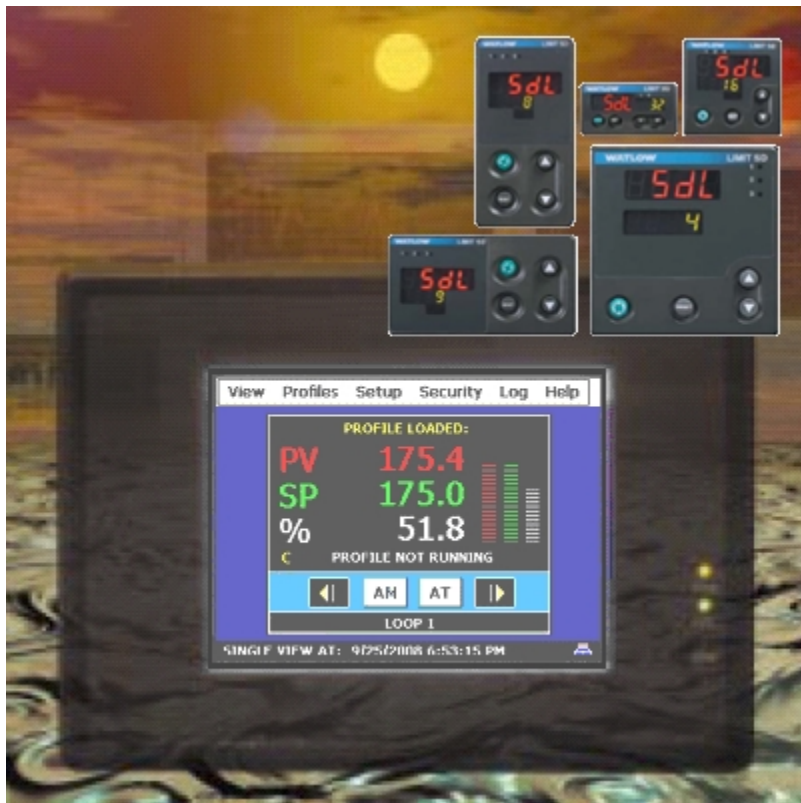




Orion-M

Watlow SD Controller System Guide



Safety Information in this Manual

Notes, cautions and warnings appear throughout this book to draw your attention to important operational and safety information.

A “**NOTE**” marks a short message to alert you to an important detail.

A “**CAUTION**” safety alert appears with information that is important for protecting your equipment and performance.

A “**WARNING**” safety alert appears with information that is important for protecting you, others and equipment from damage. Pay very close attention to all warnings that apply to your application.



This symbol (an exclamation point in a triangle) precedes a general CAUTION or WARNING statement.



This symbol (a lightning bolt in a lightning bolt in a triangle) precedes an electric shock hazard CAUTION or WARNING safety statement.

Technical Assistance

If you encounter a problem with your Orion-M controller, review all of your configuration information to verify that your selections are consistent with your application: inputs; outputs; alarms; limits; etc. If the problem persists after checking the above, you can get technical assistance by dialing +1 (866) 342-5332 or by faxing your request to +1 (866) 332-8014, Monday thru Friday, 8:00 a.m. to 5:00 p.m. Eastern Standard Time. You can also email your request to support@futuredesigncontrols.com.

An applications engineer will discuss your application with you.

Please have the following information available:

- Complete Model #'s and/or Serial #'s for Component(s) in Question
- Complete Software Version #'s
- All Configuration Information
- All User Manuals

Warranty and return information is on the back cover of this manual.

Your Comments

Your comments or suggestions on this manual are welcome. Please send them to:
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1 What is the Orion-M?

The Orion-M is a multi-loop process control system combined with an embedded SCADA color touch interface. The Orion-M provides a configurable control platform for a variety of OEM applications requiring up to 15 separate loops of control. In addition to 15 loops of control, the Orion-M can also provide up to an additional 15 inputs for process monitoring, for a total of 30 process inputs.

The system is provided with eight 24Vdc digital inputs, two 24Vdc outputs and 6 relay outputs standard. The Orion-M can be expanded to a total of 16 digital inputs and 32 digital outputs. The Orion-M also provides the capability of accepting analog inputs for remote set point control and analog outputs capable of retransmitting system variables (PV, SP or %Out) to other devices such as a chart recorder. The 0-10Vdc or 4-20mA user selectable signals are provided through the addition of optional analog expander cards.

The Orion-M complements its versatile hardware platform by providing a host of standard features and configuration capabilities, all through its visual, touch interface. The touch screen interface is an embedded, industrial PC with all software included. No external PC software is required for setup or configuration of the Orion-M. All of the setup and configuration data is saved to the Orion-M's internal memory.

Individual process controllers, one for each loop in the system, provide reliable, consistent and accurate control by distributing the process control requirements of the system among multiple processors. Each loop controller provides full auto tune functionality with high resolution, universal process inputs. When coupled with the built in ramping profiler of the Orion-M, it allows for automatic, timed control of all processes and outputs of the system. No other control system on the market provides the flexibility, functionality and configurability of the Orion-M.

1.1 Features

The digital inputs of the Orion-M can be configured as alarm inputs with adjustable delay timers, as control inputs for controlling profile operation or for direct control of the system's digital outputs.

The digital outputs of the Orion-M can be used as direct outputs for controlling external equipment related to the application through software switches, called events, or be programmed to act as system alarm or status outputs. All outputs have adjustable delay times for on, off and cycle times.

The Orion-M can be operated in single set point or automatic profile control mode. Profile entry is made easy through the use of copy, paste and delete menu selections. Profiles can be copied to the external 'USB' memory stick and then imported to another Orion-M controller which eliminates the need to enter duplicate profiles into multiple Orion-M systems. When running in automatic profile mode, the operator can place the system into hold and change any control parameter without modifying the saved profile. This gives the operator maximum flexibility over the controlled process.

Data file analysis tools (auto-trend) make looking at historical data a simple task. Any control variable saved to the Orion-M flash memory can be plotted on the historical data trend, for any time frame within the data file's total time range. Full 'USB' print capabilities from the Orion-M interface to a standard HP inkjet printer Model 6540, 6940, 6980 (or compatible printer), eliminates the need for a PC, strip or circular chart-recording device. Graphics trends, historical and report print functions are standard.

The built in Ethernet functionality includes a 'Web Server' to provides access to all Orion-M data (view only), a VNC interface for remote control and monitoring and an NTS clock, all available via a local Intranet connection (wired or wireless), or the World Wide Web using standard software like Microsoft's Internet Explorer.

The Orion-M provides a rich set of tools for control interaction and data analysis. Views include system overviews, trends, alarms, profiles as well as historical data, alarm history and audit trail views. The menu driven interface eliminates screen 'clutter' by providing an easy to use 'Windows' interface for interaction between the user and the Orion-M system.

The Orion-M can store more than one year of data on its internal compact flash card. Data logging can be enabled manually or automatically during automatic profile run. Data backup is provided with the 'USB I-Stick' for plug and play transfer of files to any PC running Microsoft Windows XP operating systems.

The Orion-M security module provides full system security with three levels of access. Each of the three access levels allow for independent user rights. Up to 30 users can be entered into the system while the audit trail tracks all operator actions and records them.

The Orion-M control system includes the following interface features:

- Overview screen that displays all "runtime" information.
- Profile run and monitor views.
- Profile entry, open, save and download interface screens.
- Current alarm and alarm history views (alarm history for up to 1 year).
- Real time trends (with adjustable X,Y limits) for all inputs.
- System and application setup (control loops, monitors, inputs/outputs, alarms, etc.).
- Data logging interface screens include log point selection and historical viewing.
- 'Plug and Play' memory stick functionality for data transfer/backup.
- Full USB print capabilities and on-line help screens
- Web server for intranet/internet access (view only).
- VNC server for intranet/internet access (control/view).
- FTP data back-up for automatic data file transfer over intranet/internet.
- Integrated email server for alarm notification and file transfer.
- NTS clock with daylight savings time insures that the system is up to date.
- Full security with audit trail for tracking user actions.
- Maintenance counters for output cycles and on times.
- Helps screens are available for most screen views; configurable in English, Spanish and French
- Voice assisted help in English, Spanish and French (external speakers required – not included).

2 Getting Started

The Orion-M requires one Watlow SD for each control loop required in the system. Since the Orion-M is capable of interfacing to more than one brand of controller, refer to the Orion-M part number matrix for the operating system to be sure that the WTSD, CM application software has been provided. The Orion-M will not operate correctly if any other version of CM application software is used with a Watlow SD controller.

2.1 Installing the Watlow SD Controller

For applications requiring several loops of control or more, proper planning and arrangement of the Watlow SD controllers prior to mounting is critical for optimum routing of the controller wiring. For applications requiring frequent access to the controllers, panel mounting provides direct access. For applications where operator access to the controllers is not required, or is desired to be kept at a minimum, the controllers can be mounted directly inside of an enclosure. This also reduces wiring concerns by eliminating the need to run the sensor, communication and control wiring for each controller to and from an enclosure door.

Refer to the Watlow SD User's Manual for the control being used for dimensions, appropriate mounting and operating conditions, including proper electrical connections. Connect sensor and control wiring as required, paying close attention to all wiring precautions and guidelines as noted in the controller manual. It is recommended that all sensor and communication wiring, to and from the Watlow SD controllers, be routed away from all high voltage and/or output control wiring. This will minimize the chances of electrical transients or spikes in the power/control wiring from causing communications or sensor reading errors.

2.1.1 Communications Wiring

Each Watlow SD control used in the Orion-M system is its own independent loop control. However, in order for the controllers to work as part of the system, they must communicate with the Orion-M control module using RS485 serial communications. Therefore, each Watlow SD used must be equipped with the RS485 communications option or they will not operate as part of the Orion-M system:

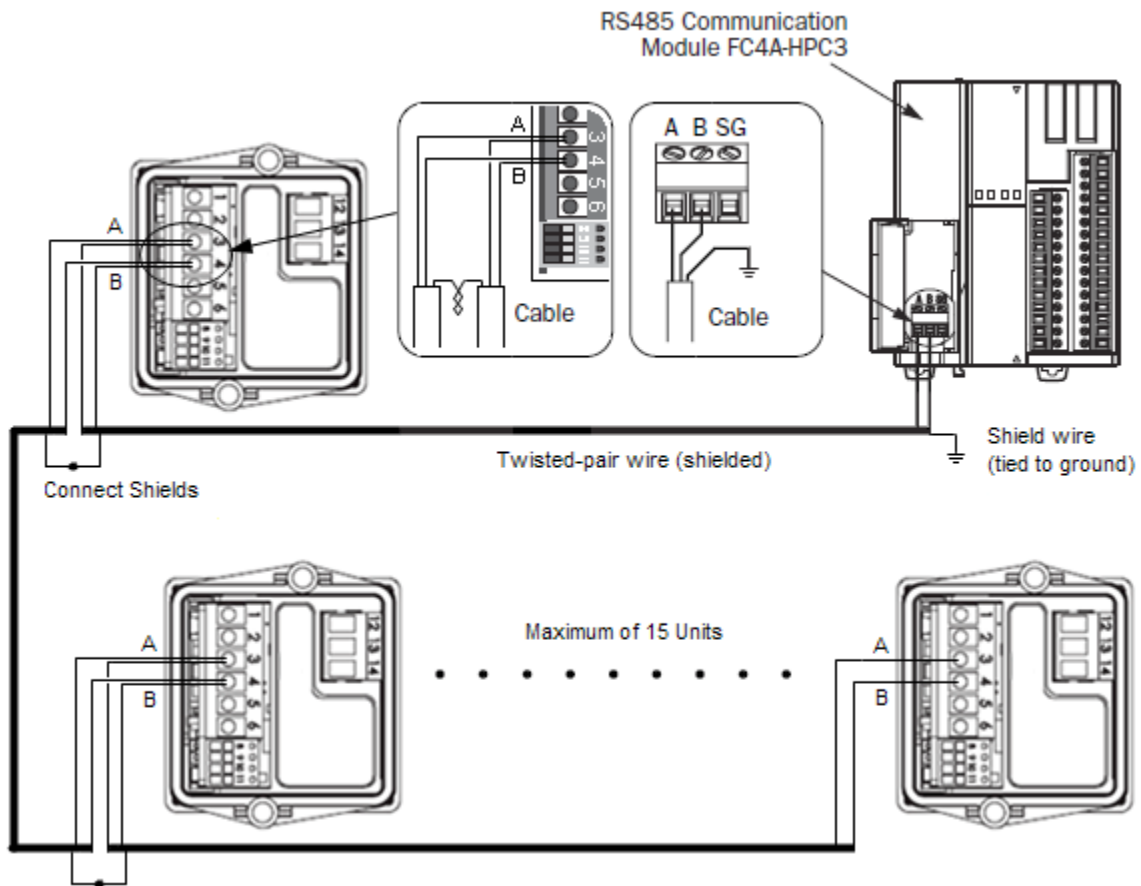
SD X X - X X **U** X - X X X X

Order code **U** designates RS-485 Modbus RTU serial communications
(see Watlow SD User's Manual for order code descriptions)

Communications wiring must be run using a minimum of 24 AWG twisted-pair, copper conductors. For short runs (< 50 feet total), non-shielded wiring can be used as long as proper separation from power/control conductors is maintained. For communications wiring where the total length will exceed 50 feet, up to the maximum allowed length of 650 feet, shielded twisted-pair must be used.

NOTE: FDC recommends the use of shielded wire for all installations regardless of the total length in order to maintain optimum performance and minimize the possibility of communications errors.

When using shielded twisted-pair, be sure to ground the shield at only one end, preferably at the Orion-M control module. Allowing any other portion of the cable shield to come in contact with ground, or grounding both ends, will allow ground loop currents to flow in that section of the cable shield which can disrupt communications.



Communications Wiring Example (1/16th DIN Watlow SD Shown)

NOTE: Refer to the Watlow SD User's Manual for all other connections including power, sensor and control wiring. Since no two applications are the same, it is up to the system designer to insure that the controllers are properly installed and wired to meet design specifications.

3 Configuring the Watlow SD Controller

The unique and inherently flexible design of the Orion-M system allows the OEM to tailor each component of the system to the application. By using independent loop controls, each one can be configured for various input and output types, control algorithms, etc., based on the requirements of the application. It also allows control loops to be added or replaced on the system at any time, simply by connecting the controller to the Orion-M's control module, RS-485 communication link.

If the application requirements change and a different input or output type is required, or if the controller were to fail, it can be replaced quickly, and at a lower cost as compared to having to repair or replace larger, integrated multi-loop controllers. The Orion-M only requires that the communications settings for each loop control be properly assigned, and that the input type of the controller is set in the Orion-M Configurator, so that the control loop input and set point can be displayed and set properly through the Orion-M interface.

3.1 Assigning the Proper Communications Settings

The Orion-M can support up to 15 Watlow SD controls. They can be mixed and matched as required, but each one must have its own communication address. The allowable address range is 1 – 15 corresponding to Loop Input #1 – 15 in the Orion-M Configurator. Communication addresses must be assigned to all controllers on the communications link beginning with 1, up to the total number of controllers.

As control loops are enabled in the Orion-M Configurator, the Orion-M will automatically use the Loop Input # as the corresponding controller address. If more than one Watlow SD has the same address, or a loop input is enabled but a controller is not assigned to that address, the Orion-M will report a communications alarm for that loop input when the runtime application is started.

NOTE: *The order of the loop controls on the communication link is not important. The communications address for a controller can be assigned regardless of its position on the link.*

*Required Watlow SD Controller Settings for Proper Communications:

- Modbus Device Address (Addr): 1-15 (based on system design)
- Baud Rate (bAud): 9600

***See chapter 5, Setup Page, in the Watlow SD User's Manual for instructions on changing parameter values as required.**

Non-Volatile Memory



The SD series store all settings in non-volatile EEPROM memory. This type of memory has a finite life of approximately 100,000 write cycles. To prevent premature failure of the EEPROM, the Orion-M turns off the non-volatile memory write control of the SD series controller when the set point is under profile control, remote set point analog input control or when the loop is configured for either cascade control or as a wetbulb loop in the Orion-M configurator. Under these circumstances, the constant writing of new set points would cause the EEPROM to fail prematurely.

It is important to note that when the non-volatile write is disabled, the set point on the SD control will NOT match that on the Orion-M touch screen interface. The SD control does not update its set point display when the non-volatile write is disabled. If the SD controls are visible to the operator, they must understand that control loops in the above modes of operation are working correctly even if the set point does not match the Orion-M display.

3.2 Input Type Assignments

The Watlow SD Series controls offer a standard universal input that can be configured for thermocouple, RTD or various linear input options for different voltage and current ranges. The Loop Input # for the corresponding control in the Orion-M Configurator is set to match the selected input type of the SD Series control. Based on this selection, the Orion-M assumes control of certain parameters related to the input and automatically assigns them based on settings made in the Orion-M.

3.2.1 Input 1 Operation

When input 1 of the SD control is a temperature input, i.e., RTD or thermocouple, the temperature units of the Watlow SD communications interface is set by the Orion-M to match the selection on the Degrees C/F screen. However, the temperature units for the Watlow SD display are a different setting which the Orion-M can not change. Therefore, if the Watlow SD controls are visible to the operator, the display units of the SD controls should be set to match the temperature units of the Orion-M.

NOTE: *It is recommended that the Degrees C/F selection screen be disabled in the Orion-M Configurator once the proper temperature units selection has been made to prevent it from being accessed. This will prevent the temperature units from being accidentally changed and causing operator confusion when the units do not match between the SD Series control and the Orion-M. See section 3.6 Orion Functions/Startup View, in the Orion-M Configuration Manual for information on enabling and disabling this item.*

For either temperature or process (voltage/current) input types, the Orion-M provides lower and upper set point limits for the loop input in the Configurator. These lower and upper set points must be set to match the lower and upper set point limits set in the SD control. The Orion-M is not able to set the set point limits in the SD control, so it is important that they be set to match in order to prevent the Orion-M from sending a set point value that is out of the valid range for the SD control.

CAUTION: *If the Orion-M set point limits are greater than those set in the SD control, a set point entered outside of the SD controller set point range will not be accepted by the SD control. However, the Orion-M will show the new set point as the controller set point even though it was not accepted.*

The decimal point selection for the Loop Input in the Orion-M is independent of that set in the Watlow SD Series control. Loop Inputs set as temperature in the Orion-M Configurator allow a decimal point selection of 0 or 1. Process type loop inputs can be displayed on the Orion-M with a resolution of 0 to 3 decimal points. Note that the Orion-M has a display range of -32768 to 32767, -3276.8 to 3276.7, -327.68 to 327.67 or -32.768 to 32.767 depending upon decimal point selection. When selecting the decimal point resolution for the Loop Input in the Orion-M Configurator, make sure that range of the SD control input does not exceed the range selected in the Orion-M or the value may not be displayed correctly.

3.3 Control Output Assignments

The SD Series controls have two control outputs that can be assigned to operate as heat/cool (indirect/direct). If only a single control output is used for heating or cooling operation, the Orion-M will display a percentage of output of 0.0 – 100.0% for the output if heating is selected for the output mode or 0.0 to -100.0% for the output if cooling is selected for the output mode.

If both outputs are used in a heat/cool application (output 1 is heat and output 3 is cool), the Orion-M will display a value of -100.0% to 100.0% for the percentage of output. In this case, 0.0% represents both heat and cool outputs are off. Values from 0.0 to 100.0% represent the percentage of heat output from off to full on and values from 0.0 to -100.0% represent the percentage of cool output from off to full on.

3.3.1 Auto-Tune and Auto/Manual Operation

The Orion-M provides the ability to switch each Watlow SD control in the system between auto and manual output operation as well as initiating the controller's auto-tune function. These functions are accessed from the Orion-M runtime, Single Loop View screen via the 'AM' and 'AT' control buttons.

NOTE: *If there are no outputs programmed for PID, pressing the 'AT' button on the Single Loop View screen in the Orion-M runtime will provide the appearance that it will activate the auto-tune on the control, but once initiated, it will immediately turn off. This is due to the fact that the SD Series auto-tune function can only be initiated when at least one control output is programmed for proportional control.*

3.4 Loop Permissions

The Orion-M iSeries configuration provides permissions which can be set to allow the control loop set point, auto/manual and auto tune operations to be performed at the loop control itself as well as through the Orion-M. These can allow an operator to make changes at the loop control in cases where the Orion-M interface is located in a remote location.

3.4.1 Set Point Permission Exception

If the control loop is configured to operate under cascade control or is configured as an RH wet bulb loop type, the set point for the loop is generated by logic within the Orion-M. The loop will not function as configured unless the set point is constantly set by the Orion-M. Thus, any change made at the loop control will be overridden by the Orion-M. If local adjustment at the loop control may be required for any reason, loop set point communications must be interrupted via a digital input to the Orion-M configured as 'loop SP comms disable'.

Appendix

Software Usage Note:

The selection, application or use of Future Design Control products or software is the purchaser or user's responsibility. No claims will be allowed for any damages or losses, whether direct, indirect, incidental, special or consequential.

In addition, Future Design reserves the right to make changes without notification to purchaser or user to materials or processing that do not affect compliance with any applicable specification. Future Design makes no warranties when using the Orion-M system.

Warranty:

Future Design Controls products described in this book are warranted to be free from functional defects in material and workmanship at the time the products shipped from Future Design Controls facilities and to conform at that time to the specifications set forth in the relevant Future Design Controls manual, sheet or sheets for a period of one year after delivery to the first purchaser.

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