising the LOOPMATE operating mode. If Hard Manual Enable is selected (DS1 switch #0 - OFF), this input must be held high

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to keep the LOOPMATE in automatic mode. When low, the LOOPMATE is forced to manual operation. (See Section 5.3 for dip switch descriptions.)

FRONT PANEL LOCKOUT: 24-POS HEADER, POS 15-16
When held high, this discrete input disables all keypad pushbuttons on the LOOPMATE front panel.

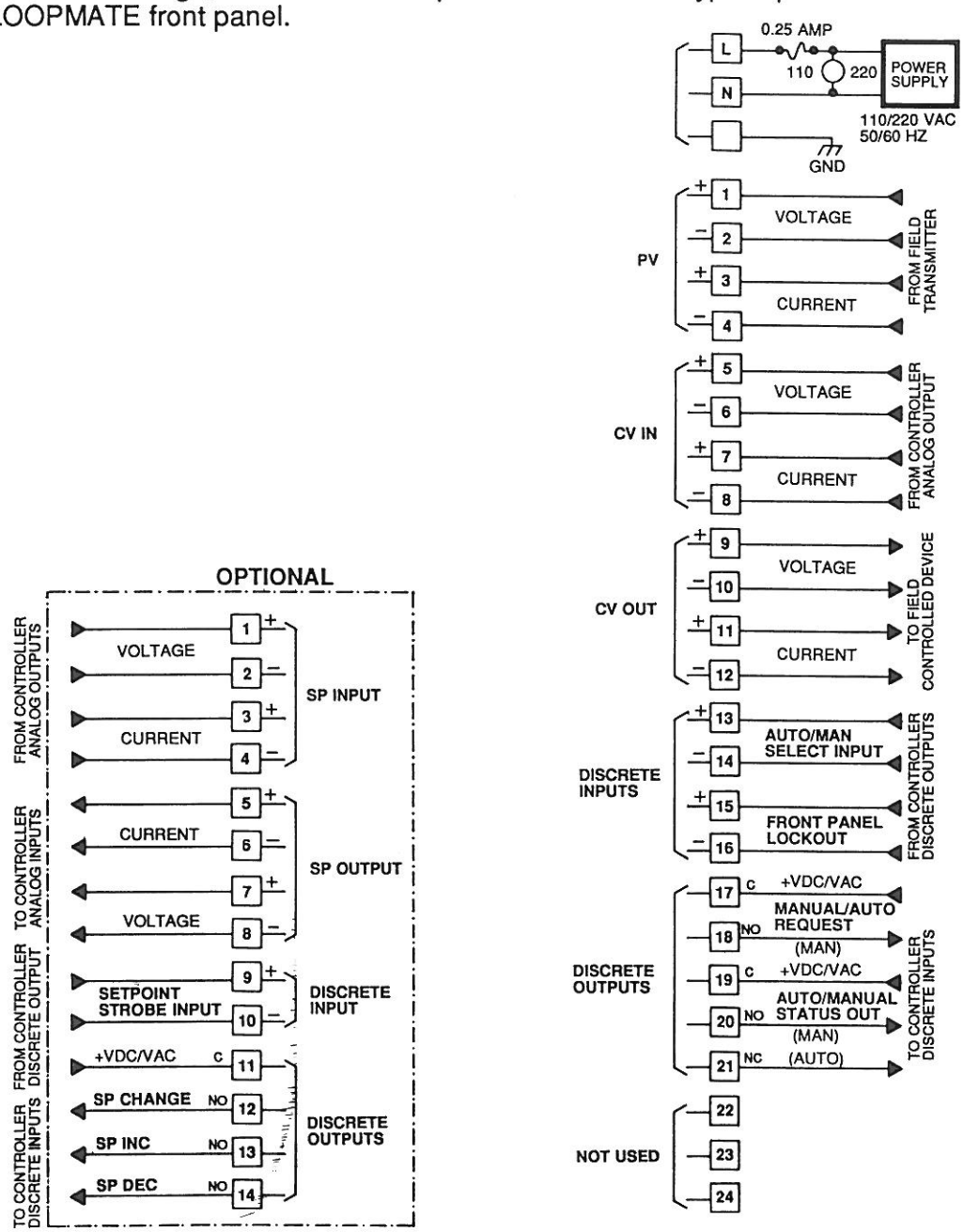


Figure 4. Loopmate Inputs/Outputs (Standard Rear Panel)

4.2. Outputs (see Figure 4)

LOOPMATE outputs provided with the standard units:

NOTE:

The LOOPMATE discrete outputs are actually relay contact closures which can switch up to 0.5A @ 125 VAC without seriously affecting contact life.

Analog output range is 0-5VDC, 1-5VDC, 0-20mA, 4-20mA depending on dip switch and jumper positions.

CV-OUTPUT: 24-POS HEADER, POS 9-10 or 11-12
When the LOOPMATE is in automatic mode, this analog output is the controller controlled variable and equals CV-Input. In manual mode, CV-Output is generated by the LOOPMATE and can be manipulated via ∧ and ∨ keys. Manual mode compliance is 800Ω (current mode). Position selection depends on voltage/current mode (see Section 5.2).

MANUAL/AUTO REQUEST: 24-POS HEADER, POS 17-18
This contact closure provides indication to the controller that a transfer from automatic mode to manual mode has been requested from the front panel keypad. This relay is enabled only by selecting Handshaking (DS1 switch #9 - ON). See Section 5.6 for Handshaking description.

AUTO/MANUAL STATUS: 24-POS HEADER, POS 19-20 (N.O.) or 19-21 (N.C.)
This contact closure allows the LOOPMATE operational mode status to be sent to the controller. Normally open (N.O.) and normally closed (N.C.) relay contacts are provided so that a "high" signal may be transmitted to the controller to indicate automatic or manual mode. The relay is in the N.C. position when the LOOPMATE is in automatic mode.

5. FIELD CONFIGURATIONS (USER-SELECTED)

Operating features that are user-selected are accessible by removing the side panel. This is accomplished by removing the retaining screw and washer on the rear panel and sliding the side panel toward the rear and off. See Figure 5 for switch and jumper locations.

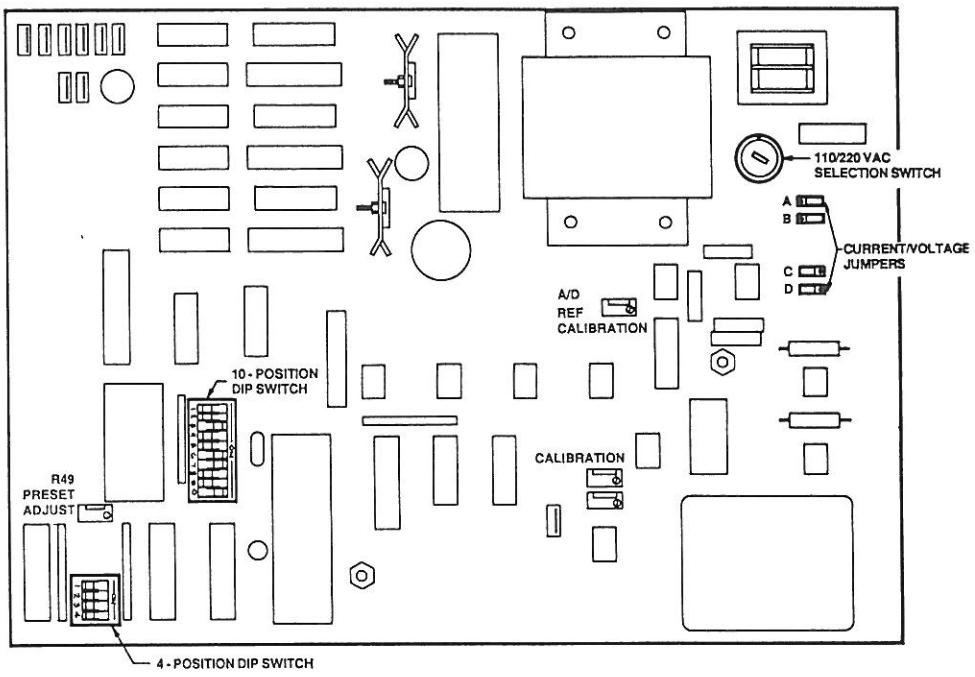


Figure 5. Switch and Jumper Locations

5.1. Power Selection Switch

Power input to the LOOPMATE may be selected for 110VAC @ 60 Hz or 220VAC @ 50 Hz as indicated on the switch. The switch is preset for 110VAC operation.

5.2. Current/Voltage Mode

The selection of current or voltage mode for the PV and CV signals is made by the placement of four jumper plugs on the main circuit board. The mode selection for each signal may be set independently. Both signals are factory set for current mode. See Figure 6 for jumper placement details.

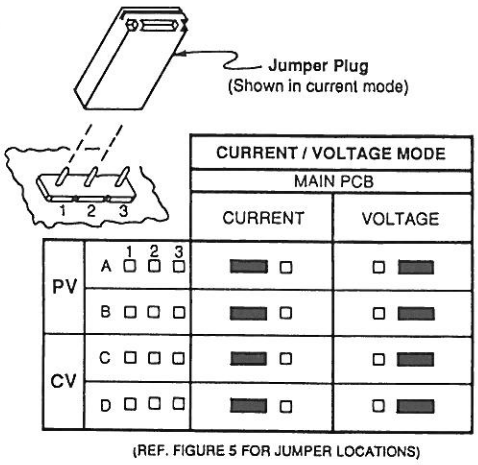


Figure 6. Current/Voltage Jumper Placement

5.3. 10-Position DIP Switch Settings (DS1)

Operating features may be selected on the 10-position dip switch (DS1) (see Figure 5). The switch positions are set as follows prior to shipping:

SWITCH	POSITION	FUNCTION
1	ON	MANUAL RECOVERY
2	OFF	LAST CV VALUE
3	ON	SIGNAL OFFSET
4	OFF	NORMAL CV OUTPUT/DISPLAY
5	OFF	NORMAL PV DISPLAY
6	OFF	BALANCE ENABLE
7	ON	AUTO BALANCE
8	OFF	CV NORMAL OPERATION
9	OFF	NO HANDSHAKING
10	OFF	HARD MANUAL ENABLE

NOTE:

The term "Hard Manual" is used frequently in describing LOOPMATE operation. A Hard Manual condition is simply a transfer from automatic to manual mode due to the Auto-Manual Select Input dropping low. This input is normally controlled by the process control system, and a low signal would indicate a controller failure or emergency condition.

"Low Loop" is a term used to describe a condition in which the LOOPMATE detects a CV-Input less than 3.2mA (0.8VDC) and automatically transfers to manual mode. A low CV-Input would indicate a failed controller output or open current loop. Both Hard Manual and Low Loop detection may be selected or disabled via dip switches.

DS1 Switch functions are defined as follows:

SWITCH#1- **ON** **MANUAL RECOVERY**

The MAN/AUTO pushbutton on LOOPMATE keypad must be pressed to transfer from manual to automatic mode after a Hard Manual condition (DS1 switch #0 - OFF). The Auto/Manual Select Input must be high before the pushbutton is pressed.

OFF **AUTOMATIC RECOVERY**

The LOOPMATE automatically transfers to automatic mode after a Hard Manual condition when the Auto/Man Select Input goes high.

NOTE: DS1 switch #6 and switch #7 positions affect the manner in which the manual to automatic transfer is completed.

SWITCH #2 - ON **PRESET CV**

The LOOPMATE automatically ramps the CV-Output to the Preset CV Value after transferring to manual mode due to a Hard Manual or Low Loop condition. Hard Manual Enable must be selected (DS1 switch #0 - OFF). See DS1 switch #8 and Section 5.5 for description of Preset CV Value.

OFF **LAST CV**

The LOOPMATE CV-Output remains at the last valid CV-Input value monitored before a Hard Manual condition is encountered. Valid CV-Input values depend on the signal range selected by the position of DS1 switch #3.

SWITCH #3 - ON **SIGNAL OFFSET**

The LOOPMATE PV and CV scales display "live zero" analog signal ranges (4-20mA or 1-5VDC). When the LOOPMATE is in manual mode, The CV-Output signal will not go below 4mA (1VDC) or above 20mA (5VDC). See Section 5.2 for selection of currrent or voltage mode.

OFF **SIGNAL PRESET**

The LOOPMATE PV and CV scales display analog signal ranges of 0-20mA or 0-5VDC. See Section 5.2 for selection of current or voltage mode.

SWITCH #4 - ON **REVERSE CV-OUTPUT/DISPLAY**

The CV scale display is reversed, i.e., a 20mA (5VDC) signal is displayed as 0% (no lighted segments). In manual mode, pressing the ∧ pushbutton actually **decreases** the CV-Output signal.

OFF **NORMAL CV-OUTPUT/DISPLAY**

The CV scale display is direct-acting, i.e., a 20mA (5VDC) signal is displayed as 100% (all segments lighted).

SWITCH #5 - ON **REVERSE ACTION PV DISPLAY**

The PV scale display is reversed, i.e., a 20mA (5VDC) signal is displayed as 0% (no lighted segments).

OFF **NORMAL PV DISPLAY**

The PV scale display is direct-acting, i.e., a 20mA (5VDC) signal is displayed as 100% (all segments lighted).

SWITCH #6 - ON **BALANCE DISABLE**

Transfer from manual to automatic mode is completed without regard to the CV-Output relative to the CV-Input. Care must be taken to manually balance the CV-Output with the CV-Input when conditions require a "bumpless" transfer. BALANCE DISABLE is primarily used when the controller performs the balancing function (usually when the controller requires a Tieback input).

OFF **BALANCE ENABLE**

The LOOPMATE will complete a manual to automatic mode transfer only if the CV-Output equals the CV-Input (±2%). This results in a "bumpless" transfer into auto mode. BALANCE ENABLE is the normal operating mode.

NOTE: BALANCE ENABLE must be selected for switch #7 to have any effect on LOOPMATE operation.

SWITCH #7 - ON **AUTO BALANCE**

When a transfer from manual to automatic mode is initiated, the LOOPMATE automatically ramps the CV-Output to balance with the CV-Input before completing the mode change.

OFF **MANUAL BALANCE**

CV-Output must be manually balanced with CV-Input by using the ∧ or ∨ pushbuttons on the front panel keypad prior to a manual to automatic mode transfer.

SWITCH #8 - ON **CV SETUP**

This position permits adjustment of The CV Value potentiometer for setting the Preset CV Value. It is used in conjunction with DS1 switch #2 and switch #0. See Section 5.5 for description of Preset CV Value.

OFF **NORMAL CV**

The CV scale displays the LOOPMATE CV-Output. This is the normal operating position.

SWITCH #9 - ON **HANDSHAKING**

Establishes a protocol for automatic-to-manual and manual-to-automatic mode transfers. This switch position enables a relay which provides a contact closure when the AUTO/MAN pushbutton on the front panel is pressed to initiate a mode transfer. See Section 5.6 for description of HANDSHAKING feature.

OFF **NON-HANDSHAKING**

Permits immediate transfer to manual and automatic modes via the front panel keypad.

NOTE: DS1 switch #6 and switch #7 positions affect mode transfers.

SWITCH #0 - ON **HARD MANUAL DISABLE**

The LOOPMATE ignores the Auto/Manual Select Input. Mode transfers must be made via the front panel keypad. This switch position should be used in applications where machine control over the LOOPMATE operating mode is **NOT** desired.

OFF **HARD MANUAL ENABLE**

The Auto/Manual Select Input is constantly monitored to determine the LOOPMATE operating mode. If the input is high, automatic mode is selected. If the input goes low, the LOOPMATE transfers to manual operation.

5.4. 4-Position DIP Switch Settings (DS2)

LOOPMATE's with serial numbers 2000 or greater contain a 4-position switch which provides additional operating features. See Figure 5 for dip switch location. The switches are factory set for the following configuration:

SWITCH	POSITION	FUNCTION
1	OFF	SLEW RATE SELECT
2	OFF	SLEW RATE SELECT
3	OFF	LOW LOOP DETECT DISABLE
4	OFF	NOT USED

DS2 Switch functions are defined as follows:

SWITCH #1
SWITCH #2 — **SLEW RATE SELECTION** (SEE FIGURE 7)

RATE	SWITCH 1	SWITCH 2	FULL SCALE SLEW	FULL SCALE BALANCE
RATE 1	OFF	OFF	14.12 SECONDS	32.07 SECONDS
RATE 2	ON	OFF	12.05 SECONDS	15.49 SECONDS
RATE 3	OFF	ON	9.09 SECONDS	5.43 SECONDS
RATE 4	ON	ON	6.90 SECONDS	3.52 SECONDS

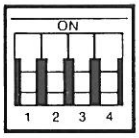


FIGURE 1
SLEW RATE **DIP** SWITCH
(Shown RATE 1 configuration)

Figure 7. Slew Rate DIP Switch Positions

See Figure 8 for a graphic comparison of the 4 slew rates. It provides a plot of the LOOPMATE's CV-Output in milliamps vs. Slew Rate in seconds. It is applicable to 4-20mA/1-5VDC as well as 0-20mA/0-5VDC signal ranges.

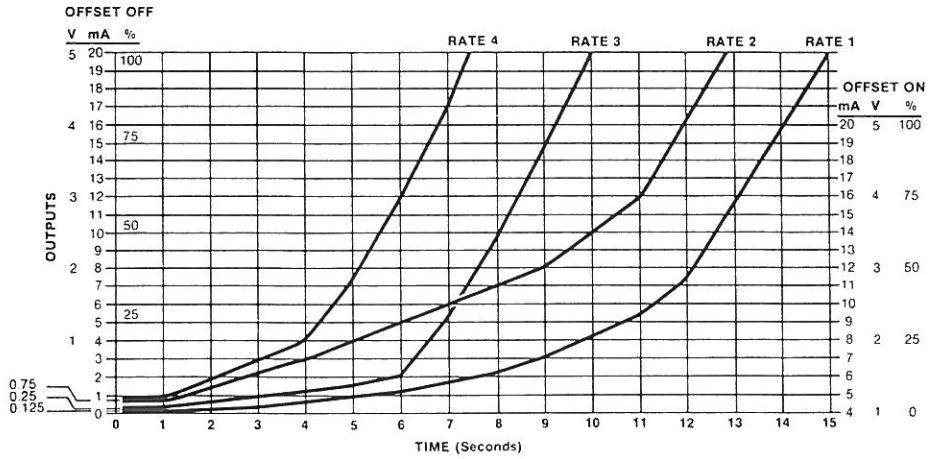


Figure 8. CV-Output (mA) vs. Time (Secs)

SWITCH #3 - ON **LOW LOOP DETECT ENABLE**

The LOOPMATE is enabled to automatically transfer to manual mode and maintain a valid CV-Output signal to the controlled device when the CV-Input to the LOOPMATE falls below 3.2mA (0.8VDC). This would be the result of a failed controller output or an open CV current loop. The LOOPMATE indicates this condition by flashing the **OK** LED and illuminating the **M** on the front panel. It also signals the process controller of the mode change via relay contacts (Auto/Manual Status).

Upon transfer to manual mode, the LOOPMATE will react according to the position of DS1 switch #2. If OFF (LAST CV VALUE), the LOOPMATE will maintain a 4mA (1.0VDC) CV-Output signal to the field device. If ON (PRESET CV VALUE), the CV-Output will be ramped to the Preset CV-Output value. See Section 5.5 for description of Preset CV Value.

There are two means of completing the transfer from manual to automatic mode after the controller output has returned to normal. The selection of MANUAL RECOVERY (DS1 switch #1 - ON) requires that the **MAN/AUTO** pushbutton on the LOOPMATE front panel be pressed after the controller output has returned to

normal. This is indicated by a continuously lit **OK** (not blinking), and the current controller output displayed on the CV scale by a single LED segment. The selection of DS1 switch #6 - OFF (BALANCE ENABLE) will prevent a mode transfer to automatic from the front panel if the LOOPMATE CV-Input is not in the valid range (4-20mA or 1-5VDC).

The transfer from manual to automatic mode can be controlled from a remote location by selecting AUTOMATIC RECOVERY (DS1 switch #1 - OFF) and AUTO BALANCE (DS1 switch #7 - ON). The Auto/Manual Select Input must be toggled low and back high after the LOOPMATE has failed to manual mode. When the controller output returns to the valid range, the LOOPMATE will then automatically balance CV-Output to CV-Input and transfer to automatic mode.

The LOW LOOP DETECTION feature is enabled by the following selections:

1. LOW LOOP DETECT ENABLE (DS2 switch #3 - ON)
2. SIGNAL OFFSET (DS1 switch #3 - ON)
3. HARD MANUAL ENABLE (DS1 switch #0 - OFF)

SWITCH #3 - OFF **LOW LOOP DETECT DISABLE**

This switch position prohibits the LOOPMATE from transferring to manual mode based on the CV-Input value. If SIGNAL OFFSET is selected (DS1 switch #3 - ON), a CV-Input less than 3.2mA will cause the **OK** LED to blink indicating low CV loop current. However, the unit will remain in automatic mode. Transferring to manual mode via the front panel keypad will force the CV-Output to 4mA. This switch selection can be used with any combination of dip switch settings.

SWITCH #4 - **NOT USED**

5.5. Preset CV Value

PRESET CV VALUE (DS1 switch #2 - ON) should be selected when a specific controlled variable output is required during emergency or critical situations. Upon transfer to manual mode after a Hard Manual or Low Loop condition, the LOOPMATE will ramp the CV-Output to the value set by the Preset CV Potentiometer. See Figure 5 for potentiometer location (labeled R49).

The Preset CV Value must be set prior to the LOOPMATE being placed in service. Factory setting is 4mA (1VDC). To adjust the Preset CV Value, select PRESET CV (DS1 switch #2 - ON), CV Setup (DS1 switch #8 - ON), and Hard Manual Enable (DS1 switch #0 - OFF). Apply power to the LOOPMATE and verify transfer to manual mode. Turn the Preset Pot (R49) clockwise to increase the Preset CV value. One complete turn will change the CV value approximately 0.8mA (0.25VDC). The new setting can be verified by observing the CV bargraph or monitoring CV-Output. When the adjustment is completed, Normal CV (DS1 switch #8 - OFF) must be selected for normal operation.

5.6. Handshaking

Handshaking provides a means for the controller or host computer to monitor and control the operational mode of the LOOPMATE at all times. The selection of DS1 switch #9 - ON prohibits unauthorized mode transfers from the LOOPMATE front panel and forces all transfers to be "authorized" by the host. Handshaking enables the Manual/Auto Request Output relay to provide indication when a mode transfer is initiated from the front panel keypad. The LOOPMATE then monitors the Auto-Manual Select Input for control of the actual mode transfers. LOOPMATE mode status can be monitored via the Auto/Manual Status Output.

Handshaking involves a three-step sequence and can be incorporated as described in the following examples:

Example 1:

Select Handshaking (DS1 switch #9 - ON) and Hard Manual Disable (DS1 switch #0 - ON).

The LOOPMATE powers up in automatic mode. Auto-Manual Select Input should be held high. (However, LOOPMATE will not fail to manual mode if input is low.) Operator initiates auto-to-manual transfer by pressing Auto\Manual key on the front panel. Manual/Auto Request Output contact closes (pins 17-18) signaling controller that mode change has been requested.

The host reads the input and evaluates the transfer to manual mode. If allowed, the host drops the signal low to the Auto/Manual Select Input (pins 13-14) forcing the LOOPMATE into manual mode. The LOOPMATE will not transfer to manual mode if the input drops low without the AUTO/MANUAL key being pressed. If the input is low when the AUTO/MAN key is pressed, the LOOPMATE will transfer to manual mode immediately.

The host monitors the Auto/Manual Status Output (pins 19,20,21) to determine if the transfer was completed.

The sequence is repeated to return to automatic mode. The operator presses the AUTO/MAN key, opening the Manual/Auto Request Output contact. The host outputs a high signal to the Auto-Manual Select Input forcing the LOOPMATE into automatic mode. The transfer is completed only after the AUTO/MAN key is pressed and the input is high. The host then reads the Auto/Manual Status Output is verify the mode change.

NOTE:

Incorporate Handshaking as shown in Example 1 when control over the LOOPMATE operating mode is required, but all mode transfers will be initiated from the LOOPMATE front panel.

This configuration does not allow the LOOPMATE to automatically transfer to manual mode on a Hard Manual failure.

Example 2:

Select Handshaking (DS1 switch #9 - ON), Hard Manual Enable (DS1 switch #0 - OFF), and Manual Recovery (DS1 switch #1 - ON).

The LOOPMATE powers up in automatic mode. The Auto-Manual Select Input must be held high to keep the LOOPMATE in automatic mode. The operator initiates the mode change by pressing the Auto/Man key on the front panel. Manual/Auto Request Output contact closes (pins 17-18) signaling controller that mode change has been requested.

The host reads the input and evaluates the transfer to manual mode. If allowed, the host drops the signal low to the Auto-Manual Select Input (pins 13-14) forcing the LOOPMATE into manual mode. Because Hard Manual Enable is selected, the LOOPMATE will transfer to manual mode immediately if the Auto-Manual Select Input drops low (even if the Auto/Manual key is not pressed).

The host monitors the Auto/Manual Status Output (pins 19,20,21) to determine if the transfer was completed. When manual mode is verified (or failure is corrected), the host should return the Auto-Manual Select Input should be returned to the high signal level.

To return to automatic mode, the operator presses the AUTO/MAN key on the front panel. Because the Auto/Manual Select Input is high, the LOOPMATE will immediately transfer to automatic mode, if possible. (To complete manual-to-auto transfer, CV-Input must be in valid range and CV-Out balanced with

CV-In if Balance Enable is selected.) Then, the Manual/Auto Request Output contact is opened. The host then reads the Auto/Manual Status Output to verify the mode change.

This configuration also allows the controller to distinguish between a "Hard Manual" failure and an operator-initiated transfer. If the LOOPMATE goes into manual mode (determined by the state of the Auto/Manual Status Output) with the Manual/Auto Request Output contact in the open position, the mode transfer was caused by a "Hard Manual" condition.

6. INSTALLATION

6.1. Mounting

The 7300 Series LOOPMATE can be panel mounted or rack mounted to fit specific applications. See Figure 9 for details of panel cutout and depth requirements.

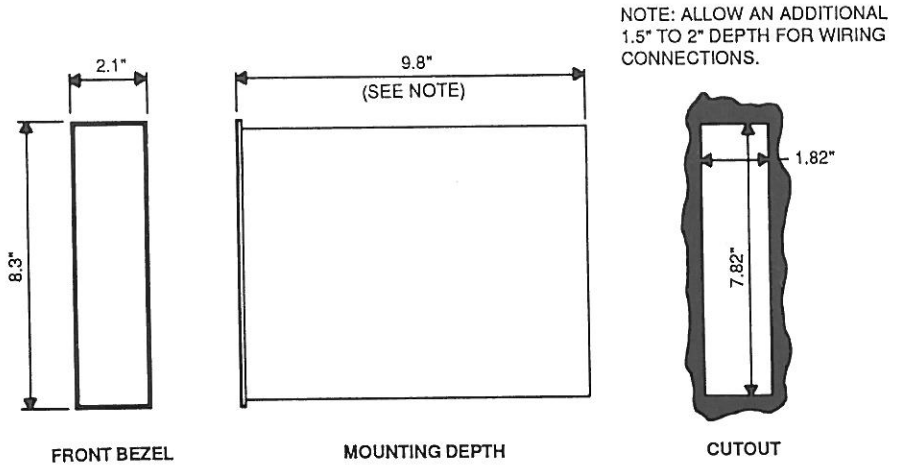


Figure 9. Panel Mounting Details

For rack mounted applications, a custom chassis (7300-RCK) is available. It holds 8 LOOPMATES and mounts in a standard DIN 19" instrument rack.

6.2. Field Wiring

6.2.1. Standard Rear Panel

LOOPMATES with the standard rear panel are provided with two-piece connectors to facilitate wiring and are keyed to maintain polarity (see Figure 10). See Section 4.0 for description of LOOPMATE inputs and outputs. If a set point option card is included, a 14-position connector will be present. See Section 7.0 for a description of the set point signals.

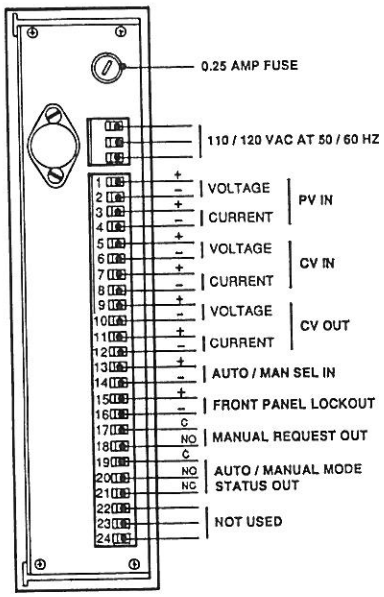


Figure 10. Standard Rear Panel Configuration

6.2.2. Loop Integrity Block

The optional Loop Integrity Block (7300-LIB) is used with LOOPMATES equipped with the standard rear panel configuration. Field wiring for PV, CV-Input, and CV-Output signals is terminated on the FIELD WRG side of the LIB rather than wired directly to the LOOPMATE connector. Additional wiring is required to connect these signals from the 7300 WRG side of the LIB to the LOOPMATE rear panel. See Figure 11 for details.

When the switch is in the OPERATE position, the PV, CV-Input, and CV-Output signals are passed through the LIB and into the LOOPMATE. In this configuration, the LIB is simply a wiring junction between the LOOPMATE and the process control system. When the switch is in the DISCONNECT position, contacts maintain the integrity of the current loops on the FIELD WRG side, but no signals are passed through the LIB. In this switch position, the LOOPMATE is isolated from the critical control parameters and may be removed from service without disrupting the process.

NOTE:

Set point signals (if SP option card is installed) and any discrete signals (see Section 4.0 for a description) used by the LOOPMATE must be wired directly to the rear panel connector and do not pass through the LIB.

The Loop Integrity Block mounts on a flat rail, DIN EN "C" rail or minirail. These mounting rails may be acquired from a Phoenix Contact distributor:

Minirail NS 35/7.5 (DIN EN 50022) Phoenix part number 08 01 733

C Rail (DIN EN 50035) Phoenix part number 12 01 00 2

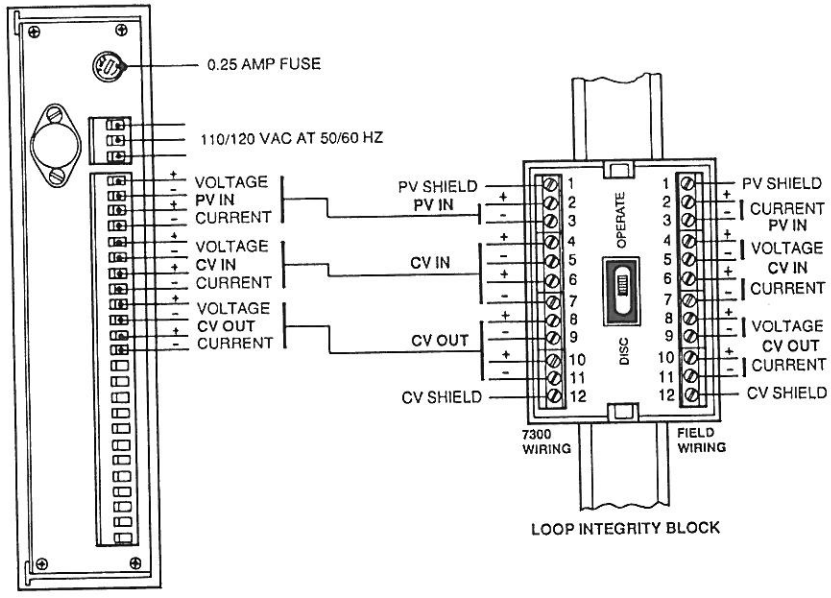


Figure 11. Loop Integrity Block Wiring

6.2.3. DIN Rail Block

The optional DIN Rail Block (7300-DIN) provides a convenient method terminating field wiring away from the LOOPMATE rear panel. The DIN Rail option includes a special 36-pin ribbon cable connector on the LOOPMATE rear panel, 3-foot ribbon cable, and DIN Rail Loop Integrity Block. This DIN Rail Block contains a 36-position wiring terminal, loop integrity switch, and ribbon cable connector. All signals required to interface with the LOOPMATE (including optional set point signals) are terminated at the DIN Rail Block and connected via ribbon cable to the LOOPMATE. See Figure 12 for details.

When the loop integrity switch is in the OPERATE position, all signals are passed through the DIN Rail Block and into the LOOPMATE. In this position, the DIN Rail Block is simply a wiring junction between the LOOPMATE and the process control system. When the switch is in the DISCONNECT position, contacts maintain the integrity of the current loops on the field termination side but no signals are passed through the DIN Rail Block. In this switch position, the LOOPMATE is isolated from the critical control parameters and may be removed from service without disrupting the process.

The DIN Rail Block includes wiring terminals for all possible set point inputs and outputs. If a set point option card is included, see Section 7.0 for a description of the connections required for each specific option card.

The DIN Rail Loop Integrity Block mounts on a flat rail, DIN EN "C" rail or minirail.

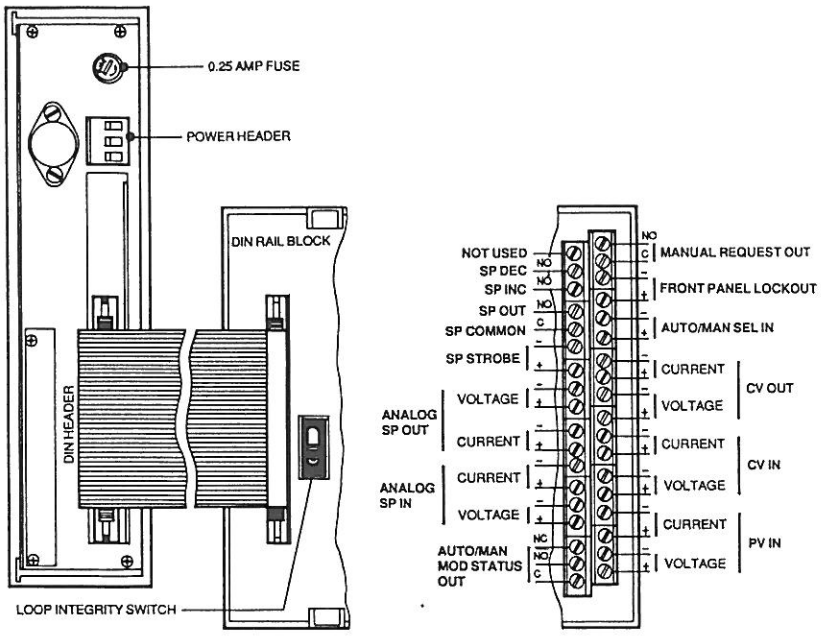


Figure 12. DIN Rail Block Connection Wiring

7. SET POINT OPTION CARDS

The LOOPMATE is equipped with connectors which allow optional cards to be added which display the controller set point via an analog input (7300-DS), display and change the controller set point via analog input/output (7300-AN), or display the controller set point via an analog input and change it via discrete outputs (7300-DIS).

All set point cards require the placement of two jumper plugs for selection of current or voltage mode for the set point signals. The jumpers are factory set for current mode. See Figure 13,14, or 15 for jumper location on each specific card.

The selection of signal offset for set point inputs/outputs depends on the position of DS1 switch #3. The selection of SIGNAL OFFSET (DS1 switch #3 - ON) chooses "live zero" analog signals (4-20mA or 1-5VDC). The position of SIGNAL PRESET (DS1 switch #3 - OFF) selects an analog signal range of 0-20mA or 0-5VDC.

Set point option cards are available for standard or DIN rear panel connections. The cards for the DIN rear panels differ in that no rear edge header is provided for wiring terminations (all field wiring is terminated on the DIN Rail Block).

NOTE:

Discrete inputs associated with the set point option cards must be held in the range of 5-24VDC to be considered high (true). Leakage current less than 2mA is allowed from the controller outputs.

Discrete outputs are actually relay contact closures which can switch up to 125VAC without seriously affecting contact life.

Analog input/output range is 0-5VDC, 1-5VDC, 0-20mA, or 4-20mA depending on dip switch and jumper position.

CAUTION:

When current mode is selected for the ANALOG SET POINT INPUT signal, the LOOPMATE input resistance is 100Ω. Excessive currents will result in damage to components and the circuit board.

<u>DO NOT</u> ALLOW THIS SIGNAL TO EXCEED 20 MILLIAMPS.

7.1. Set Point Display (7300-DS)

This card allows the LOOPMATE to display the process controller set point. The LOOPMATE is furnished the process set point value via an analog signal from the controller. See Figure 13 for wiring details.

7300-DS INPUTS:

ANALOG SET POINT INPUT: 14-POS HEADER, POS 1-2 or 3-4
This analog signal from the controller indicates the set point currently being used by the process control algorithm. The set point value is indicated on the PV scale by a single LED segment. Wiring position selection depends on the jumper placement for current/voltage mode (see Figure 13).

SET POINT STROBE: 14-POS HEADER, POS 9-10
This discrete input must be held high for the LOOPMATE to continuously sample and display the controller set point value. This input allows one analog signal to be used for displaying the process set point to multiple LOOPMATES. (See Section 7.4 for description of Multiplexing Analog Set Point Input Signals.) If a dedicated analog signal is used for Analog Set Point Input, this input should always be held high.

7300-DS OUTPUTS: NONE

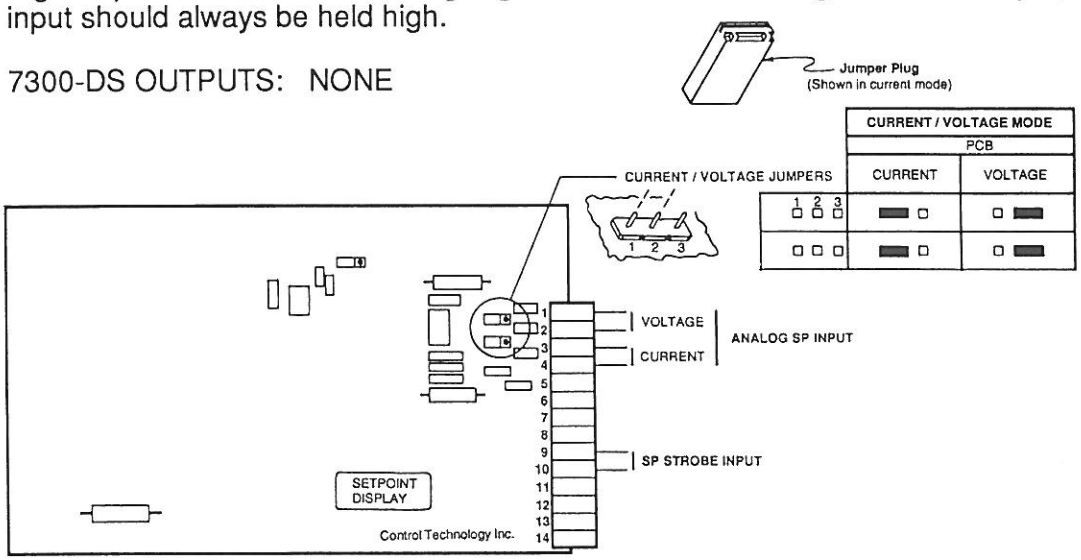


Figure 13. Set Point Display Option Card (Standard Rear Panel)

7.2. Set Point Display and Change [Analog] (7300-AN)

This card allows the LOOPMATE to display the controller set point and permits an operator-initiated change of this parameter from the front panel keypad. The LOOPMATE is furnished the process set point value via an analog signal from the controller. An additional analog output from the LOOPMATE indicates the current set point value as requested from the front panel keypad. See Figure 14 for wiring details.

7300-AN INPUTS:

ANALOG SET POINT INPUT: 14-POS HEADER, POS 1-2 or 3-4
This analog signal from the controller indicates the set point currently being used by the process control algorithm. The set point value is indicated on the PV scale by a single LED segment. Wiring position selection depends on the jumper placement for current/voltage mode (see Figure 14).

SET POINT STROBE: 14-POS HEADER, POS 9-10
This discrete input must be held high for the LOOPMATE to continuously sample and display the controller set point value. This input allows one analog signal to be used for displaying the process set point to multiple LOOPMATES. (See Section 7.4 for description of Multiplexing Set Point Values.) If a dedicated analog signal is used for Analog Set Point Input, this input should always be held high.

7300-AN OUTPUTS:

SET POINT CHANGE: 14-POS HEADER, POS 11(COM)-12(N.O.)
This contact closure allows the controller to monitor the status of the **SP** pushbutton on the LOOPMATE front panel keypad. When the **SP** pushbutton is pressed, the N.O. relay energizes. This signal can be used in conjunction with the Analog Set Point Output to notify the controller that a change in set point is being requested.

ANALOG SET POINT OUTPUT: 14-POS HEADER, POS 5-6 or 7-8
This analog signal from the LOOPMATE provides the controller with an analog value which represents the process set point **REQUESTED** from the front panel keypad. Wiring position selection depends on the jumper placement for current/voltage mode and is always the same as the Analog Set Point Input signal.

When powered up, the LOOPMATE sets the Analog Set Point Output signal equal to the Analog Set Point Input signal. If SIGNAL OFFSET is selected (DS1 switch #3 - ON), the minimum output is 4mA (1VDC). The Analog Set Point Output remains at this offset value until the **SP** pushbutton is pressed (regardless of the change in the Analog Set Point Input signal). At this instance, the Analog Set Point Output is set equal to the Analog Set Point Input. While holding down the **SP** pushbutton, pressing the ∧ or ∨ key causes the Analog Set Point Output value to ramp up or down. Holding down both keys causes the Analog Set Point Output to increase or decrease at a exponential rate until the signal range limits are reached.

NOTE:

The controller must sense the Set Point Change Input, monitor the new analog value (Analog Set Point Output), internally modify its loop set point, and then output the new set point value to the LOOPMATE. This analog signal is received as Analog Set Point Input. This signal allows the LOOPMATE to display the current set point value on the PV bargraph.

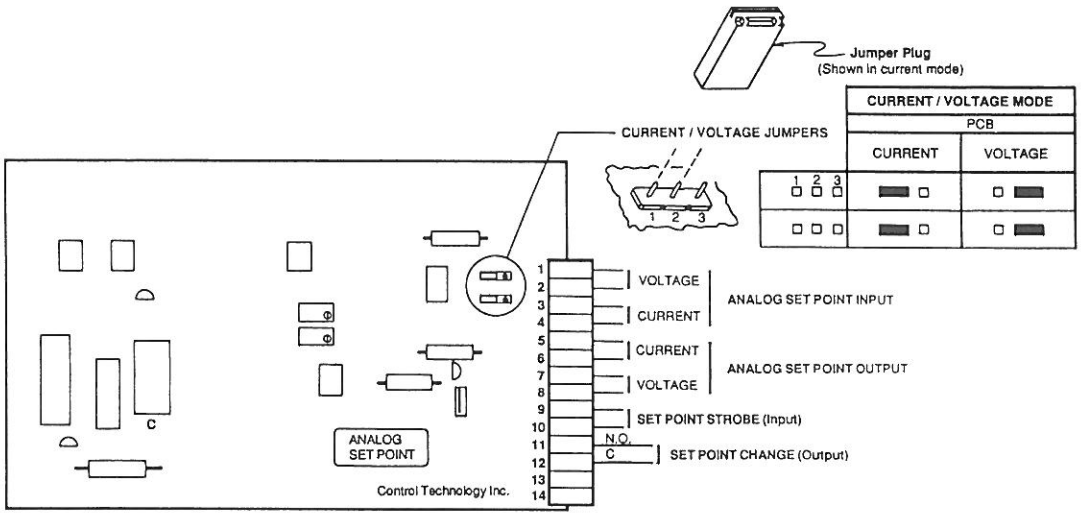


Figure 14. Set Point Display and Change [Analog] Option Card (Standard Rear Panel)

7.3. Set Point Display and Change [Discrete] (7300-DIS)

This card allows the LOOPMATE to display the controller set point and permits an operator-initiated change of this parameter from the front panel keypad. The LOOPMATE is furnished the process set point value via an analog signal from the controller. Relay contacts provide indication of the status of the SP , ∧ , and ∨ pushbuttons which can be used by the controller to modify its process set point. See Figure 15 for wiring details.

7300-DIS INPUTS:

ANALOG SET POINT INPUT: 14-POS HEADER, POS 1-2 or 3-4
This analog signal from the controller indicates the set point currently being used by the process control algorithm. The set point value is indicated on the PV scale by a single LED segment. Wiring position selection depends on the jumper placement for current/voltage mode (see Figure 15).

SET POINT STROBE: 14-POS HEADER, POS 9-10
This discrete input must be held high for the LOOPMATE to continuously sample and display the controller set point value. This input allows one analog signal to be used for displaying the process set point to multiple LOOPMATES. (See Section 7.4 for description of Multiplexing Set Point Values.) If a dedicated analog signal is used for Analog Set Point Input, this input should always be held high.

7300-DIS OUTPUTS:

SET POINT CHANGE: 14-POS HEADER, POS 11 (COM) - 12 (N.O.)
This contact closure allows the controller to monitor the status of the **SP** pushbutton on the LOOPMATE front panel keypad. When the **SP** pushbutton is pressed, the N.O. relay energizes. This signal must be used in conjunction with the SP Increment or SP Decrement Output to indicate a set point change has been requested from the LOOPMATE front panel keypad.

SP INCREMENT: 14-POS HEADER, POS 11 (COM) - 13 (N.O.)
This contact closure allows the controller to sense when the ∧ pushbutton on the LOOPMATE front panel keypad is pressed. The N.O. relay energizes when the ∧ key is pressed.

SP DECREMENT: 14-POS HEADER, POS 11 (COM) - 14 (N.O.)
This contact closure allows the controller to sense when the ∨ pushbutton on the LOOPMATE front panel keypad is pressed. The N.O. relay energizes when the ∨ key is pressed.

The SET POINT DISPLAY AND CHANGE [DISCRETE] option is used primarily in Programmable Logic Controller (PLC) systems where discrete inputs are readily available and less costly than analog inputs. Although more programming support is required, this option permits flexibility in determining the rate of change of the set point value.

NOTE:

The current process set point is displayed on the PV bargraph via the Analog Set Point Input signal from the controller. A change in the set point value may be REQUESTED from the LOOPMATE front panel keypad by pressing and holding the SP key, and then pressing the ∧ or ∨ key.

When the controller senses the **SP** and ∧ keys or the **SP** and ∨ keys simultaneously pressed, the program can initialize a counter. This value can be added or subtracted from the current set point, effectively raising or lowering the set point value. The counter should remain initialized, resulting in continuous set point change, as long as both keys are pressed. The rate at which the counter increments can be tailored for each specific application and should consider such factors as PLC scan time and analog module resolution.

In addition to internally modifying the loop set point, the controller must transfer the new set point value for analog output to the LOOPMATE. This signal becomes the Analog Set Point Input displayed on the PV bargraph.

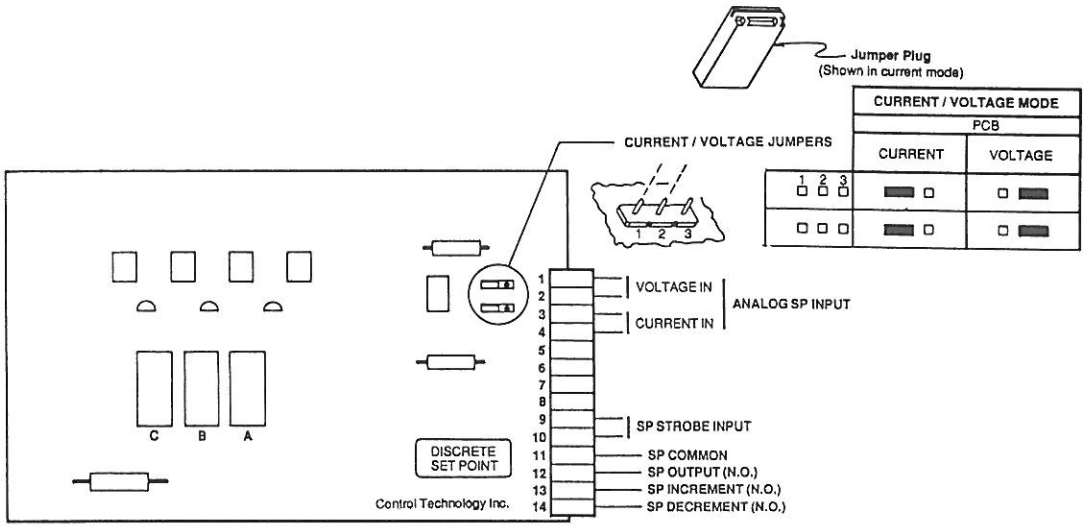


Figure 15. Set Point Display and Change [Discrete] Option Card (Standard Rear Panel)

7.4. Multiplexing Analog Set Point Input Signals

LOOPMATES equipped with any set point option card use a "sample at strobe" technique for monitoring and displaying the process set point value via the Analog Set Point Input signal. This involves sampling the analog input only when the Set Point Strobe discrete input is high. This technique permits one analog output channel to be used as the Analog Set Point Input signal to multiple LOOPMATES, each using a separate discrete point for Set Point Strobe.

A typical application would involve the multiplexing of the Analog Set Point Input to four LOOPMATES. The controller would use one analog output channel (Analog Set Point Input) and four discrete outputs (Set Point Strobe). See example in Figure 16. The program would perform the following:

1) Transfer set point value for loop #1 to analog output channel. Turn on discrete output #1 (Set Point Strobe) for LOOPMATE #1.

At this point, LOOPMATE #1 will display loop #1 set point value on PV bargraph.

2) Turn off Set Point Strobe for LOOPMATE #1. Transfer set point value for loop #2 to analog output channel. Turn on discrete output #2 (Set Point Strobe) for LOOPMATE #2.

Now LOOPMATE #1 displays loop #1 set point value (value present when Set Point Strobe dropped low), and LOOPMATE #2 displays loop #2 set point value.

3) Turn off Set Point Strobe for LOOPMATE #2. Transfer set point value for loop #3 to analog output channel. Turn on discrete output #3 (Set Point Strobe) for LOOPMATE #3.

LOOPMATE #1 displays loop #1 set point value, LOOPMATE #2 displays loop #2 set point value, and LOOPMATE #3 displays loop #3 set point value.

4) Turn off Set Point Strobe for LOOPMATE #3. Transfer set point value for loop #4 to analog output channel. Turn on discrete output #4 (Set Point Strobe) for LOOPMATE #4.

Now all four LOOPMATES display the appropriate set point values.

5) Turn off Set Point Strobe for LOOPMATE #4. Repeat sequence.

NOTE:

When using Analog Set Point Input multiplexing, remember the value present when the Set Point Strobe goes low is the value held in the PV display. This value will not change until the Set Point Strobe goes high.

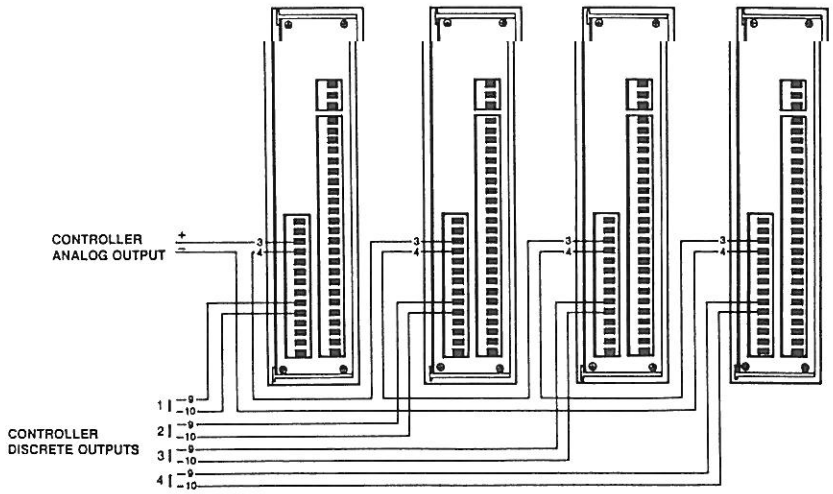


Figure 16. Analog Set Point Input Signal Multiplexing

8. DIAGNOSTICS

The LOOPMATE may be configured to run a diagnostic self test that checks for proper operation of the power supply, PV, CV-Input, and CV-Output circuitry. The following steps are necessary to perform the self test:

1) The jumpers on the main logic board must be set for current mode (see Figure 6).

2) All 10 DS1 dip switches must be set to the "ON" position (see Figure 5).

3) For self test operation, see Figure 17 for rear panel connection wiring. If the unit includes a DIN Rail Connector option (7300-DIN), see Figure 18 for DIN Rail Block terminal wiring.

4) Apply power to the LOOPMATE. The PV and CV bargraphs will light to indicate full scale readings. The **A** LED will light, and the **OK** LED will flash.

5) Press the front panel pushbuttons in the following sequence:

   Press **SP** and ∧ simultaneously
   Press **MAN/AUTO** and ∨ simultaneously
   Press **MAN/AUTO** and ∧ simultaneously

   This three step sequence initiates the self test and should be completed with the following results:

   The **M** LED will light while the **A** and **OK** LED's remain lit. The PV and CV bargraphs will ramp from full scale to zero and back to full scale. The ramping action will continue for approximately four minutes or until power is removed from the LOOPMATE. It is not necessary to run the diagnostic self test for the full four minutes. Several cycles of the PV and CV display ramp are sufficient to prove the proper operation of the unit.

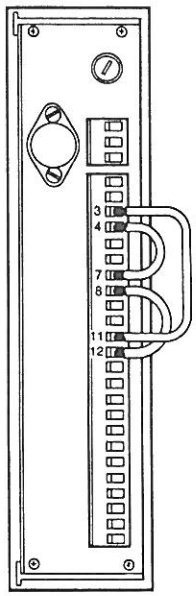


Figure 17. Self Test Configuration (Standard Rear Panel)

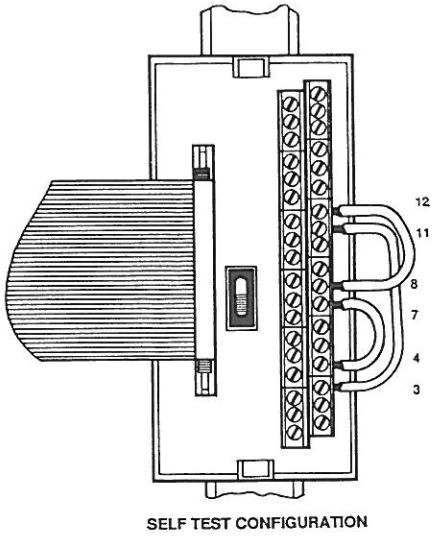


Figure 18. Self Test Configuration (DIN Rail LIB)

9. SPECIFICATIONS

PROCESS VARIABLE (PV)/ SETPOINT (SP)

	CURRENT	VOLTAGE
Signal Range	0-20mA or 4-20mA	0-5VDC or 1-5VDC
Input Impedance	100Ω	500KΩ
Common Mode Rejection Ratio	45 dB	45 dB
Display Resolution	2% of Full Scale	2% of Full Scale

CONTROLLED VARIABLE (CV)

CV-INPUT

Signal Range	0-20mA or 4-20mA	0-5VDC or 1-5VDC
Input Impedance	100Ω	500KΩ
Common Mode Rejection Ratio	45 dB	45 dB
Display Resolution		
Model 7301	5% of Full Scale	5% of Full Scale
Model 7302	2% of Full Scale	2% of Full Scale

CV-OUTPUT

Signal Range	0-20mA or 4-20mA	0-5VDC or 1-5VDC
Manual Mode Load Impedance	800Ω (Max)	1KΩ (Min)

ENVIRONMENTAL

Storage Temperature	-40° to 85°C (-40° to 185°F)
Operating Temperature	0° to 60°C (32° to 150°F)
Humidity	5% to 95% R.H. (non-condensing)
Front Panel Seal Rating	NEMA 12
Case Dimensions (HWD)	7.8 x 1.8 x 10.4 inches (19.2 x 4.6 x 26.4 cm)
Front Panel (HW)	8.3 x 2.1 inches (21.1 x 5.3 cm)
Recommended Cutout (HW)	7.9 x 1.9 inches (19.4 x 4.8 cm)
Weight	4 lbs (1.8 kg)
Wiring Terminal Size	Accepts No. 14 - 22 AWG wire

POWER INPUT

Voltage	110VAC @ 60 Hz or 220VAC @ 50Hz
Power	18 Watts (Max)

INPUT SIGNALS (DISCRETE)

Signal Range	5-24 VDC
On-State Current	24mA (Max)
Off-State Leakage Current Allowed	2mA

RELAY CONTACT RATING

Current Rating (Max)	0.5 Amp @ 60VDC or 120VAC

10. LIMITED PRODUCT WARRANTY

CTI warrants that this CTI Industrial Product shall be free from defects in material and workmanship for a period of one (1) year after purchase from CTI or from a authorized CTI Industrial Distributer. This CTI Industrial Product will be newly manufactured from new and/or serviceable used parts which are equal to new in the Product.

Should this CTI Industrial Product fail to be free from defects in material and workmanship at any time during this one (1) year warranty period, CTI will repair or replace (at its option) parts or Products found to be defective and shipped prepaid by the customer to a designated CTI service location along with proof of purchase date and associated serial number. Repair parts and replacement Product furnished under this warranty will be on an exchange basis and will be either reconditioned or new. All exchanged parts or Products become the property of CTI. Should any Product or part returned to CTI hereunder be found by CTI to be without defect, CTI will return such Product or part to the customer.

This warranty does not include repair of damage to a part or the Product resulting from: failure to provide a suitable environment as specified in applicable Product specifications, or damage caused by an accident, disaster, neglect, abuse, misuse, transportation, alterations, attachments, accessories, supplies, non-CTI parts, non-CTI repairs or activities, or to any damage whose proximate cause was faulty installation done by someone other than CTI.

Control Technology Inc. reserves the right to make changes to the Product in order to improve reliability, function, or design in the pursuit of providing the best possible Product. Since CTI does not possess full access to data concerning all of the uses and application of customer's product, CTI assumes no responsibility for indirect or consequential damages resulting from the use or application of this equipment.

THE WARRANTY SET FORTH ABOVE IN THIS ARTICLE IS THE ONLY WARRANTY CTI GRANTS AND IT IS IN LIEU OF ANY OTHER IMPLIED OR EXPRESSED GUARANTY OR WARRANTY ON CTI PRODUCTS, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE AND IS IN LIEU OF ALL OBLIGATIONS OR LIABILITY OF CTI FOR DAMAGES IN CONNECTION WITH LOSS, DELIVERY, USE OR PERFORMANCE OF CTI PRODUCTS OR INTERRUPTION OF BUSINESS, LOSS OF USE, REVENUE OR PROFIT. IN NO EVENT WILL CTI BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR CONSUMER PRODUCTS, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY FROM STATE TO STATE.

11. REPAIR POLICY

In the event that the Product should fail during or after the warranty period, a Return Material Authorization number (RMA) can be requested verbally or in writing from CTI main offices. Whether this equipment is in or out of warranty, a Purchase Order number provided to CTI when requesting the RMA number will aid in expediting the repair process. The RMA number that is issued and your Purchase Order number should be referenced on the returning equipment's shipping documentation. Additionally, if under warranty, proof of purchase date and serial number must accompany the returned equipment.

Emergency product exchanges can be accomplished within 24 hours contingent on availability. The current repair and/or exchange rates can be obtained by contacting CTI main office.

CTI's TOLL FREE NUMBER:

(800) 537-8398

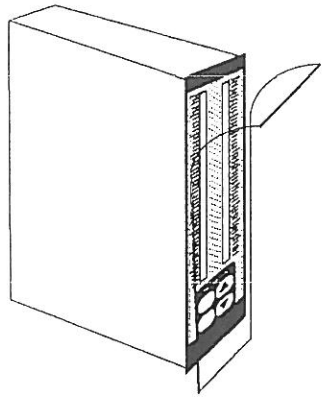
CTI's SHIPPING ADDRESS:

Control Technology Inc.
5734 Middlebrook Pike
Knoxville, TN 37921

12. INDEX

13. APPENDIX

13.1. Clear Front Panel Protective Overlay



The clear plastic overlay furnished with the 7300 LOOPMATE is designed to protect custom scales, legends, or reference marks. To apply, peel the backing off of the overlay and carefully align over the 7300 front panel. Press gently in place once properly aligned.

Figure 19. Front Panel Clear Plastic Overlay

13.2. Loop Integrity Block Dimensions

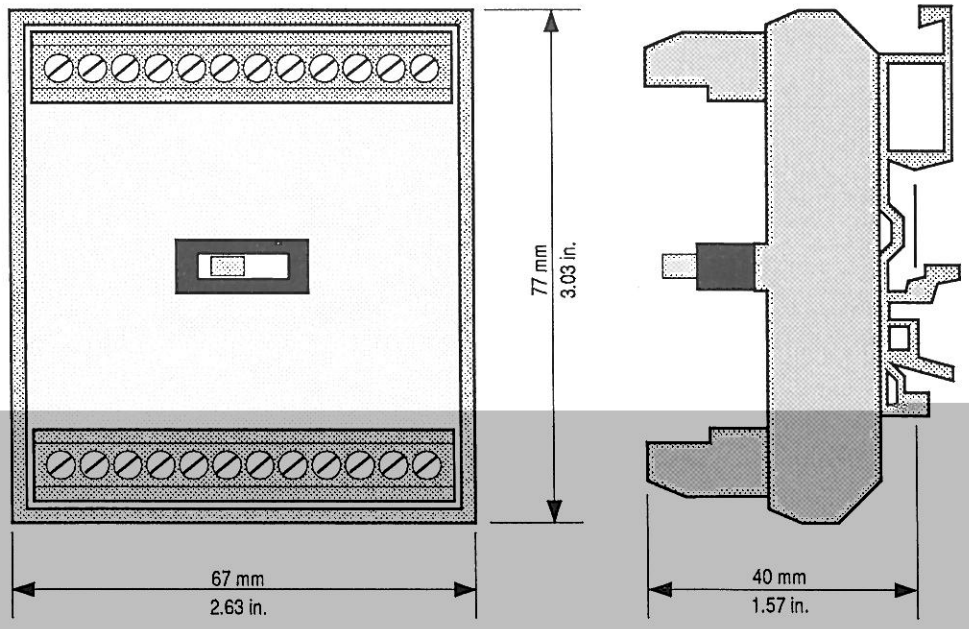


Figure 20. Loop Integrity Block Dimensions

13.3. DIN Rail Block Dimensions

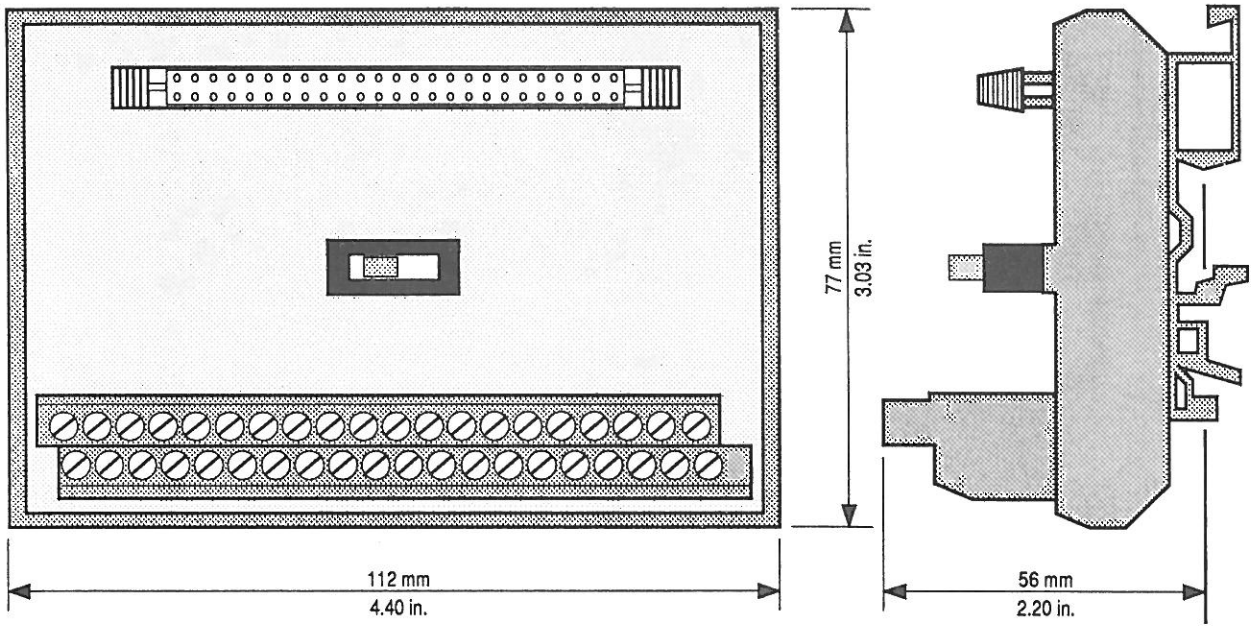


Figure 21. DIN Rail Block Dimensions