

# Installation and Operating Instructions

**Before operating this product, read all installation, commissioning, and operating instructions. Failure to follow these instructions could result in product damage or cause a hazardous condition. Check all ratings, product specifications, and installation requirements provided to ensure the product is suitable for the intended application. This product must be setup and maintained in the field by qualified combustion personnel.**

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## Installation Instructions

### SMARTLINK™ MRV Components

As shown below, the minimum SMARTLINK™ MRV system requires two Valve Actuators and one (DIN rail-mounted) Control Interface. A total of four Valve Actuators can be supported by one Control Interface. In addition, several optional DIN rail-mounted components are available to simplify electrical interfacing and commissioning. These optional components include:

- a.) **Relay Input Interface** – Provides the electrical interface between the 6 Control Interface inputs and the customer's burner management or flame safety device. This device is available in 120VAC, 230VAC, and 24VDC models.
- b.) **Relay Output Interface** – Provides the electrical interface between the 5 Control Interface outputs and the customer's burner management or flame safety device.
- c.) **Network Interface** – Provides a plug-type terminal connector for all SMARTLINK™ MRV field devices.
- d.) **User Display** – Provides a 4-line x 20-character LCD display for system commissioning and maintenance.
- e.) **Universal Power Supply** – Provides regulated 24VDC power to all SMARTLINK™ MRV system components.

These optional components can be ordered individually and wired by the customer. However, two SMARTLINK™ MRV Interface Panel assemblies are available with factory-wired components as follows:

- (1) **24"x20" Interface Panel:** Includes factory-wired Input & Output Relay Interfaces, Network Interface, Supply, Control Interface, User Display, and Terminal Block Assembly
- (2) **20"x16" Interface Panel:** Includes factory-wired Input & Output Relay Interfaces, Network Interface, Supply, Control Interface, and Terminal Block Assembly

The larger, 24" x 20" Interface Panel includes a User Display. Both Interface Panels provide a 4-Amp breaker and power switch as well as a labeled terminal block for field wiring.

The Interface Panels can be specified with a windowed, NEMA 4X enclosure in painted steel, 304-stainless or 316-stainless. **When provided with a NEMA 4X enclosure, the complete package is Class 1, Division 2 approved and no purging equipment is required.**

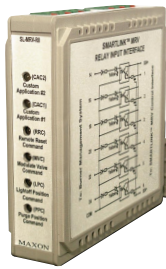
Because SMARTLINK™ Valve Actuators communicate digitally to the Control Interface, an EIA Level 4 Cable with 2 twisted pair and shield is required for these connections. See the Electrical Installation section for wiring specifications.



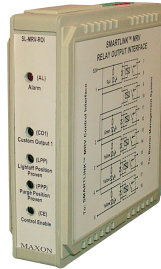
**Minimum SMARTLINK™ MRV System Requirements**  
*2 Valve Actuators & 1 Control Interface*

# Installation Instructions

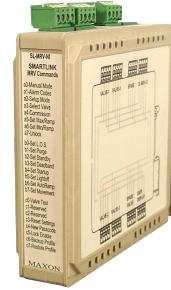
## Optional Components



Relay Input Interface



Relay Output Interface



Network Interface

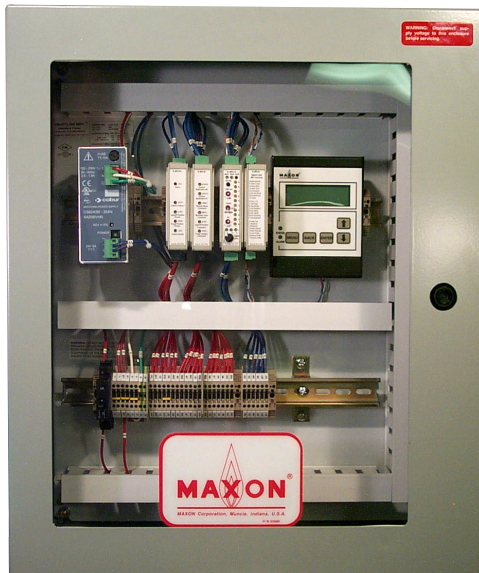


User Display

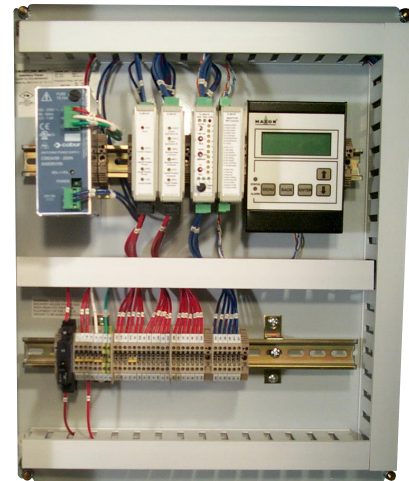


Universal Supply

## Optional SMARTLINK™ MRV Interface Panel Assemblies



**Interface Panel with Enclosure**  
 (24" x 20" Interface Panel shown; 20" x 16" Interface Panel does not include User Display)



**Interface Panel without Enclosure**  
 (24" x 20" Interface Panel shown; 20" x 16" Interface Panel does not include User Display)

# Installation Instructions

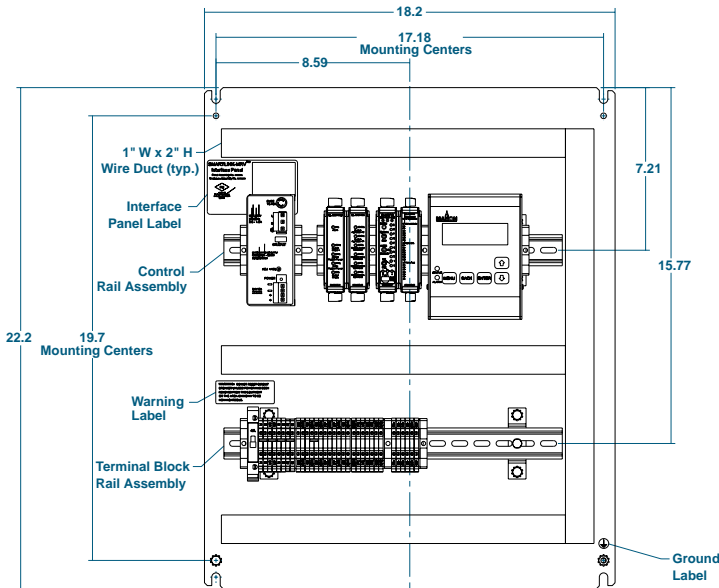
## Mechanical Installation

The mechanical installation of the SMARTLINK™ MRV system requires the following:

- SMARTLINK™ Valve Actuators:**  
 Install the Valve Actuator assemblies in any orientation within the appropriate air and fuel pipe trains. SMARTLINK™ MRV is available as a 2, 3, or 4-valve system. The number of Valve Actuators to be installed with the MRV Control Interface is indicated by one of the fields within the Control Interface model number. (See Assembly Number page 7400-A/P-4.)
- SMARTLINK™ MRV Control Interface (When ordered without Interface Panel):**  
 The Control Interface must be snapped onto a DIN rail within a customer's enclosure.

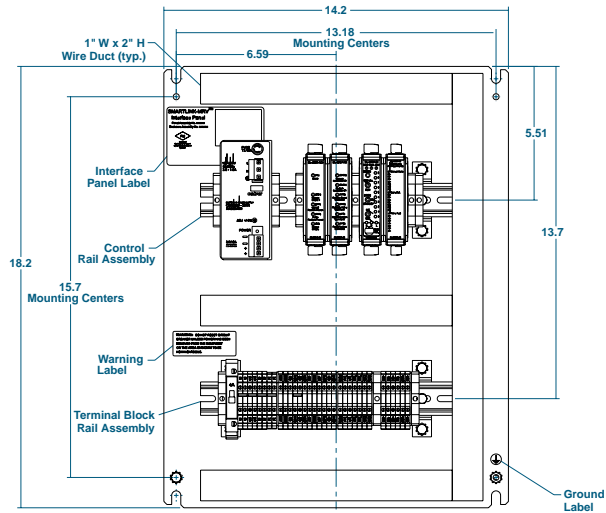
- SMARTLINK™ MRV Control Interface (When ordered with Interface Panel and no enclosure):**  
 Remove the 4 threaded mounting studs on the Interface Panel saving the bolts, washers and nuts for re-installation later. (Refer to panel drawings below.) If the back of the customer's panel is inaccessible, tap four 6mm holes in the customer panel using the SMARTLINK™ MRV Interface Panel as a template. Re-install the threaded studs into the customer panel and bolt the Interface Panel using the hardware removed earlier. (If the back of the customer panel is accessible, drill 4 holes on the customer panel and install the mounting hardware using the nuts to capture the studs on the back of the customer plate.)

**24" x 20" SMARTLINK™ MRV Interface Panel (without enclosure)**



NOTE: Maximum Options Shown

**20" x 16" SMARTLINK™ MRV Interface Panel (without enclosure)**



NOTE: Maximum Options Shown

# Installation Instructions

## Mechanical Installation *(continued)*

- SMARTLINK™ MRV Control Interface  
*(When ordered with Interface Panel & Enclosure):*  
 Bolt the NEMA 4X enclosure to a wall using the slot  
 (0.44" x 0.75") in each of the four mounting feet.  
 (Refer to enclosed panel drawings below).

### Enclosure Options:

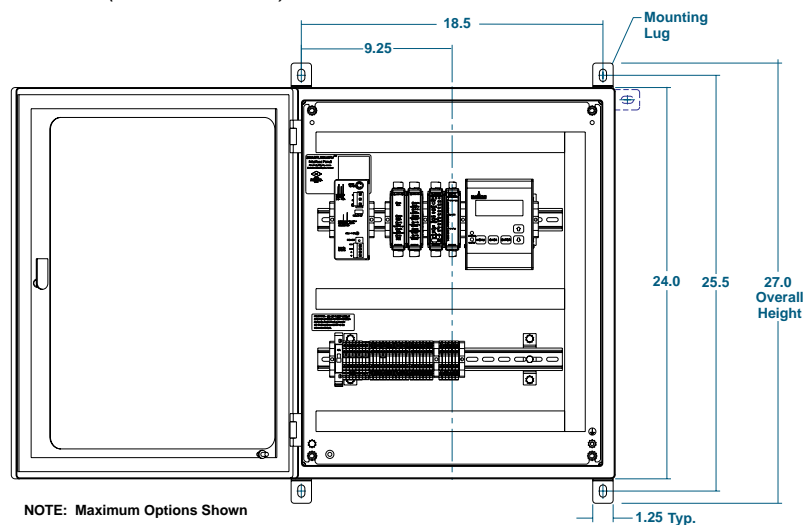
#### With User Display -

- User Display w/dust cover mounted on solid door (dust cover recommended)
- User Display mounted on solid door without dust cover

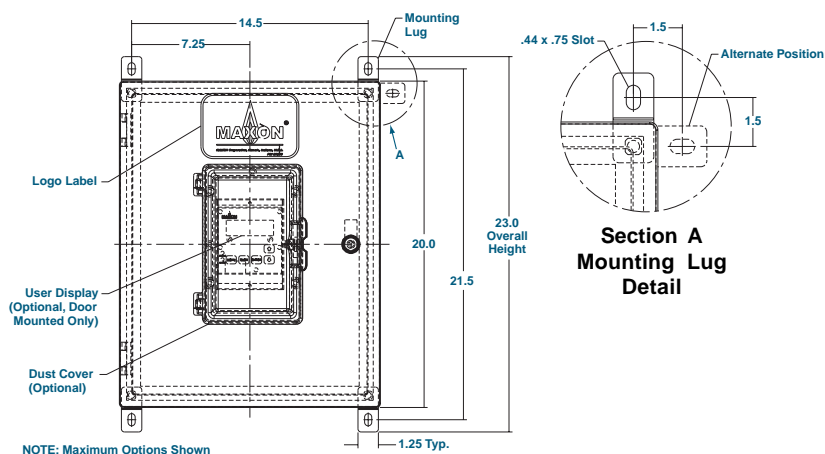
#### Without User Display -

- Window in door
- Solid door

**24" x 20" SMARTLINK™ MRV Interface Panel**  
*(with enclosure)*



**20" x 16" SMARTLINK™ MRV Interface Panel**  
*(with enclosure)*



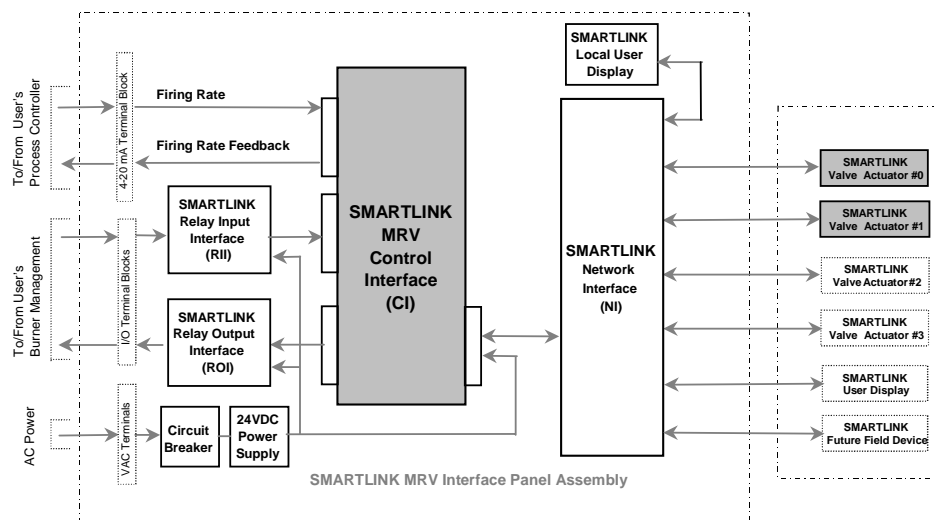
# Installation Instructions

## Electrical Installation

The SMARTLINK™ MRV System block diagram below indicates the sources and destinations of all electrical wiring. **If the Control Interface is ordered with an Interface Panel assembly**, the following field wiring is required:

- **120/230 VAC supply and protective earth wiring** between the customer's fused, AC power source and Interface Panel terminal block (L1, L2, and PE).
- **Low voltage 4-20mA firing rate command and feedback signal wiring** between the user's process controller and Interface Panel terminal block (INA+, INA-, OUT+, and OUT-). The shield wire for the firing rate command (INA+ and INA-) should be grounded immediately as it enters the enclosure that houses the MRV Interface Panel. **If the Interface Panel is purchased with the enclosure option**, terminate the shield wire on the corner ground post closest to where the cable enters. The shield wire for the 4-20mA firing rate feedback (OUT+, OUT-) should be terminated only at the process or temperature controller end.
- **Input Command Relay wiring** between the customer's burner management or flame safety device and the Interface Panel terminal block (PPC, LPC, MVC, RRC, and CCOM). **The ground reference (CCOM) must be wired for any of the input command signals to function.**
- **Output Relay wiring** between the customer's burner management or flame safety system and the Interface Panel terminal block (ALM/ALMR, CE2/CE1R, PPP/PPPR, and LPP/LPPR).
- **Communications Network wiring** between each SMARTLINK™ Valve Actuator (+24, GND, DA, DB, SHD) and the 4-terminal connectors (F24+, F24-, DA, DB) of the Network Interface. The shield wire of each network cable should be connected to the actuator "SHD" terminal (keeping the shield length to 1 inch or less). The shield wire should also be tied to ground as it enters the enclosure of the MRV Interface Panel (keeping the maximum length to 6 inches or less). **If the Interface Panel is purchased with the enclosure option**, terminate the shield wire on the corner ground post closest to where the cable enters the enclosure.

Maxon SMARTLINK™ MICRO-RATIO® Valve (MRV)  
System Block Diagram



- Notes:
- 1.) Non-shaded blocks indicate optional Maxon-supplied equipment
  - 2.) Shaded blocks indicate SMARTLINK MRV required components

# Installation Instructions

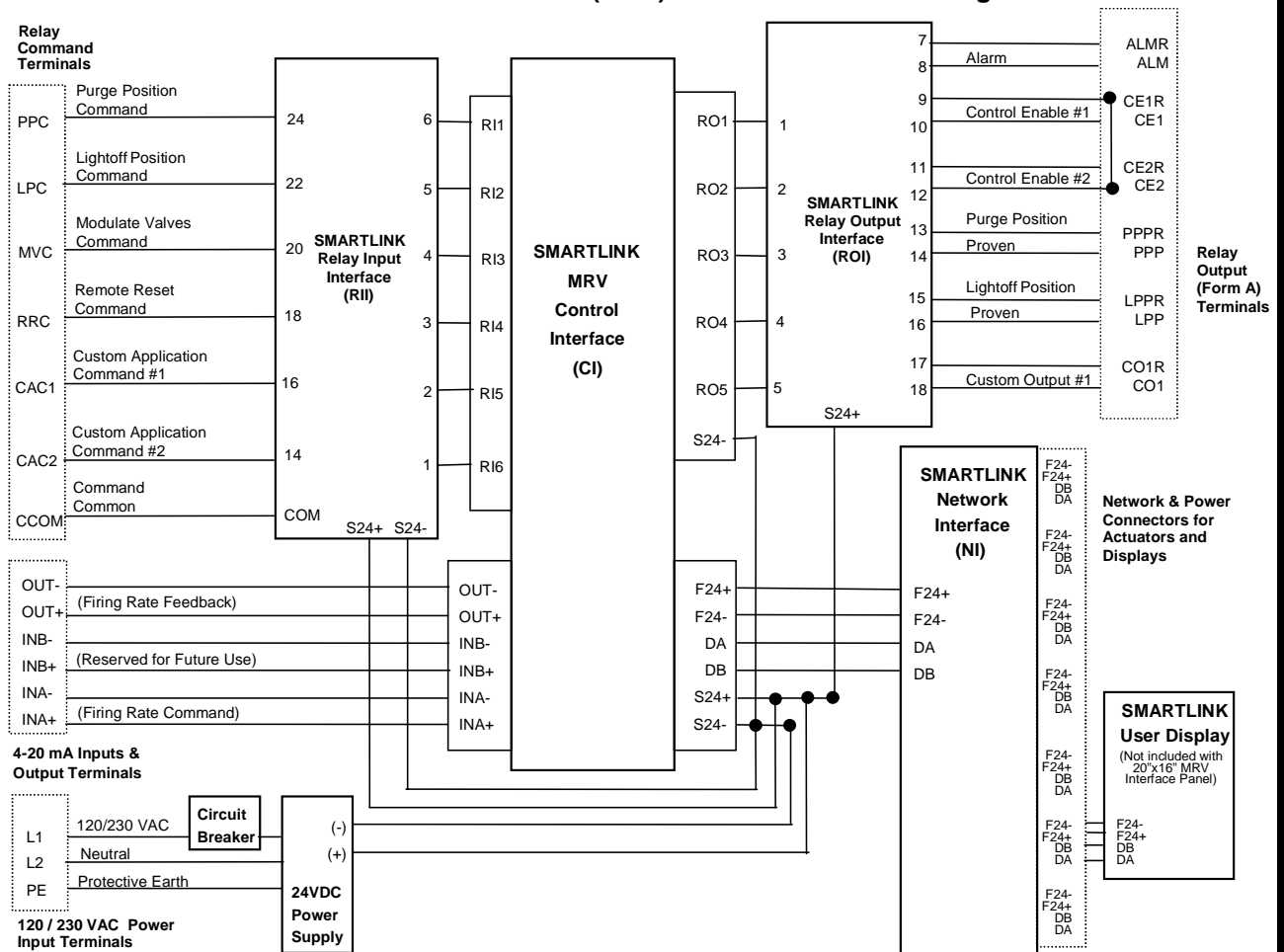
## Electrical Installation

The MRV Interface Panel includes a Universal Power Supply, Relay Input Interface, Relay Output Interface and Network Interface module. (The 24"x20" Interface Panel also includes a User Display.) These DIN rail-mounted devices are factory-wired to the SMARTLINK™ MRV Control Interface and a labeled terminal block assembly for field wiring as shown in the wiring diagram below. A "typical" electrical schematic of a SMARTLINK™ MRV system is also provided as a representative example of how the system is interfaced to a temperature controller and flame safety device.

Electrical wiring should be performed in accordance with all local and NEC 1 codes. See Reference Table 1 and Table 2 (page 7400-S-26 & 27) for terminal descriptions of the MRV Interface Panel and Valve Actuator. Reference Table 3 (page 7400-S-28) summarizes the maximum length, type, and size of all field wiring required for the MRV Interface Panel.

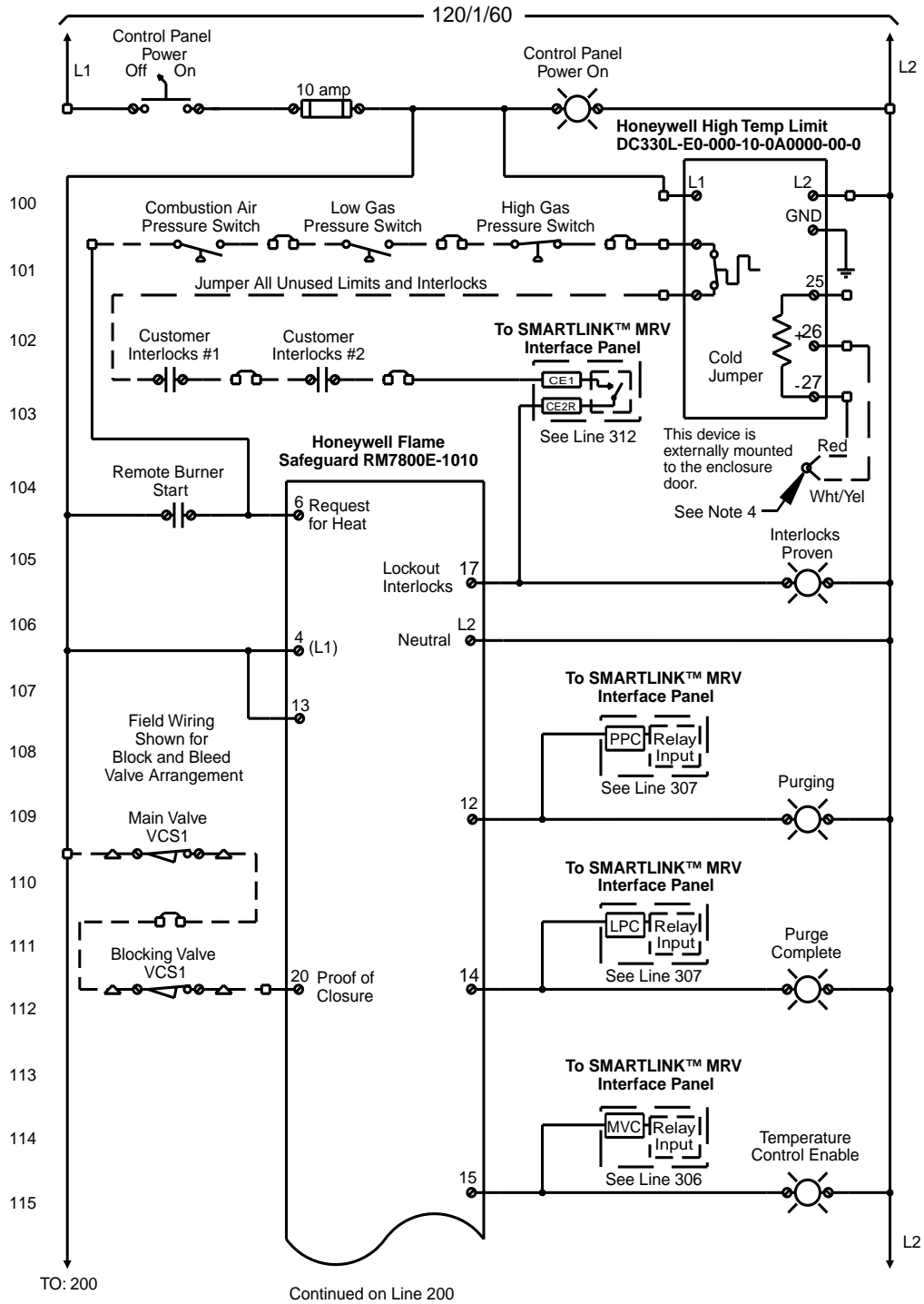
If the Control Interface is purchased without a factory-wired Interface Panel, see Reference Tables 4 through 9 (pages 7400-S-29 to 34) for terminal descriptions of the individual SMARTLINK™ MRV electronic components: Control Interface, Relay Input Interface, Relay Output Interface, Network Interface and User Display.

SMARTLINK™ MICRO-RATIO® Valve (MRV) Interface Panel Block Diagram



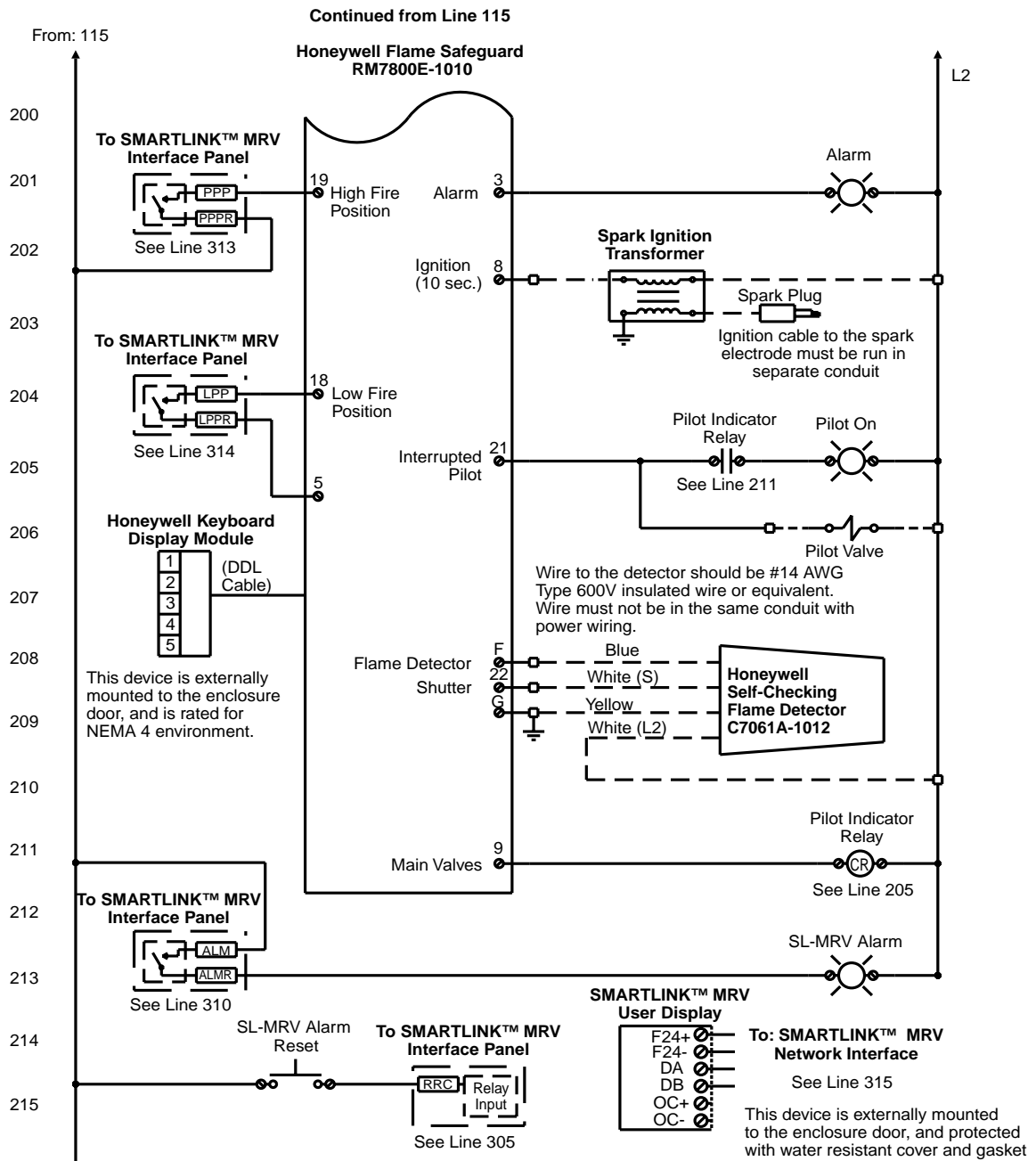
# Installation Instructions

## Typical SMARTLINK™ MRV Wiring Schematic



# Installation Instructions

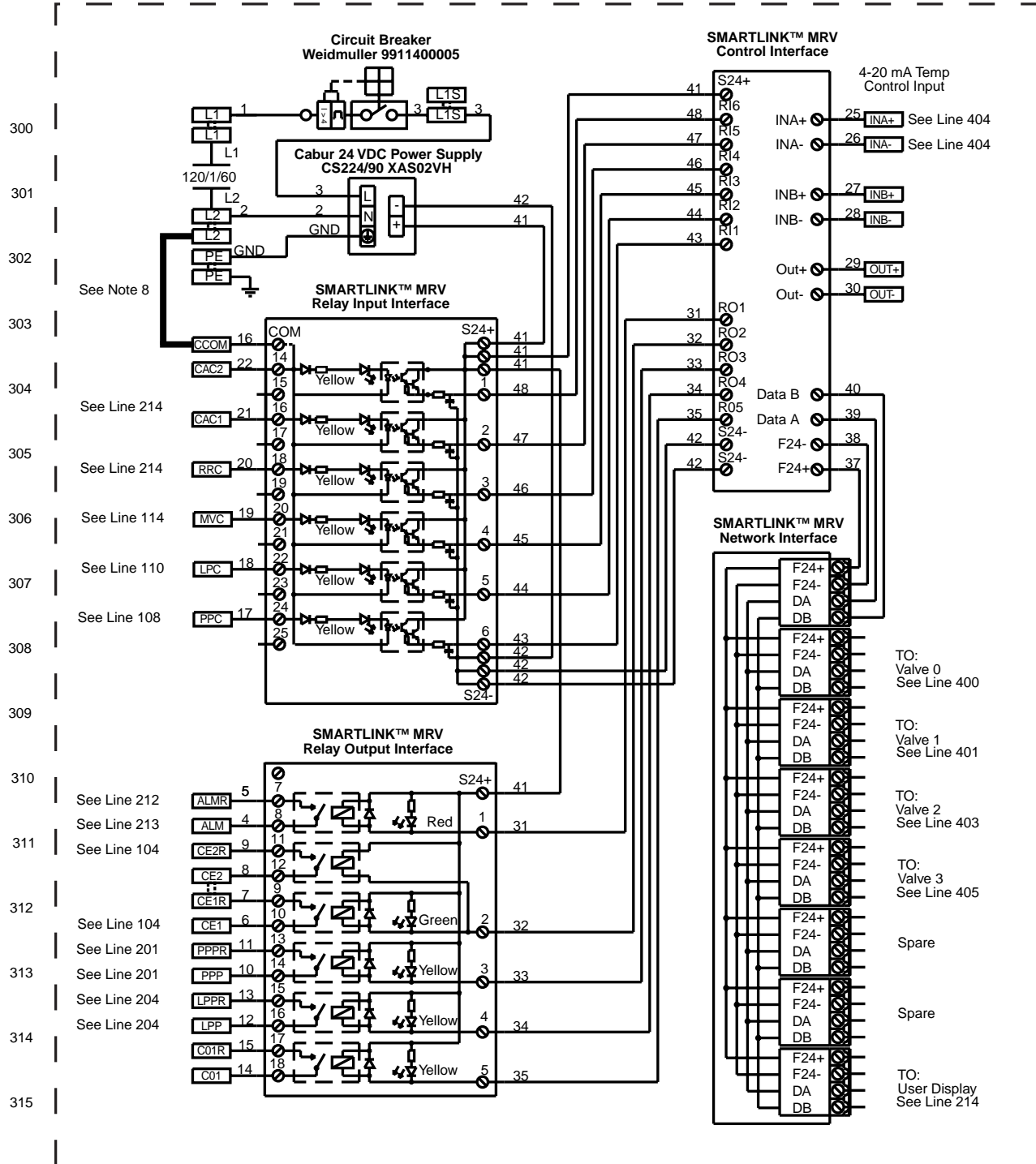
## Typical SMARTLINK™ MRV Wiring Schematic (continued)



# Installation Instructions

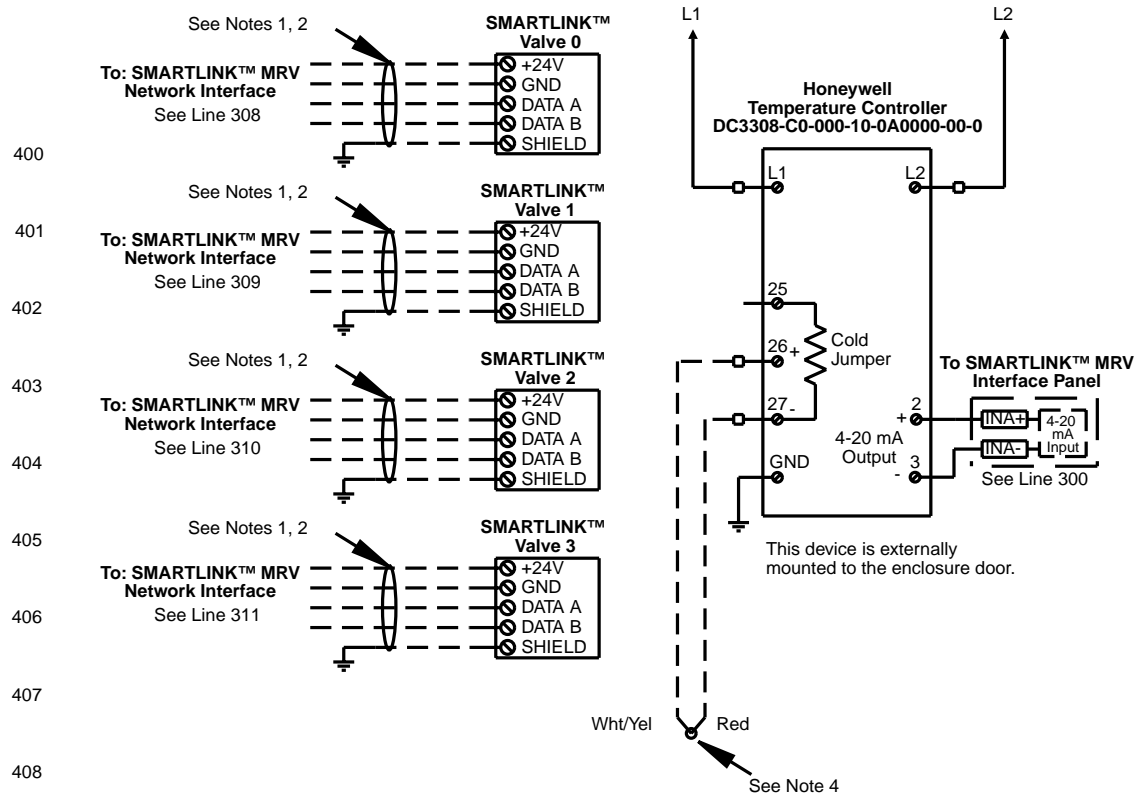
## Typical SMARTLINK™ MRV Wiring Schematic (continued)

### SMARTLINK™ MRV Interface Panel without User Display



# Installation Instructions

## Typical SMARTLINK™ MRV Wiring Schematic (continued)



### NOTES:

**NOTE 1:** Recommended wire color code for SMARTLINK™ MRV Control Network

Component Terminal Designation	SMARTLINK™ MRV Network Cable	
	Maxon #59829 (not to exceed 100 ft.)	Beldon #30861 (not to exceed 300 ft.)
F24+ / +24	white / orange	brown
F24- / GND	orange	blue
DA	white / blue	white
DB	blue	black

**NOTE 2:** All shields should terminate to GND within 6" of where it enters the cabinet.

**NOTE 3:** Blue 14AWG MTW/AWM wire is to be used on 4-20mA signal.

**NOTE 4:** Type "J" thermocouples are color coded with white as (+) and red as (-). Type "K" thermocouples are color coded with yellow as (+) and red as (-). Thermocouple wires must be run in separate conduit.

**NOTE 5:** Installation, operation, and maintenance shall conform with National Fire Protection Association standards, national and local codes, and authorities having jurisdiction.

**NOTE 6:** Wire numbers assigned only to SMARTLINK™ MRV Interface Panel.

**NOTE 7:** Symbol Key

- Indicates terminals and wiring in SMARTLINK™ MRV Control Panel
- Indicates component terminals
- Indicates SMARTLINK™ MRV Interface Panel DIN Rail Terminal Block
- Indicates adjacent SMARTLINK™ MRV Interface Panel DIN Rail Terminal Blocks jumpered together
- Indicates external wiring

**NOTE 8:** The ground reference for all input command signals must be wired by the customer and its termination depends on the relay input interface purchased (i.e. VAC vs. VDC).

## Operating Instructions

The installer should perform the following steps prior to commissioning the SMARTLINK™ MRV system:

- **Review SMARTLINK™ MRV Control Interface** operation and command entry
- **Wiring checkout** prior to applying power
- **Operational checkout** after applying power
- **System configuration** if required by the application
- **System commissioning** for burner operation

### Understanding the SMARTLINK™ MRV Control Interface

The lights and switches of the SMARTLINK™ MRV Control Interface allow the user to:

- a) Display and change configuration parameters (i.e. loss of signal position and valve movement),
- b) Display the operating mode of the valve and indicate alarm conditions,
- c) “Lock” the device electronically to prevent tampering,
- d) Customize the position profile of each valve for burner tuning, and
- e) Locally control the movement of the valves.

#### SMARTLINK™ MRV Control Interface Switch & Light Functions



**MAN Light** – Unit in Manual Positioning Mode when lit or blinking.

**RUN Light** – Unit in Run Mode when lit; Startup Mode when blinking; Position Setup Mode if RUN and MAN lights are blinking; Shutdown Mode if RUN and MAN lights are OFF.

**ALM Light** – Alarm exists when lit; Unit is locked if blinking.

**0 – 9 Lights** – Indicates valve position index when unit is in Manual or Position Setup Mode; Also indicates command number selected by rotary CMD SEL switch and configuration setting.

**ENTER Switch** – Momentary pushbutton for command entry and saving configuration or valve position changes.

**MODE Switch** – 3 positions: (1) RUN (down) places unit in Run or Startup Mode for relay input and 4-20mA command operation, (2) Command Entry (middle) for selecting user command with rotary switch, and (3) CMD abc (up, with momentary action) for Command Set selection.

**ADJUST Switch** – 3 positions: (1) MINIMUM (down) for emergency movement to minimum positions when not in Run Mode, (2) ADJ (middle) enables valve movement in 0.1 degree steps when using the INC/DEC switch in Manual or Position Setup Mode, and (3) INDEX enables positioning moves to the 19 position indexes when using INC/DEC switch in Manual Mode.

**INC/DEC Switch** – 3 positions: INC and DEC (up & down, with momentary action) for valve opening and closing in Manual or Position Setup Mode; also used for changing configuration settings and selecting a valve to change its respective profile. Middle position has no function.

**Command Set Lights** – Identifies which command set (a, b, or c) is currently selected (when blinking) or active (when not blinking).

**CMD SEL (Rotary) Switch** – Selects command number, 0 thru 7.

# Operating Instructions

## Using the Control Interface for Command Entry

There are 3 SMARTLINK™ MRV command sets (a, b, and c) as listed below. Several of the commands have special requirements before they can be executed. For example, before entering the Set Max Position & Ramp Command, the unit must be at position index #9 or the command cannot be executed.

<b>Command Set "A"</b>	A-0	..... Enter Manual Positioning Mode	..... Unit not in Shutdown Mode
	A-1	..... Display Alarm Codes	
	A-2	..... Enter Position Setup Mode	..... Unit not in Shutdown Mode
	A-3	..... Display/Change Selected Valve	
	A-4	..... Commission Valve	..... Unit in Setup Mode, MVC input on; Shutdown Mode to replace valve
	A-5	..... Set Max Position and Ramp	..... Unit at Position Index = 9, not in Shutdown Mode
	A-6	..... Set Min Position and Ramp	..... Unit at Position Index = 0, not in Shutdown Mode
	A-7	..... Unlock System Configuration	..... Unit must be already "locked"
<b>Command Set "B"</b>	B-0	..... Select Loss of Signal Position	
	B-1	..... Set Purge Position	..... Custom Startup enabled, MVC off, not in Shutdown Mode
	B-2	..... Set Standby Position	..... Custom Startup enabled, MVC off, not in Shutdown Mode
	B-3	..... Select Deadband	
	B-4	..... Select Startup Configuration	
	B-5	..... Set Light-Off Position	..... Custom Startup enabled, MVC off, not in Shutdown Mode
	B-6	..... Select Auto Ramp Adjust	
	B-7	..... Select Movement Configuration	
<b>Command Set "C"</b>	C-0	..... Valve Test	..... Unit in Shutdown Mode
	C-1	..... Reserved for Trained Personnel	..... See Installation & Operating Instructions
	C-2	..... Reserved for Trained Personnel	..... See Installation & Operating Instructions
	C-3	..... Reset Factory Default Settings	..... Unit in Position Setup Mode, MVC input off
	C-4	..... Enter New Lock Passcode	..... Unit "unlocked" and lock function enabled to modify
	C-5	..... Select Lock Enable / Disable	..... Unit "unlocked" to modify
	C-6	..... Save Profile as Backup	..... Unit in Position Setup Mode
	C-7	..... Restore Backup Profile	..... Unit in Position Setup Mode, MVC input off

## Operating Instructions

### Using the Control Interface for Command Entry *(continued)*

Each of the user commands can be initiated by following the general command entry procedure outlined below.

#### ***General Command Entry Instructions:***

1. A user command can be performed only when the following conditions are all satisfied:
  - a.) Mode switch is not in the RUN position,
  - b.) One of the green Command Set lights (a, b, c) is blinking,
  - c.) ADJUST switch is not in the MINIMUM position,
  - d.) Unit is “unlocked”, and
  - e.) For some commands, the unit must be in a specific mode, position index, etc. (See command entry requirements listed on page 7400-S-13 or in Reference Tables 12 through 14 on pages 7400-S-37 through 44.

**Note:** Condition d. above is not required for Command A-7, Unlock Configuration and Command A-1, Display Alarm Codes.

2. If the a, b, or c Command Set light is not blinking, momentarily push the MODE switch in the CMD abc position (up) or, change the position of the rotary CMD SEL switch. This will start the Command Set light blinking and permit a command to be entered.
3. Select the desired Command Set by momentarily pushing the MODE switch upward to the CMD abc position. Subsequent CMD abc switch entries will change the command set selection as indicated by the green Command Set (a, b, c) lights.
4. Select the desired command number by changing the position of the rotary CMD SEL switch. When one of the command set lights is blinking, the command number selected is indicated by the corresponding numbered (0-9) light being lit.
5. After the command set and number are selected, press the ENTER button. If all of the numbered lights flash momentarily after the ENTER button is pushed, a command entry error has occurred and the command was not executed. If an entry error occurs, check to see if the unit is locked (i.e. alarm light blinking) or the ADJUST switch is in the MINIMUM position. If neither condition exists, check the specific entry requirements of the command.

# Operating Instructions

## User Display Operation

The optional SMARTLINK™ MRV User Display simplifies commissioning and viewing system status with a back-lit, 4-line by 20-character, liquid crystal display (LCD). The User Display can be remotely mounted up to 1000 feet away from the Control Interface for remote commissioning and control room monitoring. Multiple displays can be connected to the system for both local and remote operation. All commissioning functions provided within the Control Interface can be performed with the User Display. However, the User Display provides the following functions in addition to the Control Interface commissioning and status capabilities:

- Alarm and fault condition text message display
- Time-stamped history of 6 shutdown events
- System and valve maintenance functions
- Storing and viewing of up to 5 system profiles
- Restoring system profile in replacement Control Interface

See Reference Table 15 for a summary of the Main Menu and Sub-Menu Command list. The five keys on the display are used as follows:

- 1) Press [MENU] key to move down Main Menu or Sub-Menu command list.
- 2) Press [BACK] key to move up Main Menu or Sub-Menu list.
- 3) Press [ENTER] to move from Main Menu command item to Sub-Menu list.
- 4) Press [BACK] key to move from the top command item in a Sub-Menu list back to the Main Menu.
- 5) Press [ENTER], [BACK] or [ARROW] keys to accomplish specific Sub-Menu tasks as prompted by the display.
- 6) When on a Main Menu item, press [MENU] and [DOWN] key simultaneously to reach last Main Menu item.
- 7) When on a Main Menu item, press [BACK] and [UP] key simultaneously to reach first main menu item.

## Wiring Checkout

Before applying power to the SMARTLINK™ MRV Interface Panel, Control Interface, or Valve Actuators, perform the following wiring checkout:

- 1) Verify that 120 VAC (or 230 VAC) power and burner management control signals are connected to the proper field wiring terminals of the MRV Interface Panel.
- 2) If a factory-wired Maxon MRV Interface Panel was not purchased, verify that no 120 VAC (or 230 VAC) wiring is connected directly to any Control Interface or Valve Actuator terminal. The MRV Control Interface (and Valve Actuators) must be powered by a 24Volt DC source.
- 3) Verify the proper wire type and maximum wire length requirements are satisfied for all connections.
- 4) Verify network/power connection color codes are correct for the Valve Actuators.
- 5) Measure the resistance between earth ground at the enclosure of the Control Interface and each of the four signals wired to the Valve Actuator: F24+ (Field 24VDC), F24- (Field 24VDC Common), DA (Data-A), and DB (Data-B). The resistance should indicate an open circuit (i.e., a resistance value greater than  $10^6$  Ohms). If an open circuit is not measured, damage or incorrect wiring of the control network cable exists and must be located.
- 6) Verify proper termination of shields for the 4-20mA cables and the power/network cable between the MRV Interface Panel, Control Interface and Valve Actuators.
- 7) If a Maxon SMARTLINK™ MRV Interface Panel is not provided, verify that all customer-provided output relays connected to RO1 through RO5 of the Control Interface have a 24 VDC coil rating and require less than 100mA to turn on.

Refer to SMARTLINK™ MRV Reference Tables 1 through 5 (pages 7400-S-26 to 30) for all terminal definitions and wiring/shielding requirements.

# Operating Instructions

## Operational Checkout

Apply power to the SMARTLINK™ MRV System. If an MRV Interface Panel was purchased, switch the breaker located on the lower rail of the Interface Panel to the ON (or up) position. The breaker switch will power all system components including the SMARTLINK™ Valve Actuators. Perform the following operational checkout prior to attempting burner light-off and commissioning the system for burner operation:

- 1) Disable the flame safety or burner management system by turning the combustion blower off and manually turning off the pilot and main fuel supply.
- 2) Place the Mode switch of the Control Interface in its middle position. With all Valve Actuators wired, verify the Control Interface Alarm light is off and the Run light is blinking indicating the system is in the Startup Mode. If the Control Interface alarm light is on, see Page 7400-S-23 on troubleshooting and alarms, to determine the cause of the alarm and corrective actions.
- 3) Verify operation of each SMARTLINK™ MRV relay output by using the procedures summarized in Table 10 (page 7400-S-35). If a Maxon MRV Interface Panel is provided, the Relay Output Interface (ROI) is factory-wired to the Control Interface and a field wiring terminal block for easy access to the output contacts. The relay output terminals of the Control Interface are also referenced in Table 10 to assist in operational checkout of systems with customer-supplied relays or a PLC-based burner management system that controls burner startup (without the Maxon Relay Output Interface).
- 4) Turn on the combustion blower. Re-enable the burner management system but keep the pilot and main fuel supply turned off. Verify that all combustion system safety interlocks are satisfied.
- 5) Power cycle SMARTLINK™ MRV and verify the relay input commands from the burner management system properly drive SMARTLINK™ MRV to its purge and light-off states. If a Maxon MRV Interface Panel is provided, the Relay Input Interface (RII) is factory-wired to the Control Interface and a field wiring terminal block. The lights of the Relay Input Interface indicate when each input command relay is energized and the 4-20mA output (OUT-/OUT+ terminals) can be measured by a current meter to verify SMARTLINK™ MRV has responded to the input command. When the burner management system (or flame safety) issues a Purge Position Command, the PPC terminal of the Interface Panel is energized and the Relay Input Interface (terminal #6) outputs a voltage greater than 22VDC to the Control Interface input terminal RI1 (Relay Input #1). When a Light-Off Position Command is issued, the LPC terminal of the Interface Panel is energized and the Relay Input Interface (terminal #5) outputs a voltage greater than 5VDC to the Control Interface input terminal RI2 (Relay Input #2). The following 4-20mA output currents can be measured for each of the following SMARTLINK MRV states: 1mA = Standby Positions; 2mA = Purge Positions; 3mA = Light-Off Positions.

# Operating Instructions

## System Configuration

There are 7 SMARTLINK™ configuration settings that can be changed through execution of the commands listed below. Detailed explanations of each setting appear in Reference Table 11: SMARTLINK™ MRV System Configuration Summary (page 7400-S-36).

<b><u>Command Name</u></b>	<b><u>Command Number</u></b>	<b><u>Factory Default</u></b>
Select Loss of Signal (LOS) Position	B-0	Setting #0: Position Index 0 (Minimum)
Select Control Deadband	B-3	Setting #2: 0.06% Deadband
Select Startup Configuration	B-4	Setting #0: Default Startup
Select Auto Ramp Adjust	B-6	Setting #1: Auto Ramp ON
Select Movement Configuration	B-7	Setting #1: Medium Speed (~40 seconds)
Enter New Lock Passcode	C-4	Default Passcode: 0, 0, 0, 0
Select Lock Enable/Disable	C-5	Setting # 0: Lock Disable

**Review the factory default settings before changing any of the system configuration settings.** In many applications, modification of the default settings is not necessary. If a setting does need to be changed, follow the procedure below.

### ***Procedure for Changing a System Configuration Setting:***

- a) Select and enter the required system configuration command.
- b) After the command is entered, one of the numbered (0-9) lights will be on, indicating the current configuration setting. (For example: If the lock configuration is set to #0, Lock Disable, the 0 light will be solidly lit after Command C-5, Lock Enable/Disable, is entered successfully.)
- c) Select the desired configuration setting by using the INC/DEC switch. As the INC/DEC switch is momentarily pushed up or down, the selected setting changes as indicated by turning on the corresponding numbered (0-9) light.
- d) Push the ENTER button after the desired configuration setting is selected. The numbered light (i.e. selected configuration) that is lit will momentarily turn off indicating the command is complete and the configuration setting is saved.
- e) To confirm the correct setting is saved, re-enter the command and verify the new setting by the numbered (0-9) light indication.

## Operating Instructions

### 10-Point System Commissioning

The SMARTLINK™ MRV Control Interface is shipped with configuration settings that support a 10-point commissioning procedure as described on the following page. Specifically, the Auto Ramp ON configuration is selected as the default setting so that fuel valve adjustment is needed for only 10 position indexes (0, 1, 2...9). The 9 intermediate position indexes (0.5, 1.5, 2.5, etc.) are automatically set to positions mid-way between the 10 integer position indexes, 0 through 9. In addition, the Default Startup Configuration sets the standby, purge, and light-off positions to the same values as those established for Index 0 (minimum), Index 9 (maximum), and Index 0 (minimum), respectively. See Reference Table 11 for a detailed description of these configuration settings.

When SMARTLINK™ MRV is in the Position Setup Mode for commissioning, the ADJUST switch can be pushed to the MINIMUM position (down). This action will immediately move the valves synchronously to position index #0, the minimum position. This feature provides a method (during commissioning when the user's temperature controller is not in automatic mode) to quickly ramp the burner back to low fire if a process or combustion condition warrants an immediate burner firing rate change.

An optional User Display with a 4-line by 20 character LCD can also be used for SMARTLINK™ MRV commissioning instead of the Control Interface switches and lights. The commissioning procedure using the User Display is described on page 7400-S-20. See Reference Table 15 on page 7400-S-45 for a description of User Display key operation and commands, as well as a numbered menu structure.

### 19-Point System Commissioning

There are combustion applications that require burner adjustment at more than 10 points throughout the firing range to meet emissions or fuel efficiency requirements. For these applications, the Auto Ramp configuration should be OFF, setting #0. With Auto Ramp OFF, adjustment of each fuel valve at all 19 position indexes (0, 0.5, 1.0, 1.5...8.5, and 9) is now required and no automatic "smoothing" is performed on points adjacent to the position index being adjusted.

The procedure for adjusting all 19 points is identical to the 10-point procedure described above with the following exceptions:

- 1.) In step g of the 10-Point Commissioning (using the Control Interface) procedure on page 7400-S-19, execute Command B-6 to ensure the auto ramp function is OFF, setting #0. In step g of the 10-Point Commissioning (using the User Display), go to Main Menu 9 (Set Configuration) and use the ARROW up key until the auto ramp configuration can be verified.
- 2.) In step h, the firing rate should be adjusted at 0.5-position index steps instead of every whole integer position index.

In some applications, it may also be desirable to adjust positions at all 19 points of the air valve(s) in order to provide a linear flow characteristic. The same 19-point adjustment process used for the fuel valves would be performed for the air valve(s) instead of the 2-point linear position setup using Commands A-5 and A-6 (described in steps c through e).

### Custom Startup Positions

The Custom Startup Configuration is intended for burners or applications that require standby, light-off, or purge positions that are independent of the burner's normal operating valve position curves.

To enable this function using the Control Interface, execute Command B-4, Select Startup Configuration. Use the INC/DEC switch to select setting #1 (Custom Startup) and press the ENTER switch to save the configuration setting if it has been changed. Command B-1 (Set Purge Positions), Command B-2 (Set Standby Positions), and Command B-5 (Set Light-Off Positions) can now be executed to set custom valve positions during startup. See Reference Table 19 for a more detailed explanation of how to use these commands.

These custom startup adjustment commands can also be executed from the User Display using Main Menu 9 to select the Startup Configuration item (using the ARROW keys) and Sub-Menu 9.1 to change (ARROW keys) and save (ENTER key) the setting. See Reference Table 15 (page 2400-S-45) for the User Display command menu structure.

# Operating Instructions

## Commissioning Procedure with Control Interface

### **SMARTLINK™ MRV 10- Point Commissioning Procedure with Control Interface:**

- a) Disable burner light-off by turning off the burner management system or disabling a combustion permissive so that interlocks cannot be proven. Turn on the combustion blower.
- b) Execute Command A-0, Enter Manual Mode. With the ADJUST switch in the up (INDEX) position, push the INC/DEC switch momentarily to advance the firing rate to position index #9.
- c) Execute Command A-3 and select the SMARTLINK Air Valve Actuator's number by using the INC/DEC switch to light the desired valve number. (The number of the Air Valve Actuator is on the unit's label.) Execute Command A-5, Set Max Position & Ramp, and adjust the air valve maximum position to satisfy the pressure/flow requirements of the burner. When this command is executed, both the yellow and green run lights will be flashing indicating the system is in Position Setup Mode.
- d) With the ADJUST switch in the middle (ADJ) position, push the INC/DEC switch up or down to change the valve position. Each push of the INC/DEC switch moves the valve 0.1 degrees. If the switch is held in the up or down position for more than 3 seconds, the valve will move in 0.5 degree steps up to a total travel of 8 degrees from the stored valve position. (All the numbered lights will momentarily flash when this 8-degree limit or the maximum valve travel is reached.) After moving the valve to the desired position, press the ENTER button to save the position setting. The command 'a' light will momentarily turn off and then begin blinking when the position is saved. Record the valve position feedback in milliamps (mA) or percent that is present on the OUT+/- terminals of the Control Interface.
- e) Execute Command A-0, Enter Manual Mode, again and move to position index #0. Execute Command A-6, Set Min Position & Ramp, and adjust the minimum air valve position in the same manner as the maximum position was adjusted in step d.
- f) Repeat steps b through e for all other air valves installed. SMARTLINK MRV is shipped with factory default minimum and maximum valve positions of 6.0 and 60.0 degrees, respectively.
- g) Momentarily set the mode switch in the RUN position, re-enable the burner management system and light the burner. Execute Command B-7 to ensure the auto ramp function is set to #1, ON. Select the fuel valve for adjustment using Command A-3 and then execute Command A-6, Set Min Position and Ramp. This command permits adjustment of the minimum position and then creates a linear ramp to the current maximum position. The system is placed in Position Setup Mode, indicated by the flashing of both the yellow (MANUAL) and green (RUN) lights. With the ADJUST switch in the middle position, trim the fuel valve's position at index #0 (minimum) based on burner pressure or flow measurement equipment as performed in step d above. Repeat this step to adjust the minimum and linear position ramp for all other fuel valves in the system.
- h) After adjusting index #0 (and forcing a linear position ramp) for the fuel valve, place the adjust switch in the INDEX (up) position. Move the MRV firing rate to the next whole integer position index (index #1) by momentarily pressing the INC/DEC switch until the desired index number is turned ON. Move the ADJUST switch back to the middle (ADJ) position. Use the INC/DEC switch to adjust valve position based on burner pressure or flow measurement and press ENTER to save the profile to memory as described in step d above. Repeat this adjustment procedure for each whole integer index up to and including index #9 (maximum). If necessary, make gas pressure regulator adjustments at index #9 and then work back down through the lower indexes making adjustments as required.
- i) After the last adjustment is made in Position Setup Mode, use the INC/DEC switch to move to position index #9 (or the highest position index adjusted for all valves) with the ADJUST switch in the INDEX (up) position. Select the air valve using Command A-3 and then execute Command A-4, Commission Valve. Repeat this step for each installed SMARTLINK MRV valve actuator. The commission command stores the selected valves current position index as its maximum allowable position index while in RUN mode (i.e. under 4-20mA firing rate control). If one valve has a "maximum run index" less than the other commissioned valves, the system will not modulate above the lowest run index. The system will also not modulate in RUN mode if any valve is not commissioned.
- j) Record in the SMARTLINK MRV commissioning table (Table 16, page 7400-S-47 and 48) the position of each valve and pressure (or flow) at each index. Execute Command C-6 to save the profile as a backup. Move the MODE switch to the RUN position and set the user's temperature controller to AUTO.

# Operating Instructions

## Commissioning Procedure with User Display

### SMARTLINK™ MRV 10- Point Commissioning Procedure with User Display:

*Menu & Sub-Menu reference numbers and instructions for moving between menu levels are shown in Table 15 (pg 7400-S-45)*

- a) Disable burner pilot trials by turning off the burner management system or disabling a combustion permissive so that interlocks cannot be proven. Turn on the combustion blower. Go to Sub-Menu 5.5 (Set Valve #) and Sub-Menu 5.6 (Set Fluid) and, using the ARROW keys, select each valve and its fluid type (air, oxygen, natural gas, propane, etc.) Display of the fluid type during commissioning helps prevent selection and adjustment of the wrong valve.
- b) Go to Menu 2 and enter Manual Mode (Command A-0) by pressing the ENTER key. After entering Manual Mode, Sub-Menu 2.1 (Maximum Fire) is displayed. Press the ENTER key and wait for the system to move to position index #9. Press the BACK key to return to Main Menu 2. Press the MENU key to move to Main Menu 3 (Set Max & Ramp).
- c) If the system is at position index #9 (maximum), press the ENTER key in Menu 3 (Set Max & Ramp, Command A-3). This command permits adjustment of the maximum position and provides a linear position ramp on all lower indexes. When this command is successfully executed, both the yellow and green mode lights on the Control Interface will be flashing (indicating that the system is in Position Setup Mode) and Sub-Menu 3.1 (Set Valve #) is displayed.
- d) Use the ARROW keys to select the air valve in Sub-Menu 3.1 (Set Valve #). Press the MENU key to go to Sub-Menu 3.2 (Trim 1.0 deg). Use the ARROW keys to adjust the air valve's maximum position in 1.0 degree increments until the required burner pressure (flow) is achieved. The valve's position can be moved 8 degrees from its stored position or until the maximum travel of the valve (80 degrees) is reached. (The display will indicate an invalid command request if the 8-degree limit or max/min travel is reached.) Press the ENTER key to save the maximum position and linear ramp.
- e) Use the BACK key to return to Menu 2 (Manual Mode). Press the ENTER key in Menu 2 to enter Manual Mode (Command A-0). Go to Sub-Menu 2.4 (Set Valve #) and verify the correct valve is selected. Go back to Sub-Menu 2.2 (Minimum Fire). Press the ENTER key and wait for the system to move to position index #0 (minimum). When the system is at index #0, go to Main Menu 4 (Set Min & Ramp). Press the ENTER key and verify the correct valve is selected in Sub-Menu 4.1 (Set Valve #). Go to Sub-Menu 4.2 (Trim 1.0 deg) and use the ARROW keys to adjust the minimum air valve position in the same manner as the maximum position was adjusted in step d. After adjustment is complete, press ENTER in Sub-Menu 4.2 to save the setting in memory.
- f) Repeat steps b through e for all other air valves installed. SMARTLINK MRV is shipped with factory default minimum and maximum valve positions of 6.0 and 60.0 degrees, respectively.
- g) Momentarily set the mode switch in the RUN position, re-enable the burner management system and light the burner. Go to Main Menu 9 (Set Configuration) and press the up ARROW key until the Auto Ramp setting is displayed. Auto Ramp should be set to #1, ON. (If not, press ENTER to change the setting in Sub-Menu 9.1 using the up ARROW key to select ON and press ENTER to save the modified configuration.) Go back to Main Menu 4 (Set Min & Ramp) and press ENTER. Go to Sub-Menu 4.1 (Set Valve #) and select the fuel valve using the ARROW keys. Go back to Sub-Menu 4.2 (Trim 1.0 deg) and use the ARROW keys to adjust the minimum fuel valve position for the required burner pressure (flow). After adjustment is complete, press ENTER to save the setting in memory. Repeat setting the minimum position (and linear ramp) for each fuel valve in the system.
- h) Once the fuel valve minimum and linear ramp are set, go to Main Menu 5 (Setup Mode). Press the ENTER key and Sub-Menu 5.1 (Set Index) is displayed. Use the ARROW keys in Sub-Menu 5.1 to move the system to the next whole integer position index. Press the MENU key to display Sub-Menu 5.2 (Set Valve #). Verify the correct fuel valve is selected; use the ARROW keys if a change is required. Press the MENU key to display Sub-Menu 5.3 (Trim 1.0 deg) and then adjust the fuel valve position using the ARROW keys to achieve the required burner pressure (flow). Press the ENTER key to save the position profile in memory. (Use Sub-Menu 5.4, Trim 0.1 deg, if finer adjustments are needed.) Select each fuel valve in the system and adjust its position. Repeat this step until all 10 whole integer position indexes are adjusted. If additional gas pressure is required at index #9 (maximum), adjust the regulator and then re-adjust the fuel valves at each whole integer index position while working back to index #0 (minimum).
- i) After the last adjustment is made in Position Setup Mode, go to Sub-Menu 5.1 (Set Index) and use the ARROW keys to move the system to index #9 (or the highest possible with the burner firing). Go to Sub-Menu 5.7 (Commission) and press the ENTER key to execute the Commission Valve Command (A-4) for the selected valve. Use the ARROW keys to select each valve and then press ENTER to commission the newly-selected valve. Repeat this process for each installed SMARTLINK MRV Valve. The commission command stores the selected valve's current position index as its maximum allowable position index while in RUN mode (i.e. under 4-20 mA firing rate control). If one valve has a maximum run index less than the other commissioned valves, the system will not modulate above the lowest run index. The system will also not modulate in RUN mode if any valve is not commissioned.
- j) To make a back-up profile in the Control Interface, go to Sub-Menu 5.9 (Save Back-up) and press ENTER to execute Command C-6, Save Profile as Back-up. To back-up the profile and all system configuration settings in the User Display, go to Sub-Menu 10.4 (Save System Data) and press ENTER. Backing up system data to the User Display takes approximately 30 seconds. Go to Sub-Menu 5.8 (Run Mode) and press ENTER. Place the user's temperature controller in AUTO. SMARTLINK MRV will modulate the burner's firing rate based on the 4-20 mA input command.

# Operating Instructions

## Unit Locking and Passcode Entry

The SMARTLINK™ MRV Control Interface is shipped with the lock function disabled and a factory default 4-digit passcode or “combination” of 0,0,0,0. To lock the unit for the first time and change the default passcode, the lock function must first be enabled (Command C-5) and the default passcode entered (Command A-7) as described in the first two procedures below. After the lock function is enabled and the unit is “unlocked”, a new passcode can be entered using Command C-4 as described in the procedure on the following page. If you forget the passcode, call Maxon for the “master” passcode.

### **Procedure for Enabling the “Lock” Configuration Setting (Command C-5):**

- a) If the alarm light is blinking, the lock function is already enabled and the unit is in a “locked” state. Before changing the passcode, the unit must be unlocked by entering the current passcode (Command A-7) using the procedure below.
- b) If the alarm light is not blinking, select and enter Command C-5, Lock Enable/Disable.
- c) After the command is entered, one of the numbered (0-9) lights will be on, indicating the current configuration setting. If the #1 light is on, the lock function is already enabled and the procedure below can be performed to change the passcode. If the #0 light is on, the lock function is disabled.
- d) To select the #1 setting (Lock Enable), momentarily push the INC/DEC switch in the up position. The #1 light will now be on, indicating the new setting is selected.
- e) Push the ENTER button. The #1 light will turn off indicating the command is complete and the configuration setting is saved. The unit is now locked and the alarm light will be blinking. To change the current passcode, perform the next two procedures (Command A-7 & C-4).

### **Procedure for Entering the Current “Lock” Passcode (Command A-7):**

- a) Select and enter Command A-7, Unlock Valve Configuration.
- b) After the command is entered, the INC/DEC switch is used to select the first passcode digit. The digit selected is indicated by a numbered light (0-9).
- c) Once the first digit of the passcode is selected, push the ENTER button once. The numbered light should momentarily turn off indicating the entry was accepted.
- d) Repeat steps b and c for the 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> passcode digits. If the passcode was entered incorrectly, all the numbered lights will momentarily flash after entry of the 4<sup>th</sup> and final passcode digit. If the passcode was correct, the alarm light will stop flashing and will be turned off completely if no other alarms exist.
- e) To change the current passcode, perform the procedure (Command C-4) on the following page.

## Operating Instructions

### Unit Locking and Passcode Entry (continued):

#### **Procedure for Entering a New “Lock” Passcode (Command C-4):**

- a) To enter a new lock passcode, the lock function must be enabled (Command C-5) and the current passcode must be entered (i.e. the unit must be “unlocked” using Command A-7). See the two previous procedures if these command entry requirements have not been satisfied.
- b) Select and enter Command C-4, Enter New Lock Combination.
- c) After the command is entered, the INC/DEC switch is used to select the first new passcode digit. The digit selected is indicated by a numbered light (0-9).
- d) Once the first new digit of the passcode is selected, push the ENTER button once. The numbered light should momentarily turn off indicating the entry was accepted. Write down the new digit for later use.
- e) Repeat steps c and d for the 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> passcode digits, remembering to write down each passcode digit as it is entered.
- f) Verify the new passcode by re-locking the unit (MODE switch to the RUN position and then back to the middle, Command Entry position), and entering the new passcode using Command A-7 as described in the procedure on the previous page.

### Manual Operation

Command A-0, Enter Manual Positioning Mode, is used to override the 4-20mA position command input and the startup (burner management) command inputs (i.e. Purge Position, Lightoff Position, Standby Position). This command is used during the operational checkout of the system prior to commissioning and after commissioning to verify burner performance at each position index.

#### **Procedure for Entering Manual Positioning Mode (Command A-0):**

- a) Select and enter Command A-0, Enter Manual Positioning Mode. If the numbered lights flash momentarily after entering Command A-0:
  - The ADJUST switch may be in the MINIMUM position, or
  - The unit may be “locked” to prevent tampering.
- b) After entering the command, the yellow manual (MAN) light will be on. The INC/DEC switch can be used to move the valve open or closed. If the ADJUST switch is in the INDEX position, the INC/DEC switch is used to move between the 19 position “indexes”. If the ADJUST switch is in the ADJ position, pushing the INC/DEC switch up or down changes the valve position in 1.0-degree steps. If the INC/DEC switch is held in the up or down position, the position is continuously adjusted until the maximum or minimum position is reached. When the max or min position setpoint is reached, all the numbered lights will momentarily flash.
- c) To return control back to the 4-20mA firing rate command input or burner management startup control, move the MODE switch to the RUN position (down).

# Operating Instructions

## Troubleshooting and Alarms

If the alarm light of the Control Interface is on or flashing, view the alarm condition by executing Command A-1, Display Alarms. After command entry, the INC/DEC switch is used to scroll through the alarm codes. The cause of the alarm can be determined by observing the numbered lights turned on and matching the light pattern to the table entry below. Corrective action and the optional User Display text message of each alarm are also provided in the following tables.

### Valve Actuator Alarms

Alarm Code <i>Light #0-3 = Valve # Light #5-9 = Alarm Condition</i>	Alarm Name	User Display Message <i>(V# = Valve No. 0, 1, 2, or 3 )</i>	Alarm Description and Corrective Action <i>(Alarms shown as "faults" in User Display message indicate system was shutdown and requires a remote reset command or power cycling)</i>
<b>Actuator Alarms</b>			
Valve #, 5	Position Overshoot	"ALARM: V# OVERSHOOT"	Actuator detected problem with position control. If alarm persists, replace valve actuator.
Valve #, 6	Position Breakaway	"ALARM: V# BREAKAWAY"	Actuator detected problem holding commanded position. Check valve's operating differential pressure and compare with specification; if alarm persists and measured pressure does not exceed valve rating, replace actuator.
Valve #, 5, 6	Sticky Valve	"ALARM: V# STICKY"	Actuator could not momentarily position to within 0.1 degree. With the system and valve powered down, check if there is debris or a mating flange inhibiting valve movement. If the alarm persists and no mechanical problem is found, replace actuator.
Valve #, 7	Stuck Valve	"FAULT: V# STUCK"	Actuator could not position to within 0.1 degree. With the system and valve powered down, check if there is debris or a mating flange inhibiting valve movement. If the alarm persists and no mechanical problem is found, replace actuator.
Valve #, 5, 7	Temperature	"ALARM: V# TEMP"	Actuator senses out-of-specification ambient temperature. Check temperature of actuator's enclosure. If actuator temperature is within specification, replace actuator. Otherwise, remove (or add) heat source.
Valve #, 6, 7	Calibration	"ALARM: V# CALIBRATE"	Actuator is not calibrated. This alarm condition should be addressed by Maxon-trained personnel only. Select the alarming valve number (Command A-3) and perform calibration by executing Command C-1 and C-2.
Valve #, 5, 6, 7	DC Supply Voltage	"ALARM: V# 24VDC"	Actuator senses out-of-specification +24VDC supply. Check for heavily loaded power supply, a failed supply, or cable length out-of-specification.
Valve #, 8	Processor Reset	"ALARM: V# RESET"	Actuator detected processor reset due to improper software execution, high electrical noise, improper shield terminations, or electronics failure. If alarm persists after checking for noise source, replace actuator.
Valve #, 5, 8	ADC Hardware	"ALARM: V# ADC"	Actuator detected an analog-to-digital hardware or position control problem. If alarm occurs with sticky or stuck valve alarm, see corrective action for sticky/stuck alarm above. If only this alarm occurs and persists after re-powering actuator, replace actuator.
Valve #, 6, 8	Network Communication	"FAULT: V# NET COMM"	Actuator lost communication with Control Interface. Check for an intermittent control cable connection at both ends. On the actuator end, check for a solid ON green power light and a blinking red status light. A green diagnostic light will blink 0, 1, 2, or 3 times per second indicating its valve number. (The green diagnostic light of Valve #0 will remain on without blinking). The yellow service light should not be turned on.
Valve #, 5, 6, 8	Commission	"ALARM: V# COMMISSION"	Actuator was not commissioned and the burner management system is issuing a command to modulate the burner. Commission the valve as described in Pages 7400-S-18 through 20.
Valve #, 7, 8	Swap	"ALARM: V# SWAP"	Actuator was replaced (or swapped) on a commissioned system without performing the re-commissioning procedure. Re-commission the alarming valve using Command A-4, Commission Valve, as described in Reference Table 12. If all valves indicate a swap alarm, the Control Interface was replaced on a commissioned system without performing the re-commissioning commands; execute the Commission Command A-4 for each installed valve.

## Operating Instructions

### Troubleshooting and Alarms (continued)

#### Control Interface Alarms

Alarm Code (Code = CI #0-9 Lights ON)	Alarm Name	User Display Message	Alarm Description and Corrective Action (Alarms shown as "faults" in User Display message indicate system was shutdown and requires a remote reset command or power cycling)
4, 5	Memory	"FAULT: CI MEMORY"	Control Interface detected data corruption. Reload commissioning data if stored in optional User Display. If a User Display was not purchased, reset factory defaults and re-commission system using the Commissioning Table filled out during initial commissioning. If alarm persists, replace Control Interface.
4, 6	Lock	"ALARM: CI LOCK"	Control Interface is locked and Mode switch is in Command Entry (middle) position. A flashing alarm light also indicates this condition. Move Mode switch on Control Interface to the RUN position or unlock the unit by entering Command A-7 followed by the 4-digit passcode.
4, 5, 6	Processor Reset	"ALARM: CI RESET"	Control Interface detected a reset due to improper software execution, high electrical noise, improper shield connections, or electronics failure. If alarm persists after checking for noise source, replace Control Interface.
4, 7	User- Initiated Shutdown	"FAULT: CI U- SHUTDOWN"	Control Interface user-initiated system shutdown occurred via User Display. Cycle power to the system or momentarily provide a Remote Reset command to the Control Interface.
4, 5, 7	Firing Rate Limit	"ALARM: CI FR LIMIT"	Control Interface firing rate exceeds commissioned maximum "running" index. Re-commission installed valves at position index #9 as described in Pages 7400-S-18 through 20.

# Operating Instructions

## Actuator Replacement

*Actuator replacement should be accomplished by Maxon-trained personnel only*

### Actuator Removal

1. Power down the SMARTLINK™ MRV system. Turn off the fuel supply and burner management system.
2. Remove the actuator access cover using a 4mm Allen wrench and verify the green power light is OFF.
3. Record the wire color code sequence and then disconnect the four wires and shield from the terminal block. Disconnect any conduit fittings.
4. Loosen the clamp collar set screw with a 3/16" Allen wrench.
5. Remove the four M6x1x18 mm screws connecting the actuator to the adapter with a 4mm Allen wrench.
6. Remove the actuator by holding the actuator housing and pulling the actuator away from the valve.

### Actuator Reinstallation

1. Inspect the actuator shaft and verify that the 1/8" square 1/2" long key is completely seated in the shaft slot.
2. Verify the clamp collar is loose and position the screw head on the left when looking at the clamp collar at the top.
3. Place the actuator shaft with key into the clamp collar. Slide the keyed shaft into the coupling key slot, then rotate the actuator housing so the alignment pin mates with the pin hole in the valve adapter. The parts are a clearance fit but should slip together with little force. Apply pressure until the actuator is flat against the adapter. **Do not apply an excessive force.** If the subassemblies do not mate together, recheck that the clamp is loose and the key is pressed to the bottom of the key slot.
4. **Verify that the valve will close completely.** With the valve closed, the coupling hard-stop pin should be centered and touching the hard-stop set screw.
5. With valve in the fully closed position, assemble the actuator to the valve adapter with four M6x1x18 mm fasteners using Loctite 242. Use a torque wrench with a 4mm Allen bit to apply 18in-lbs of torque in an alternating diagonal tightening sequence.
6. With the valve in the fully closed position, verify that the clamp collar is seated flush against the coupling shoulder. Tighten the stainless steel clamp collar with a torque wrench and 3/16" Allen bit to 110 in-lbs.
7. Make the necessary water-tight electrical conduit connection. Re-connect the four wires to the terminal strip per the original color code sequence. Re-connect the shield wire to the terminal strip, keeping it less than 1" in length.

8. Apply power to the SMARTLINK™ MRV System. Verify the green power light is ON.
9. Reinstall the access cover and torque the four fasteners to 18 in-lbs. using a 4mm Allen wrench.
10. Make sure the system is in Shutdown Mode (i.e. The Control Interface RUN and MANUAL lights are off and ALARM light is on.) If not, disconnect power for 10 seconds to the valve actuator being replaced and re-power the actuator after the system enters Shutdown Mode.)
11. With the Control Interface, select the valve number that is being replaced (Command A-3). Next, execute Command A-4, Commission Valve. This command electronically "replaces" the spare unit (valve #4) as the valve requiring replacement (valve #0, 1, 2 or 3). If a User Display is used, select the valve to be replaced and execute the "Replace" command (Sub-Menu #11.5) under the Valve Maintenance Main Menu #11.
12. Execute Command C-1, Enable Calibration, from the Control Interface or the User Display. If all the numbered lights flash on the Control Interface after command entry, the command was not successfully executed. Refer to Table 14 (page 7400-S-43) for detailed command information. In the User Display, this command is available under the Valve Maintenance Menu in the Test Mode Sub-Menu (#11.1). Successful completion of this command will result in the test mode being displayed as "ON".
13. Execute Command C-2, Calibrate Valve. This command takes approximately 3 minutes. If the command is executed from the Control Interface, the even numbered lights will flash on and off. If the command is executed from the User Display (Sub-Menu #11.4), the valve positions displayed will slowly change as the valve moves through its full travel. Refer to Table 14 for detailed command information. If the command is executed from the Control Interface and all the lights flash on and then off, the calibration procedure did not execute properly.
14. Power the complete system down and then up. If a valve calibration alarm still exists, the calibration command did not complete successfully. Verify that the actuator was mounted properly as described above and perform the previous steps again.
15. Turn on the fuel supply and burner management system and re-verify burner performance throughout its full firing range. The valve attached to the new actuator will be within approximately 1 degree of its previously commissioned positions due to mechanical tolerances. Verify burner operation with the new actuator through its entire firing range and re-commission if necessary.

## SMARTLINK™ Reference Tables

**Table 1: SMARTLINK™ MRV Interface Panel Terminal Descriptions**

Terminal Designator: Name (Label Abbreviation)	Description
<b>Line Voltage Terminals</b>	
<i>Location: Terminal block assembly on lower DIN rail of Interface Panel</i>	
Line Voltage (L1)	120 to 230 VAC customer power source, 50-60Hz 2 Valve System: 61Watts (max) load 3 Valve System: 90 Watts (max) load 4 Valve System: 118Watts (max) load
Line Voltage Switched (L1S)	Switched line voltage from breaker used to locally power down the SMARTLINK MRV system. <i>Note: No field wires should be connected to these terminals.</i>
Neutral (L2)	Neutral
Protective Earth (PE)	Earth Ground
<b>Relay Output Terminal Block</b>	
<i>Location: Terminal block assembly on lower DIN rail of Interface Panel</i>	
All relay outputs below are Form A (Normally Open) contacts with the following specifications: 12A, 250VAC/DC (max)	
Alarm (ALM)	Output: Alarm relay contact closes if one or more MRV alarm or fault conditions exist. (See Page 7400-S-23 for alarm/fault description).
Alarm Return (ALMR)	
Control Enable (CE1)	Output: Control Enable #1 & #2 relay contacts are closed when no MRV system fault exists; outputs provide a combustion system permissive signal. (See Page 7400-S-23 for descriptions of fault conditions and Page 7400-S-8 for wiring the Control Enable in a typical combustion system.) The two contacts are wired in series to prevent a single-point, welded contact failure. <i>Note: A jumper is installed between CE1R and CE2. Field wiring should be connected to only CE1 and CE2R.</i>
Control Enable Return (CE1R)	
Control Enable (CE2)	
Control Enable Return (CE2R)	
Purge Position Proven (PPP)	Output: Purge Position Proven relay contact closes when all valve positions are greater than or equal to maximum positions or user-defined, custom purge positions.
Purge Position Proven Return (PPPR)	
Light-Off Position Proven (LPP)	Output: Light-off Position Proven relay contact closes when all valve positions are less than or equal to minimum positions or user-defined, custom light-off positions.
Light-Off Position Proven Return (LPPR)	
Custom Output #1 (CO1)	Output: Reserved for future use.
Custom Output #1 Return (CO1R)	
<b>Relay Input Terminal Block</b>	
<i>Location: Terminal block assembly on lower DIN rail of Interface Panel</i>	
All relay inputs below are solid-state with following specifications: Input On-State Voltage: 120VAC (230VAC and 24VDC options available) Input On-State Current: 25mA (max) Input Off-State (Leakage) Current: 4mA	
Command Common (CCOM)	N/A: Common for all solid-state relay input command signals listed below. <b>Must be wired to ground reference of all input command signals below.</b>
Purge Position Command (PPC)	Input: Purge Position Command drives all SMARTLINK MRV valves to their maximum or user-defined, custom purge positions if the LPC and MVC inputs are not energized.
Light-off Position Command (LPC)	Input: Light-off Position Command drives all SMARTLINK MRV valves to their minimum or user-defined, custom light-off positions if the MVC input is not energized.
Modulate Valves Command (MVC)	Input: Modulate Valves Command enables all SMARTLINK MRV valves to synchronously modulate based on the 4-20mA firing rate command input signal. This command overrides the PPC and LPC commands when energized.
Remote Reset Command (RRC)	Input: Remote Reset Command resets the MRV system when a fault condition occurs and the system has entered Shutdown Mode. (See Page 7400-S-23 for fault condition descriptions.)
Custom Application Command #1 (CAC1)	Input: Reserved for future use.
Custom Application Command #2 (CAC2)	Input: Reserved for future use.
<b>4-20mA Terminal Block</b>	
<i>Location: Terminal block assembly on lower DIN rail of Interface Panel</i>	
4-20mA In A + (INA+)	Input: Isolated 4-20mA firing rate command; current flows into INA+ and out of INA- terminal; 4mA = 0% firing rate demand (minimum valve positions); 20mA = 100% firing rate demand (maximum valve positions)
4-20mA In A - (INA-)	
4-20mA In B + (INB+)	Input: Reserved for future use
4-20mA In B - (INB-)	
4-20mA Out + (OUT+)	Output: Isolated 0-20mA signal with current provided by the Control Interface, i.e. no external loop power supply is required <i>During Run, Manual, or Shutdown Mode:</i> Output represents firing rate feedback (actual); 4mA = 0% actual firing rate (minimum valve positions); 20mA = 100% actual firing rate (maximum valve positions) <i>During Startup Mode:</i> Output represents startup system status; 1mA = all valves in standby positions; 2mA = all valves in purge positions; 3mA = all valves in light-off positions <i>During Position Setup Mode:</i> Output represents the actual position of the selected valve so that system commissioning is possible using only a 4-20mA meter; 4mA = 0.0 degrees; 20mA = 80.0 degrees; Actual valve position = [current (mA) – 4.0mA] / 16.0mA * 80.0 degrees
4-20mA Out - (OUT-)	

## SMARTLINK™ Reference Tables

**Table 1: SMARTLINK™ MRV Interface Panel Terminal Descriptions (*continued*)**

Terminal Designator: Name (Label Abbreviation)	Description
<b>Network Interface Terminal Connectors</b>	
<i>Location: 4-position plug-type connectors of Network Interface module; Quantity-8</i>	
<i>Valve-0:</i> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #0 communications network and field +24VDC power
<i>Valve-1:</i> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #1 communications network and field +24VDC power
<i>Valve-2:</i> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #2 communications network and field +24VDC power
<i>Valve-3:</i> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #3 communications network and field +24VDC power
<i>User Display:</i> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: User Display communications network and field +24VDC power Note: Factory-wired in MRV 24"x20" Interface Panel
<i>SL-MRV-CI:</i> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Input: Communications network and field +24VDC power from SMARTLINK MRV Control Interface Note: Factory-wired in MRV Interface Panels
<i>Spares (2):</i> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Spare communications network and field +24VDC power for optional remote User Display and future SMARTLINK field devices.

**Table 2: SMARTLINK™ MRV Valve Actuator Terminal Descriptions**

Terminal Name (Abbreviation)	Description
<b>24V / Data Connector</b>	
24VDC Power (+24)	Valve actuator +24VDC power; 25Watts peak, 12Watts average
Common (GND)	Valve actuator +24VDC common
Data A (DA)	Input / Output: Communications network data 'A' signal
Data B (DB)	Input / Output: Communications network data 'B' signal
Shield (SHD)	Field device shield

## SMARTLINK™ Reference Tables

### Table 3: SMARTLINK™ MRV Interface Panel Field Wiring Specifications

Terminal Designator: Name (Label Abbreviation)	Wiring Specifications (Maximum Length, Min/Max Size, and special requirements)
<b>Line Voltage Terminals</b>	
Line Voltage (L1) Neutral (L2) Protective Earth (PE)	14 or 16 AWG wire No length restrictions other than voltage drop considerations for 115Watts (max) load Follow all local and NEC 1 wiring codes
<b>Relay Output Terminal Block</b>	
Alarm (ALM) Alarm Return (ALMR) Control Enable (CE1) Control Enable Return (CE1R) Control Enable (CE2) Control Enable Return (CE2R) Purge Position Proven (PPP) Purge Position Proven Return (PPPR) Light-Off Position Proven (LPP) Light-Off Position Proven Return (LPPR) Custom Output #1 (CO1) Custom Output #1 Return (CO1R)	14 or 16 AWG wire No length restrictions other than voltage drop considerations for 12 Amps (max) load Follow all local and NEC 1 wiring codes Terminals CO1 and CO1R for future use
<b>Relay Input Terminal Block</b>	
Command Common (CCOM) Purge Position Command (PPC) Light-off Position Command (LPC) Modulate Valves Command (MVC) Remote Reset Command (RRC) Custom Application Command #1 (CAC1) Custom Application Command #2 (CAC2)	14-22 AWG wire No length restrictions (25mA max load) Follow all local and NEC 1 wiring codes Terminals CAC1 and CAC2 for future use
<b>4-20mA Terminal Block</b>	
4-20mA In A + (INA+) 4-20mA In A - (INA-)	1000 feet maximum length Use Belden 9535, 2-conductor, 100% shield coverage, 300V 80C (UL 2464, CSA PCC FT 4) or equivalent <i>Notes on shield wire termination:</i> The shield wire should be grounded immediately as it enters the enclosure that houses the MRV Interface Panel. If the Interface Panel is purchased with the enclosure option, terminate the shield wire on the corner ground post closest to where the cable enters.
4-20mA In B + (INB+) 4-20mA In B - (INB-)	Terminal INB+ and INB- for future use
4-20mA Out + (OUT+) 4-20mA Out - (OUT-)	1000 feet maximum length Use Belden 9535, 2-conductor, 100% shield coverage, 300V 80C (UL 2464, CSA PCC FT 4) or equivalent <i>Notes on shield wire termination:</i> The shield wire should be terminated at the process controller end only, not at the Interface Panel enclosure.
<b>Network Interface Terminal Connectors</b>	
<b>Valve-0:</b> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	100 feet max length to each actuator; 1000 feet maximum to optional remote User Display EIA Level 4 cable, 2 twisted pair with shield, 22 AWG <i>Cable sources:</i> Maxon - P/N 59829 (available in 100 and 500ft. lengths) Connect-Air International P/N W22P-1005 <i>Suggested wiring color code convention:</i> Orange/White (F24+), Orange (F24-), Blue (DA), Blue/White (DB) 300 feet max length to each actuator with Belden P/N 3086A: 2 twisted pair with shield; 16 AWG – power pair, 20 AWG - data pair <i>Suggested wiring color code convention:</i> Brown (F24+), Blue (F24-), White (DA), Black (DB) <i>Note on shield wire terminations:</i> The shield wire of each actuator network cable should be connected to the actuator “SHD” terminal (keeping the shield length to 1 inch or less). In addition, the shield wire should be tied to ground as it enters the enclosure of the MRV Interface Panel (keeping the maximum length to 2 inches or less). If the Interface Panel is purchased with the enclosure option, terminate the shield wire on the corner ground post closest to where the cable enters the enclosure.
<b>Valve-1</b>	Same requirements as Valve #0 connections above.
<b>Valve-2</b>	Same requirements as Valve #0 connections above.
<b>Valve-3</b>	Same requirements as Valve #0 connections above.
<b>User Display</b>	Factory-wired with MRV Interface Panel (24" x 20" Interface Panel only)
<b>SL-MRV-CI</b>	Factory-wired with MRV Interface Panel
<b>Spares (2)</b>	Same requirements as Valve #0 connections above.

## SMARTLINK™ Reference Tables

**Table 4: SMARTLINK™ MRV Control Interface Terminal Descriptions**

Terminal Name (Abbreviation)	Description
<b>24V / Data Connector</b>	
Field 24VDC Power (F24+)	Field (actuator) +24VDC power; 2,3, & 4 Valve systems – 50, 75, 100 Watts (max), respectively
Field Common (F24-)	Field (actuator) +24VDC common
Data A (DA)	Input / Output: Communications network data 'A' signal
Data B (DB)	Input / Output: Communications network data 'B' signal
Supply 24VDC (S24+)	System power supply +24VDC; 2,3, & 4 Valve systems – 53, 78, 103 Watts (max), respectively
Supply Common (S24-)	System power supply common
<b>4-20mA Connector</b>	
4-20mA In A + (INA+)	Input: Isolated 4-20mA firing rate command; current flows into INA+ and out of INA-terminal; 4mA = 0% firing rate demand (minimum valve positions); 20mA = 100% firing rate demand (maximum valve positions)
4-20mA In A - (INA-)	
4-20mA In B + (INB+)	Input: Reserved for future use
4-20mA In B - (INB-)	
4-20mA Out + (OUT+)	Output: Isolated 0-20mA signal with current provided by the Control Interface, i.e. no external loop power supply is required <i>During Run, Manual, or Shutdown Mode:</i> Output represents firing rate feedback (actual); 4mA=0% actual firing rate (min positions); 20mA=100% actual firing rate (max positions) <i>During Startup Mode:</i> Output represents startup system status; 1mA = all valves in standby positions; 2mA = all valves in purge positions; 3mA = all valves in light-off positions <i>During Position Setup Mode:</i> Output represents the actual position of the selected valve so that system commissioning is possible using only a 4-20mA meter; 4mA = 0.0 degrees; 20mA = 80.0 degrees; Actual valve position = [current (mA) – 4.0mA] / 16.0mA * 80.0 degrees
4-20mA Out - (OUT-)	
<b>Relay Input Connector</b>	
	The following relay inputs are solid-state and require 5-24VDC and 2mA (max) to turn "ON". <i>Note #1:</i> RI1 through RI6 must all be referenced to RCOM <i>Note #2:</i> If the Control Interface is used with the Maxon Relay Input Interface (RII) module, the RI1-RI6 inputs below can be connected to Relay Input Interface, terminals #6-#1.
Relay In 1 (RI1)	Input: The ON state of Relay Input #1 drives all SMARTLINK MRV valves to their maximum or user-defined, custom purge positions if either RI2 and RI3 are not ON.
Relay In 2 (RI2)	Input: The ON state of Relay Input #2 drives all SMARTLINK MRV valves to their minimum or user-defined, custom light-off positions if RI 3 is not ON.
Relay In 3 (RI3)	Input: The ON state of Relay Input #3 enables all SMARTLINK MRV valves to synchronously modulate based on the 4-20mA firing rate command signal. When RI3 is ON, commands from either or both RI1 and RI2 inputs are overridden.
Relay In 4 (RI4)	Input: A momentary ON state of Relay Input #4 resets the MRV when a fault has occurred and the system is in Shutdown Mode. (See Page 7400-S-23 for fault condition descriptions.)
Relay In 5 (RI5)	Input: Relay Input #5 is reserved for future use.
Relay In 6 (RI6)	Input: Relay Input #6 is reserved for future use.
<b>Relay Output Connector</b>	
	The following relay drive outputs are solid-state, 30VDC, 100mA (max) open collectors. <i>Note #1:</i> RO1 through RO5 must all be referenced to RCOM <i>Note #2:</i> If the Control Interface is used with the Maxon Relay Output Interface (ROI) module, the following RO1-RO5 outputs can be directly connected to Relay Output Interface, terminals #1-#5.
Relay Out 1 (RO1)	Output: Relay drive Output #1 is turned ON if one or more MRV alarm or fault conditions exist. (See Page 7400-S-23 for alarm/fault descriptions.)
Relay Out 2 (RO2)	Output: Relay drive Output #2 is turned ON when no MRV system fault exists. (See Page 7400-S-23 for descriptions of fault conditions.)
Relay Out 3 (RO3)	Output: Relay drive Output #3 is turned ON when all MRV valve positions are greater than or equal to their maximum positions or user-defined, custom purge positions.
Relay Out 4 (RO4)	Output: Relay drive Output #4 is turned ON when all MRV valve positions are less than or equal to their minimum positions or user-defined, custom light-off positions.
Relay Out 5 (RO5)	Output: Relay drive Output #5 is reserved for future use.
Relay Common (RCOM)	Common for all relay output drive signals (RO1-RO5) and relay input signals (RI1-RI6).

## SMARTLINK™ Reference Tables

**Table 5: SMARTLINK™ MRV Control Interface Field Wiring Specifications**

(For applications with optional Maxon MRV Interface Panel or optional MRV Relay Input, Relay Output, and Network Interface Modules)

Connector Name / Terminal Name (Label Abbreviation)	Wiring Specifications (Maximum Length, Type, Min/Max Size, and special requirements)
<b>24V / Data Connector</b>	
Field 24VDC Power (F24+) Field Common (F24-) Data A (DA) Data B (DB)	100 feet maximum length to each actuator; EIA Level 4 cable, 2 twisted pair with shield, 22 AWG <i>Cable sources:</i> Maxon P/N 1055654 (100 ft. length); P/N 59829 (500 ft. length) Connect-Air International P/N W22P-1005 <i>Suggested wiring color code convention:</i> Orange/White (F24+), Orange (F24-), Blue (DA), Blue/White (DB) 300 feet maximum length to each actuator with Belden P/N 3086A: 2 twisted pair with shield; 16 AWG – power pair, 20 AWG - data pair <i>Suggested wiring color code convention:</i> Brown (F24+), Blue (F24-), White (DA), Black (DB) <i>Note on shield wire terminations:</i> The shield wire of each actuator network cable should be connected to the actuator “SHD” terminal (keeping the shield length to 1 inch or less). In addition, the shield wire should be tied to ground as it enters the enclosure of the Control Interface (keeping the maximum length to 2 inches or less).
Supply 24VDC (S24+) Supply Common (S24-)	14-18 AWG No length limitations other than voltage drop considerations +24VDC with 2, 3, & 4 Valve systems require 2.2, 3.3, and 4.3 DC Amps (max), respectively
<b>4-20mA Connector</b>	
4-20mA In A + (INA+) 4-20mA In A - (INA-)	1000 feet maximum length Use Belden 9535, 2-conductor, 100% shield coverage, 300V 80C (UL 2464, CSA PCC FT 4) or equivalent <i>Notes on shield wire termination:</i> The shield wire should be grounded immediately as it enters the enclosure that houses the Control Interface.
4-20mA In B + (INB+) 4-20mA In B - (INB-)	Terminal INB+ and INB- for future use
4-20mA Out + (OUT+) 4-20mA Out - (OUT-)	1000 feet maximum length Use Belden 9535, 2-conductor, 100% shield coverage, 300V 80C (UL 2464, CSA PCC FT 4) or equivalent <i>Notes on shield wire termination:</i> The shield wire should be terminated at the process controller end only, not within the enclosure housing the Control Interface.
<b>Relay Input Connector</b>	
Relay In 1 (RI1) Relay In 2 (RI2) Relay In 3 (RI3) Relay In 4 (RI4) Relay In 5 (RI5) Relay In 6 (RI6)	14-22 AWG wire No length restrictions other than voltage drop considerations (5-24VDC, 2mA max) Follow all local and NEC 1 wiring codes RI5 and RI6 for future use
<b>Relay Output Connector</b>	
Relay Out 1 (RO1) Relay Out 2 (RO2) Relay Out 3 (RO3) Relay Out 4 (RO4) Relay Out 5 (RO5) Relay Common (RCOM)	14-22 AWG wire No length restrictions other than voltage drop considerations (30VDC, 100mA max) Follow all local and NEC 1 wiring codes RO5 for future use

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**Table 6: SMARTLINK™ MRV Relay Input Interface Terminal Descriptions and Wiring Specifications**

Terminal Number / Name	Description
<b>Power Connections</b>	
	14-22 AWG No length limitations other than voltage drop considerations Follow all local and NEC 1 wiring codes
Supply 24VDC (S24+)	System power supply +24VDC (+/- 5%), 50mA (max when all inputs are energized)
Supply 24VDC Common (S24-)	System power supply common
<b>Command Input Drive Signals</b> (To Control Interface signals, RI1-RI6)	
	14-22 AWG wire No length restrictions other than voltage drop considerations Follow all local and NEC 1 wiring codes <i>Note: The following command input drive signals are solid-state</i>
#1	Output: Greater than 22 VDC in ON state when terminal #14 is energized.
#2	Output: Greater than 22 VDC in ON state when terminal #16 is energized.
#3	Output: Greater than 22 VDC in ON state when terminal #18 is energized.
#4	Output: Greater than 22 VDC in ON state when terminal #20 is energized.
#5	Output: Greater than 22 VDC in ON state when terminal #22 is energized.
#6	Output: Greater than 22 VDC in ON state when terminal #24 is energized.
<b>Relay Command Inputs</b> (From burner management system)	
	The following relay command inputs are solid-state with the following specifications: Input On-State Voltage: 120VAC (230VAC and 24VDC options available) Input On-State Current: 25mA (max for each input) Input Off-State (Leakage) Current: 4mA  14-22 AWG wire No length restrictions other than voltage drop considerations Follow all local and NEC 1 wiring codes <i>Note #1: All relay command inputs must be referenced to the COM terminal</i>
#14	Input: When energized with 120VAC (230VAC or 24VDC with other models), greater than 22VDC will appear at terminal #1 (which should be wired to terminal RI6 of the SMARTLINK MRV Control Interface).
#16	Input: When energized with 120VAC (230VAC or 24VDC with other models), 22VDC (or greater) will appear at Terminal #2 (which is wired to terminal RI5 of the SMARTLINK MRV Control Interface).
#18	Input: When energized with 120VAC (230VAC or 24VDC with other models), 22VDC (or greater) will appear at terminal #3 (which is wired to terminal RI4 of the SMARTLINK MRV Control Interface).
#20	Input: When energized with 120VAC (230VAC or 24VDC with other models), 22VDC (or greater) will appear at terminal #4 (which is wired to terminal RI3 of the SMARTLINK MRV Control Interface).
#22	Input: When energized with 120VAC (230VAC or 24VDC with other models), 22VDC (or greater) will appear at terminal #5 (which is wired to terminal RI2 of the SMARTLINK MRV Control Interface).
#24	Input: When energized with 120VAC (230VAC or 24VDC with other models), 22VDC (or greater) will appear at terminal #6 (which is wired to terminal RI1 of the SMARTLINK MRV Control Interface).
COM	Relay command input common

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**Table 7: SMARTLINK™ MRV Relay Output Interface Terminal Descriptions and Wiring Specifications**

Terminal Number / Name	Description
<b>Power Connections</b>	14-22 AWG No length limitations other than voltage drop considerations Follow all local and NEC 1 wiring codes
Supply 24VDC (S24+)	System power supply +24VDC (+/- 5%), 100mA (max when all inputs are ON)
<b>Relay Drive Inputs</b> (From Control Interface signals, RO1-RO5)	The following input signals energize electromechanical relay coils. Each input has the following specification: 24VDC, 20mA (max)  14-22 AWG wire No length restrictions other than voltage drop considerations Follow all local and NEC 1 wiring codes
#1	Input: 24VDC energizes a Form A relay, closing contacts between terminal #7 and #8.
#2	Input: 24VDC energizes 2 Form A relays, closing 2 contacts between terminal #9 and #10 and between #11 and #12. (Redundant contacts are provided for additional reliability.)
#3	Input: 24VDC energizes a Form A relay, closing contacts between terminal #13 and #14.
#4	Input: 24VDC energizes a Form A relay, closing contacts between terminal #15 and #16.
#5	Input: 24VDC energizes a Form A relay, closing contacts between terminal #17 and #18.
<b>Relay Contact Outputs</b> (To customer burner management system)	Each Form A (normally open) relay contact has the following specification: Contact Voltage: 250VAC (max) Contact Current: 12A (max) <i>Note:</i> Contacts are "dry", i.e. no voltage is applied to these contacts by this module  14-16 AWG wire No length restrictions other than voltage drop considerations Follow all local and NEC 1 wiring codes
#7 and #8	Output: Contact closes between terminals when relay coil is energized on terminal #1.
#9 and #10	Output: Contact closes between terminals when relay coil is energized on terminal #2.
#11 and #12	Output: Contact closes between terminals when relay coil is energized on terminal #2.
#13 and #14	Output: Contact closes between terminals when relay coil is energized on terminal #3.
#15 and #16	Output: Contact closes between terminals when relay coil is energized on terminal #4.
#17 and #18	Output: Contact closes between terminals when relay coil is energized on terminal #5.

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**Table 8: SMARTLINK™ MRV Network Interface Terminal Descriptions and Wiring Specifications**

Terminal Name	Description
<b>Network Interface Terminal Connectors</b> <i>(4-position plug-type; Quantity-8)</i>	<p>100 feet maximum length to each actuator; 1000 feet maximum to optional remote User Display EIA Level 4 cable, 2 twisted pair with shield, 22 AWG</p> <p><i>Cable sources:</i> Maxon P/N 1055654 (100 ft. length); P/N 59829 (500 ft. length) Connect-Air International P/N W22P-1005</p> <p><i>Suggested wiring color code convention:</i> Orange/White (F24+), Orange (F24-), Blue (DA), Blue/White (DB)</p> <p>300 feet maximum length to each actuator with Belden P/N 3086A: 2 twisted pair with shield; 16 AWG – power pair, 20 AWG - data pair</p> <p><i>Suggested wiring color code convention:</i> Brown (F24+), Blue (F24-), White (DA), Black (DB)</p> <p><i>Note on shield wire terminations:</i> The shield wire of each actuator network cable should be connected to the actuator “SHD” terminal (keeping the shield length to 1 inch or less). In addition, the shield wire should be tied to ground as it enters the enclosure of the Control Interface (keeping the maximum length to 6 inches or less).</p>
<i>Valve-0:</i> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #0 communications network and field +24VDC power
<i>Valve-1:</i> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #1 communications network and field +24VDC power
<i>Valve-2:</i> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #2 communications network and field +24VDC power
<i>Valve-3:</i> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Valve #3 communications network and field +24VDC power
<i>User Display:</i> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: User Display communications network and field +24VDC power <i>Note:</i> Factory-wired in MRV 24"x20" Interface Panel
<i>SL-MRV-CI:</i> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Input: Communications network and field +24VDC power from SMARTLINK MRV Control Interface <i>Note:</i> Factory wired in MRV Interface Panels
<i>Spares (2):</i> Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	Output: Spare communications network and field +24VDC power for optional remote User Display and future SMARTLINK field devices.

## SMARTLINK™ Reference Tables

**Table 9: SMARTLINK™ MRV User Display Terminal Descriptions and Wiring Specifications**

Terminal Name (Label Abbreviation)	Description
<b>Network Interface Terminals</b> (4-position screw-type connector)	
Field 24VDC Power (F24+) Field 24VDC Common (F24-) Data A (DA) Data B (DB)	<p>Communications network and field +24VDC power</p> <p>1000 feet maximum to optional remote User Display EIA Level 4 cable, 2 twisted pair with shield, 22 AWG <i>Cable sources:</i> Maxon P/N 1055654 (100 ft. length); P/N 59829 (500 ft. length) Connect-Air International P/N W22P-1005 <i>Suggested wiring color code convention:</i> Orange/White (F24+), Orange (F24-), Blue (DA), Blue/White (DB)</p> <p><i>Note on shield wire terminations:</i> The shield wire should be connected to the actuator "SHD" terminal (keeping the shield length to 1 inch or less). In addition, the shield wire should be tied to ground as it enters the enclosure of the Control Interface (keeping the maximum length to 2 inches or less).</p>
<b>Relay Drive Output Terminals</b> (2-position screw-type connector)	
Open Collector +(OC+) Open Collector - (OC -)	<p>OC+ and OC- are for future use 30VDC, 100mA (max)</p> <p>14-22 AWG wire No length restrictions other than voltage drop considerations Follow all local and NEC 1 wiring codes</p>



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