MODEL 7312 AUTO/MANUAL

ANALOG CONTROL STATION

INSTALLATION AND OPERATION GUIDE

Ver. 1.8

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PREFACE

This *Installation and Operation Guide* is intended for engineers and technicians who are installing, configuring and operating the CTI 7312.

This *Guide* is organized into the following chapters:

Chapter 1. Describes the general functions of the 7312.

Chapter 2. Describes each of the options available for the 7312.

Chapter 3. **Front Panel Operation** covers operation of the front panel controls.

Chapter 4. **Inputs/Outputs** describes each of the 7312 inputs and outputs.

Chapter 5. **Configuration** details each of the possible user selected field configurations.

Chapter 6. **Installation** gives physical installation instructions.

Chapter 7. **Set Point Option Cards** describes configuration and operation of the available Set Point Option Cards.

Chapter 8. **Diagnostics** covers the 7312 self-diagnostic routines.

Chapter 9. **Calibration** describes calibration procedures for the 7312.

Chapter 10. **Specifications** provide detailed physical and electrical specifications.

The **Warranty** and **Repair Policy** are at the end of this *Guide*.

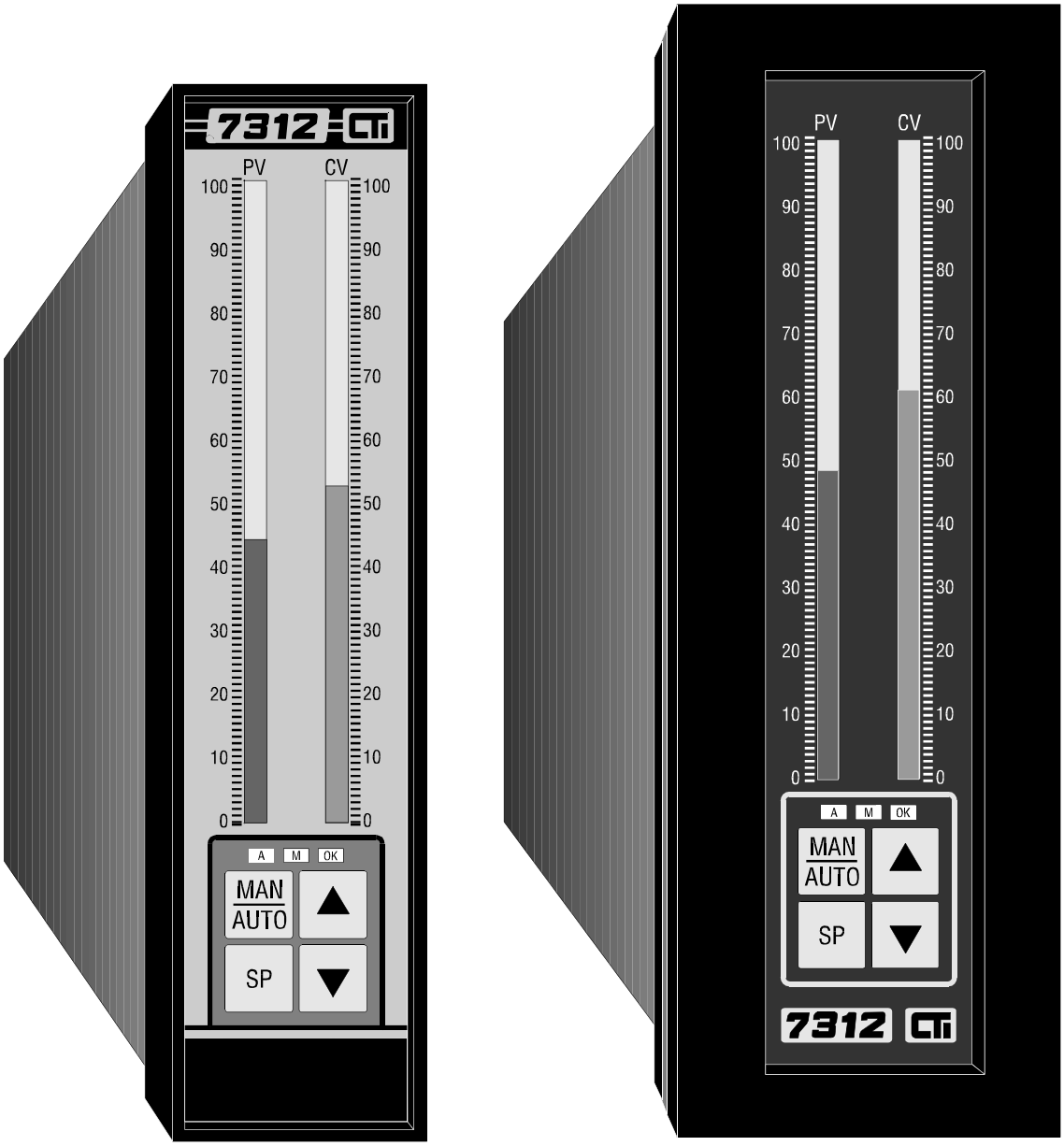

Figure 1 *Models 7312-NM12 and 7312-NM04*

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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.

The ▲ symbol is used to represent the **UP** front panel pushbutton.

The ▼ symbol is used to represent the **DOWN** front panel pushbutton.

The **A** symbol is used to represent the **"AUTO" LED**.

The **M** symbol is used to represent the **"MANUAL" LED**.

The **OK** symbol is used to represent the **"OK" LED**.

CHAPTER 1. GENERAL DESCRIPTION

NOTE:
In this document, the term PV will be used to denote the process variable signal. The term CV will be used to denote the controlled variable signal.

The 7312 Analog Control Stations are designed to allow the user to monitor and interact with analog process control loops. The 7312 is installed between the analog process controller and the controlled field device as shown in the figure below.

The 7312 provides manual and hard manual back-up for process loop control systems, protecting manufacturers from loss of product due to out-of-control loops. The 7312 may be configured to switch automatically to manual control if the process controller fails or when detecting a low control variable output. The user may select either of two manual control modes. The station can hold the last input or ramp to a user defined CV-Output value.

The 7312 in automatic mode is a truly passive device and allows the process controller's CV-Output to pass directly to the actuator. A loss of power in the 7312 will not disturb the process loop integrity. When in automatic mode the 7312 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 7312.

The 7312's fail-safe design protects loop integrity regardless of its operational status. When no power is applied, the 7312 is a totally passive device that maintains loop continuity.

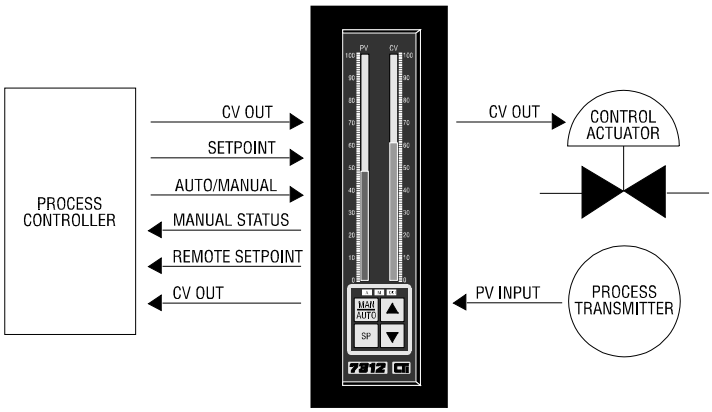


Figure 2 *Typical Field Installation*

CHAPTER 2. OPTIONS

The following features are optionally available with the 7312:

2.1 7312-NM12

The 7312-NM12 provides a NEMA 12 front panel seal (see section 6.1 for additional information).

2.2 7312-NM04

The 7312-NM04 provides a NEMA 4 front panel seal (see section 6.2 for additional information).

2.3 7312-24V

The 7312-24V is a 7312 with a 24 VDC power input. This unit may be ordered with any of the other 7312 options (see Figure 3 for wiring details).

2.4 ANALOG SET POINT DISPLAY AND CHANGE (ANLG)

The ANLG option allows the 7312 to monitor the SP value and request a change in the SP value to the host controller. The ANLG option provides an additional analog input to accept the current SP value from the host controller. This value is displayed on the PV bargraph. The ANLG option provides an additional analog output to send the requested SP value to the host controller (see section 7.1 for additional information).

2.5 DISCRETE SET POINT DISPLAY AND CHANGE (DISC)

The DISC option allows the 7312 to monitor the SP value and request a change in the SP value to the host controller. This option provides an additional analog input to accept the current SP value from the host controller. This value is displayed on the PV bargraph. The DISC option provides discrete contact outputs to the host controller which request the controller to increase or decrease the SP value (see section 7.2 for additional information).

2.6 LOOP INTEGRITY BLOCK (LIB)

The LIB allows removal of the 7312 from the control circuit without interrupting loop continuity. The LIB consists of a six pole, double throw instrumentation grade switch to maintain process loop currents (PV and CV) when the 7312 is removed (see section 6.4.2 for additional information).

2.7 DIN RAIL BLOCK (DIN)

The DIN provides a convenient method of control wiring termination at a single point. Included are full-function DIN Rail Block and 3-foot ribbon cable. The DIN Rail Block, like the Loop Integrity Block, allows removal of the 7312 from the control circuit without interrupting loop continuity. The DIN Rail Block utilizes a six pole, double throw instrumentation grade switch to maintain process loop currents (PV and CV) when the 7312 is removed (see section 6.4.3 for additional information).

2.8 SPECIAL SCALES FOR PV/CV BARGRAPHS (SC)

Linear and/or non-linear scales in addition to the scales provided may be special ordered for PV/CV displays. Consult the factory for special scales. Several varieties are readily available. Scales which are not available may be created at a nominal set-up charge.

2.9 500 mSec CV MEMORY ON SWITCH TO MANUAL

In automatic mode, the CV value is continuously stored in 7312 internal memory. When manual mode is selected, the average value of the CV 500 milliseconds before manual mode was requested is made available to the 7312 CV-Output. This will help compensate changes that may have occurred in the CV signal during loop fault conditions. This option requires a special PROM chip (programmable read only memory) and must be installed at the factory.

CHAPTER 3. FRONT PANEL OPERATION

3.1 DISPLAYS

3.1.1 PV Bargraph

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 VDC), or the minimum value may be offset to represent 4 mA (1 VDC). This display may be scaled in various engineering units to fit most applications; i.e., GPM, PSI, etc.

3.1.2 CV Bargraph

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 bargraph. When the 7312 is in automatic mode, the CV-Input equals the CV-Output value and is displayed on the bargraph. When the 7312 is in manual mode, the CV-Output signal generated by the 7312 is operator-controlled from the front panel keypad, and is displayed on the CV bargraph. The CV-Input is displayed as a single LED segment, flashing when less than the CV-Output and continuously lit when greater than the CV-Output. The CV value displayed, represents 0-100% of the controller or 7312 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 (1 VDC). This display may be scaled in various units of measurement.

3.1.3 LEDs

The **OK** is lighted when power is applied, and the 7312 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 DIP switch #3 - ON), the **OK** will flash to indicate a CV-Input less than 3.1 mA (0.78 VDC), signifying an invalid signal range (see section 5.4).

The **A** is lighted when the 7312 is in automatic operation and flashes if internal diagnostics fail.

The **M** is lighted when the 7312 is in manual mode and flashes if internal diagnostics fail.

3.2 KEYS AND SWITCHES

The **MAN/AUTO** initiates a change in the 7312 operational mode. Mode changes may be operator initiated at any time, but the actual man/auto transfer depends on DIP switch settings that are user selected (see section 5 for a description of switch settings and operating characteristics).

The **SP** enables the set point change option. Both analog and discrete set point change options are enabled with this key. Pressing and holding **SP** and simultaneously pressing the ▲ or ▼ key can alter the SP-Output value to the host. If no set point option is installed, **SP** has no function. (See Chapter 7 for more details on set point operation.)

The ▲ or ▼ alters the CV-Output value when the 7312 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 (0.031 VDC) so that four toggles will light one bar on the CV bargraph. Neither key has any effect when the 7312 is in automatic mode unless the **SP** button is pressed.

CHAPTER 4. 7312 INPUTS / OUTPUTS

This chapter describes the 7312 inputs and outputs associated with the standard units (see Figure 3 for connector diagrams). If a set point option is included, see Chapter 7 for details of the additional inputs/outputs used with each specific card.

4.1 INPUTS

> ***NOTE:***
> *Discrete inputs into the 7312 must be held in the range of 5-24 VDC to be considered high (true). Leakage current less than 2 mA is allowed from the controller outputs.*

7312 inputs provided with the standard units:

4.1.1 PV-Input: 24-Position Header, Position 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 5.3).

> ***CAUTION:***
> *When current mode is selected for PV and/or CV-Input signals, the 7312 input resistance is 100 ohms. Excessive currents will result in damage to components and the circuit board. DO NOT ALLOW THESE SIGNALS TO EXCEED 20 MILLIAMPS!*

4.1.2 CV-Input: 24-Position Header, Position 5-6 or 7-8

This analog signal generated by the controller is monitored and displayed on the CV scale and becomes a 7312 output (CV-Output) in automatic mode. Wiring position selection depends on current/voltage signals (see section 5.3).

4.1.3 AUTO/MAN Select Input: 24-Position Header, Position 13-14

This discrete input to the 7312 provides a means of determining controller failure and/or supervising the 7312 operating mode. If Hard Manual Enable is selected (DS1 DIP switch #0 - OFF), this input must be held high to keep the 7312 in automatic mode. When low, the 7312 is forced to manual operation (see section 5.4 for DIP switch descriptions).

> ***NOTE:***
> *Analog input range is 0-5 VDC, 1-5 VDC, 0-20 mA, or 4-20 mA depending on DIP switch and jumper positions.*

4.1.4 Front Panel Lockout: 24-Position Header, Position 15-16

In the automatic mode, this discrete input (when held high) disables all keypad pushbuttons on the 7312 front panel. This feature prevents unwanted tampering of the loop. In manual mode, all keypad pushbuttons are functional providing full manual control of the loop.

4.2 OUTPUTS

7312 outputs provided with the standard units:

4.2.1 CV-Output: 24-Position Header, Position 9-10 or 11-12

In automatic mode, the 7312 analog output is generated by the loop controller (the 7312 uses internal contacts to pass the loop controller signal through to the external actuator). In manual mode, CV-Output is generated by the 7312 and can be manipulated via ▲ and ▼ keys. Header positions 9 and 10 are used in voltage mode. Header positions 11 and 12 are used in current mode (see section 5.3).

> ***NOTE:***
> *The 7312 discrete outputs are actually relay contact closures which can switch up to 0.5 A at 125 VAC without seriously affecting contact life.*

NOTE:
The Analog output range is 0-5 VDC, 1-5 VDC, 0-20 mA, or 4-20 mA depending on DIP switch and jumper positions.

4.2.2 MAN/AUTO Request: 24-Position Header, Position 17-18 (N.O.)

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 DIP switch #9 - ON). (See section 5.4 for Handshaking description.)

4.2.3 AUTO/MAN Status: 24-Position Header, Position 19-20 (N.O.) or 19-21 (N.C.)

This contact closure allows the 7312 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.

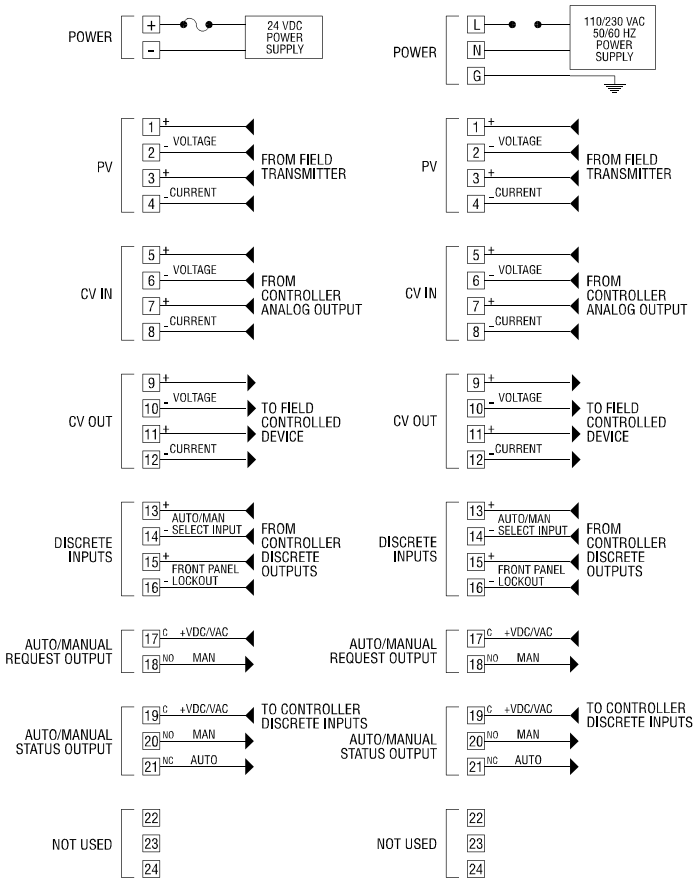


Figure 3 *7312 Inputs/Outputs (Standard Rear Panel)*

CHAPTER 5. FIELD CONFIGURATIONS (USER-SELECTED)

5.1 7312 CONFIGURATION PLANNING

Before using the 7312, you must set the jumpers and switches for the proper mode of operation. The user configuration can be divided into 5 separate categories.

1. 110/230 VAC Power Selection Switch (110/230 VAC unit only)
2. Setting Current and Voltage Jumpers
3. Configuring for Auto to Manual transfer
4. Configuring for Manual to Auto bumpless transfer
5. Configuring Special Functions

The following paragraphs will outline the different configuration choices for the above categories.

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 4 for switch and jumper locations.)

5.2 POWER SELECTION SWITCH

Power input to the 7312 may be selected for 110 VAC @ 60 Hz or 230 VAC @ 50 Hz as indicated on the switch. The switch is preset for 110 VAC operation. The 7312-24V does not require power input selection.

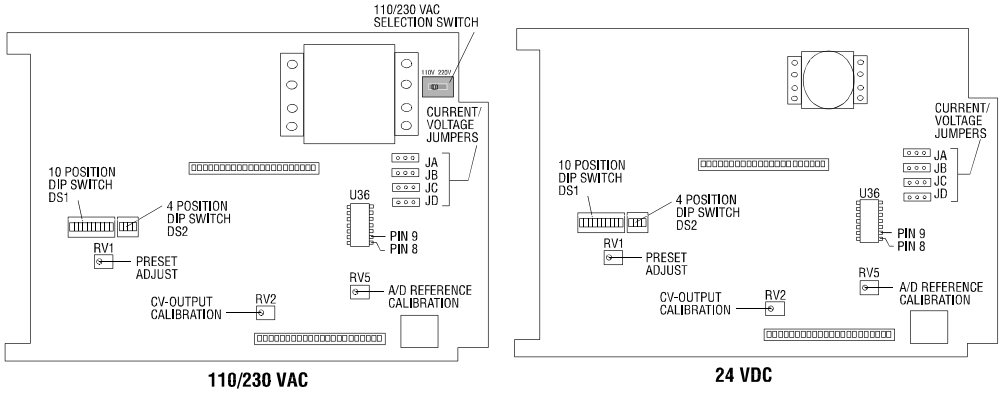


Figure 4 *Power Selection Switch*

5.3 SETTING CURRENT OR VOLTAGE MODES

5.3.1 Current/Voltage Mode - PV

The selection of current or voltage mode for the PV input signal is made by the placement of jumper plugs JA and JB on the main circuit board. The PV input signal is factory set for current mode (see Figure 5 for jumper placement details).

5.3.2 Current/Voltage Mode - CV

The selection of current or voltage mode for the CV-Input signal is made by the placement of jumper plugs JC and JD on the main circuit board. The CV-Input signal is factory set for current mode (see Figure 5 for jumper placement details).

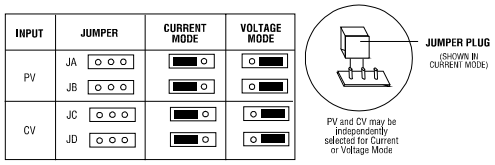


Figure 5 *Current/Voltage Jumper Placement*

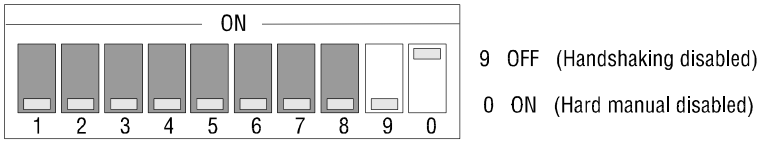
5.4 SETTING AUTO TO MANUAL TRANSFER

There are four basic modes of auto to manual transfer: Non-handshaking, which allows the operator to perform the transfer; Handshaking, which allows the loop controller to perform the transfer; Hard Manual Failure, which will force the 7312 into manual mode when a system failure is detected; and Low Loop Detect, which forces the system into manual mode when the Control Variable goes below 3.2 mA.

5.4.1 Non-Handshaking

The Non-Handshake mode gives the operator direct control of auto to manual (and manual to auto) transfer at any time by pressing the Auto/Man pushbutton. The external Auto/Man Select Input (see section 4.1.3) has no effect in this mode. To set up the 7312 for non-handshake mode, set switch # 9 and switch # 0 on DS1 DIP switch as follows:

> ***NOTE:***
> *DIP switch labeling may vary with manufacturer.*



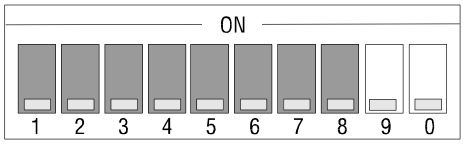
5.4.2 Handshaking

(See Appendix C for detailed discussion)

The 7312 provides discrete inputs and outputs which can give the loop controller the capability of approving the switch from auto to manual and preventing the operator from disturbing critical loop processes. When the operator presses the Auto/Man pushbutton, the 7312 will remain in automatic mode. The Manual/Auto Request output (see section 4.2.2) will close signaling to the loop controller that the operator has requested manual control. When manual control is acceptable to the process, the loop controller can switch the 7312 to manual mode by using the external Auto/Man Select Input (see section 4.1.3). With this mode enabled, a voltage of 5 to 24 VDC must be applied to the Auto/Man Select Input to maintain automatic control.

5.4.3 Hard Manual Failure

This mode functions the same as non-handshaking mode except that the external Auto/Man Select Input (see section 4.1.3) will cause an auto to manual transfer. In this mode, the external Auto/Man Select Input can be used to select manual mode, keeping the Analog Loop active in the event of process related failures. With this mode enabled, a voltage of 5 to 24 VDC must be applied to the Auto/Man Select Input to maintain automatic control. To utilize the features of Hard Manual Failure mode, set switch # 9 and switch # 0 on DS1 DIP switch as follows:



9 OFF (Handshaking disabled)

0 OFF (Hard manual enabled)

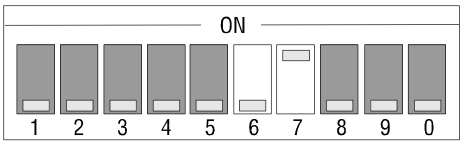
(See section 5.7.3 for auto to manual recovery from a Hard Manual Failure.)

5.5 SETTING MANUAL TO AUTO BUMPLESS TRANSFER

The 7312 provides several "bumpless transfer" alternatives before switching from manual to auto. The 7312 can ramp the CV-Output until it meets the CV value from the loop controller (see section 5.5.1). The 7312 can allow the operator to manually adjust the CV-Output to match the CV value from the loop controller or allow the loop controller to match the 7312 output (see section 5.5.2).

5.5.1 7312 Balances the CV-Output

When the Auto/Man pushbutton is pressed, the 7312 will ramp the 7312 CV-Output until it matches the loop controller signal at the 7312 CV-Input. The 7312 will switch to automatic mode at this time.



6 OFF (Balance enabled)

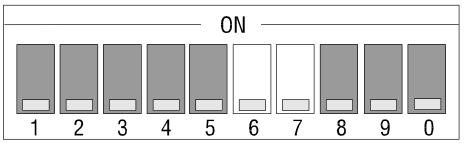
7 OFF (Auto balance)

5.5.2 Operator or Loop Controller Balance

With this option, the 7312 will ignore the Auto/Man pushbutton and remain in manual mode until the CV-Input matches the CV-Output. When the CV-Input matches the CV-Output, the 7312 will allow the Auto/Man pushbutton to select automatic mode.

The operator can balance the CV by using the 7312 ▲ and ▼ keys to adjust the 7312 CV-Output until it matches the loop controller signal at the 7312 CV-Input.

The Loop Controller can balance the CV by adjusting its output to match the 7312 CV-Output. This process requires the loop controller to monitor the 7312 CV-Output.



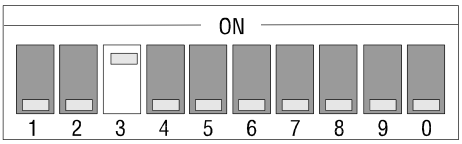
6 OFF (Balance enabled)

7 OFF (Manual balance)

5.6 SELECTING SPECIAL FUNCTIONS

5.6.1 Signal Offset

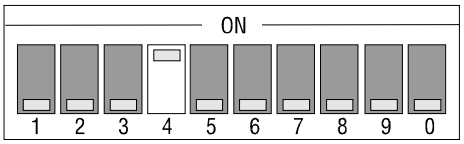
Signal offset allows the bargraphs to display 4 to 20 mA (1 to 5 Volts) as 0 to 100%. When this feature is not selected, the bargraphs will display 0 to 20 mA (0 to 5 Volts) as 0 to 100%.



3 ON (Signal offset)

5.6.2 Reverse Acting CV Scale and Output

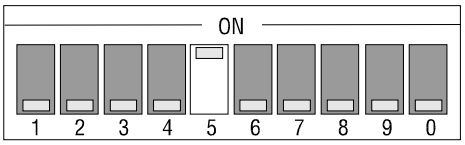
The CV scale display is reversed, 20 mA is displayed as 0% (no lighted segments on the bargraph). In manual mode, pressing the Up pushbutton decreases the CV-Output.



4 ON (Reverse CV display)

5.6.3 Reverse Acting PV Scale

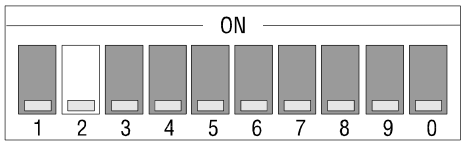
The PV scale is reversed, 20 mA is displayed as 0% (no lighted segments on the bargraph).



5 ON (Reverse PV display)

5.6.4 Last CV

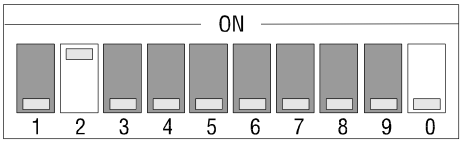
The 7312 monitors the CV from the loop controller. If manual mode is requested, the 7312 outputs a voltage or current CV as the last CV value from the loop controller.



2 OFF (Last CV)

5.6.5 Preset CV

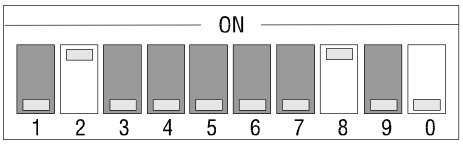
This function allows the 7312 to switch to a user defined level during a Hard Manual condition or a Low Loop Detect condition.



2 ON (Preset CV)
0 OFF (Hard Manual Enabled)

Also used in conjunction with preset CV is the CV setup switch (#8). To select the level of CV preset, set switch 8 ON and adjust Preset POT RV1.

For normal operation, please turn switch 8 OFF.



2 ON (Preset CV)
8 ON (Adjust Preset)
0 OFF (Hard Manual Enable)

Preset CV Value Operation:

Preset CV value 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 Detect condition, the 7312 will ramp the CV-Output to the value set by the Preset CV Potentiometer (RV1). (See Figure 4 for location of RV1.)

The Preset CV value must be set prior to the 7312 being placed in service. Factory setting is 4 mA (1 VDC). To adjust the Preset CV value, select PRESET CV (DS1 DIP switch #2 - ON), CV Setup (DS1 DIP switch #8 - ON), and Hard Manual Enable (DS1 DIP switch #0 - OFF). Apply power to the 7312 and verify transfer to manual mode. Turn the Preset Pot (RV1) clockwise to increase the Preset CV value. One complete turn will change the CV value approximately 0.8 mA (0.25 VDC). The new setting can be verified by observing the CV bargraph or monitoring CV-Output. ***When the adjustment is completed, Normal CV (DS1 DIP switch #8 - OFF) must be selected for normal operation.***

5.6.6 10-Position DIP Switch (DS1) Factory Settings

The switch positions are set as follows prior to shipping:

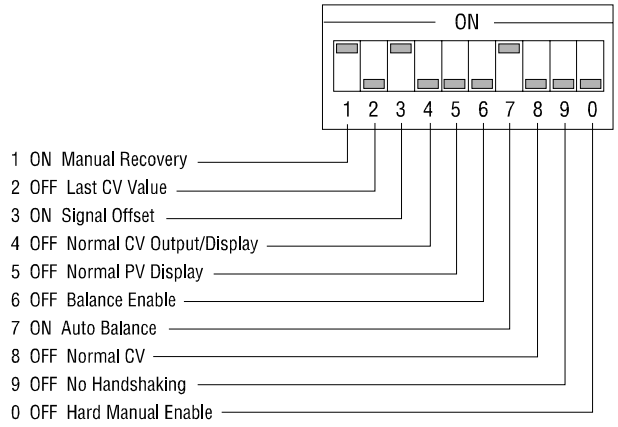


Figure 6 *10-Position DIP Switch (DS1) Factory Settings*

NOTE:
The term "Hard Manual" is used frequently in describing 7312 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.

4-POSITION DIP SWITCH (DS2) SETTINGS

The 4-position DIP switch located on the main printed circuit board (see Figure 4) controls slew rate selection and low loop detect. The switches are factory set for the following configuration:

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

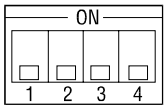


Figure 7 *4-Position DIP (DS2) Switch Factory Settings*

Slew Rate Select

Refer to the figure below when selecting the slew rate:

RATE	SWITCH 1 DS2	SWITCH 2 DS2	FULL SCALE SLEW	FULL SCALE BALANCE
1	OFF	OFF	14.12 seconds	32.07 seconds
2	ON	OFF	12.05 seconds	15.49 seconds
3	OFF	ON	9.09 seconds	5.43 seconds
4	ON	ON	6.90 seconds	3.52 seconds

Figure 8 *Slew Rate DIP Switch Positions (Switches 1 and 2)*

The following figure is a graphic comparison of the 4 slew rates. The graph represents the 7312 CV-Output in milliamps vs. Slew Rate in seconds. It is applicable to 4-20 mA/1-5 VDC as well as 0-20 mA/0-5 VDC signal ranges.

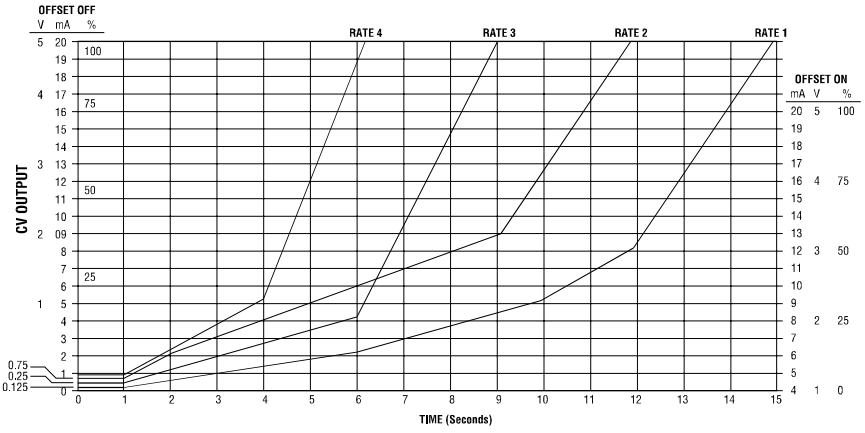


Figure 9 *CV-Output (mA) vs. Time (Seconds)*

5.6.7 Low CV Loop Current Detect

> ***NOTE:***
> *"Low Loop" is a term used to describe a condition in which the 7312 detects a CV-Input less than 3.2 mA (0.8 VDC) 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 Detect must be selected via DIP switches and the Auto Select Input must be held high.*

The 7312 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 7312 falls below 3.2 mA (0.8 VDC). This would be the result of a failed controller output or an open CV current loop. The 7312 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 7312 will react according to the position of DS1 DIP switch #2. If OFF (LAST CV VALUE), the 7312 will maintain a 4 mA (1.0 VDC) 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 5.6.5 for a description of Preset CV Value).

5.6.8 Auto/Manual Recovery

The Auto/Manual Recovery options are used when transferring from manual mode to automatic mode during Low Loop Detect (see section 5.7.2) or Hard Manual Failure (see section 5.4.3).

The selection of MANUAL RECOVERY (DS1 DIP switch #1 - ON) requires that the **MAN/AUTO** pushbutton on the 7312 front panel be pressed after the controller output has returned to normal or the Hard Manual Failure condition is removed. The selection of DS1 DIP switch #6 - OFF (BALANCE ENABLE) will prevent a mode transfer to automatic from the front panel if the 7312 CV-Input is not equal to the CV-Output.

The selection of AUTOMATIC RECOVERY (DS1 DIP switch #1 - OFF) will return the 7312 to automatic mode when the controller output returns to the valid range (4-20 mA or 1-5 VDC) for Low Loop Detect or the Hard Manual Failure condition is removed. The selection of DS1 DIP switch #6 - OFF (BALANCE ENABLE) will prevent a mode transfer to automatic if the 7312 CV-Input is not equal to the CV-Output.

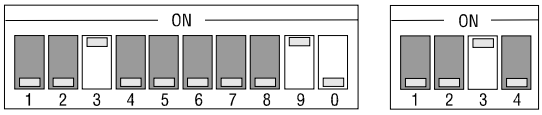


Figure 10 *Low CV Loop Current Detection Switch Settings*

CHAPTER 6. INSTALLATION

The mounting procedures for the 7312-NM12 Option and 7312-NM04 Option differ. Refer to the following sections for specific mounting instructions for the Model 7312-NM12 or 7312-NM04.

> ***CAUTION:***
> *Failure to comply with the installation procedure given below may result in damage to the 7312, and/or other units mounted in the enclosure. Damage from improper installation is not covered by any warranty.*

6.1 7312-NM12 MOUNTING

The 7312-NM12 can be panel mounted or rack mounted to fit specific applications. The following procedure describes how to mount the 7312-NM12 in a panel (Figure 11 gives dimensional information for rack mounting the 7312):

Step 1. Locate the position in the enclosure where the 7312 is to be mounted. Ensure that there is adequate panel and depth clearance for mounting. Refer to Figure 11 for front bezel and mounting depth dimensions.

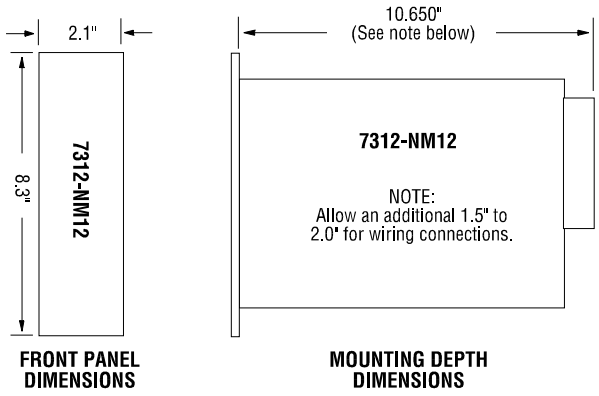


Figure 11 *7312-NM12 Mounting Dimensions*

Step 2. Cut an opening in the enclosure as shown in the following figure:

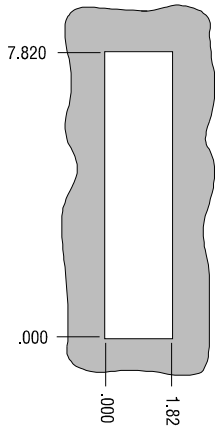


Figure 12 *7312-NM12 Panel Cut-out*

Step 3. Slide module through enclosure opening. Insert mounting brackets into slots on top and bottom of the module. Stand brackets up vertically. Tighten mounting screws through brackets into the back of the panel/enclosure. Do not over tighten the screws (see the figure below).

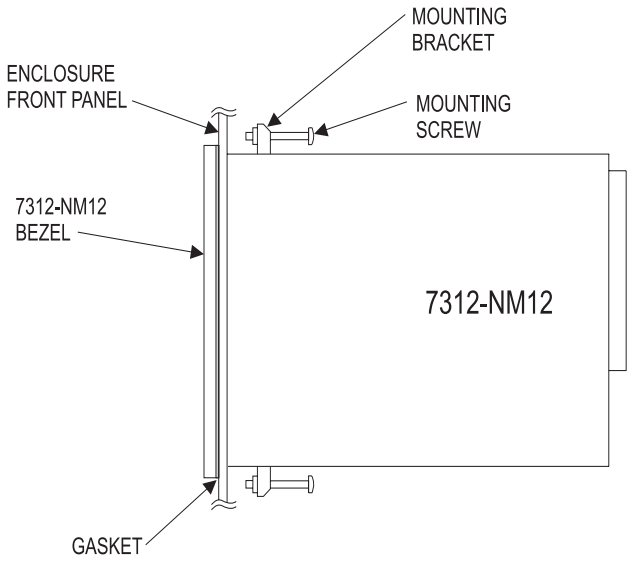


Figure 13 *7312-NM12 Mounting Brackets*

6.2 7312-NM04 MOUNTING

The 7312-NM04 is designed to be panel mounted. To comply with NEMA 4 specifications, the 7312-NM04 must be installed in a NEMA 4 environment according to the following procedure:

Step 1. Locate the position in the NEMA 4 enclosure where the 7312 is to be mounted. Ensure that there is adequate panel and depth clearance for mounting. See the following figure for overall clearances:

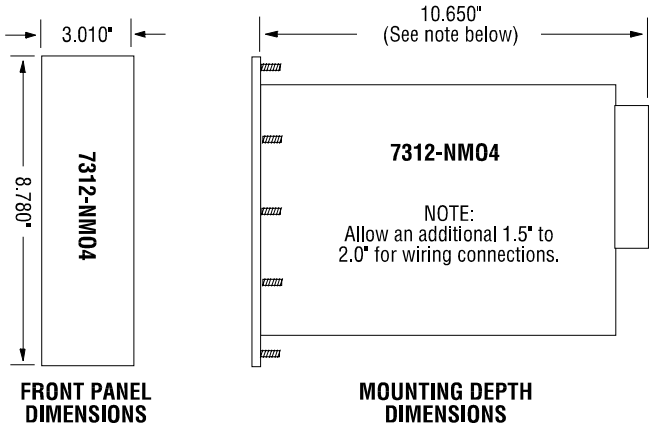


Figure 14 *7312-NM04 Overall Dimensions*

Step 2. Cut an opening and drill 10 mounting holes (#10 clearance) in the enclosure as shown in the following figure.

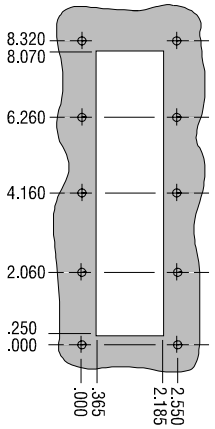


Figure 15 *7312-NM04 Panel Cut-out and Hole Pattern*

Step 3. Remove the 4 nuts from the studs on the back of the 7312-NM04 front panel. Do not disassemble the 7312 front panel/gasket assembly.

Step 4. Line up the studs on the 7312 with the holes in the NEMA 4 enclosure panel, then insert the 7312 into the cut-out through the front of the panel.

Step 5. Place the nuts onto the threaded studs (additional nuts are packed in an envelope with the 7312-NM04 for a total of 10 nuts). Tighten the nuts in the sequence and to the torque specifications shown in the following figure:

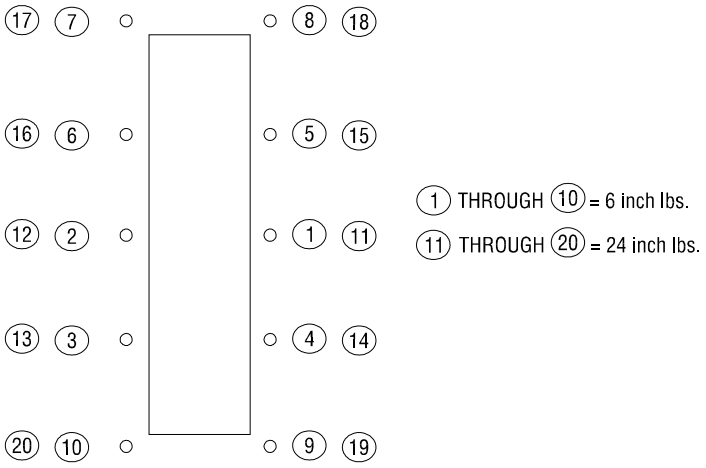


Figure 16 *7312-NM04 Mounting Torque Sequence*

6.3 CLEAR FRONT PANEL PROTECTIVE OVERLAY

The clear plastic overlay (CTI part number 502A-7312) furnished with the 7312 is designed to protect custom scales, legends, or reference marks. To apply, peel the backing off of the overlay and carefully align over the 7312 front panel. Press gently in place once properly aligned.

6.4 FIELD WIRING

6.4.1 Standard Rear Panel

The 7312 with a standard rear panel is provided with two-piece connectors to facilitate wiring and is keyed to maintain polarity (see Figure 17). See Chapter 4 for description of 7312 inputs and outputs. If a set point option card is included, a 14-position connector will be present (see Chapter 7 for a description of the set point signals).

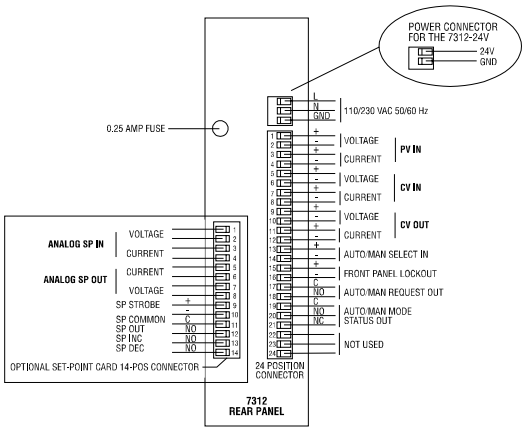


Figure 17 *Standard Rear Panel Configuration*

6.4.2 Loop Integrity Block

The optional Loop Integrity Block (7300-LIB) is used with 7312s equipped with the standard rear panel configuration. Loop Integrity Block dimensions are shown in the following figure:

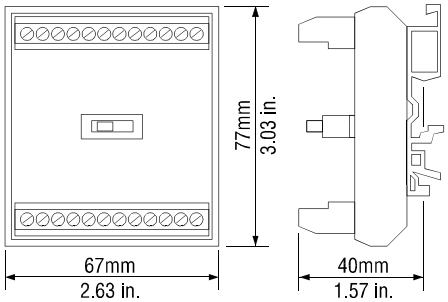


Figure 18 *LIB Dimensions*

Field wiring for PV (current), CV-Input, and CV-Output signals are terminated on the FIELD WRG side of the LIB rather than wired directly to the 7312 connector. Additional wiring is required to connect these signals from the 7312 WRG side of the LIB to the 7312 rear panel. See the following figure for wiring details:

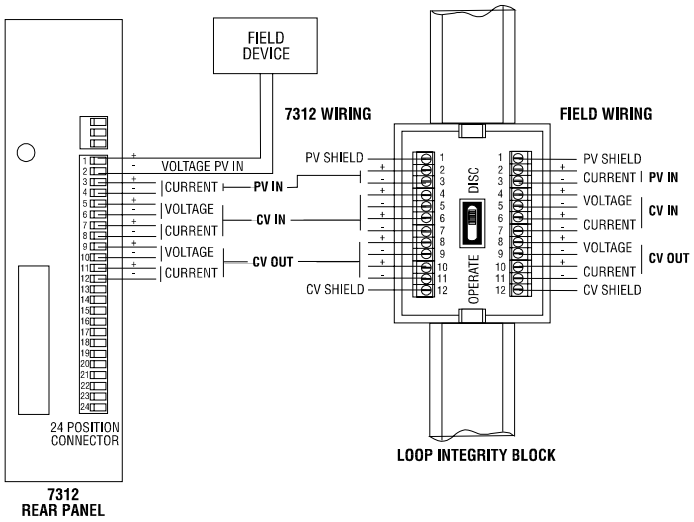


Figure 19 *Loop Integrity Block Wiring*

When the switch is in the OPERATE position, the PV (current), CV-Input, and CV-Output signals are passed through the LIB and into the 7312. In this configuration, the LIB is simply a wiring junction between the 7312 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 7312 is isolated from the critical control parameters and may be removed from service without disrupting the process.

NOTE:
Any discrete signals (see Chapter 4) used by the 7312 must be wired directly to the rear panel 24-position connector and do not pass through the LIB. Set point signals (if SP option card is installed) must be wired directly to the rear panel 14-position 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

6.4.3 DIN Rail Block

The optional DIN Rail Block (7300-DIN) provides a convenient method terminating field wiring away from the 7312 rear panel. The DIN Rail option includes a special ribbon cable connector on the 7312 rear panel, 3-foot ribbon cable, and DIN Rail Loop Integrity Block. Dimensions of the DIN Rail Block are shown in the following figure:

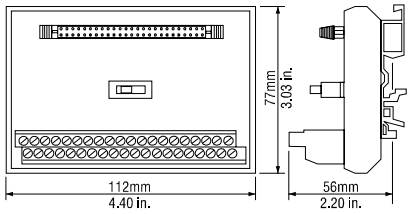


Figure 20 *DIN Rail Block Dimensions*

This DIN Rail Block contains a 36-position wiring terminal, loop integrity switch, and ribbon cable connector. All signals required to interface with the 7312 (including optional set point signals) are terminated at the DIN Rail Block and connected via ribbon cable to the 7312. See the following figure for wiring details:

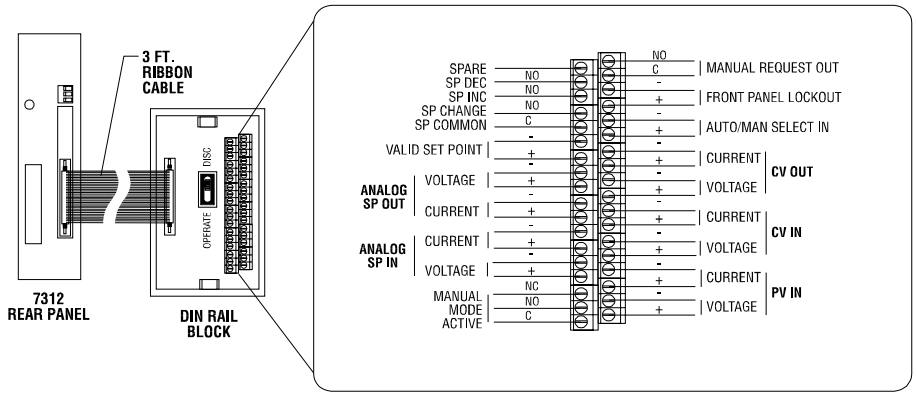


Figure 21 *DIN Rail Block Connection Wiring*

When the loop integrity switch is in the OPERATE position, all signals are passed through the DIN Rail Block and into the 7312. In this position, the DIN Rail Block is simply a wiring junction between the 7312 and the process control system. When the switch is in the DISCONNECT position, contacts on the switch 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 7312 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 Chapter 7 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. 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

CHAPTER 7. SET POINT OPTION CARDS

The 7312 is equipped with connectors which allow optional cards to be added which display and change the controller set point via analog input/output (7312-ANLG), or display the controller set point via an analog input and change it via discrete outputs (7312-DISC).

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 Figures 22 and 23 for jumper location on each specific card.

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

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

NOTE:
Discrete outputs are actually relay contact closures which can switch up to 0.5 A at 125 VAC without seriously affecting contact life.

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

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 7312 front panel keypad by pressing and holding the SP key, and then pressing the ▲ or ▼ key.

CAUTION:

Set Point Option Cards manufactured for pre-1990 Models 7301 or 7302 cannot be used in 7312s manufactured after 1989. Using the older model cards in the newer model 7312 will damage circuit board components.

CAUTION:

When current mode is selected for the ANALOG SET POINT INPUT signal, the 7312 input resistance is 100 ohms. Excessive currents will result in damage to components and the circuit board. ***DO NOT ALLOW THIS SIGNAL TO EXCEED 20 MILLIAMPS.***

7.1 SET POINT DISPLAY AND CHANGE [ANALOG] (7312-ANLG)

This card allows the 7312 to display the controller set point and permits an operator-initiated change of this parameter from the front panel keypad. The 7312 is furnished the process set point value via an analog signal from the controller. An additional analog output from the 7312 indicates the current set point value as requested from the 7312 front panel keypad. See Figure 22 for wiring details.

7.1.1 7312-ANLG Inputs:

Analog Set Point Input: 14-Position Header, Positions 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 22).

Set Point Strobe: 14-Position Header, Positions 9-10

This discrete input must be held high for the 7312 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 7312s (see section 7.3 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.

NOTE:

The controller must sense the Set Point Change Output contact, 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 7312. This analog signal is received as Analog Set Point Input. This signal allows the 7312 to display the current set point value on the PV bargraph.

7.1.2 7312-ANLG Outputs:

Set Point Change: 14-Position Header, Positions 11 (COM) - 12 (N.O.)

This contact closure allows the controller to monitor the status of the **SP** pushbutton on the 7312 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-Position Header, Positions 5-6 or 7-8

This analog signal from the 7312 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 mode.

7.1.3 Operation

When powered up, the 7312 sets the Analog Set Point Output signal equal to the Analog Set Point Input signal. If SIGNAL OFFSET is selected (DS1 DIP switch #3 - ON), the minimum output is 4 mA (1 VDC). 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 at an exponential rate until the signal range limits are reached or the key is released.

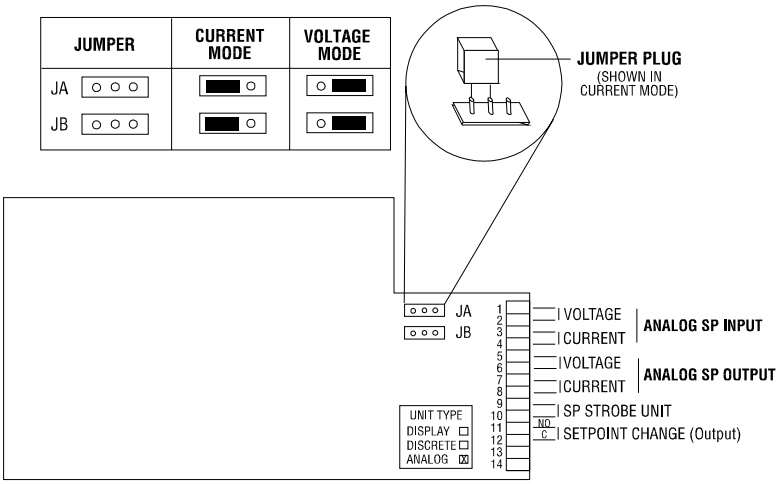


Figure 22 *Set Point Display and Change [Analog] Option Card*

7.2 SET POINT DISPLAY AND CHANGE [DISCRETE] (7312-DISC)

This card allows the 7312 to display the controller set point and permits an operator-initiated change of this parameter from the front panel keypad. The 7312 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 23 for wiring details.

7.2.1 7312-DISC Inputs:

Analog Set Point Input: 14-Position Header, Positions 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 23).

Set Point Strobe: 14-Position Header, Positions 9-10

This discrete input must be held high for the 7312 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 7312s (see Section 7.3 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.

NOTE:
The controller must sense the Set Point Change Output contact, monitor the SP increment and SP decrement contacts, internally modify its loop set point, and then output the new set point value to the 7312. This analog signal is received as Analog Set Point Input and allows the 7312 to display the current set point value on the PV bargraph.

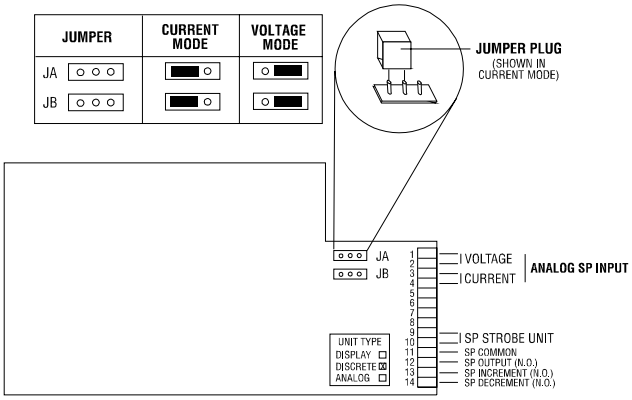


Figure 23 *Set Point Display and Change Option Card*

7.2.2 7312-DISC Outputs:

Set Point Change: 14-Position Header, Positions 11 (COM) - 12 (N.O.)

This contact closure allows the controller to monitor the status of the **SP** pushbutton on the 7312 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 7312 front panel keypad.

SP Increment: 14-Position Header, Positions 11 (COM) - 13 (N.O.)

This contact closure allows the controller to sense when the ▲ pushbutton on the 7312 front panel keypad is pressed. The N.O. relay energizes when the ▲ and the **SP** pushbutton is pressed.

SP Decrement: 14-Position Header, Positions 11 (COM) - 14 (N.O.)

This contact closure allows the controller to sense when the ▼ pushbutton on the 7312 front panel keypad is pressed. The N.O. relay energizes when the ▼ and the **SP** pushbutton is pressed.

7.2.3 Operation

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.

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 setting of the counter increments can be configured for each specific application. Factors such as PLC scan time and analog module resolution must be considered.

In addition to internally modifying the loop set point, the controller must transfer the new set point value for analog output to the 7312. This signal becomes the Analog Set Point Input displayed on the PV bargraph.

7.3 MULTIPLEXING ANALOG SET POINT INPUT SIGNALS

The 7312 equipped with any set point option card uses 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 7312s, 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 7312s. The controller would use one analog output channel (Analog Set Point Input) and four discrete outputs (Set Point Strobe). See example in the following figure:

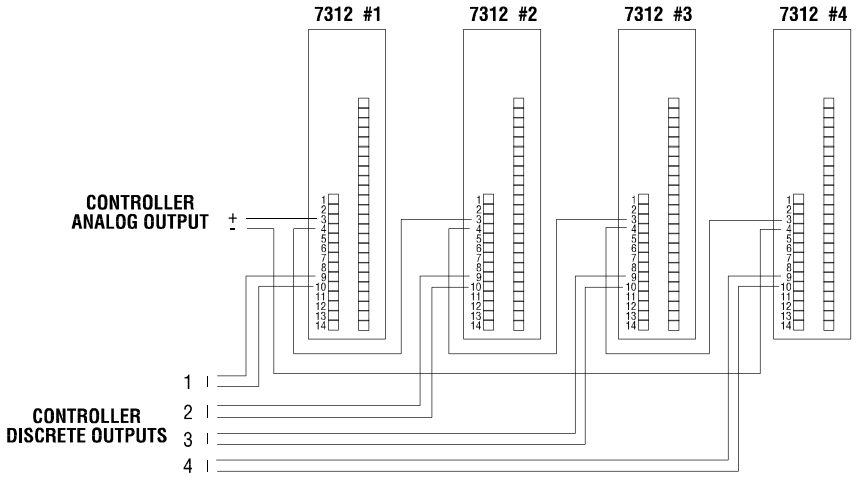


Figure 24 *Analog Set Point Input Signal Multiplexing*

The program would perform the following:

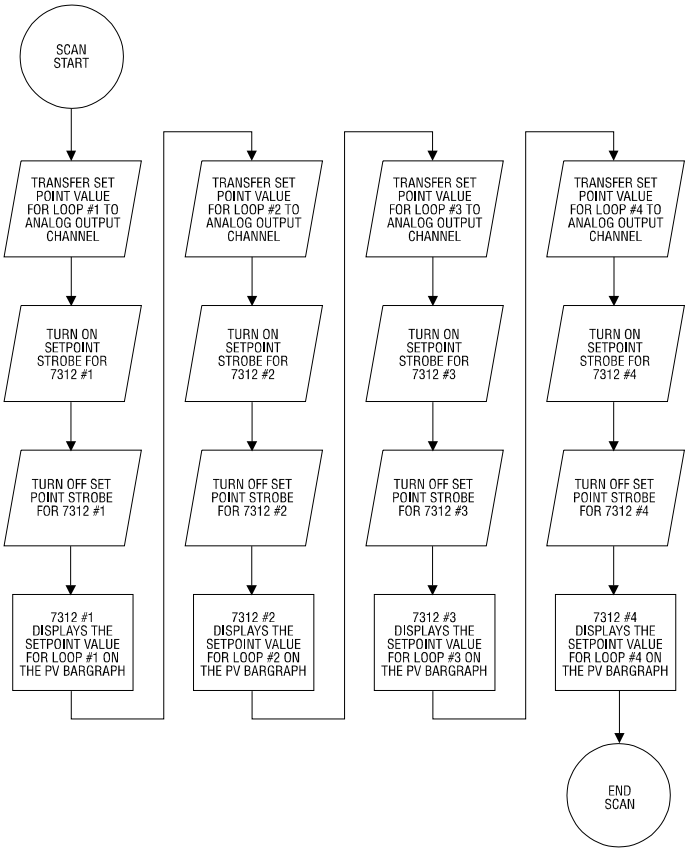


Figure 25 *Multiplexing Flow Diagram*

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.

CHAPTER 8. DIAGNOSTICS

The 7312 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 Figures 28 and 29).
2. All 10 DS1 DIP switches must be set to the "ON" position (see Figure 27).
3. For self test operation, make the connections as shown in the following figure for rear panel or DIN Rail Block wiring.

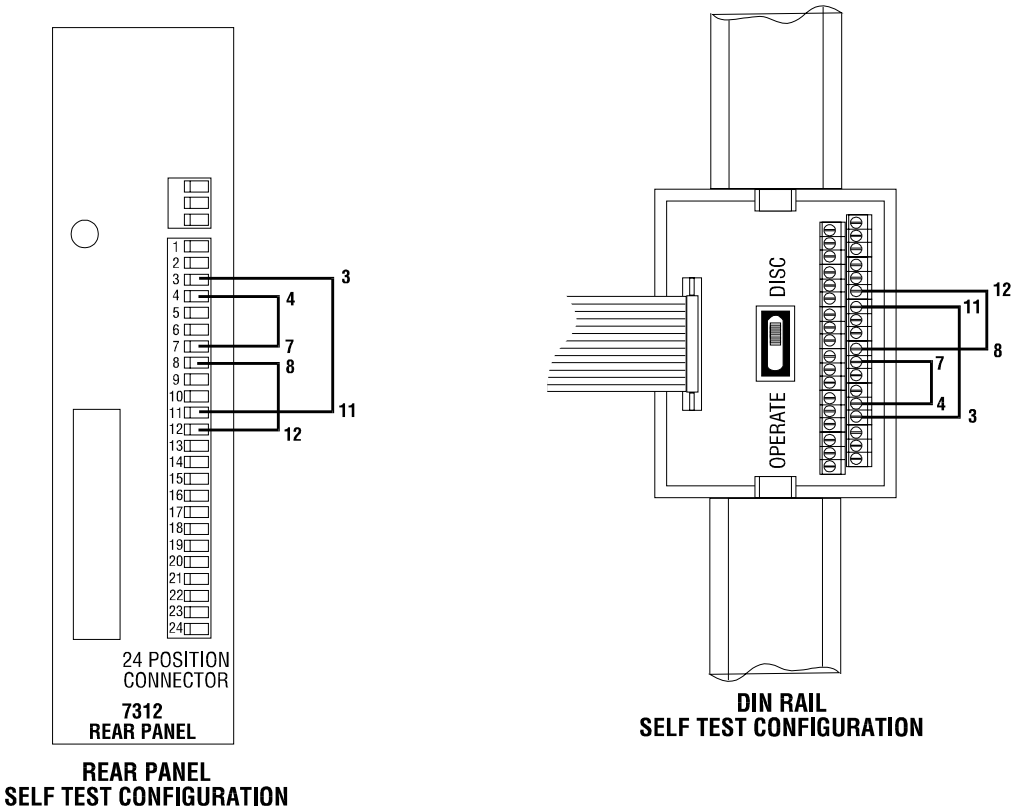


Figure 26 *Self Test Configuration (Standard Rear Panel)*

4. Apply power to the 7312. 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** LEDs 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 7312. 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.

CHAPTER 9. 7312 CALIBRATION

When shipped from the factory, the 7312 has been calibrated. If it becomes necessary to recalibrate the 7312, the following procedure should be used.

WARNING:
Only qualified personnel familiar with electrical safety procedures should perform the 7312 calibration.

WARNING:
The 7312 must be powered up to perform the following calibration procedure. Extreme caution should be exercised when accessing components on the circuit card to prevent electric shock or damage to the unit.

Step 1. Remove the screw and flat washer on the rear panel which secures the left side (as seen from the rear) side panel. Slide the side panel out to expose the main circuit board.

Step 2. Record the positions of the 10 position DIP switch and 4 position DIP switch.

Step 3. Set the 10-position DIP Switch as follows:

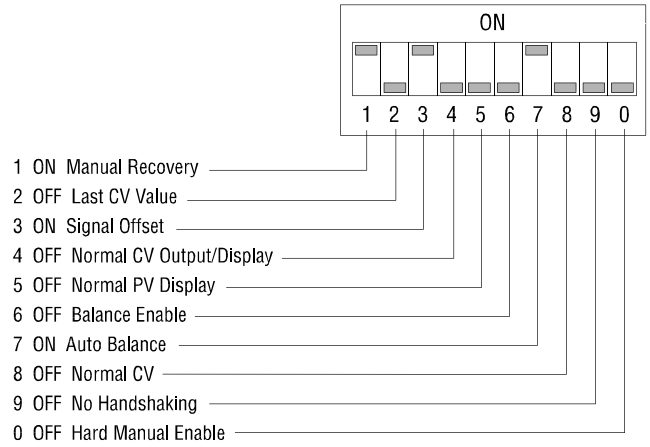


Figure 27 *10-Position DIP Switch (DS1)*

Step 4. Power up the 7312. Locate IC U36 and trim pot RV5 on the main circuit board (see the following figure). Connect a Digital Volt Meter (DVM), reference ground to U36 pin 8 and monitor VDC at pin 9. Adjust the voltage to 1.28 VDC with trim pot RV5.

Step 5. Remove power from the 7312. Configure the 7312 for Voltage Mode CV-Output with Jumpers JC and JD (see section 5.3). Power up the 7312. Place the 7312 in manual mode. Increment the CV-Output to full scale. Monitor the CV-Output with a DVM. Adjust the CV-Output to 5 VDC with trim pot RV2 (see Figure 28).

Step 6. Remove power from the 7312. Configure the 7312 for Current Mode CV-Output with Jumpers JC and JD (see section 5.3). Power up the 7312. Increment the CV-Output to full scale. Monitor the CV-Output with a DVM. The CV-Output should read 20 mA.

Step 7. Return all switches to their original position (see step 2). Calibration is now complete.

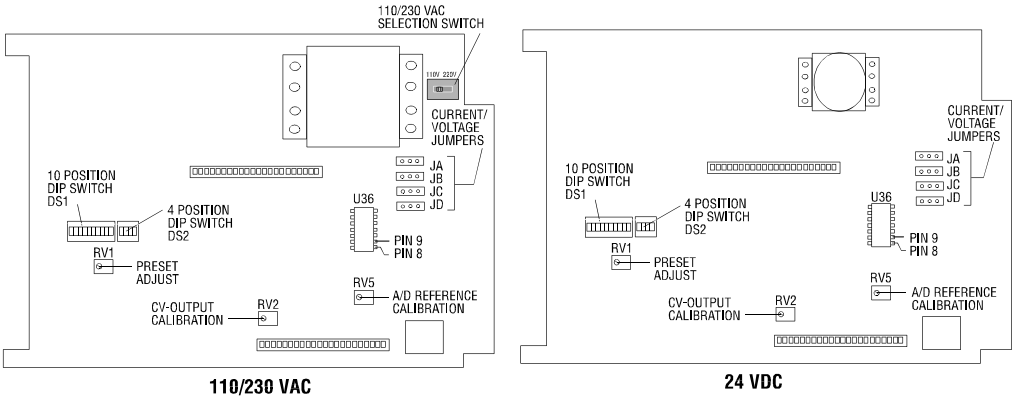


Figure 28 *IC and Calibration Potentiometer Locations*

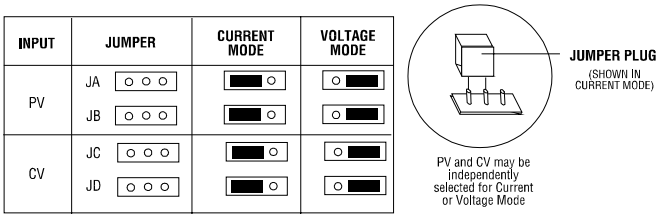


Figure 29 *Current and Voltage Jumper Placement*

SPECIFICATIONS

PROCESS VARIABLE (PV)/ SET POINT (SP)

	CURRENT	VOLTAGE
Signal Range	0-20 mA or 4-20 mA	0-5 VDC or 1-5 VDC
Input Impedance	100 Ω 0.1%	500 K Ω Min.
Common Mode Rejection Ratio	45 dB Min.	45 dB Min.
Display Resolution Accuracy	2% of Full Scale	2% of Full Scale

CONTROLLED VARIABLE (CV)

CV-INPUT

Signal Range	0-20 mA or 4-20 mA	0-5 VDC or 1-5 VDC
Input Impedance	100 Ω 0.1%	500 K Ω Min.
Common Mode Rejection Ratio	45 dB Min.	45 dB Min.
Display Resolution Accuracy	2% of Full Scale	2% of Full Scale

CV-OUTPUT

Signal Range	0-20 mA or 4-20 mA	0-5 VDC or 1-5 VDC
Manual Mode Load Impedance	800 Ω Max.	1 K Ω Min.
Electrical Isolation	1500 VRMS	1500 VRMS
Mode Transfer Error		
Auto to Manual	1% (Typical)	1% (Typical)
	2% (Maximum)	2% (Maximum)
Manual to Auto	1% (Typical)	1% (Typical)
	2% (Maximum)	2% (Maximum)
Auto Balance Time user selected	3.52 sec to 32.07 sec	

POWER INPUT 7312

Voltage	110 VAC @ 60 Hz or 230 VAC @ 50Hz
Power	15 Watts (Max)

POWER INPUT 7312-24

Voltage	24 VDC (20 to 28 VDC)
Power	15 Watts (Max)

INPUT SIGNALS (DISCRETE)

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

OUTPUT SIGNALS (DISCRETE)

Relay Contact Current Rating (Max)	0.5 Amp @ 30 VDC or 120 VAC
	0.25 Amp @ 230 VAC

MANUAL CONTROL

Slew Rate	Variable (user selected)
Full Scale Slew Time	6.90 sec to 14.12 sec (user selected)

ENVIRONMENTAL

Storage Temperature	-40° to 85°C (-40° to 185°F)
Operating Temperature	0° to 60°C (32° to 140°F)
Humidity	5% to 95% R.H. (non-condensing)
Front Panel Seal Rating	
Model 7312-NM12:	NEMA 12
Model 7312-NM04:	NEMA 4

DIMENSIONS

Case Dimensions (HWD)	7.8" x 1.8" x 10.4" (19.2 x 4.6 x 26.4 cm)
Front Panel (HW)	
Model 7312-NM12:	8.3" x 2.1" (20.335 x 5.145 cm)
Model 7312-NM04:	8.780" x 3.010" (22.3 x 7.7 cm)
Recommended Cutout (HW)	
Model 7312-NM12:	7.82" x 1.82" ± .010" (19.16 x 4.46 cm) ± (.2mm)
Model 7312-NM04:	7.82" x 1.82" ± 0.10" (19.16 x 4.46 cm) ± (.2mm)
Maximum Enclosure Panel Thickness:	.375" (9.525 mm)
7312-NM04 Gasket material:	.062 Cellular Urethane Poron (#4701-01-20062-1604-IPSA)
7312-NM04 Threaded studs:	10 #8-32
7312-NM04 Stud hole diameter:	.201" (5.105 mm) .004" (0.10 mm)
Weight:	4 lbs (1.8 kg)
Wiring Terminal Size:	Accepts No. 14 - 22 AWG wire
Agency Approval:	UL
Approvals Pending:	FM, CSA

APPENDIX A . DS1 DIP SWITCHES

The following is a detailed description of the DS1 DIP switches:

SWITCH #1 ON MANUAL RECOVERY

The MAN/AUTO pushbutton on 7312 keypad must be pressed to transfer from manual to automatic mode after a Hard Manual condition (DS1 DIP switch #0 - OFF). The Auto/Manual Select Input must be high before the pushbutton is pressed.

OFF AUTOMATIC RECOVERY

The 7312 automatically transfers to automatic mode after a Hard Manual condition when the Auto/Man Select Input goes high.

NOTE:

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

SWITCH #2 ON PRESET CV

The 7312 automatically ramps the CV-Output to the Preset CV Value after transferring to manual mode due to a Hard Manual or Low CV Loop Current condition. Hard Manual Enable must be selected (DS1 DIP switch #0 - OFF). See DS1 DIP switch #8 and section 5.6.5 for description of Preset CV Value.

OFF LAST CV

The 7312 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 DIP switch #3.

SWITCH #3 ON SIGNAL OFFSET

The 7312 PV and CV scales display "live zero" analog signal ranges (4-20 mA or 1-5 VDC). When the 7312 is in manual mode, The CV-Output signal will not go below 4 mA (1 VDC) or above 20 mA (5 VDC). See section 5.3 for selection of current or voltage mode.

OFF SIGNAL PRESET

The 7312 PV and CV scales display analog signal ranges of 0-20 mA or 0-5 VDC. See section 5.3 for selection of current or voltage mode.

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

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

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

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

OFF **NORMAL PV DISPLAY**

The PV scale display is direct-acting, i.e., a 20 mA (5 VDC) 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 analog input).

OFF **BALANCE ENABLE**

The 7312 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 7312 operation.

SWITCH #7 ON **AUTO BALANCE**

When a transfer from manual to automatic mode is initiated, the 7312 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 DIP switch #2 and switch #0. See section 5.6.5 for description of Preset CV Value.

OFF **NORMAL CV**

The CV scale displays the 7312 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 (Manual/Auto Request) which provides a contact closure when the AUTO/MAN pushbutton on the front panel is pressed to initiate a mode transfer to manual mode. See section 5.4.2 and Appendix C for a description of HANDSHAKING features.

OFF NON-HANDSHAKING

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

NOTE: DS1 DIP switch #6, switch #7, and switch #9 positions affect mode transfers.

SWITCH #0 ON HARD MANUAL DISABLE

The 7312 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 7312 operating mode is **NOT** desired.

OFF HARD MANUAL ENABLE

The Auto/Manual Select Input is constantly monitored to determine the 7312 operating mode. If the input is high, automatic mode is selected. If the input goes low, the 7312 transfers to manual operation.

APPENDIX B. DS2 DIP SWITCHES

4-Position DIP Switch Settings (DS2):

SWITCH #1 and #2 SLEW RATE SELECT

See section 5.7.1 for detailed description of slew rate selection.

SWITCH #3 ON LOW CV LOOP CURRENT DETECT ENABLE

This switch position forces the 7312 into manual mode when the CV-Input falls below 3.2 mA (0.8 VDC). See section 5.7.2 for more details.

OFF LOW CV LOOP CURRENT DETECT DISABLE

With Low CV Loop Current Detect disabled, the CV-Input has no effect on Auto to Manual transfer.

SWITCH #4 NOT USED

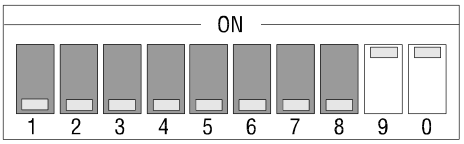
APPENDIX C. HANDSHAKING

Handshaking

Handshaking provides a means for the controller or host computer to monitor and control the operational mode of the 7312 at all times. The selection of DS1 DIP switch #9 -ON prohibits unauthorized mode transfers from the 7312 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 7312 then monitors the Auto-Manual Select Input for control of the actual mode transfers. 7312 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:

Handshaking Example 1:



9 ON (Handshaking enabled)
0 ON (Hard manual disabled)

The 7312 powers up in automatic mode. Auto/Manual Select Input should be held high. (However, 7312 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.

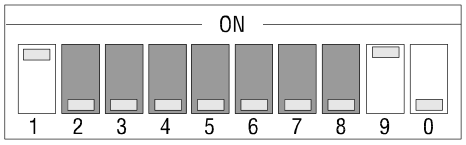
NOTE:
Incorporate Handshaking as shown in Example 1 when control over the 7312 operating mode is required, but note that all mode transfers will be initiated from the 7312 front panel. This configuration does not allow the 7312 to automatically transfer to manual mode on a Hard Manual failure.

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 7312 into manual mode. The 7312 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 7312 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 (19 and 20 closed in manual mode).

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 7312 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 (19 and 21 closed in automatic mode).

Handshaking Example 2:



1 ON (Manual recovery)
9 ON (Handshaking enabled)
0 OFF (Hard manual enabled)

The 7312 powers up in automatic mode. The Auto-Manual Select Input must be held high to keep the 7312 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.

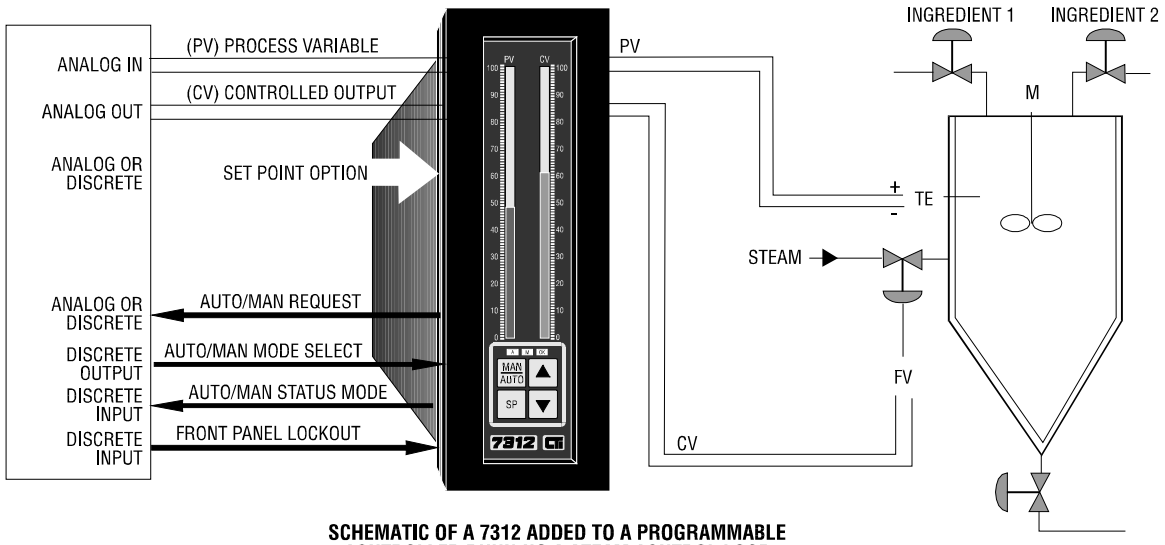
The host reads the input and evaluates the transfer to manual mode. If allowed, the host drops the signal low to the Auto/Manual Select Input (pins 13-14) forcing the 7312 into manual mode. Because Hard Manual Enable is selected, the 7312 will transfer to manual mode immediately if the Auto/Manual Select 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 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 7312 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 7312 goes into manual mode with the Manual/Auto Request Output contact in the open position, the mode transfer was caused by a "Hard Manual" condition.

APPENDIX D. TYPICAL APPLICATION



SCHEMATIC OF A 7312 ADDED TO A PROGRAMMABLE CONTROLLER RUNNING A STEAM CONTROL LOOP

LIMITED PRODUCT WARRANTY (EXCLUDING SOFTWARE)

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 an authorized CTI Industrial Distributor. 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, acts of God, neglect, abuse, misuse, transportation, alterations, attachments, accessories, supplies, non-CTI parts, non-CTI repairs or activities, or to any damage whose proximate cause was utilities or utility like services, or faulty installation or maintenance done by someone other than CTI.

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