Orion-M SR
iSeries Interface
Multi-loop Control System
Manual
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: Future Design Controls, P.O. Box 1196, Bridgeview, Illinois, 60455 Telephone: +1 (888) 751-5444; fax: +1 (888) 307-8014 csr@futuredesigncontrols.com

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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 8 inputs for process monitoring, for a total of 23 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 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 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, ramp rate 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 Installation

The following two sections will explain how to install the Orion-M control system. Orion-M control systems are pre-loaded with all operating software and firmware before leaving the factory, so it is ready to install when you receive it. Refer to Section 2 for mounting information and Section 3 for power, signal and control wiring.

Before beginning installation, read through these sections to gain an understanding of the entire installation. Consider the installation carefully. Plan the power, signal and control wiring before installing the Orion-M. Also consider the cabinet space, hardware dimensions and environmental conditions. Use good wiring practices to minimize problems that may occur due to electrical ‘noise’.

### WARNING:

- To avoid potential electric shock and other hazards, all mounting and wiring for the Orion-M must conform to the National Electric Code (NEC) and other locally applicable codes.
- Special expertise is required to install, wire, configure and operate the Orion-M controller. Personnel without such expertise should not install, wire or operate the Orion-M.

### CAUTION:

- Prevent metal fragments and pieces of wire from dropping inside the housing of any Orion-M component. If necessary, place a cover over the component during installation and wiring. Ingress of such fragments and chips may cause a fire hazard, damage or malfunction of the device.
- Do not touch the connector pins of the CF card socket on the Orion-M touch screen interface or electrostatic discharge may damage internal components.
- Locate the Orion-M and all related control components away from AC power/motor wiring and sources of direct heat output such as transformers, heaters or large capacity resistors.

2.1 Enclosure Guidelines

The Orion-M must be installed correctly for reliable operation. The Orion-M is designed for installation within a suitable enclosure. Do not install the Orion-M outside of an enclosure. Care must be taken when locating components to ensure that AC power wiring, contactors, starters, relays and other sources of electrical interference are properly located to minimize their impact on the Orion-M.

Particular note should be taken to the position of variable speed drives and switching power supplies. Their input and load cables should be screened and properly grounded to a central equipment grounding point.
2.1.1 Locating the Orion-M Touch Screen Interface

It is recommended that the unit be mounted on the front panel of a steel enclosure, through an appropriately sized opening. Proper enclosure depth is required to insure that there is adequate spacing between the rear of the interface and the front of any components when the enclosure door is closed. It is required that a minimum separation of 2” be maintained, so plan a depth to accommodate at least 4” (102mm) behind the panel.

Proper clearance must also be maintained below the interface to accommodate the power and communications wiring. This height may vary according to the cable type used. Typically, plan for a minimum of 3” (76mm) below the interface for minimum bend radius and proper wire routing. Allow a minimum clearance of 1” (25mm) on the sides and top of the unit for mounting hardware.

_NEMA-4 Mounting_

The Orion-M touch screen interface is rated for a NEMA 4 installation. In order to meet the NEMA 4 requirements, all mounting clamps must be used. Tighten the clamping screws in an even pattern until the unit is secured in the panel. Use caution when tightening the mounting clamps. DO NOT over tighten the mounting clamps!

**NOTE:** To seal to NEMA-4 specifications, the panel must not flex more than 0.010”.

2.2 Environmental Considerations

Do not subject the Orion-M to operating temperatures below 0°C (32°F) or above 45°C (113°F). Minimum and maximum relative humidity levels are limited to between 10% and 90%, non-condensing. The Orion-M touch screen interface is to be used indoors only. The unit should not be installed where fast temperature variations may occur as this can cause condensation of water vapor inside the device.

The Orion-M should not be exposed to excessive dust, dirt, salt, direct sunlight or shock and vibration. Do not operate the Orion-M in an area where chemicals or flammable gases are present. Permitted storage temperature extremes are limited to -20°C (-4°F) and 60°C (140°F).

2.3 Mounting Dimensions

This section provides mounting details and dimensional information for the various components that comprise of the Orion-M control system. Note that your system may not include some of these components, and that quantities of certain components vary depending upon the application and options ordered. Make sure that you have all components required for your application prior to installation.

2.3.1 Orion-M Touch Screen Interface

The Orion-M, I-Series interface is available in both 7” and 10” models. The Orion-M software is specifically designed to support both display models interchangeably. This provides the OEM with design flexibility and allows the cost conscious customer to purchase a system with the 7” display model, and later upgrade to the 10” model by simply removing the SD card from their 7” unit and installing it in the new 10” unit. All profiles, system configuration and data log files are carried over so no data is lost and no additional setup is necessary. Just plug it in and you are up and running.
NOTE: The Orion-M will not operate without the SD card installed properly into the SD card slot on the bottom of the display interface. The SD card has all software required, loaded onto the card for 'Auto-Boot' operation. The slot on the display interface is 'keyed' so the card can only be installed in one direction. The card is pre-installed for your convenience. If the card is removed, take care when inserting the SD card and do not force it into the slot. The card MUST be installed before powering on the unit.
Front View

Side View

Rear View

Bottom View

Cutout dimensions:
MT-8100i:
259mm [10.20"] W x 201mm [7.91"] H

Orion-M 10i Series
2.3.2 Orion-M Process Loop Controllers

The Orion-M requires one PID loop controller (FDC model 9300) for each process control loop required in the system. Refer to the FDC 300 Series operating manual for dimensions, appropriate mounting and operating conditions.

For applications requiring several loops of control or more, proper planning and arrangement of the process controllers prior to mounting is critical for optimum routing of the controller wiring. For applications requiring frequent access to the process controllers, panel mounting provides direct access to the controllers. 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.

2.3.3 Orion-M Process Monitor Modules

The monitor module as shown below, mounts directly onto an industry standard DIN rail. Field sensor wiring is on the front of the module via a plug in connector. The module power and RS485 communications wiring is on a separate, plug in connector on the bottom side of the housing.

Allow at least 25mm (1") in front of and below the module to accommodate the wiring. Ensure that enough space is available above and below the module for adequate ventilation.
2.3.4 Orion-M Control Module

The basic Orion-M control module consists of the RS-485 communications module (FC4A-HPC3) and the main CPU (FC5A-D16RS1). The components mount directly onto an industrial standard DIN rail. Prior to mounting the components on the DIN rail, they should be assembled and latched together.

**NOTE:** If additional I/O modules are used in the application, they should also be connected to the CPU prior to mounting on the DIN rail. See the following section, 2.3.5, for dimensional information on the optional I/O modules.
2.3.4.1 Installing the RS485 Communication Module

CAUTION:

- When using a small screwdriver to remove the communication connector cover from the CPU, insert the screwdriver carefully to avoid damage to the connector and components within the CPU.

- When pushing in on the communication connector cover to break support tabs, use caution to avoid injury to your finger.

1. Carefully push in the communication connector cover at position (1) to break bridges as shown in either figure below.

2. The other end (2) of the communication connector cover will come out as shown at left below. Push in this end.

3. Then, the opposite end (3) will come out. If the end does not come out, insert a thin screwdriver into the gap and pull out the end (3).

   Hold the communication connector cover at (3), and pull off the communication connector cover to break bridges.
2.3.4.2  Installing the Control Module in a Panel

The control module must be mounted horizontally on a vertical plane as shown below. All other mounting directions are not allowed. Be sure to leave adequate spacing between the sides of the enclosure and/or wiring duct and the control module for proper ventilation.
2.3.5 Orion-M I/O Modules

The Orion-M I/O modules provide connections for user communications interfaces, additional digital inputs and outputs and analog remote set point input and retransmit outputs. The I/O modules attach to the right side of the main CPU.

As each I/O module is added, it will connect to the right side of the previous module. In order to connect each module, the protective sticker that covers the connector on the module, must be removed in order to expose the connector for the next module to be plugged in. When adding I/O modules, it is recommended that communication adapters be connected first, then digital input and output modules, and lastly analog input/output modules.

2.3.5.1 User Communication Modules

The Orion-M offers an RS-485 (FC5A-SIF4) communications interface which allows multiple Orion-M systems to be connected to a single PC interface. In addition, an RS-232 (FC4A-SIF2) is offered which allows a bar code reader to be connected to the Orion-M.

2.3.5.2 Digital Input Module

The Orion-M digital input card (FC4A-N08B1) provides eight additional control inputs to the system.
2.3.5.3 **Digital Output Module**

The Orion-M digital output card (FC4A-R161) provides 16 additional relay outputs to the system.

2.3.5.4 **Analog I/O Module**

Each Orion-M analog I/O card (FC4A-L03A1) provides two inputs and one output to the system.
2.4 Orion-M Control Module Installation Example

The Orion-M is supplied with a DIN rail mounted power supply accepting 85-264VAC with a 24Vdc 60 Watt power output for the control module and color touch screen. The order of arrangement for the control module expansion cards is important, and should be installed (from left to right) in the following order:

1.) FC4A-HPC3: RS485 Card
2.) FC5A-D16RS1: Main CPU
3.) FC4A-SIF2 and/or FC5A-SIF4: User Communication Card(s)
4.) FC4A-N08B1: 8-point 24 VDC Input Card
5.) FC4A-R161: 16-point Relay Output Card
6.) FC4A-L03A1: Analog Input/Output Card(s)

**IMPORTANT:** The Orion-M CPU can only support up to seven expansion cards. If more than seven expansion cards are required for the application, contact Future Design Controls for information regarding the use of the FC5A-EXM2 expansion interface module and the possibility of supporting more than seven expansion cards.

AC input and analog I/O cards can not be connected through the expansion interface module. Only DC input cards, transistor/relay output cards and user communication cards can be attached through the expansion interface module. AC input and analog I/O cards must be attached to the control module CPU.
3 Wiring

This section describes the methods and precautions for wiring the Orion-M system components. Before beginning wiring, be sure to read “Safety Precautions” in the beginning of this manual.

**WARNING:**

- Turn off power to the Orion-M before starting installation, removal, wiring, maintenance and inspection of the Orion-M. Failure to turn off power may cause electric shock, create a fire hazard or cause damage to the Orion-M.

- Emergency stop and interlocking circuits **MUST** be configured outside of the Orion-M. If such circuits are made through the use of the Orion-M, failure of the Orion-M may cause uncontrollable operation, damage to equipment or accidents.

**CAUTION:**

- This section presents recommended installation practices and procedures. Since no two applications are identical, these recommendations should be considered as guidelines. The system designer should be aware that devices in control systems could fail and thereby create an unsafe condition.

- Electrical interference in an operator interface can lead to equipment start-up, which could result in property damage and/or physical injury to the equipment operator.

If the application requires an operator or attendant, you should be aware that this potential safety hazard exists and take appropriate precautions. Consult NEMA ICS 3-304 for more information regarding safety for the installation of solid-state programmable control devices.

3.1 Power Requirements

The Orion–M operates on a nominal 24Vdc supply voltage with an allowable range of 21 to 25Vdc. Do not power the Orion-M and highly inductive DC loads, or input circuitry to other equipment, with the same power supply used for the Orion-M.

**NOTE:**  
*FDC recommends only using the power supply that is included with the Orion-M controller.*

In order to insure that the Orion-M properly starts and stops due to power failure, momentary power interruptions or brown-out conditions, it is a system requirement that a time delay-on relay be installed in the power supply wiring to all components of the Orion-M system.

This will insure that the system starts and stops correctly. Failure to install the time delay-on relay may cause the analog input/output cards (if equipped) to stop operating and/or prevent the Orion-M interface from booting up properly.
3.1.1 Installing the Power-On Delay Relay

Due to the rate at which AC/DC power supplies reach their nominal supply voltage after application of power, the relay contact of the timer should be installed between the output of the power supply and the power input of the Orion-M components. This allows the power supply output voltage to reach its nominal value prior to connecting the Orion-M to its output terminals.

In order to properly sense the loss of power, due to the hold-up times associated with AC/DC power supplies, the time delay relay coil should be wired to the AC power source for the DC power supply of the Orion-M. This will insure that the Orion-M is turned off/on at the proper times and prevent malfunction that can be caused by rising or falling voltage at the power supply output during power interruption.

**NOTE:** It is recommended that the time delay-on relay be set for a minimum period of 12-15 seconds to insure proper operation of the Orion-M system.
3.2 Grounding Requirements

Proper grounding is critical to the performance and reliability of the Orion-M. Most of the problems in electrical systems can be attributed to poor or improper grounding techniques, as well as poor earth grounds at the installation site. Control systems like the Orion-M, which contain sensor and communication wiring as well as sensitive electronics, are particularly acceptable to stray electrical transients.

Proper wire routing, away from sources of high power AC or inductive DC circuits, and the use of shielded cables for sensor and communications wiring must be considered carefully. Ground conductors should be as short and as large in size as is feasible. Each ground conductor should be individually run back to the central earth grounding point for the system. Ground conductors should not be daisy-chained or branched off from one device to another. This can cause an imbalance in the ground potential at each device in the system, which can induce electrical currents to flow between devices along the ground path and result in damage to, or malfunction of the device.

3.2.1 Special Considerations for Low Voltage System Grounding

Typical installation of the Orion-M will result in a combination of both high voltage (possibly 120Vac or higher) and low voltage (24Vdc) components and wiring. While all components that are required to be grounded must all attach to the central ground point of the system, randomly combining the grounds from both AC and DC components to a central ground bar can introduce noise into the DC grounds. This is due to small ground loop currents that can come across the ground bar due to leakage from AC components such as variable speed drives.

It is good design practice, and is recommended if the installation includes variable speed drives, to install a separate DC, isolated ground bar that is then connected to the central earth ground of the equipment through a single conductor. This prevents ground currents of AC equipment from traveling across this ground bar and inducing small voltage imbalances across the DC component grounds. While this may not be practical in all installations, if problems arise in the system due to electrical interference, installing this type of grounding system may reduce or eliminate the source of the problem.

NOTE: Even though the DC power supply for the Orion-M system is powered from an AC source, the ground of the power supply should be connected to the DC ground bar. This insures that any electrical ‘noise’ or stray voltages that come across the AC power wiring or DC power wiring is distributed evenly across the DC ground bar to reduce the chance for voltage imbalances between different components of the Orion-M system.
### 3.3 Connecting to the Orion-M Interface

Power wiring lengths should be kept to a minimum, and it is preferable to have the power wiring run using a minimum of 18/2 twisted shielded cable. This keeps the ‘hot’ and common wires paired to minimize the affects of external noise. The shield wire of the cable is used as the ground wire for the interface which helps funnel all external noise away from the interface.

To make a connection, strip about ¼” of insulation off the end of the wire, turn the connector screw counterclockwise until the gap is wide open, insert the wire all the way in, and turn the screw clockwise until it's tight. Connect positive DC line to the ‘+’ terminal and the negative DC line (common) to the ‘-’ terminal. The shield wire should be connected to the ground terminal. The other end of the cable should be properly terminated at the 24Vdc power source, and the shield connected to the main earth ground.

**NOTE:** Upon application of power, if the display does not come on within 2 seconds, remove power. The interface is reverse polarity protected. Check wiring to insure proper connections and try to power up again. An internal fuse will prevent damage for over voltage conditions; however, it isn’t guaranteed. DC voltage sources should provide proper isolation from main AC power and similar hazards.

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![Diagram of Orion-M SR iSeries wiring connections](image)

The color touch display interface is then connected to the Orion-M control module via a single cable with a 9pin connection on the display end, and an 8pin “mini-din” connection at the CPU end. This cable is supplied by Future Design Controls with every Orion-M system and requires no special installation practices or service. Replacement cables are available from Future Design Controls if required.
3.4 Connecting to the Orion-M Process Loop Controllers

The Orion-M can support up to 15 individual control loops. The controllers communicate with the Orion-M control module using the RS485 communications port. This allows one, or multiple, controllers to be connected using one 2-wire link. The controllers are wired in parallel with each one having a unique address from 1 to 15 (corresponding to loop controllers 1-15).

NOTE: It is important to keep the power/control and sensor/communications wiring separated from one another. Relay and/or high voltage outputs can interfere with the sensor and communication wiring as they cycle on and off, which could erroneous sensor readings or communications errors.

3.4.1 Communications Wiring

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 in order to maintain optimum performance and minimize the possibility of communications errors.

When using shielded twisted-pair, be sure to ground only when end of the cable, 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 cause ground loop currents to flow in that section of the cable shield which can disrupt communications.

[Diagram of communications wiring]
3.5 Connecting to the Orion-M Process Monitor Modules

The Orion-M offers four different versions of monitor modules. Each version of module provides a different input type so that it can be tailored to match the application. The IO-8TCS provides up to eight thermocouples, the IO-8AII S or IO-8AIVS provide up to eight current or voltage inputs and the IO-6RTD provides up to 6 RTD inputs.

While the input connections to each module are dependant on the input type, each module requires the same power and communications connections to the Orion-M control module. The power and communications wiring are via the 4-terminal connector located on the bottom of the module. In addition to power and communications, the module must be configured for the proper communications address. This is done by setting DIP switch 5 to the on (up) position for card 1 (address 16) or DIP switches 5 and 1 to the on (up) position for card 2 (address 17). DIP switches 2-4, 6-7 and DIP switch 10 must be set to the off position or the module will not work correctly with the Orion-M.

DIP switches 8 and 9 are used to select the input scaling and failure mode for the module. See the following sections on how to set DIP switch 8 and 9 for each module.

**NOTE:** The IO modules can be connected at any point in the communication link between the Orion-M control module and process controllers as long as the communication wiring is properly ‘daisy-chained’ between units.
3.5.1 Thermocouple Module (IO-8TCS) Input Wiring

The IO-8TCS is an 8 isolated thermocouple input module. The module uses differential inputs to reduce effects of electrical noise. The thermocouple inputs are isolated from the internal logic and from each other. The module has built in Cold Junction Compensation. Be sure to use the correct thermocouple extension wire to avoid reading errors.

DIP switch 9 is used to select upscale or downscale burnout. A value of 32,768 is used to indicate upscale burnout and a value of –32,767 is used to indicate downscale burnout. When DIP switch 9 is turned on, the module will use the upscale burnout value and when turned off, the module will use the downscale burnout value.

NOTE: DIP switch 8 is not used with the thermocouple module so its position does not affect operation.

3.5.2 Current (IO-8AIIS) and Voltage (IO-8AIVS) Module Input Wiring

The analog input modules are supplied as either a current input module (IO-8AIIS) or a voltage input module (IO-8AIVS). The inputs are fully isolated from the internal logic and between inputs. The standard setting for the IO-8AIIS module is 0-20mA input current which represents the minimum to maximum range setting in the Orion-M. To obtain an input signal of 4 to 20mA the offset switch, DIP switch 8, must be switched on.

The same applies to the IO-8AIV module. An input voltage of 0-10Volts represents the minimum to maximum range setting in the Orion-M. To obtain an input signal range of 2 to 10V the offset switch, DIP switch 8, must be switched on.

NOTE: DIP switch 9 is used to select upscale or downscale failure when the input signal is too far above or too far below the selected input range. A value of 32,768 is used to indicate upscale failure and a value of –32,767 is used to indicate downscale. When DIP switch 9 is turned on, the module will use the upscale failure value and when turned off, the module will use the downscale value.
The following diagram shows how the analog inputs are connected to a 0(4)-20mA source. Note that all of the common terminals are isolated from each other.

The following diagram shows how the analog inputs are connected to a 0(2)-10Vdc source. Note that all of the common terminals are isolated from each other.
3.5.3 RTD Module (IO-6RTD) Input Wiring

The IO-6RTD module is a 6 RTD input module. The module can accommodate either 2 or 3 wire RTD sensors. The RTD inputs are isolated from the internal logic. DIP-switch 9 is used to select the upscale or downscale value for sensor break detection. A value of 32,768 is used to indicate upscale break and a value of −32,767 is used to indicate downscale break.

**NOTE:** DIP switch 8 is not used with the RTD module so its position does not affect operation. As there is no inter-channel isolation, isolated RTD’s must be used in order to prevent ground loops and reading errors.
3.6 Connecting to the Orion-M Control Module

CAUTION: If output relays or transistors in the control module should fail, outputs may remain on or off. For outputs that may cause malfunction of equipment that could lead to property damage or injury, provide a monitoring circuit outside of the control module.

Depending on the load, a protection circuit may be needed for the relay output of the Orion-M. Choose the appropriate protection circuit from A through D shown below according to the power source for the load. For protection of the two transistor outputs of the Orion-M, connect protection circuit C shown below to the transistor output circuit.

- **Protection Circuit A**
  - This protection circuit can be used when the load impedance is smaller than the RC impedance in an AC load power circuit.
  - R: Resistor of approximately the same resistance value as the load
  - C: 0.1 to 1 μF

- **Protection Circuit B**
  - This protection circuit can be used for both AC and DC load power circuits.
  - R: Resistor of approximately the same resistance value as the load
  - C: 0.1 to 1 μF

- **Protection Circuit C**
  - This protection circuit can be used for DC load power circuits.
  - Use a diode with the following ratings.
  - Reverse withstand voltage: Power voltage of the load circuit × 10
  - Forward current: More than the load current

- **Protection Circuit D**
  - This protection circuit can be used for both AC and DC load power circuits.
3.6.1 Main CPU Wiring

**NOTE:** The following information covers basic input/output connection information for the Orion-M control module. Since the Orion-M is a fully configurable control system, the use of each input and output is dependant upon the application; therefore, the input and output control devices and ‘real world’ connections are determined by the system designer.

Main CPU Digital Input Assignments (24Vdc inputs):

(I0) Digital Input 0 – function determined by Orion-M configuration
(I1) Digital Input 1 – function determined by Orion-M configuration
(I2) Digital Input 2 – function determined by Orion-M configuration
(I3) Digital Input 3 – function determined by Orion-M configuration
(I4) Digital Input 4 – function determined by Orion-M configuration
(I5) Digital Input 5 – function determined by Orion-M configuration
(I6) Digital Input 6 – function determined by Orion-M configuration
(I7) Digital Input 7 – function determined by Orion-M configuration

Main CPU Digital Output Assignments (Q0 and Q1 are transistor source outputs; others are relay):

(Q0) Digital Output 0 – function determined by Orion-M configuration
(Q1) Digital Output 1 – function determined by Orion-M configuration
(Q2) Digital Output 2 – function determined by Orion-M configuration
(Q3) Digital Output 3 – function determined by Orion-M configuration
(Q4) Digital Output 4 – function determined by Orion-M configuration
(Q5) Digital Output 5 – function determined by Orion-M configuration
(Q6) Digital Output 6 – function determined by Orion-M configuration
(Q7) Digital Output 7 – function determined by Orion-M configuration
3.6.2 Optional User Communications Card Wiring

The RS485 communications card (FC5A-SIF4) allows multiple Orion-M controllers to be connected to a single communications link. The connection requires a single twisted-pair cable that is daisy-chained from one Orion-M to the next. Use of this card requires an RS485 connection on the host computer. Since most computers do not provide this type of interface, an RS232 to RS485 adapter is required. Future Design recommends the use of the SNA10A or SNA10B network adapter.

NOTE: When using shielded twisted-pair cable, be sure to ground only when end of the cable, preferably at the RS232 to RS485 network adapter. Allowing any other portion of the cable shield to come in contact with ground, or grounding both ends, will cause ground loop currents to flow in that section of the cable which can cause communication errors.
3.6.3 Optional Barcode Scanner Communications Card Wiring

Future Design recommends and supports the use of the Unitech MS-120-2 barcode scanner with an RS232 interface and built in decoder. The barcode scanner also requires a separate 5Vdc power supply which attaches to the decoder module (Unitech model 101000-0150 110V power adapter).

NOTE: Other barcode scanners with built-in decoders can be used with the Orion-M; however, due to the numerous types and models available, Future Design can only provide support on models tested for use with the Orion-M.

The barcode scanner must be configured for use with the Orion-M prior to use or it will not communicate properly with the Orion-M. See Section 8.5, Barcode Reader Setup for information on the proper settings and use of the barcode scanner.
In order to connect the barcode scanner to the Orion-M, an optional RS232 communications card (FC4A-SIF2) is required. However, this must be the second communications card on the Orion-M control module. The first communications card supports the optional user communications (FC5A-SIF2 or SIF4). The second card is assigned to support the barcode reader. Thus, if the optional user communications are not required, the card must still be installed in order to use the barcode scanner.

To connect to the RS232 interface of the barcode scanner, a DB9 male connector must be wired as shown. The connection only requires three of the 9 available pins on a standard DB9 connection.

**NOTE:** Even though the barcode scanner is connected to the Orion-M, if its communication parameters are not set properly, the scanner will not operate correctly with the Orion-M. See Section 8.5, Barcode Scanner Setup.
3.6.4 Optional Digital Input Expansion Card Wiring

NOTE: The following information covers basic input connection information for the Orion-M digital input expansion cards. Since the Orion-M is a fully configurable control system, the use of each input is dependant upon the application; therefore, the input control devices and ‘real world’ connections are determined by the system designer.

**FC4A-N08B1 (8-point DC Input Module) — Screw Terminal Type**
Applicable Terminal Block: FC4A-PMT10P (supplied with the input module)

**FC4A-N08A11 (8-point AC Input Module) — Screw Terminal Type**
Applicable Terminal Block: FC4A-PMT11P (supplied with the input module)

* Two COM terminals are interconnected.
* Do not connect an external load to the input terminals.
Expansion Digital Input Assignments:

(I30) Digital Input 8 – function determined by Orion-M configuration
(I31) Digital Input 9 – function determined by Orion-M configuration
(I32) Digital Input 10 – function determined by Orion-M configuration
(I33) Digital Input 11 – function determined by Orion-M configuration
(I34) Digital Input 12 – function determined by Orion-M configuration
(I35) Digital Input 13 – function determined by Orion-M configuration
(I36) Digital Input 14 – function determined by Orion-M configuration
(I37) Digital Input 15 – function determined by Orion-M configuration

3.6.5 Optional Digital Output Expansion Card Wiring

NOTE: The following information covers basic output connection information for the Orion-M digital output expansion cards. Since the Orion-M is a fully configurable control system, the use of each output is dependant upon the application; therefore, the output load devices and ‘real world’ connections are determined by the system designer.

FC4A-T08S1 (8-point Transistor Source Output Module) — Screw Terminal Type
Applicable Terminal Block: FC4A PMT10P (supplied with the output module)

* Connect a fuse appropriate for the load.
FC4A-R081 (8-point Relay Output Module) — Screw Terminal Type
Applicable Terminal Block: FC4A-PMT11P (supplied with the output module)

* COM0 and COM1 terminals are not interconnected.
* Connect a fuse appropriate for the load.

FC4A-T16S3 (16-point Transistor Source Output Module) — Connector Type
Applicable Connector: FC4A-PMC28P (not supplied with the output module)

* COM(+) terminals are interconnected.
* -V terminals are interconnected.
* Connect a fuse appropriate for the load.
Expansion Digital Output Assignments:

(Q30) Digital Output 8 – function determined by Orion-M configuration
(Q31) Digital Output 9 – function determined by Orion-M configuration
(Q32) Digital Output 10 – function determined by Orion-M configuration
(Q33) Digital Output 11 – function determined by Orion-M configuration
(Q34) Digital Output 12 – function determined by Orion-M configuration
(Q35) Digital Output 13 – function determined by Orion-M configuration
(Q36) Digital Output 14 – function determined by Orion-M configuration
(Q37) Digital Output 15 – function determined by Orion-M configuration
(Q38) Digital Output 16 – function determined by Orion-M configuration
(Q39) Digital Output 17 – function determined by Orion-M configuration
(Q40) Digital Output 18 – function determined by Orion-M configuration
(Q41) Digital Output 19 – function determined by Orion-M configuration
(Q42) Digital Output 20 – function determined by Orion-M configuration
(Q43) Digital Output 21 – function determined by Orion-M configuration
(Q44) Digital Output 22 – function determined by Orion-M configuration
(Q45) Digital Output 23 – function determined by Orion-M configuration
(Q46) Digital Output 24 – function determined by Orion-M configuration
(Q47) Digital Output 25 – function determined by Orion-M configuration
(Q48) Digital Output 26 – function determined by Orion-M configuration
(Q49) Digital Output 27 – function determined by Orion-M configuration
(Q50) Digital Output 28 – function determined by Orion-M configuration
(Q51) Digital Output 29 – function determined by Orion-M configuration
(Q52) Digital Output 30 – function determined by Orion-M configuration
(Q53) Digital Output 31 – function determined by Orion-M configuration

* COM0 terminals are interconnected.
* COM1 terminals are interconnected.
* COM0 and COM1 terminals are not interconnected.
* Connect a fuse appropriate for the load.
3.6.6 Optional Analog Input/Output Expansion Card Wiring

**NOTE:** The following information covers basic input/output connection information for the Orion-M analog expansion card. Since the Orion-M is a fully configurable control system, the use of each input/output is dependant upon the application; therefore, the input and output devices and 'real world' connections are determined by the system designer.

The number of analog expansion cards in the system will also vary depending upon the application. The Orion-M can support up to 14 analog inputs and 7 analog outputs for a total of 7 analog expansion cards.

The analog expansion card must receive separate 24Vdc power from the Orion-M power supply. If power is not supplied to the (+) and (-) terminals, the input/output circuitry of the card will not operate. The 'PWR' indicator light on the card indicates bus power only and that it is properly connected to the Orion-M CPU. It does not indicate that the 24Vdc power source is present.

The analog inputs and outputs increase in sequential order as expansion cards are connected to the Orion-M CPU, from left to right. For example, the first analog expansion card is assigned inputs 0 and 1 and output 0. As the next analog expansion card is connected (to the right of the first card), it will be assigned inputs 2 and 3 and output 1. This sequence continues up to the maximum of 7 expansion cards to provide inputs 12 and 13 and output 6.

Expansion Card #1 Assignments:
- OUT  Analog Output 0
- IN0  Analog Input 0
- IN1  Analog Input 1

Expansion Card #2 Assignments:
- OUT  Analog Output 1
- IN0  Analog Input 2
- IN1  Analog Input 3
Expansion Card #3 Assignments:
OUT  Analog Output 2
IN0  Analog Input 4
IN1  Analog Input 5

Expansion Card #4 Assignments:
OUT  Analog Output 3
IN0  Analog Input 6
IN1  Analog Input 7

Expansion Card #5 Assignments:
OUT  Analog Output 4
IN0  Analog Input 8
IN1  Analog Input 9

Expansion Card #6 Assignments:
OUT  Analog Output 5
IN0  Analog Input 10
IN1  Analog Input 11

Expansion Card #7 Assignments:
OUT  Analog Output 6
IN0  Analog Input 12
IN1  Analog Input 13

Example Installation:

Analog Input/Output Cards

<table>
<thead>
<tr>
<th>RS485</th>
<th>MAIN CPU</th>
<th>Card 1</th>
<th>Card 2</th>
<th>Card 3</th>
<th>Card 4</th>
<th>Card 5</th>
<th>Card 6</th>
<th>Card 7</th>
</tr>
</thead>
</table>

**IMPORTANT:** The Orion-M CPU can only support up to seven expansion cards. If all seven analog expansion cards are required for the application, but additional digital I/O and/or user communications are also required, contact Future Design Controls for information regarding the use of the FC5A-EXM2 expansion interface module and the possibility of supporting more than seven expansion cards.

AC input and analog I/O cards can not be connected through the expansion interface module. Only DC input cards, transistor/relay output cards and user communication cards can be attached through the expansion interface module. AC input and analog I/O cards must be attached to the control module CPU.
4 Operation Basics

This section is designed to help guide you through the Orion-M’s touch screen interface and menu structure, so that you can navigate through the various operation, monitor and setup screens and learn how to use them in order to operate the Orion-M. Subsequent sections of this manual are tailored to the special features and functions of the Orion-M. Consult those sections of the manual for further information and specifics on how to set up and operate them.

4.1 OEM Configuration Options

The availability of certain menu items, screens and the functionality of the Orion-M are determined by the configuration of the controller. This manual covers all available options, some of which may not be available on your system.

*If there are questions or concerns about the operation and available options on your Orion-M system, contact your OEM for further information. Only your OEM can address equipment related issues.*

4.1.1 OEM Control Loop Configuration Options

The Orion-M provides the OEM with special loop configuration options that can affect user interaction with the control loops. It is important for the end user to note that these special loop modes exist in case they are present on your Orion-M and understand their operation to avoid confusion when operating the equipment.

4.1.1.1 Cascade Control Loop Mode

If a loop is configured for cascade control, it may appear as a normal control loop on the Orion-M; however, this type of loop is operated by another control loop on the Orion-M. The set point of the cascade loop can not be changed by the user. It is a calculated set point generated by the other control loop. If you suspect that there is a problem with your Orion-M if unable to change a loop set point, contact your OEM and verify the configuration of your Orion-M to determine if the loop is operating under cascade control and how that interacts with your equipment.

4.1.1.2 Calculated RH Loop Mode

If a loop is configured as an RH (wet bulb) control loop, it will appear as a normal control loop on the Orion-M interface; however, the reading on the Orion-M display is a calculated relative humidity value while the reading on the process loop controller will be a temperature reading. The Orion-M calculates humidity by using two temperature loops, a dry bulb loop and a wet bulb loop as set in its configuration, to calculate humidity.

When entering the humidity set point on the Orion-M, the set point shown on the display of the process loop controller will not match that of the Orion-M display because it is a calculated wet bulb temperature set point. This set point value will change as the dry bulb temperature input varies in order to maintain the proper set point to maintain the desired relative humidity setting on the Orion-M. If you suspect that there is a problem with your Orion-M or a control loop does not seem to be operating properly, contact your OEM and verify the configuration of your Orion-M to determine if the loop is operating under the calculated RH loop mode and how that applies to your equipment.
4.2 Touch Screen Interface

The Orion-M display is divided into three main sections; the menu bar, main display area and detail window.

Menu Bar: Used to navigate through the available control, monitoring and setup screens.
Main Display Area: Contains the active values for the menu item selected.
Detail Window: Provides display specific and status information.

At the lower right of the screen, there is a special control icon. The ‘Printer Icon’ allows you to print a snapshot of the current screen to any PCL compatible printer such as an HP Officejet model 6000 or 8000 series color printer connected to the Orion-M’s USB port. To select items on the display, simply touch the desired menu or numerical entry item. For detailed information regarding the different screen elements and their use, reference the following sections.

IMPORTANT: Do not use any sharp or metal objects on the touch screen as they may damage the surface. Also be sure that hands and fingers are free from oils or chemicals which may mar the surface of the touch screen.
4.3 Print Features

The Orion-M interface will print a variety of graphic, trend and textual reports. The Orion-M can be connected to a standard “USB” printer (compatible with the Hewlett Packard PCL printer command language) via the standard USB host port on the back of the interface. No drivers are necessary; operation is “plug and play”. The USB port can be used for the ‘I-Stick’ data backup and printing by ‘hot swapping’ them at any time during the Orion-M’s operation. If you would like to leave the I-Stick connected and the printer connected at the same time, a USB hub could be connected the Orion-M comes equipped with two USB host ports for simultaneous operation of ‘I-Stick’ and printer functions.

The Orion-M will alert the user to any problems during print operation. After a print error (printer not connected or bad cable), the Orion-M will return to its normal operation after alerting the user. The Orion-M interface may change colors during printing to prolong ink cartridge life (blue backgrounds require more ink than white backgrounds). During printing, the Orion-M interface will be ‘locked’ until the print function is complete and then return to normal operation.

NOTE: The print icon at the bottom right corner of each screen will activate the current screens print function. If there is not a print function associated with the screen that is active, the Orion-M will not print a report or graphic.

In order to use a printer with the Orion-M, the printer’s USB cable must be plugged into the Orion-M interface after it is powered up and in ‘runtime’ mode, and the printer is powered up and ready for printing (neither device should be in startup mode).

When the USB cable is connected to the Orion-M interface (or FDC ‘USB’ panel mount adapter connector), the following dialog may appear on the Orion-M display (each time the printer cable is plugged in):

![Unidentified USB Device dialog box]

Press the ‘X’ at the top right of the dialog box and the dialog will disappear. The printer is now ready for printing text or graphics from the Orion-M interface. This dialog will not appear again unless the printer cable is disconnected and then re-inserted into the Orion-M ‘USB’ interface connection.

The print driver in the Orion-M interface provides standard USB printing using ‘PCL 3’ language support. Since printer models change so often, many manufactures add features to new models of printers. To take advantage of these new features (Ethernet connectivity, etc.), each manufacturer supplies driver disks for different Windows ‘OS’ versions. Since the Orion-M is an embedded device (no hard disk or moving parts), installation of these drivers is not required. The dialog box appears due to the additional functionality the USB printer is transmitting to the Orion-M interface. Pressing the ‘X’ at the top of the dialog instructs the Orion-M interface to ignore the advanced printed features and skip the installation of any print drivers.
4.4 Menu Navigation

The Orion-M display provides the user with an intuitive interface for navigating through the different menus and settings without having to go multiple levels deep in screens like other 'button style' systems. The Orion-M provides a familiar feel with drop down menus and online help at all times.

NOTE: The available menu items are dependant upon the configuration of the Orion-M. Not all of the menu items shown may be available on your system. The following information is provided as an overview of all available menus in the Orion-M.

4.4.1 Main Menu

The main menu is the top level, default menu provided when the Orion-M first powers on.

View Menu
The ‘View’ menu provides navigation to all standard view screens. These include the Single, 6 Bank and All Loops views, Loop/Monitor Trends, System Event Control, digital input/output status and alarm information.

Profiles Menu
The ‘Profile’ menu provides access to profile actions, edit and status views. From these screens a user can open, save, edit or delete as well as download profiles to the Orion-M control module. The Run, Hold and Stop profile menu items allow quick access to these functions if a profile is already downloaded to the Orion-M control module.

Setup Menu
The ‘Setup’ menu provides access to system and controller setup options. These options include profile recovery, alarms, communication settings, email setup and offline settings for date/time etc.

Security Menu
The ‘Security’ menu provides access for user login, security settings and audit trail viewing if the security system is enabled.

Log Menu
The ‘Log’ menu provides access to data log functions and the historical data viewer.

Help Menu
The ‘Help’ menu provides simple help regarding settings and use of screen parameters.
4.4.2 Profiles Menu

The ‘Profiles’ menu, from the Orion-M main menu structure, provides access to the automated profile section of the Orion-M. Selecting either ‘Profile Entry View’ or ‘Profile Status View’ will take you to the corresponding screen, and the menu structure will change to the profile sub-menu as shown below. Selecting ‘Main View’ from the ‘Screens’ menu, will return you to the Orion-M main menu structure. See the section on Profile Operation for information on how to create and run profiles.

Screens Menu
The ‘Screens’ menu provides navigation back to the main menu and the profile view screens. These include Profile Status, Profile Entry, Guaranteed Soak Limits and Profile Auto Start screens.

Edit Menu
The ‘Edit’ menu provides all of the functions needed to open, create, edit and save profiles.

Run Menu
The ‘Run’ menu contains the profile control selections such as run, hold and stop.

Help Menu
The ‘Help’ menu provides simple help regarding settings and use of screen parameters.

4.4.3 Setup Menu

The ‘Setup’ menu, from the Orion-M main menu structure, provides access to the ‘runtime’ setup section of the Orion-M. Selecting ‘System Setup’ will take you to the setup area, and the menu structure will change to the system setup sub-menu as shown below. Selecting ‘Main View’ from the ‘Screens’ menu, will return you to the Orion-M main menu structure. See the section on System Setup for information on these settings and their use.
Screens Menu
The ‘Screens’ menu provides navigation back to the main menu.

Setup Menu
The ‘Setup’ menu provides access to the Orion-M’s setup screens and the link to the offline system maintenance area.

Email Menu
The ‘Email’ menu provides access to the Orion-M’s email server settings.

Help Menu
The ‘Help’ menu provides simple help regarding settings and use of screen parameters.

4.4.3.1 Offline Setup Menu
The ‘Offline Setup’ menu, from the Orion-M system setup menu structure, provides access to the ‘offline’ setup section of the Orion-M. Selecting ‘Offline Setup’ will take you to the offline setup area, and the menu structure will change to the offline setup sub-menu as shown below. Selecting ‘Main Setup’ from the ‘‘Screens’ menu, will return you to the Orion-M ‘runtime’ setup menu structure. See the section on Offline Setup for information on these settings and their use.

NOTE: Offline setup can only be accessed when a profile is not running and data logging is turned off. When entering offline setup, the Orion-M will go ‘offline’. This means that all outputs and control functions will turn off and be disabled. If the current control process can not be interrupted, DO NOT enter offline setup until the process can be properly stopped.
4.4.4 Log Menu

The ‘Log’ menu, from the Orion-M main menu structure, provides access to the data logging and historical data file access section of the Orion-M. Selecting ‘Data Logger’ will take you to the Start/Stop Logging screen, and the menu structure will change to the data logging sub-menu as shown below. Selecting ‘Main View’ from the ‘Screens’ menu, will return you to the Orion-M main menu structure. See the section on Data Logging for information on these settings and their use.

*Screens Menu*

The ‘Screens’ menu provides navigation back to the main menu.

*Edit Menu*

The ‘Edit’ menu provides access to the history files, file utilities, FTP file transfer settings and the operator event and digital signature file access settings.

*DataLogging Menu*

The ‘DataLogging’ menu provides access to the logging setup and historical file viewing utilities.

*Help Menu*

The ‘Help’ menu provides simple help regarding settings and use of screen parameters.
4.5 Control Loops (Single Set point Operation)

The loop view screens provide different viewing options for the control and monitoring of the Orion-M control loops and process monitor inputs. The loop screens allow you to adjust the current loop set points (SP) and view the process variables (PV) and percentages of output (%) for each loop. If the loop is a process monitor input only, the set point and percentage of output will not be displayed since no control is associated with the input.

**NOTE:** The OEM configuration of the Orion-M may allow the operator to change the loop set point, auto/manual mode and initiate an auto tune at the loop control itself. If any of these permissions are active, any change made at the loop control will be indicated on the loop view screens. If these permissions are not enabled, any change made at the loop control will be overridden by the setting from the Orion-M.

If in doubt about which permissions, if any, are allowed from the loop control, contact the equipment manufacturer or consult the OEM configuration. Any changes made at the loop controls are not logged or protected by the Orion-M security settings. These changes will not appear in the audit trail. If adjustments to control loop settings are to be made only by authorized users with the proper security access, the loop permissions should be disabled in the Orion-M configuration or other means are necessary to prevent unauthorized users from accessing the loop controls.

4.5.1 Single Loop View

The Single Loop View display shows one control loop or process monitor input at a time. It is accessed from the main ‘View’ menu. The screen provides special loop control functions not available on the 6 bank or All Loops View screens. These special functions are accessed by the auto/manual (AM) and auto tune (AT) control buttons.

The **left and right scroll buttons** allow you to cycle through each loop and monitor point available in the system. By pressing either button, the previous or next loop will appear in sequential order. When the first or last loop is reached, the Orion-M will automatically wrap around to the beginning or end of the list to show the next loop.

The **loop name**, shown at the bottom of the loop view, will update as each loop or monitor point is selected. The unit display field will update as well, in order to provide the user with the units of measurement for the selected loop or monitor point.
The **set point entry field** as indicated on the figure above, shows the area where the screen can be touched in order to bring up the keypad entry window. Using the pop-up keypad, a new set point can be entered. Once entered, the new set point will be shown in the set point entry field. Adjustment of the set point is locked out if the loop is under profile control.

The **ramp rate (deg/hr)** entry field is used to enter the rate at which the set point will ramp from the current PV value to the desired set point when entered. The ramp rate can be zero, which means that the set point will immediately change to the set point entered, and the control loop will attempt to get the process to set point as quickly as possible. With a ramp rate greater than zero, when a set point is entered, the SP display will change to the current PV value, and begin ramping to the set point entered, at the specified ramp rate.

**NOTE:** When a loop is under profile control, the ramp rate will be forced to zero since the profile is what defines the loop set point and ramp rate. Placing a profile in hold will allow user adjustment of the ramp rate; however, once the profile is resumed, the ramp rate will again be forced to zero.

The **bar graph field** is the display area for set point, process variable and percentage of output bar graphs. The bar graphs for the process variable (PV) and set point (SP) share a common range for minimum to maximum of the displayed value. To change this range, touch anywhere in the bar graph field. Upon doing so, low and high range entry boxes will appear. Enter the new range(s) and press the ‘Set’ button to accept the new values. The low and high range fields can be set to a minimum of -32,760 to a maximum of 32,760.

**NOTE:** The %Output bar graph is fixed for a range of 0% to 100% and changes color to indicate the output for bimodal control loops (heat/cool) of specific controllers supported by the Orion-M such as the FDC 100 and 300 Series. Heating is represented by a value of 0 to 100% in the %Out field and the bar graph will indicate the percentage of heating output in a ‘soft’ red color. Cooling is represented by a value of 0 to -100% in the %Out field and the bar graph will indicate the percentage of output in aqua.

The **list box** provides the operator to with the ability to view event status, digital input or output status or any current system alarms by selected the desired item from the drop down menu. The operator can then keep one eye on the control loop status while obtaining other important operating information without having to leave the loop view screen.

The special loop control function buttons, AM and AT are used to define the mode of operation of the loop. These buttons will not be available for process monitor inputs since there is no control function for the input.

**AM** - This button switches the loop mode between automatic and manual operation. When the loop is in automatic mode (button is gray), the loop will automatically adjust its output based on its PID settings. When the loop is in manual operation (button highlighted green), the percentage of output for the loop can then be set manually, to a fixed output percentage.

To switch the loop between auto and manual operation, press the ‘AM’ button and select ‘Yes’ to put the loop in auto or manual mode. To exit without changing the current loop mode, select ‘No’. To adjust the loop output percentage when in manual operation, touch the percent output display field and enter a positive value for heating or negative value for cooling.

**AT** - This button initiates the Orion-M process controller’s auto tune function. To initiate the auto tune function, press the ‘AT’ button and select ‘Yes’. During the auto tune procedure, the AT button will be highlighted green to show the tune is in progress. When the tune is complete, the AT button will automatically return to its default gray color, to indicate the tune is off. If at any time during the tune process, you want to cancel the auto tune, press the AT button and select ‘Yes’ to cancel the tune.

**NOTE:** The ‘AM’ and ‘AT’ functions may not be functional with all controller options and/or configurations. Consult the FDC Controller Configuration Guide for the specific brand and model controller being used.
4.5.2 6 Bank View

The 6 Bank View display shows six control loop and/or process monitor inputs at a time. It is accessed from the main 'View' menu. The screen allows manual set point entry for each loop by touching the respective set point entry field. As on the Single Loop View screen, the left and right scroll buttons allow you to cycle through each loop and monitor point available in the system.

![6 Bank View Display](image)

4.5.3 All Loops View

The All Loops View display shows all available control loops and process monitor inputs available on the system in a tabular format. From this view all set points, process variables and output percentages can be monitored at a glance.

![All Loops View Display](image)

The set point entry field is located at the lower right of the screen. In order to modify a loop’s set point, select the loop by touching its Tagname field in the table. The selected loop will be highlighted in blue as shown above. The loop’s set point will then be available for edit. Touch the set point field in order to access the keypad and enter the new set point.
4.6 System Event Control

Events are the ‘switches’ used to turn the digital outputs of the Orion-M on and off. These events can be manually turned on and off as well as programmed into profiles so that they can be turned on and off at set time intervals.

**NOTE:** Not all of the digital outputs of the Orion-M may be able to be controlled as event outputs. Depending upon the configuration of the Orion-M, some outputs may perform specific control or alarm functions. The use of each output, and what it controls, is determined by the system designer. Consult the section on the setup of Digital Outputs and how to program them as event outputs or any of the other available control functions.

The names of events are also determined by the system designer. The screen shot below is an example showing factory default event names. Consult the section on the setup of Event Tagnames in order to see how to change the names of events so that their description in the list matches their function to avoid operator confusion.

To turn the system events on and off, select ‘System Event Control’ from the main View menu. Select the events you want to turn on by touching the Tagname of the event in the list box to change the ‘User State’ to ON. Likewise, to turn off events, touch the event Tagname to turn the user state to OFF. Press the ‘Update’ button to set the new event status based on the user states selected.

**NOTE:** The event status will not change until the update button is pressed.
4.7 Process Monitoring

The loop view screens only provide the current process values of the Orion-M. In order to view the process inputs over time, the Orion-M provides real-time trends. Each loop and monitor input of the Orion-M has its own trend display with individual trend settings. In addition, the Orion-M provides status monitors for all of the digital inputs and outputs of the system. This allows an operator to keep track of all inputs and outputs to the Orion-M and know exactly how the system is operating.

4.7.1 Loop/Monitor Trends

The ‘Loop/Monitor Trends’ are accessed from the main ‘View’ menu. The real-time trends can display the set point (SP), process variable (PV) and percentage of output (%) history over a period of time. The vertical axis determines the range of displayed data while the horizontal axis determines the history period. The maximum time period that can be shown in a trend is four hours. The trends plot a new point on one minute, fixed time intervals.

As on the Single Loop View and 6 Bank View screens, the left and right scroll buttons allow you to cycle through each loop and monitor point available in the system. The trends on the Orion-M also allow you to ‘zoom in’ on a particular area to have a more detailed look at current trend data. By using your finger to select an area on the screen, the trend will zoom in on that area.

To select a portion of the trend, touch and hold the screen with your finger. Drag your finger across the trend and a box will be drawn around the selected area. Removing your finger from the screen will cause the trend to redraw with only the selected area. To return to the normal view, touch the ‘X’ or ‘Y’ axis and select zoom out to return to the previous zoom setting or zoom normal to return to the full trend display.

**NOTE:** When a trend is ‘zoomed in’, the trend will not update with new information. The trend must be in normal view mode in order to update at each time interval. The trend will return to normal view automatically when selecting a different screen to view.

If the Orion-M’s clock updates for daylight savings time, or is corrected to the proper time by the NTS clock server settings in the Orion-M, the offset in time may cause the trend to display data inaccurately due to this time offset. The trend will automatically correct itself once the trend buffer is cleared of this data. The clock is updated at 2 AM., so with a buffer length of 4 hours, the trend data will display accurately at 6 AM.
4.7.1.1 Trend Setup

To adjust the displayed variables, range and history period, touch the ‘Setup Trend’ button in the upper right corner of the trend display. The trend setup parameters will then appear below the trend view window.

Trend Zero - The zero value sets the minimum range of the vertical access for the trend variables with a minimum value of -32,760 and a maximum of 32,760.

Trend Span - The span value sets the maximum range of the vertical access for the trend variables with a minimum value of -32,760 and a maximum of 32,760.

Time(Mins) - The time interval is in minutes and adjusts the displayed time period for the trend. The allowable range is from 4 to 240 minutes (4 hours).

Trend Points - To adjust what items are shown on the trend, select/deselect the desired items by touching the selection box next to the variable.

4.7.2 Digital Input/Output Monitor

The Digital Input/Output Monitor screen is accessed from the main ‘View’ menu. It provides simple, at a glance status monitoring of all digital inputs and outputs configured on the Orion-M.
4.8 System Alarms

The Orion-M offers the ability to program system alarms using any of the available digital inputs and also offers 30 alarms that can be programmed to respond to any of the loop and monitor inputs. When an alarm condition occurs, the Orion-M main view screen background turns red, to provide a visual indication of an alarm condition.

**NOTE:** The alarm settings for digital inputs and loop/monitor alarms are determined by the system designer. For information on how to program digital inputs as alarms, see the section on offline setup for Digital Outputs. For information on loop/monitor alarm operation, see Section 8.4, Alarm Settings.

### 4.8.1 Alarm Monitor

The Alarm Monitor screen is accessed from the main ‘View’ menu. It displays all current and/or previously silenced alarms according to time and date of occurrence. On each new alarm occurrence, the Orion-M’s screen background will turn red to notify the user of a new alarm. Once the alarm is silenced, the screen background will revert to the standard blue background; however, the alarm condition may still be present.

The alarm will only leave the grid when cleared by an operator by pressing the ‘Clear’ button. Only alarms that are not currently active in the system can be cleared from the alarm grid.

### 4.8.2 Alarm History

The Alarm History screen is accessed from the main ‘View’ menu. It displays all alarms for any daily period for a year or longer (time based on storage usage for data history). Each time an alarm is active in the Orion-M system, the alarm is written to a history file. History filenames are listed as month_day_year. The history alarm grid displays alarm type, date and time for each alarm.

The ‘Open File’ button will display an ‘Open’ dialog box where the user can select any alarm history file to view.

**NOTE:** If no alarms occurred on a given day, an alarm file will not be created for that day.
The email icon ![email icon] allows the user to send a copy of the currently opened alarm history file to any user configured in the Orion-M system. When the email icon is pressed, an ‘Add Recipients’ window will be displayed where the user can select recipients for the file from any of the email addresses configured in the Orion-M. For information on how to add email recipients to the Orion-M, see the section on setup for Email Settings.
5 Profile Operation

A profile is a set of instructions (set points and system events) programmed as a timed sequence of steps. When a profile is run, the Orion-M executes each step of the profile automatically, in sequence, based on the ramp rate or dwell time duration settings for each step. The Orion-M can store hundreds of profiles (depending on storage usage for data history) with up to 99 steps in each profile. This section covers the use and operation of the Orion-M profiler.

To assist in setup and documentation of the Orion-Mi, see the “Orion-M Configuration and Setup Worksheets” Excel file provided on the Future Design Controls website (http://www.futuredesigncontrols.com/Orion-M.htm). This document provides setup and configuration forms and templates for all of the Orion-Mi features including Profiles.

5.1 Entering a Profile

Profiles are created and edited from the Profile Entry screen. The Profile Entry screen is accessed from the main ‘Profiles’ menu. To create a profile:

1.) From the Edit menu, select ‘New Profile’ and ‘Yes’ to create a new profile.

2.) Enter the number of steps that will be in the profile you want to create. The default setting, and minimum number of steps is one. You can only adjust settings for step numbers within the range of 1 to the Total Steps entered (maximum of 99). Thus, to adjust settings for step 5, you must have the Total Steps set to a value of at least 5.

   NOTE: The number of steps can be changed at any time during the profile entry to shorten or lengthen the profile as required without affecting steps already programmed.

3.) For each step, enter the step events, any wait for conditions, set points and ramp rate or dwell time.

4.) Save the profile.

   NOTE: Profiles can be saved with names of up to 16 characters long. However, the Orion-M only uses the first ten characters of the profile name for display updates and record keeping. When naming profiles, try to keep profile names limited to ten characters in order to have the full profile name shown, or use the first ten characters as a means of more clearly identifying the profile when more than ten characters are used to save a profile.
To assist with profile entry, the Edit menu provides additional tools to help with the programming process.

### Edit Menu Options

- **New Profile**: Clears any existing profile entry data so that a new profile can be entered.
- **Insert Step**: Inserts a step into the profile at the current step number.
- **Delete Step**: Deletes the current step.
- **Copy Step**: Copies the current step data.
- **Paste Step**: Pastes previously copied step data to the current step.
- **Select Profile**: Opens the file explorer window so that the user can select a profile from a list of profiles currently stored in the Orion-M’s memory.
- **Save Profile**: Saves any changes made to the current profile under the existing name. If the profile has not yet been named (saved), the user must enter one in order to save the profile.
- **Save As..**: Allows the user to save the current profile to a different file name. This is useful for making different versions of the same profile that only requires minimal changes.
- **Delete Profile**: Allows the user to delete the current profile from the Orion-M’s memory.

#### 5.1.1 Setting Step Events

For each step of the profile, you can select which system events are to be on during the step. To select step events, press the ‘Events/Profile Loops’ button at the top right of the screen and select ‘Step Events’. This selects the step events for the list view. You can then select which events are to be on during the step by placing a check mark in the check box next to the event name. The step events list is the default list view and will be shown when creating a new profile, opening a saved profile or when selecting the next step during profile edit.

**NOTE:** The step events must be set individually for each step. Even though a profile may be in operation, if the events are not set, the associated digital output will not turn on.
5.1.2 Setting Guaranteed Soak (GS) Events

The ‘GS Events’ are used to turn on the guaranteed soak option for one or more of the controlled loops. In order to enable a guaranteed soak in a step, you must select the loop(s) to be monitored by turning on the corresponding event. To enter the GS events, press the ‘Events/Profile Loops’ button and select ‘Guar Soak Events’. This selects the guaranteed soak events for the list view. You can then select which guaranteed soak events (if any) that are to be on during the step.

NOTE: If guaranteed is used during a ramp step, the ramp rate will be affected if any process variable deviates from its soak band because the profile will be placed into hold. When the profile is in hold, all loop set points will be held at their current value, until all loops are within their soak band.

5.1.2.1 Setting Guaranteed Soak Limits

The Guaranteed Soak Limits screen is used to set the control tolerance for each loop during guaranteed soak steps when in profile operation. When a process variable deviates from its set point by more than its soak limit value, the profile timer will stop until the process variable re-enters the soak band. These limits apply to every step in the profile and only need to be set once. To access the Guaranteed Soak Limits screen, select ‘Soak Limits’ from the profile ‘Screens’ menu.
To change a limit, touch the Tagname of the value to be changed from the list. The selected limit name and set point will be shown at the bottom right of the screen. To change the limit value, touch the set point entry box and enter the new set point from the keypad. The new limit value will then be shown in the entry box. To accept the value and use it as the new soak limit setting, press the ‘Enter’ button. The set point will not be assigned to the selected loop until the ‘Enter’ button is pressed.

**NOTE:** If soak limit is set too tight, i.e., a very small deviation value from set point, it could prevent the profile from operating as desired because the process may not be able to be controlled to such a tight limit setting.

### 5.1.3 Setting Wait For Conditions

The “Wait For” function is a powerful tool for pausing a profile until selected process variables and/or digital inputs reach a predefined set point. This differs from the guaranteed soak function by being a single shot monitor. With the guaranteed soak, the process variable is monitored throughout the whole step. If the process exceeds the limit, the profile will pause until the process returns to within the limit setting. The wait for function pauses the profile and ‘waits for’ the process to reach a particular value that is set for the step. Once the process reaches this set point value, the profile will resume operation.

The profile can also be set to wait for a digital input. This allows any of the available inputs of the Orion-M to be selected (must be configured as a wait for input). When the Orion-M reaches the step, it will wait for the input to change state before continuing the step. Any combination of loops, monitors and inputs can be set for a step, but all of them must meet the wait for condition for the step to continue.

To enable a wait for condition in a step, press the ‘Events/Profile Loops’ button and select ‘Wait For Events’. This opens the wait for entry window. This is a ‘tabbed’ interface that allows you to select each page for individual selections for loops, monitors and inputs.

The loop and monitor tab selections, as shown above, allow you to select which loops and/or monitors (if any) will be used as a wait for condition. The loop and monitor selections share two common settings, the ‘Wait Type’ and ‘Wait SP’. These settings are used to set the trigger point for the wait for condition, i.e., the value that each loop and/or monitor must meet for the profile to continue.

The **Wait SP** is the set point value that each selected loop and monitor must reach.

The **Wait Type** setting selects how the Orion-M determines if the loop or monitor input has reached the wait set point. There are three possible selections that can be made from the drop down list box; auto (edge detect), loop/monitor PV rising and loop/monitor PV falling.
The default setting is ‘auto (edge detect)’. With this selection, the Orion-M samples each loop and monitor input selected and determines that the wait for condition is met when each input crosses the set point value, either rising or falling. If loop/monitor PV rising or PV falling is selected, each input must be above, or be below the set point for the wait for condition to be met.

**NOTE:** The set point entry for a ‘wait for’ loop and/or monitor is critical when the auto (edge detect) selection is made in order for the step to operate correctly. During the wait state, each selected loop and/or monitor input must arrive at or cross the set point in order for the profile to resume operation.

The digital input selections are made from the 'Digital' tab on the wait for entry screen. When using the digital input wait for selection, the digital input must be configured as a ‘wait for event’ input. If it is not configured as a ‘wait for event’ input, the profile will ignore that input when the wait for step is executed and continue through the step as normal. See the section on offline setup of Digital Inputs for information on setting the digital input mode.

5.1.3.1 **Delta Control Setting**

The Delta control feature is NOT available on the Orion-M SR version and is not accessible by the user.
5.1.4 Setting the Set Point and Ramp Rate/Dwell Time

The set point for a step is specified as a single entry which applies to all control loops, and is used as the target set point for the step, i.e., the set point that each control loop will arrive at by the end of the step. To enter the set point and ramp rate for a step, touch the ramp rate and set point entry fields to enter the desired settings. As the values are entered, the table will update accordingly. Note that all control loop set points will be updated with the value entered in the set point field.

**NOTE:** A ramp rate of zero can be entered for a step to implement an immediate set point change.

If the set point for the current step is equal to the set point of the previous step, and the ramp rate is set to zero, a dwell (soak) step can be entered. To enter the time duration for the dwell, enter the desired hours and minutes in the ‘dwell hours’ and ‘dwell minutes’ fields. When the profile is run and the step is executed, the loop set points will remain at the step’s set point for the dwell time entered.

For example, if step 1 of a profile is a ramp up to 600 degrees and you require that the control loops hold at that temperature for 2.5 hours, you would enter step 2 with a ramp rate of 0 and a set point for all loops of 600. Then enter dwell hours of 2 and dwell minutes of 30. When the profile was started, all loops being profiled would begin ramping their set points from the lowest PV value of all loops profiles, to the set point of 600 during the first step. Once step 2 was started, the loop set points would remain at 600 for the desired 2.5 hours.

5.1.5 Loop Not Used in Profile

When a profile is run in the Orion-M, it takes over all loop set point control, thus the set point of each loop will be set to whatever value is dictated by the step of the profile. Since applications vary, it may not be desirable to have all loops under automatic control. They may need to be manually adjusted, or remain at a constant set point.

To remove a loop, or loops, from profile control, press the ‘Events/Profile Loops’ button and select ‘Loops To Profile’. The event list box will then be populated with the available control loops in the system. You can then select which loops are not to be used by placing a check in the check box next to the loop(s) that you do not want under profile control. Note that this selection is not on a per step basis and needs to be set only once if you wish to remove any of the control loops from profile control.
NOTE: These selections are saved with the profile and are profile specific. You must make these selections for each profile when there are loops that you do NOT want under profile control.

5.1.6 Setting Jump Steps

This feature allows the profile to ‘jump’ between different steps within itself. When a jump is programmed on a step, the profile will first execute the step as a normal step; however, once the step time is complete, the profile will jump to the specified ‘jump step’ rather than continuing on to the next step in the profile. After all of the programmed jumps have been completed, the profile will then continue to the next sequential step in the profile without making any further jumps.

To program a jump, enter the step number that you want the profile to jump to when the step is complete, along with the total number of times the jump is to be made. A jump count of zero on a step indicates that no jump will be made once the step is complete regardless of what the jump step number is set to.

Jump Step: Sets the step number that the profile will jump to upon the completion of the step. The profile will only jump to this step if the number of jump counts is greater than zero. The step number can be a previous step number, in order to cycle back to a previous portion of the profile, or it can be set to make the profile skips steps by jumping further ahead in the profile.

Jump Count: Sets the number of jumps that will be made from the step. Once all jumps have been made, the profile will continue on to the next step in sequential order. Jumps are disabled on the step when the jump count is zero. The Orion-M will ignore the jump step so it does not have to be set. It can be left at its default value of one.

NOTE: The jump count defines how many jumps will be made. Thus, if you wish to perform 10 cycles within a profile, your jump count will be set to 9, 10 minus the 1 you performed prior to reaching the jump.

Example:
A process must cycle between 0 and 55 for 10 cycles during a portion of the profile, and then returned to its starting value for following steps.

Step 1     Start at 25
Step 2     Ramp to 55
Step 3     soak at 55
Step 4     ramp to 0
Step 5     soak at 0
Step 6     Ramp to 25
            Set Jump Step=2
            Set Jump Count=9

With the jump programmed on step 6, the profile will jump from step 6 back to step 1 after the ramp time has completed. The profile will then repeat steps 2 through 6. It will continue to do this until all 9 jumps have occurred. Once all 9 jumps have been completed, the profile will continue on to step 7 after the final ramp to 25. Since 1 cycle is made prior to the first jump at the end of step 6, a total of 10 cycles are completed.

NOTE: The Orion-M profiler has the ability to do nested looping. It has the ability to set up jumps on every step throughout the profile. It even has the ability to jump forward, skipping steps, only to allow them later by other jump steps returning to the skipped steps. However, this can become confusing. Use caution with nested loops to prevent product loss. The profile may not operate as expected due to multiple jump paths within the profile.

5.1.7 Setting Profile Auto Start

Auto Start is a feature that can be used to start a profile on a specified date or day, and time (of a 24-hour-clock). The auto start settings are saved with the profile. To program an auto start for the profile, select ‘Auto Start Profile’ from the profile ‘Screens’ menu. Choose the desired auto start method, by date or by day, and enter the start time settings. Once the desired entries have been made, press the ‘Done’ button to return to the Profile Entry screen.

When AutoStart By Date is selected, the exact date and time must be entered. Enter the month, day, year and time of day in hours and minutes for when the profile is to start. The day of week is not required to be set. It is not used for this function.
When **AutoStart By Day** is selected, only the day of week and time is required to be entered. The date settings are ignored. The Orion-M simply looks for the day of week and time to begin the profile.

**NOTE:** The time is entered in a 24 hour format. To convert time from a 12 hour format (AM/PM) into 24 hour format, add 12 to the hours for PM time. For example, 2pm will be a value of 14 (2 + 12) for hours. A time of 5:30pm will be 17 hours, 30 minutes.

### 5.2 Starting a Profile

In order to **start** a profile, it must first be loaded into the Orion-M's control module. In order to do this, you must run the selected profile from the profile ‘Run’ menu. The selected profile is shown at the bottom of the profile entry screen in the status window. To start the profile, select ‘Run Profile’ from the Run menu.

Upon selecting ‘Run Profile’ from the menu, the screen will automatically change to the Profile Status View. At the lower right of the screen, will be an entry for the step to start the profile on and a ‘Start’ button.

If necessary, use the left and right scroll buttons to adjust the start step, and then press the ‘Start’ button. The profile will then be transferred into the control module’s memory and started once the transfer is complete. The ‘Profile Status’ screen will then update with the profile operating information.
**NOTE:** If the profile was set up with the auto start feature enabled, the profile will enter the auto start mode immediately upon starting the profile. Once the set date or day and time is reached, the profile will begin running. The start date shown in the profile status view window indicates when the profile will start based on the auto start settings.

To stop a profile, the Orion-M provides two options. These selections are available from the ‘Run’ menu once the profile has been started.

The Stop Profile selection stops the running profile, but leaves the set points and system events at their current values when the profile stops. This allows you to stop a profile and continue in manual mode without disrupting any processes and causing a “hiccup” in operation.

The Stop Profile (All Off) stops the running profile and turns all system events off. The loop control set points will remain at their current values when the profile stopped and their outputs will continue to control to the set point value; however, all system events will be turned off. This allows you to immediately stop a profile and turn off any system equipment controlled by the Orion-M digital outputs.

**NOTE:** Stop Profile (All Off) does not affect loop control outputs.

### 5.2.1 Hold/Resume Profile Operation

At any time during the operation of a profile, the profile can be manually put into hold. This stops the profile timer; however, the Orion-M continues operation under the current step settings at the time the profile was put into hold. To put a profile into hold, select ‘Hold Profile’ from the Run menu and select ‘Yes’ to put the profile into hold. To resume the profile at the point in which it was put into hold, select ‘Run Profile’ from the Run menu and select ‘Yes’ to continue the profile.

**NOTE:** When a profile is in hold, the set points and system events can be manually changed to make on-the-spot adjustments to system operation in that step, without changing the original profile. When profile operation is resumed, the Orion-M will continue the step using the adjustments made to the set points and system event status.

### 5.2.2 Adjusting Step Time

During profile operation, the length of time remaining in a step can be adjusted to increase or decrease the time left. The adjust step time function allows you to add or subtract time from the current step; however, the profile must be first put into hold. Once the profile is in hold, the ‘Adjust Step Time’ menu item is enabled under the Run menu.

When selected, the adjust step time fields will be shown at the bottom of the profile status view screen. Enter the time in hours and minutes and press done when finished. The time remaining in the step will be adjusted by the total time entered. Once complete, resume the profile by selecting ‘Run Profile’ from the run menu.

**NOTE:** When adjusting the time of a set point ramp step, the ramp rate will be altered for the remainder of the step. The ramp rate will decrease if time is added and increase if time is removed. To subtract time from a step, enter negative values for hours and/or minutes.
5.2.3 Advance Previous/Next Step

The advance step functions allow you to skip certain profile steps or repeat them by advancing to the desired step. To advance to a previous or next step in the profile, the profile must be first put into hold. Once the profile is in hold, the advance step menu items are enabled under the ‘Run’ menu.

By selecting ‘Advance Prev Step’ or ‘Advance Next Step’, the profile will jump back or jump forward by one step each time the menu item is selected. When the profile is on the desired step, place the profile back into run and the profile will resume operation from the beginning of the step.
5.3 Monitoring Profile Status

The ‘Profile Status View’ screen provides all status information regarding the operation of the current profile. It can be accessed from the main ‘Profiles’ menu as well as the profile ‘Screens’ menu. When a profile is first started, the Orion-M automatically directs the user to this screen to observe profile operation.

![Profile Status View Screen]

- **Profile Status** indicates the current operating mode of the profile, i.e., auto start, run, hold, wait for, ramp, soak, guaranteed soak, etc.

- **Start Date** indicates the date and time at which the profile was started.

- **Estimated Stop Date** is the calculated stop date and time of the profile. Note that this may vary due to wait for and guaranteed soak steps set in the profile.

- **Current Step** indicates the step number currently being executed.

- **Step Time Left** is the time remaining in the current step.

- **Wait for Input** indicates the input(s) being monitored if a wait for condition is present.

- **Wait Setpoint** shows the set point or digital input number for the wait for condition if active.

- **Loop SP**’s are the target set points for each controlled process of the Orion-M and the value that will be achieved by the end of the step if the loop is in a ramping condition.

The following fields are dynamic, meaning that they are only shown if a jump condition is present on the current step or a previous jump has been made.

- **Current Jump Step** indicates the step number that profile will jump to at the completion of the step.

- **Current Jumps Remaining** indicates the number of jumps remaining for the step (if any).

- **Last Jump from Step** shows the last step a jump was made from.

- **Last Jump to Step** shows the last step a jump was made to.

- **Total Jumps Made** provides a total count of all jumps made from any and all jump steps programmed in the profile.
5.4 Common Questions About Profile Operation

1. How do I start or run a profile?

To select and start a profile, you must be on the ‘Profile Entry’ or ‘Profile Status View’ screen. Using the Edit menu, choose the ‘Select Profile’ menu item to open the list box containing all available profiles in the Orion-M’s memory. Open the desired profile from the list, and then select ‘Run’ from the Run menu. Enter the desired start step and press the ‘Start Profile’ button.

2. How do I know which profile is running?

When a profile is running, the profile name is displayed on Profile Status View screen as well as the Single Loop and 6 Bank View screens. The Orion-M will indicate that the profile is running when the profile is in operation. If a profile is not running, the Orion-M will indicate which profile is currently loaded, i.e., present in memory and ready to be run.

3. Why is the profile name not appearing correctly?

The Orion-M only uses the first ten characters of the profile name for display updates and record keeping, even though profiles can be saved with names of up to 16 characters long. When naming profiles, try to keep profile names limited to ten characters if the desire is to have the full profile name shown, or use the first ten characters as a means of more clearly identifying the profile when more than ten characters are used when saving a profile.

4. How do I enter a jump step?

A ‘jump step’ is a normal profile step; however, instead of continuing to the next step of the profile when the step is complete, the profile ‘jumps’ to a specified step. To enter a jump, set the step number you want to the profile to jump to, and the number of times that the jump is to take place, into the step you want to jump from. When that step is complete, the jump settings will tell the profile to jump to the specified step until all jumps have taken place. The next time the jump step is executed (after all jumps have taken place), the profile will continue on to the next step.

5. Why is the profile not coming out of a Wait For?

When a ‘wait for’ condition is applied to a step, the step will not begin until the wait for condition is met. When using a wait condition to initiate a soak time, be sure to place the wait for condition on the soak step. If the wait for is applied to the ramp step, the profile will not continue because the set point will not change until the wait for condition is met, i.e., the ramp can not take place until the step is executed. Since the set point does not change, the input will not change to meet the wait for set point and the profile will wait indefinitely.

If the wait for condition is a digital input, the selected input must meet its configured transition state after the wait for has been initiated. If the input turns on or off before the ‘wait for’ has begun, the profile will not continue because the change in state of the input must be seen after the wait has been initiated.
6. Why has the profile not completed its run by the stop date given when I started it?

The estimated stop date provided by the Orion-M for the profile is a calculated value based on the sum total of all step times. This time can be affected by any guaranteed soaks or wait for conditions entered into steps of the profile. The affects of these times is an unknown and can cause the profile to run longer than calculated because they pause the profile until their conditions are met.

**NOTE:** The Orion-M does update the estimated stop date based on these conditions as they occur; however, it does make the stop date a moving target.

7. Why do the control loop set points jump to a different value when the profile starts?

When a profile is started, the Orion-M checks the actual process values (temperatures) of each control loop being profiled. The Orion-M then uses the lowest process value as the starting set point and sets that set point to all control loops. This synchronizes all control loops to the same initial control value, and then the desired ramp rate entered for step 1 of the profile is then used for the duration of the step until the programmed set point is achieved.
6 Security

The Orion-M security model provides an administrator with the tools to add up to 30 users to the system. Each user must have a unique ID, full name and password. Four user levels are provided which include system, operator, supervisor and administrator levels. Specific access rights can be assigned to each user level as well as password aging for each user. Re-authentication is provided (if enabled) for any parameters that will change a control parameter, which could upset the process (i.e. set point, loop tuning, etc).

Re-authentication requires that the logged in user must log in again before the process value (at the controller) will actually be changed. This feature is provided for extra security. The following example will make re-authentication clearer:

A supervisor logs on the system. The supervisor then steps away from the system to take a phone call but does not log out before leaving. If another user tries to change the control set point on any loop, the system will require another login (by an authorized user for that level) before the control set point is actually changed. This provides an extra level of protection to make the system more “tamper proof”.

The ‘Security’ menu from the Orion-M main menu structure provides access to the security section of the Orion-M.

<table>
<thead>
<tr>
<th>Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setup</td>
</tr>
<tr>
<td>Log On System</td>
</tr>
<tr>
<td>Log Off System</td>
</tr>
<tr>
<td>View Audit Trail</td>
</tr>
<tr>
<td>View Current User</td>
</tr>
<tr>
<td>Change Password</td>
</tr>
</tbody>
</table>

The ‘Security’ menu provides the following functions:

- Setup: Provides access to security setup to add users, rights and options.
- Log On: Log on a user if security is enabled.
- Log Off: Log off a user if security is enabled.
- View Audit Trail: Allows the user to view any of the save audit trail files.
- View Current User: Shows the current user logged into the system.
- Change Password: Allows the current user to change their password.

To assist in setup and documentation of the Orion-Mi, see the “Orion-M Configuration and Setup Worksheets” Excel file provided on the Future Design Controls website (http://www.futuredesigncontrols.com/Orion-M.htm). This document provides setup and configuration forms and templates for all of the Orion-Mi features including Security.
6.1 Adding Users

The ‘Add User’ tab provides the ability to add up to 30 users to the system. Select the type of user from the drop down list (System, Operator, Supervisor or Administrator). Press each field to add the user ID, full name and password (no spaces allowed, 4 character minimum and 10 characters maximum). If the passwords do not match or the user ID is already used, the Orion-M will alert the user and not accept the entry. Click on the password aging checkbox if you wish to enable password aging for this user. If password aging is enabled and the password has expired, a new password must be entered by the user before that user can log into the system again.

![Add User Screen](image)

**NOTE:** When using password aging and aging expires for a user, the user will be required to change their password before access to the system is permitted. A user can change their password at any time (even if aging is not used) by selecting “Change Password” from the main security menu.

6.2 Viewing Users

The ‘Users’ tab provides the administrator the ability to view information on each user entered into the system. Password information is not available. The user can be deleted from this tab and a new password for each user can also be entered from this area.

![Users Screen](image)
6.2.1 New Password Entry

To change a password, select the user by touching the UserID in the list box and press the ‘New Pswrd’ button. Enter the new password and confirm the password. Press the ‘Accept’ button to change the password (no spaces allowed, 4 character minimum and 10 characters maximum).

![New Password Entry Screen](image)

6.3 Setting User Rights

The ‘User Rights’ tab provides the administrator the ability to assign rights to each user level (System, Operator, Supervisor and Administrator). Select the user group from the drop down box and then enable or disable specific program functions (rights) by selecting the checkbox next to the function. If the checkbox is selected, the user right will be enabled for the user group currently being edited. The ‘Select All’ and ‘Clear All’ buttons will select or clear all rights in the ‘User Rights’ list view.

**NOTE:** You must press the ‘Accept’ button for each user group to save the selections for that group, before selecting another user group from the drop down list, or entries made will not be saved.

![User Rights Screen](image)

The user right for ‘Access Security’ can not be disabled for the administrator group. This is a safety feature to make sure that any administrator with the proper user ID and password can access security. If the administrator losses his/her ID or password, there is no ‘back door’ to the system and a new SD card is required to resume normal system operation.
## 6.3.1 Security System User Rights

Shown below is a list of the available user rights, where to find the menu item(s) applicable to the user right and a description of what it applies to. Note that the OEM configuration allows many menu items to be disabled; in which case the menu for a specific user right may not be shown.

<table>
<thead>
<tr>
<th>User Right</th>
<th>Menu Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trend Setup</td>
<td>View/Loop Monitor Trends</td>
<td>configure PV, SP &amp; % output, scale &amp; time for Trend</td>
</tr>
<tr>
<td>Email Settings</td>
<td>Setup/Email/Email Settings</td>
<td>configure email settings and addresses</td>
</tr>
<tr>
<td>Change Setpoints</td>
<td>View/Single Loop, Dual &amp; All Loop Views</td>
<td>applies to loop controls not running a profile (does not apply to loop/monitor alarms)</td>
</tr>
<tr>
<td>Open Files</td>
<td>see description</td>
<td>Alarm, Profile, Audit &amp; Historical files</td>
</tr>
<tr>
<td>Save Files</td>
<td>see description</td>
<td>Profile “save” and “save as”; note files may be copied from system with File Utilities</td>
</tr>
<tr>
<td>Delete Files</td>
<td>see description</td>
<td>Historical Data files &amp; Profiles; note files may be deleted with File Utilities</td>
</tr>
<tr>
<td>Edit Profiles</td>
<td>Profiles/Edit profile</td>
<td>no data entry or access to Events/GS/Wait for, Segment SP/Time fields or GS Soak Limits, Auto Start Profile, Loop not used in Profile; can't insert/delete/copy/paste step.</td>
</tr>
<tr>
<td>Edit Barcode Setup</td>
<td>Setup/Barcode Reader Setup</td>
<td>applies to all barcode reader settings</td>
</tr>
<tr>
<td>Adjust SP Limits</td>
<td>Setup/Alarms Setpoints</td>
<td>applies to loop controls (does not apply to loop/monitor alarms)</td>
</tr>
<tr>
<td>Adjust Alarms</td>
<td>Setup/Alarm Settings</td>
<td>applies to all loop and monitor point alarms</td>
</tr>
<tr>
<td>System Event Control</td>
<td>View/System Event Control</td>
<td>applies to enable or disable manual events</td>
</tr>
<tr>
<td>Touch calibration</td>
<td>Setup/Offline/Calibrate Touch Screen</td>
<td>access to Touch Calibration is also required for obtaining MAC address &amp; backlight settings</td>
</tr>
<tr>
<td>Silence Alarms</td>
<td>View/Alarm Monitor View, Silence button</td>
<td>does not affect digital input alarm silence function</td>
</tr>
<tr>
<td>Clear Alarms</td>
<td>View/Alarm Monitor View, Clear button</td>
<td>prevents alarm list view from being cleared</td>
</tr>
<tr>
<td>Data Logging and Settings</td>
<td>Log/</td>
<td>applies to all data logging actions &amp; settings; does not affect digital input functions</td>
</tr>
<tr>
<td>Start/Stop/Hold Profiles</td>
<td>Profiles/Run, Hold, Stop actions</td>
<td>Stop Profile (All Off) does not affect loop control outputs. Digital Inputs configured for same action are not affected</td>
</tr>
<tr>
<td>Power Recovery</td>
<td>Setup/Profile Recovery</td>
<td>logic when running a profile with power lost &amp; recovery: Off, Hold, Continue, Restart or Resume</td>
</tr>
<tr>
<td>Access Security</td>
<td>Security/Setup</td>
<td>applies to Security Setup</td>
</tr>
<tr>
<td>Exit Application</td>
<td>Setup/Offline/Exit Application</td>
<td>prevents Orion-M runtime application from being stopped</td>
</tr>
<tr>
<td>Edit Event Names</td>
<td>Setup/Event Tagnames</td>
<td>configure Event Tagnames (seen in Manual Events &amp; Profile Events)</td>
</tr>
<tr>
<td>Edit Bar Graphs</td>
<td>View/Single Loop View</td>
<td>configure Bar Graph settings per loop</td>
</tr>
<tr>
<td>Set/Clear Mains Counters</td>
<td>Setup/Offline/Maintenance Items</td>
<td>Applies to counter setpoint entry and clearing counters</td>
</tr>
<tr>
<td>File Utilities</td>
<td>Log/Edit/File Utilities</td>
<td>allows USB I-stick memory to copy/delete Historical, Alarm, Profile &amp; Audit Trail files &amp; to import Profiles</td>
</tr>
<tr>
<td>Change Units</td>
<td>Setup/Offline/Degrees C/F</td>
<td>loop/monitor point temperature units configuration - C/F</td>
</tr>
<tr>
<td>Maints Setup</td>
<td>Setup/Offline/Maintenance Items Setup</td>
<td>Maintenance Counter Setup; Elapsed interval, Life total or Elapsed Run time</td>
</tr>
<tr>
<td>Set Date/Time</td>
<td>Setup/Offline/Set Date/Time</td>
<td>Set Date/Time, Time Zone, DST and NTS connection</td>
</tr>
<tr>
<td>Not Used</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Monitor Points Offset</td>
<td>Setup/Offline/I-O/Input Offsets</td>
<td>enter bias for monitor points</td>
</tr>
<tr>
<td>Analog Outputs</td>
<td>Setup/Offline/I-O/Analog Output Setup</td>
<td>configuration of PV, SP or %out retransmission from specific loop controls</td>
</tr>
<tr>
<td>Web/Modbus/VNC Settings</td>
<td>Setup/Web Server-Modbus-VNC</td>
<td>configure web page, Modbus address &amp; VNC settings</td>
</tr>
<tr>
<td>User Right</td>
<td>Menu Location</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------------------------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>FTP Settings</td>
<td>Log/Edit/FTP/WAN Setup</td>
<td>configure FTP client settings</td>
</tr>
<tr>
<td>NTS Clock Settings</td>
<td>Setup/Offline: Set Date/Time</td>
<td>enable &amp; choose National Time Server location</td>
</tr>
<tr>
<td>DST Settings</td>
<td>Setup/Offline: Set Date/Time</td>
<td>enable Daylight Savings Time (DST)</td>
</tr>
<tr>
<td>Config Analog Inputs</td>
<td>Setup/Offline/Analog Input Setup</td>
<td>configure Analog Input(s) to act as remote set point for specific loop controls</td>
</tr>
<tr>
<td>Config Digital Outputs</td>
<td>Setup/Offline/Digital Output Setup</td>
<td>configure Digital Outputs</td>
</tr>
<tr>
<td>Help/Voice Assistance</td>
<td>Setup/Offline/Help/Voice Assistance</td>
<td>configure voice assisted help</td>
</tr>
<tr>
<td>Import/Export Setup</td>
<td>Setup/Offline/Import/Export Setup</td>
<td>access to import/export setup files of the Orion-M</td>
</tr>
<tr>
<td>Auto-man Enable/Disable</td>
<td>Single Loop View</td>
<td>enable or disable loop control Auto-Manual (AM button)</td>
</tr>
<tr>
<td>Auto Tune Enable/Disable</td>
<td>Single Loop View</td>
<td>enable or disable loop control Auto-Tune (AT button)</td>
</tr>
<tr>
<td>Offline DO Force</td>
<td>Setup/Offline/Force System Outputs</td>
<td>access to force digital output functions</td>
</tr>
<tr>
<td>User Composed Email</td>
<td>Setup/Email/New Email Message</td>
<td>access to compose &amp; send email message</td>
</tr>
<tr>
<td>Add Operator Events</td>
<td>Log/Edit/Add Operator Events</td>
<td>access to add operator events to active log file</td>
</tr>
<tr>
<td>Add Digital Signatures</td>
<td>Log/Edit/Add Digital Signatures</td>
<td>access to add digital signature to active historical data file</td>
</tr>
<tr>
<td>Verify Digital Signatures</td>
<td>Log/DataLogging/View Digital Signatures</td>
<td>access to verify digital signatures of active historical data file</td>
</tr>
</tbody>
</table>

### 6.4 Setting Security Options

The ‘Security Options’ tab provides the administrator the ability to set the global security options.

---

**Enter Number Of Days Before Password Renewal Is Required** is a global setting for all users. Password aging starts from the day the user is entered into the system. The value can be set from 1 to 365 days.

When enabled, **Re-authenticate User During Process Changes** requires that the logged in user must log in again before the process value (at the controller) will actually be changed.

**Enable/Disable Audit Trail** is a global setting that turns the audit trail on or off. When the audit trail is turned on, all operator actions are written to a daily log.

**Enable/Disable Security** is the global setting that turns the Orion-M security system on or off. The security system must be enabled for the audit trail to be enabled.
7 Logging

The Orion-M data logging features are accessed via the main ‘Log’ menu item. The system data logging provides the ability to select individual points for logging, view data log files and start/stop logging operations. The logging ability of the Orion-M provides an easy-to-use, convenient method to obtain electronic data without the need for additional data acquisition equipment.

The data logging ‘Edit’ menu provides the following functions:

<table>
<thead>
<tr>
<th>Edit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open History File</td>
</tr>
<tr>
<td>Delete History File</td>
</tr>
<tr>
<td>File Utilities</td>
</tr>
<tr>
<td>FTP/WAN Setup</td>
</tr>
<tr>
<td>Add\View Operator Events</td>
</tr>
<tr>
<td>Add\View Digital Signatures</td>
</tr>
<tr>
<td>Check Disk Space\Memory</td>
</tr>
</tbody>
</table>

Open History File: Opens a history file for review.
Delete History File: Allows the user to delete the currently loaded history file.
File Utilities: Allows the user to access file utility functions (copy, erase files).
FTP/WAN Setup: Provides access to the automatic data file back-up settings.
Add\View Operator Events: Allows the operator to insert a notification into the currently running log file or view all operator events associated with the currently loaded historical data file.
Add\View Digital Signatures: Allows the operator to digitally sign a file to prevent data tampering and display all digital signatures associated with the currently loaded historical data file.
Check Disk Space\Memory: Displays current memory capacity remaining on the Orion-M.

**NOTE:** The ‘Delete History File’ function does not affect data from a file that is running, only the current history file loaded for review.

The data logging ‘DataLogging’ menu provides the following functions:

<table>
<thead>
<tr>
<th>DataLogging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start/Stop Logging</td>
</tr>
<tr>
<td>Select Points For Logging</td>
</tr>
<tr>
<td>Hist View Channel Setup</td>
</tr>
<tr>
<td>View History Plot</td>
</tr>
<tr>
<td>View Averages Report</td>
</tr>
</tbody>
</table>
7.1 Selecting Points for Logging

In order for the data logging function of the Orion-M to operate, you must first select what variables are to be logged to the data file. To choose which points are to be logged, select ‘Select Points For Logging’ from the ‘DataLogging’ menu. This screen allows the user to select any point(s) from the system for data logging. The ‘Select All’ and ‘Clear All’ buttons provide a quick way to select or deselect all points in the Orion-M.

Use the checkbox to enable/disable each point for logging. When selections are completed, press the ‘Accept’ button to write the point selection to memory. This is important so that the Orion-M saves the settings for power-up operation. New settings will not take effect until the ‘Accept’ button is pressed.

The Log On Startup option automatically turns logging on whenever the Orion-M is first powered on. This action simulates that of a standard chart recorder.

The Log On Profile Run option is a convenient method for gathering information that pertains only to the operation of a profile. When selected, the Orion-M will turn the logger on at the beginning of a profile and off once the profile is completed. This eliminates the need to scan through extensive data records to find the specific information you are looking for from a particular time period.

**NOTE:** The Orion-M will automatically use the profile name as the prefix for the log file. This provides a simple identifier for log files that pertain only to a profile run.
7.2 Starting/Stopping Data Logging

The Orion-M will log data to its internal SD card for a period of 1 year or more. Current data for each variable is written to the log at a fixed interval based on the settings entered in the ‘Days to log’ and ‘Log Interval (Secs)’ fields. File names are automatically generated using m_d_y_h_m_s format. To enter a new alphanumeric Filename, Batch and/or Lot data, touch the appropriate field and enter appropriate characters (up to 16 characters each) and the files will be saved as Filename_Lot_m_d_y_h_m_s. When the ‘Log On Profile Run’ checkbox is selected (on the Select Points For Logging screen), the profile name is used as the prefix for the file name ahead of the date/time stamp.

The main logging screen will display the current data file name if system logging is enabled as well as the currently loaded file name if a historical file is loaded. To start the log, press the ‘Logging On’ button. Any time logging is enabled, the ‘Logging On’ button will be green. To stop the log, press the ‘Logging Off’ button.

The logging rate is adjusted on this screen by changing the value for the ‘Days to log’ and ‘Log Interval’ parameters. These allow you to select how long the data file will be as well as what logging rate to use.

The Days to log sets length of a data file in number of days. It can be set for 1 to 31 days. Once the selected number of days has elapsed, a new data file will be created and logging will continue in the new file.

The Log Interval (Secs) field is used to set the rate at which points are written to the log file which equates to the sample rate in seconds. When the ‘Auto Interval’ checkbox is selected, the logging interval will be automatically set to record at minute intervals based on the number of days set for the file. If the file is set for 1 day in length, the logging rate will be at 1 minute intervals. If the file is set for 7 days, then the logging rate will be every 7 minutes. This keeps the data file size manageable and able to be viewed by the Orion-M’s data viewer.

The logging rate can be manually set to any rate between 6 and 1860 seconds in any combination with the number of days before a new file is started. To do this, de-select the ‘Auto Interval’ option and enter in the desired logging rate in seconds.

NOTE: Logging at shorter intervals allows the Orion-M to capture fast changing processes, but the data files can become extremely large. Files that exceed the capability of the Orion-M’s data viewer will have to be extracted from the Orion-M using a USB I-Stick or FTP file transfer in order to be viewed remotely on a PC.

These files are also not able to be digitally signed on the Orion-M. If the files are to be digitally signed, this must be done using the data viewer program running on a remote PC.
7.3 Reviewing Historical Data

Historical files can be opened and viewed using the historical trend graph. In order to view a historical data file, it must first be opened by selecting ‘Open History File’ from the data logging ‘Edit’ menu. Once the file has been opened, the user has the ability to adjust the time period to plot, and select what points from the file are to be plotted.

7.3.1 History View Channel Setup

The History View Channel Setup allows the user to select any time frame (zoom in/out) from the historical data file as well as select up to 8 channels of data to plot. The start and end dates for the currently loaded file are shown with time in hours, minutes and seconds. The file ‘Start’ and ‘End’ sliders are used to select a time span for historical viewing. The minimum time for plotting data is 5 minutes.

Any point from the data file can be selected along with the color and vertical axis to be used for each channel to be plotted. Use the drop down boxes to select a channel for the plot, the color to use for the channel and whether to use the left or right axis for the plot range. Press the ‘Add Point’ button to add the point to the current list of historical plot channels.

The ‘Clear All’ button will clear the list of all points so a new group can be added for plotting. The ‘Add All’ button can be used to automatically add the first 8 data points from the historical log file to the channel plot list. Note that all channels are assigned to the left axis when using this feature.

**NOTE:** The drop down box shown on the lower left corner allows selection of decimal point for the plot history data x-axis (left or right depending on channel assignment). Decimal point selection offers: None, 1, 2 and 3 with the default being 1 decimal point. This selection applies to all points selected to plot and does not affect the original data file decimal point resolution.

7.3.2 Plotting Historical Data

The ‘View History Plot’ screen plots the data from the currently opened history file according to the selections made on the time and channel screens. If a file has not been opened or data points have not been assigned to a plot, the Orion-M will alert the user to correct the problem. The ‘X’ and ‘Y’ axis scales are set to autoscale based on current values for each plot so no user action is required.
The ‘cursor’ icon (small trend icon with vertical bars next to the ‘Done’ button) displays a vertical data cursor that can be dragged (from the bottom of the cursor) from left to right in the trend area. When this vertical cursor is dragged, the trend labels at the top of the screen change to the actual values that correspond to the point the vertical cursor line is positioned over. This feature makes it very easy to ‘zero in’ on any actual value within the trend plot. Pressing the ‘cursor’ icon again will make the trend cursor disappear. The icon acts as a toggle button to show/hide the data cursor.

**NOTE:** When finished viewing the historical data, you must press the ‘Done’ button to exit the historical plot and return to the main data logging screen.

7.3.2.1 Auto History Plot:
The auto history plot function allows the user to view the contents of the currently running data log file, automatically and continuously, much like a real time trend. This feature is useful in instances where batch monitoring may be desired, from the beginning to the end of a run. While real time trends have a limited 8 hour display period, the history plot can display the contents of an entire log file, which can span from 1 day to 31 days.

In order to turn on auto history plot, ‘Auto Interval’ must be selected for the logging rate. The auto history plot function is only available for standard logging rates. When auto interval is checked, pressing the ‘Auto HistPlot’ button will turn the auto plot function on and off. Auto FTP data backup must also be disabled in order to turn on the auto history plot function. If auto FTP data backup is enabled, you must first disable it prior to being able to turn on the auto history plotting.
Once enabled, you must select the channels you wish to see on the plot from the History View Channel Setup screen. Once the selections are made, select ‘View History Plot’ from the ‘DataLogging’ menu. Unlike the standard history plot, when auto history plot is enabled, the plot will automatically update as each new log file entry is made. This allows the screen to be left up as the active screen, so that the batch run can be monitored from beginning to end.

**NOTE:** When auto history plot is enabled, you will be unable to open any historical data log files since this feature locks the historical data viewing into the currently running data log file. The ability to view and ‘Averages report’ will also be disabled. Also, the historical view channel setup screen does not allow the trend start or stop times to be adjusted. The auto plot feature is designed to plot from the beginning to the end of the data file, thus time adjustment is not necessary.

If it is necessary to view another historical data log file, or there is a desire to view an averages report, the auto history plot feature must be turned off. This will allow normal selection and viewing of historical data files. Once complete, the auto history plot function can be re-enabled. This function can be turned on and off at any time during logging operations without affecting the data log file.

### 7.3.3 View Averages Report:

The ‘View Averages Report’ provides a text report that displays the average, minimum and maximum value over time for each channel selected in the History Plot Channel Setup screen. Averages are calculated for the period of time selected in the History View Time Setup screen. The report supplies the average, minimum and maximum value for each channel over time as well as the combined average for all channels selected.

![Image of Averages Report]

**NOTE:** When finished viewing the averages report, you must press the ‘Done’ button to exit the historical plot and return to the main data logging screen.
7.4 File Utilities

A quick note about data and setup file storage. Data and setup files (profiles, alarm history and audit trail files) need some maintenance every now and then. After a period of time, storage devices fill up and files require backup or file deletion when no longer needed. The ‘File Utilities’ section of the Orion-M interface provides all the functionality required for maintaining the internal compact flash memory card. The internal SD card should not be removed from the Orion-M interface. Any change to SD directory structure (moving or deleting files with a PC) will cause the Orion-M interface to stop operating and a new SD card will need to be ordered. Never move or delete the directories unless using the internal Orion-M file utilities.

**NOTE:** The data log files, Profiles, alarm history and audit trail directories are saved to the internal SD card (not the USB I-Stick device) plugged into the back of the Orion-M interface. Never unplug the SD card when the Orion-M is powered up or loss of data may result.

The ‘File Utilities’ screen allows the user to copy or erase files from the internal SD card. Complete file directories for all Orion-M file types can be copied to the USB ‘I-Stick’ or erased from the internal SD card. Complete status for file functions as well as progress bar status is displayed for the operator during copy/erase operations. The Orion-M also allows profiles to be imported from the I-Stick device. Profiles must be exported from an Orion-M device to the I-Stick first, before this function can be used. The Orion-M will look for ‘Profile’ directories for import and alert the user if none exist on the I-Stick.

**NOTE:** All file utilities can be accessed while data logging is running. If the operator needs to back up or delete files from the system, a large number of files could take considerable time to backup to the I-Stick or delete from memory. The file utilities screen will be locked during file transfer so plan the timing appropriately when access to other screen functions is not required. When data logging is running, the current data log file will not be copied or deleted while using the file utility functions. This protects the current file and makes sure that the data file is complete before being copied and cannot be erased from internal memory while it is still in operation.

To **copy files** to the USB I-Stick, insert the USB memory stick into the USB port. Select the file type you wish to copy from the “Select Export Type” drop down menu. Available file selections are profile files, alarm files, audit trail files and data files. Once the selection is made, press the “Copy Files” button. All related files will be copied to the USB memory stick with progress status displayed to user.
To copy files to the USB I-Stick and then delete the files from internal memory, insert the USB memory stick into the USB port. Select the file type you wish to copy and erase from the Orion-M’s internal memory, by selecting it from the “Select Export Type” drop down menu. Available file selections are profile files, alarm files, audit trail files and data files. Once the selection is made, press the “Copy/Delete Files” button. All related files will be copied to the USB memory stick and then erased with progress status displayed to user.

To import profiles from the USB I-Stick, press the 'Import Profiles' button. The user will be prompted for profile transfer and then a dialog box will appear listing the available profile directories on the I-Stick for transfer. If no profile directories exist, the user will be alerted that the I-Stick does not contain profile directories with an ‘empty’ dialog box. If the user selects a directory that does not contain profiles, the user will be prompted that the directory does not contain profiles. Profile directory names exported from the Orion-M are in the format ‘Profiles_mm_dd_yyyy-hh_mm_ss’.

**NOTE:** The USB I-Stick must be inserted into the USB port for any of the file utility operations to function. It is recommended to only use memory sticks certified by Future Design Controls for use with the Orion-M. Future Design Controls has tested and validated these memory devices for proper operation and performance.

*Due to manufacturing variations in the USB I-Sticks, it may take anywhere from 10 to 30 seconds for the Orion-M to recognize the device when it is plugged in. Allow sufficient time for the device to be recognized before attempting any file utility operations or the Orion-M will indicate a file transfer/memory stick error.*

When files are being copied to the I-Stick storage device, a directory for each file type will be created to store the copied files. The directory structure is as follows:

- Profile files directory: Profiles_mm_dd_yyyy-hh_mm_ss
- Alarm files directory: Alarm Files_mm_dd_yyyy-hh_mm_ss
- Audit files directory: Audit Files_mm_dd_yyyy-hh_mm_ss
- Data files directory: Data Files_mm_dd_yyyy-hh_mm_ss

The reason for using the date and time as part of the directory name is to make sure the user can track the date and time of the file transfer. If a user transfers a file type more than once in a single day, the files will be grouped logically by time.

The Plug and Play I-Stick, USB memory device holds all of the Orion-M data files. These data files are in a directory named ‘Data Files’ and are in a ‘.csv’ format. These files can be opened directly with Microsoft Excel or any program that opens a comma separated file format. You can copy or empty the ‘Data Files’ directory by simply plugging in the USB ‘I-Stick’ in a PC’s USB host port. The device then becomes like any removable disk attached to the computer and can be manipulated once plugged into the PC. The I-Stick requires no drivers when using the Windows XP operating system.

The Orion-M Data Viewer program is a free Windows accessory program that allows users to view, plot and print data files and is available from Future Design Controls or any manufacturer that markets the Orion-M product. It is required when using the digital signature feature of the Orion-M.

**IMPORTANT:** Once files are deleted from Orion-M storage devices, they are gone and cannot be retrieved. Once again, do not edit, move or delete any other files from the internal compact flash card unless using the Orion-M File Utilities. The Orion-M will not operate properly if you do so.

*’Windows XP’ and ‘Excel’ are trademarks of the Microsoft Corporation.*
7.4.1 Advanced File Utilities

The “Advanced File Utilities” screen is accessed by pressing the “Show Advanced” button on the File Utilities screen. The advanced file utilities allow the user to select individual files for the copy and delete functions rather than copying and deleting all files of the selected file type when performing a copy or copy\delete function.

To copy individual files, select the file type to export from the “Select Export Type” drop down menu just as with the simple file utilities transfer. The available files stored in memory will then be shown in the left “Internal Files” list box.

Once the files have been loaded, files can be individually selected for transfer to the USB memory stick by selecting it from the list and pressing the “Add ->” button. Selected files will then be shown in the “Destination Files” list box. If you need to remove a destination file, select the file from the list and press the delete (<- Del) button. Note that this only removes the file from the list of those to copy. It does not delete the file from internal memory.

Once all files have been selected, press the “Copy Files” or “Copy\Delete Files” button to perform the desired file utility function. Only the files shown in the “Destination Files” list will be copied or copied\deleted.

**IMPORTANT:** The “Import Profiles” function will import all profiles from the selected directory on the USB memory stick. It does not allow for individual file selection for import. However, by using the individual file copy, it allows individual profiles to be copied from one Orion-M to the USB memory stick, and then only those specific profiles copied will be imported to another Orion-M during the profile import.
7.5 FTP Data Backup

The ‘FTP\Wan Setup’ screen allows the user to configure automatic back-up of all data files contained in the Orion-M’s memory to a user designated FTP site. When enabled, the Orion-M will automatically back up all historical data files at 2:00AM each day, and with an optional delete files selection, the Orion-M will automatically delete the files from its internal memory after back up. This will maintain the Orion-M’s memory automatically, so that continuous data logging can be performed without filling up the available memory space.

**NOTE:** Setting up an FTP site on your network may require authorization and/or assistance from your network administrator. Contact your network administrator for proper settings and authorization from your network server (if required) to allow the Orion-M to connect to the designated FTP site.

![FTP WAN Setup Screen](image)

The **FTP IP Add** field is used to enter the IP address of the FTP site for which the Orion-M is to send the files to.

The **User Name** field allows you to enter a user name for FTP site access. When the Orion-M connects to the FTP site to transfer data files, the user name will be used to identify the connection. If a security login is required, the proper user name will have to be entered in this field.

The **Password** field is used in conjunction with the user name field and is for entering a password, if required by your FTP site, for the Orion-M to access the site.

The **Server Dir** field is used to enter the server directory where the files are to be backed up. When the automatic back-up occurs, the Orion-M will place the data files in this directory on the FTP site.

When the **Auto Backup (2:00AM)** check box is checked, the Orion-M will perform an automatic back-up of all data files contained in internal memory to the designated FTP site. Note that if data logging is currently active, the active file will not be copied.

When the **Delete Internal Data Files After FTP** check box is checked, the Orion-M will delete all data files within its memory after completing the back-up to the FTP site. Note that if data logging is currently active, the active file will not be deleted.
Once all settings have been made, be sure to press the ‘Save’ button to store the settings, so that on the next power-up, the values will be maintained. The ‘Backup Now’ button can be used at any time to perform a manual data back-up. The Orion-M will copy all data files stored in internal memory on each back-up session. If the files already exist on the FTP site, they will be overwritten on the subsequent back-up. If the FTP site is down, or the Orion-M is not connected to the network, a local alarm message on the Orion-M Alarm Monitor screen will indicate a transmission failure.

**NOTE:** The Orion-M must have a valid connection to your network for the FTP server to operate. The Orion-M receives its IP address from DHCP on your network and it only occurs during power up. Therefore, make sure the Orion-M is properly connected to your network and cycle power to the Orion-M in order for it to obtain a valid IP address and be properly connected to your network.

Typically FTP Server software use case sensitive alpha characters for the User Name, Password and Server Directory. Contact your network administrator for proper settings.

### 7.6 Add\View Operator Events

The ‘Add\View Operator Events’ screen allows the user to add operator events to the running data log file and view any operator events currently associated with the loaded historical data file.

When a historical data file is loaded, the Add\View Operator Events screen will display any operator events that were written to the file. The date, time, user name and description of the event are shown. Note that the currently running data log file can be opened as a historical data file, and the current operator events for the running file will be shown.

To add an operator event to the running log file, touch the operator event entry field at the bottom of the screen and enter in the description of the operator event (up to 16 characters maximum). Press the ‘Add Event’ button and the event will be added to the current log file. If the running log file was opened as the historical log file, the operator event will be shown immediately on the screen as it is added. If logging is not currently running, the ‘add operator event field’ will be disabled.
7.7 Add\View Digital Signatures

The ‘Add\View Digital Signatures’ screen allows the user to add digital signatures to historical data log files and view any digital signatures currently associated with the loaded historical log file.

When a historical data file is loaded, the Add\View Digital Signatures screen will display any signatures currently associated with the file. To verify a digital signature and insure that the data file has not been altered, touch a signature in the list box and press the ‘Verify’ button. The Orion-M will compare the signature to the log file to see if any alterations to the data have been made. The Orion-m will then indicate if the signature is valid or not.

If the signature is valid, the historical data file is intact and has not been altered. If the signature is invalid, the data has been altered at some time after the signature was assigned to the file. For data integrity, the Orion-M automatically signs a data file when logging is stopped; however, this only occurs if the ‘auto interval’ is selected on the Start/Stop Logging screen. If a different logging interval is used, the Orion-M will not automatically sign the file, and it must be signed by a user.

To add a digital signature to the historical log file, touch the digital signature entry field at the bottom of the screen and enter in the comment line for the signature (up to 16 characters maximum). Press the ‘Add Sig’ button and the signature will be added to the log file. The signature includes the date and time of the signature, the user name and comment line. If a user is not logged into the system, the default user name ‘FDC System’ will be used as the user.

**NOTE:** The Add\View Digital Signatures screen is not available if security is disabled. The Orion-M’s security must be enabled in order to digital sign data log files. See Section 6, Security.
8 Setup

This section covers the use of extended controller features that enhance the functionality of your system. To gain access to the Orion-M setup options, select ‘System Setup’ from the main Setup menu.

To assist in setup and documentation of the Orion-Mi, see the “Orion-M Configuration and Setup Worksheets” Excel file provided on the Future Design Controls website (http://www.futuredesigncontrols.com/Orion-M.htm). This document provides setup and configuration forms and templates for all of the Orion-Mi features including those provided under the Setup menu.

The ‘Setup’ menu provides the following functions:

<table>
<thead>
<tr>
<th>Setup</th>
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<tbody>
<tr>
<td>Profile Recovery</td>
</tr>
<tr>
<td>Setpoint Limits</td>
</tr>
<tr>
<td>Event Tagnames</td>
</tr>
<tr>
<td>Alarm Settings</td>
</tr>
<tr>
<td>Web Server/Modbus/VNC</td>
</tr>
<tr>
<td>Barcode Reader Setup</td>
</tr>
<tr>
<td>Offline System Setup</td>
</tr>
</tbody>
</table>

- **Profile Recovery:** Allows the user to set profile recovery action on power failure.
- **Setpoint Limits:** Sets minimum and maximum set points allowed for each loop.
- **Event Tagnames:** Allows the user to edit the names used to describe system events.
- **Alarm Settings:** Provides access to the alarm module.
- **Web Server/Modbus/VNC:** Allows user to set the Orion-M communication settings.
- **Barcode Reader Setup:** Provides access to the barcode reader settings.
- **Offline System Setup:** Provides access to offline system settings (data/time etc.)

The ‘Email’ menu provides the following functions:

<table>
<thead>
<tr>
<th>Email</th>
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</thead>
<tbody>
<tr>
<td>Email Settings</td>
</tr>
<tr>
<td>New Email Message</td>
</tr>
</tbody>
</table>

- **Email Settings:** Provides access to the Orion-M email system manager.
- **New Email Message:** Allows the user to send a message to users entered in the system.
8.1 Profile/Power Recovery

The Profile Power Recovery screen allows the user to set the startup state of the system in the event of a power failure when a profile was running at the time power was lost. When power is restored, the Orion-M compares the amount of time it was off to the ‘Power Out Time’ setting and takes whatever action is selected in the ‘Recovery State on Power-up’.

To configure the power recovery settings, first determine how long the system can be off without adversely affecting the process. Set the ‘Power-Out Time’ to this time (0–32760 seconds maximum). If power is returned in less time than this setting, the profile will continue from where it left off at the time power was lost. If power is restored after a time period longer than the power-out time setting, the Orion-M will take action based on the recovery state selection.

To set the power recovery action, push the recovery mode button for the desired setting to set it as the power-up state. The selected mode button will turn green to indicate that it is now the current power recovery mode. The selections are exclusive to one another, i.e., only one can be selected at a time. As a new selection is made, the previous setting will be automatically turned off.

Select OFF to have the Orion-M default to the off state on power-up. If a profile was running when power was lost, the profile will be stopped. In addition, all system events will be turned off. Note that loop controls will continue with the profile’s last set point value prior to power loss with loop control outputs active (ON).

Select HOLD to have the Orion-M return to operation at the same point it was prior to the power outage. If a profile was running, the profile will still be active; however, it will remain in hold with the active set points and events that it was operating prior to losing power until manually set to continue.

Select CONTINUE to have the Orion-M pick-up where it left off on loss of power. If a profile was running prior to the power outage, it will resume where it left off and continue through the rest of the profile. Note that the set point ramp will continue from the set point value at the time of power interruption unless the profile is in the ‘ramp rate’ configuration.

If the profile is running under ‘ramp rate’ mode, the profile will continue a ramp step from the highest process value of all loops being profiled at the time power is restored. This insures that the ramp rate can not be exceeded if power was off for an extended period of time in which the process temperature was able to fall significantly. If the profile was running a dwell step at the time power was lost, the profile will automatically advance to the previous step (ramp rate step) when power is restored. This will ramp the temperatures back up to the dwell temperature from the highest process value based on the ramp rate entry of the previous step, and then begin the entire dwell step over again.
Select **RESTART** to automatically restart the profile that was running at power failure. Use this option if it is critical for a profile to run from start to finish without interruption.

Select **RESUME** to have the Orion-M pick-up where it would be at the current time, if power had not been lost. If a profile was running prior to the power outage, the Orion-M will advance forward through the profile to the point where it would be, at the current time, and resume operation from that point.

**NOTE:** When a profile is NOT running and a power down/up sequence occurs, the Orion-M will return with the same set points and system events active as when the power was lost. If a profile stays in hold regardless of power recovery configuration, refer to the OEM configuration provided by the installer. Digital inputs may be used to place a Profile in hold. This input may have to be reset to allow the profile to continue.

### 8.2 Setpoint Limits

The Setpoint Limits screen allows for the adjustment of the minimum and maximum operating set points allowed to be entered for the control loops. These limits can be used to prevent operators from entering a value that exceeds the survivability limits of equipment or product being manufactured, reducing the risk of property damage.

![Setpoint Limits Screen](image)

Enter the desired set point limits by touching the ‘Lower SP Limit’ and ‘Upper SP Limit’ entry fields and enter the desired values using the pop-up keypad. When the settings have been made, press the ‘Accept’ button to save the new set point values to memory. If you do not press the ‘Accept’ button prior to leaving this screen, or using the left or right scroll button to go to the next loop, your settings will be lost.

**IMPORTANT:** The minimum and maximum values for the set point limits are defined by the OEM or equipment installer limits set in the Orion-M configuration. The Orion-M prevents the user from entering set point limits outside of these configuration values. Consult your OEM or equipment installer regarding the maximum set point limits permitted for your system.
8.3 Event Tagnames

The names of the system events (digital outputs) can be changed to describe what function they are used to perform. Tagnames are limited to 20 alphanumeric characters.

To change the name of the event (digital output), select the event by touching its current tag name. The pop-up keypad will appear allowing you to enter a new description. Once complete, select ‘Done’ and the new name will appear in the event tagname list box. Once all changes have been made, press the ‘Accept’ button to begin using the new labels. If the changes are not accepted, the new tagnames will not be used and the Orion-M will continue to use the previous labels.
8.4 Alarm Settings

The ‘Alarm Settings’ screen provides access to the Orion-M’s powerful alarm module that contains up to 30 user configurable alarms. These alarms can be assigned to any loop or monitor input in the system.

NOTE: After any and all changes made to any of the following alarm settings, you MUST press the ‘Accept’ button at the lower right of the screen in order to save the changes to the alarm. If you do not press ‘Accept’ prior to leaving the screen or going to the next alarm, all changes will be lost and the alarm will maintain its previous configuration.

The alarm number, AL#, in the upper left of the display, shows the current alarm being configured. The left and right scroll buttons above the alarm number, allow the user access each alarm in the system, by pressing left or right to go to the previous or next alarm.

The Input selection is used to select the loop or monitor input that will be used for the current alarm number. The same loop or monitor input can be used more than once, on any alarm.

The alarm Type selection is used to set the type of alarm. When set to ‘No Alarm’, the alarm is disabled. Available alarm type selections are as follows:

Process: A process alarm uses one or two absolute set points to define an alarm condition. A process alarm can be set for high only, low only or both high and low.

Deviation: A deviation alarm uses one or two set points that are defined relative to the control set point. High and low alarm set points are calculated by adding and/or subtracting offset values from the control set point. If the set point changes, the window defined by the alarm set points automatically changes with it. A deviation alarm can be set for high only, low only or both high and low.

NOTE: The deviation alarm type is not available for the monitor inputs. The monitor inputs are not associated with a control set point.

Percent Output (%Out): A percent output alarm uses one or two absolute set points to define the alarm condition. The alarm can be set for high only, low only or both high and low.

NOTE: The percent output alarm type is not available for the monitor inputs. Monitor inputs do not have control outputs.
Rate of Change (ROC): A rate of change alarm looks for an amount of change in the input over a pre-determined period of time. It uses a single ‘delta’ set point to define the amount of change allowed and a single time set point to define a time period in which the amount of change is allowed to occur. A rate of change alarm can be set for high only (alarm on rise), low only (alarm on fall) or both.

The **Alarm Mode Selections** are used to select the alarm action. Available selections are as follows:

**Self Clear/Latching:** A latched alarm will remain active after the alarm condition has passed unless acknowledged by the user. Latched alarms are acknowledged by the user in pressing the ‘Silence’ button on the Alarm Monitor screen or by activating a digital input configured for ‘Remote Alarm Silence’. An alarm that is not latched (self-clearing) will deactivate automatically when the alarm condition has passed.

**NOTE:** Latching alarms are acknowledged even when the alarm condition is still present when the user activates the alarm silence. The **latched alarm will then automatically clear once the alarm condition is no longer present**. If the alarm silence was not activated during the alarm period, the alarm will remain latched until the user activates the alarm silence.

**Close/Open on Alarm:** An ‘open on alarm’ condition means that the event output assigned to the alarm, will be energized in a non-alarm condition, i.e., fail-safe. A ‘close on alarm’ setting means that the output is normally open and will close in an alarm condition.

**Silent On/Off:** This is used to control the method by which an alarm is reported. When ‘Silent Off’ is selected, an alarm condition will trigger the system/audible alarm digital output (if configured in the system) and the screen background will turn red to indicate the alarm condition. The audible alert must then be manually silenced by pressing the silence button on the alarm monitor screen.

If ‘Silent On’ is selected, there will be no audible signal when an alarm condition is present. If the alarm is set to ‘self clear’, the screen background will not turn red and the alarm will not be reported on the alarm screen. If the alarm is set to latching, the alarm will be reported in order to notify the user to acknowledge the alarm.

**Inhibit On/Off:** When ‘inhibit off’ is selected, the alarm will activate immediately when the input exceeds the alarm set points as programmed. When ‘inhibit on’ is selected, the input must first enter the normal operating range (be above the low alarm set point and/or below the high alarm set point) before the alarm can be activated. Upon the next excursion beyond the alarm set points, the alarm will then activate.

The alarm inhibit feature is typically used on processes that, when in the off state, are in an alarm condition. This allows the process to be started prior to the alarm(s) being activated and shutting down the process.

**NOTE:** The alarm inhibit feature, when activated, inhibits alarm action from power-up of the Orion-M, or entrance into ‘online’ mode.

The **Output Assignment** can be used to assign one of the Orion-M digital outputs to the alarm. When the alarm activates, the output will work in conjunction with the alarm based on the ‘close on alarm’ or ‘open on alarm’ mode.

**NOTE:** The digital output must be configured as a process alarm output. If the digital output selected is not configured to be a process alarm output, it will not function according to the alarm settings. See the section on offline setup of Digital Outputs, for information on how to configure the digital outputs.
8.4.1 Set Points and Alarm Message

The alarm set points and alarm message are accessed by pressing the ‘Setpoints/Tag’ button at the lower left of the Alarm Settings screen.

NOTE: The low and high alarm set point fields are shown for Process, Deviation & Percent Output alarm types. Although both set point fields are shown, only the high SP is used for ‘high’ alarms, low for all ‘low’ alarms and both fields are used for Process, Deviation & Percent Out ‘both’ alarm types.

The **Low Alm SP** defines the input value that will trigger a low side alarm. It must be lower than the alarm high set point.

The **Hi Alm SP** defines the input value that will trigger a high side alarm. It must be higher than the alarm low set point.

The **Deadband** (often referred to as alarm hysteresis) defines how far the input must return into the normal operating range before the alarm can be cleared.

NOTE: See the following section for information on setting the set point for a rate of change (ROC) alarm.
The alarm on delay time, On Dly (Secs), can be used to delay the activation of the alarm. If the input exceeds the alarm setting, but then re-enters the normal operating mode before the alarm delay time expires, the alarm will not be activated. The allowable time setting is from 0 – 32,760 seconds. A value of zero (0) disables the alarm delay and the alarm will activate immediately when the input exceeds the alarm settings.

The **Alarm Inhibit On Duration in Seconds** works in conjunction with the alarm inhibit mode selection. If the alarm inhibit mode is enabled, the inhibit on duration time can be used to set the maximum length of time the alarm can be inhibited. For example, if a process is started, and the alarm inhibit is enabled, what happens if the process never reaches its normal operating mode. The process will operate indefinitely in an alarm condition unless an operator notices it, because the alarm was never activated. It never entered the normal range to activate it.

By setting the inhibit duration, the alarm inhibit will be disabled once the start-up time period expires. In the above example, the alarm would then sound for the process, event though it never reached normal operating conditions. This would then alert an operator to the problem so that it can be corrected. The allowable time setting is from 0 – 32,760 seconds. A value of zero (0) disables the alarm inhibit on duration timer, so inhibit will be on indefinitely until the alarm input reaches normal operating range.

The **Alarm Message** is the text notification that appears on the Alarm Monitor screen when the alarm activates. This message can be edited (up to 24 characters maximum) so that the alarm message more accurately describes what the alarm means.

### 8.4.1.1 Rate of Change (ROC) Alarm Set Point

When rate of change (ROC) is selected as the alarm type (high, low or both), the alarm set point is defined by an amount of change in the process value over a period of time in minutes.

The **Delta SP** defines the allowable change of the selected loop or monitor input (rising or falling) over the time period set in the ‘Time(min)’ field. The time period, **Time(min)**, defines the minimum period of time that the input must take to change by the amount set in the ‘Delta SP’ field. If the input changes by more than the set amount in less than the set time period, the alarm is activated. For example, if an alarm was to be generated on a control loop if its input exceeds a rate of change of 100 degrees per hour, the alarm would be entered with a Delta SP of 100 and a Time(min) of 60 (1 hour).

The **Deadband** (often referred to as alarm hysteresis) is subtracted from the Delta SP in order to define the rate of change that the loop or monitor input must fall below in order for the alarm to clear. For example, if the alarm set point was 100 degrees per hour and a dead band of 10 was entered, the rate of change of the input would have to slow to less than 90 degrees per hour (100 – 10) in order for the alarm to clear.
NOTE: The Orion-M has a limitation on the minimum rate of change that can be detected. This value is 0.002 ‘process units’ per second. When changing either the ‘Delta SP’ or ‘Time(min)’ fields, the Orion-M will automatically coerce the other field to the minimum allowed value, if the rate of change being entered is too small.

For example, a rate of change of 2.0 degrees per hour [Delta SP = 2.0, Time(min) = 60 (1 hour)], is 0.33 degrees per minute or 0.0005 degrees per second, which is too slow of a rate of change for the Orion-M to accurately detect. The Orion-M will either coerce the ‘Delta SP’ to 7.2 if the time was the last value entered, or coerce the ‘Time(min)’ to 16.7 minutes if the delta SP was the last value entered. Both of those entries, 7.2 degrees per 60 minutes or 2.0 degrees per 16.7 minutes, are both equivalent to 0.002 degrees per second (delta SP/time).

8.4.2 Output Defeat

The alarms can be used to disable outputs of the Orion-M in an alarm condition. To assign which outputs are to be disabled when the alarm occurs, touch the ‘Output Defeat’ button.

Select which outputs are to be turned off when the alarm is active, and press the ‘Accept’ button to save the settings. Press ‘Done’ to return to the Alarm Settings screen.
8.5 Barcode Reader Setup

The ‘Barcode Reader Setup’ screen provides access to the settings for the Orion-M’s optional barcode reader. These include settings to turn the barcode reader on and off, applying a prefix to scanned data for insertion into an active data log file as an operator event and a test window for verifying proper operation.

The barcode reader is enabled/disabled through the **Barcode = Operator Event while data logging** drop down menu. The options are either ‘ON’ or ‘OFF’. When the bar code reader is turned on, and a data file is currently active, the scanned value will be entered into the data log file as an operator event.

The **Prefix for Barcode Scan** field allows the user to enter up to 16 characters that will then be used as a prefix to the scanned value when it is inserted into the active data log file. This can be used as a tag to describe what the scanned value represents, i.e., Lot or Batch number for example.

**NOTE:** Any changes made to the above settings must be saved in order for them to take affect. When changes are completed, press the ‘Accept’ button to save the new settings and begin using them.

The **Bar Code Test** field allows the operator to test the operation of the barcode scanner. As a bar code is swiped by the reader, the scanned value will appear in this field. If upon scanning a bar code, no value appears in this field, check the wiring and communication settings of the barcode scanner to be sure that it is connected and set up properly.

**NOTE:** When scanning bar codes, a minimum time period of 3 seconds is required between each code scanned. This provides the time necessary for the Orion-M to acquire the code and insert it as an operator event into a running log file. If multiple bar codes are scanned to quickly, the Orion-M may miss a scan because it is still processing the previous bar code scanned.

8.5.1 Barcode Reader Communication Settings

In order for the barcode reader to communicate properly with the Orion-M, it must be set with the proper communication settings. This includes baud rate, data bits, stop bits, parity and start/end of transmission characters as follows:

- Baud rate = 9600 baud
- Data bits = 7
- Stop bits = 1
- Parity = even
- Preamble = STX (0x02)
- Postamble = ETX (0x03)
The preamble and postamble are the start of transmission and end of transmission characters that must be used to frame the barcode transmitted to the Orion-M so that it recognizes the beginning and end of the transmission. All other terminator, BCC, ACK and/or handshaking characters must be disabled.

8.5.1.1 Setting up the Unitech MS-120-2 Barcode Scanner

The following instructions are provided for the Future Design recommended Unitech MS-120-2 barcode scanner. These instructions do not apply to other makes or models of scanner. Consult the manufacturer's manual for other makes or models for information on how to set the proper communications settings.

NOTE: The steps below are assuming manufacturer default settings are in place. If the scanner settings are unknown, restore the scanner to manufacturer defaults by scanning barcode ‘enter group 1’ on page 5 of the MS-120 Series Programming Manual and then scanning the ‘factory defaults’ barcode at the bottom of page 5. Scan ‘exit’ to complete the process.

For communication settings see page 11 (RS232 Serial Setting) of the MS-120 Series Programming Manual

Step 1 scan barcode at top of page 11 for ‘enter group 4’

Step 2 scan barcode C2 for parity on page 12 and then scan the barcode for the number 0 on page 11

Step 3 scan barcode C3 for data bit on page 12 and then scan the barcode for number 0 on page 11

Step 4 scan the barcode for ‘exit’ on page 11 to complete RS232 settings

For pre/postamble settings see page 13 (Scanner) of the MS-120 Series Programming Manual

Step 1 scan barcode at top of page 13 for ‘enter group 5’

Step 2 scan barcode D1 for terminator at top of page 14 and then scan the barcode for the number 3 on page 13

Step 3 scan barcode PP for preamble at bottom of page 14 and then scan the barcode for STX at top of page 30 (2nd down on left)

Step 4 scan barcode OO for postamble at bottom of page 14 and then scan the barcode for ETX at top of page 30 (2nd down on right)

Step 5 scan the barcode for ‘exit’ on page 13 to complete settings
8.6 Web Server/Modbus/VNC

This 'Web Server/Modbus/VNC' screen provides access to the Orion-M's communications settings. This includes settings for the optional Modbus serial interface, and the standard web server and VNC Ethernet interfaces. It also provides the Orion-M's IP address, which is required for using the VNC or web server interfaces.

The Modbus slave address (Modbus Slave Add) sets the address of the Orion-M on the optional serial communications interface. Valid addresses are 1 to 31.

The VNC address and password (VNC Add/Pwd) set access rights to the Orion-M's VNC server. Valid addresses are from 0 to 255. The VNC password selection defines the connection mode for the server. The selections are none and 'pwd' which requires users to enter the password when logging in to the Orion-M over the VNC interface.

The VNC Device Name field is used to enter a name (up to 35 characters) that can better identify the Orion-M for users logged into the VNC interface. The name entered here will be used on the VNC header window on a PC, so that if multiple VNC clients are open to different systems, each one can be identified.

The VNC Password field is used to enter the password (up to 28 characters) that a user must enter for the VNC interface to connect to the Orion-M if the VNC password is enabled.

The Web Server On/Off pushbutton is used to enable or disable the web server interface. When the button is highlighted green, the web server is enabled. When the button is gray, the web server is disabled.

The VNC Server On/Off pushbutton is used to enable or disable the VNC server interface. When the button is highlighted green, the VNC server is enabled. When the button is gray, the VNC server is disabled.

The Device IP Address field is a static field that provides the IP address of the Orion-M which is required for connecting over the VNC and web server interfaces. For more information on Device IP and other LAN information refer to Section 10, Communications.

**NOTE:** Any changes made to the above settings must be saved in order for them to take affect. When changes are completed, press the ‘Save’ button, and then cycle power to the Orion-M. The new settings will only take affect when the Orion-M boots up.
8.7 Email

The Orion-M email server has the ability to send alarm messages to email and SMS addresses. Up to 30 addresses can be programmed into the system. Each one can be configured to send emails, SMS text messages or both. Whenever an alarm occurs, the Orion-M will send an alert to the specified address for each user in the list.

8.7.1 Email Address Entry

Select the ‘Address Entry’ tab to add new addresses to the system. For each entry, enter the recipient’s name, email address and/or SMS address (up to 50 characters each). Then check the email alarms and/or SMS alarms check box(s) to specify which address(s) the alarm messages are to be sent to. Press the 'Create Address' button to add the user to the list.

**NOTE:** The SMS address is specific to the service provider. Each service provider has their own unique address; however, the phone number is always the “name” for the address entry. Below are common examples for some of the more common cell phone providers. There are internet sites with this information that cover most of the providers, or when in doubt, contact your service provider for the proper address format.

<table>
<thead>
<tr>
<th>Cell Phone Provider</th>
<th>Maximum message length</th>
<th>SMS Address to use (where 0123456789 is an example for a 10 digit cell phone number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cingular</td>
<td>150 characters</td>
<td><a href="mailto:0123456789@mobile.mycingular.com">0123456789@mobile.mycingular.com</a></td>
</tr>
<tr>
<td>Cingular (GSM)</td>
<td></td>
<td><a href="mailto:0123456789@cingularme.com">0123456789@cingularme.com</a></td>
</tr>
<tr>
<td>Cingular (TDMA)</td>
<td></td>
<td><a href="mailto:0123456789@mmode.com">0123456789@mmode.com</a></td>
</tr>
<tr>
<td>Nextel (now part of Sprint Nextel)</td>
<td>140 characters</td>
<td><a href="mailto:0123456789@messaging.nextel.com">0123456789@messaging.nextel.com</a></td>
</tr>
<tr>
<td>Sprint</td>
<td></td>
<td><a href="mailto:0123456789@sprintpaging.com">0123456789@sprintpaging.com</a></td>
</tr>
<tr>
<td>Sprint PCS (now Sprint Nextel)</td>
<td>160 characters</td>
<td><a href="mailto:0123456789@messaging.sprintpcs.com">0123456789@messaging.sprintpcs.com</a></td>
</tr>
<tr>
<td>T-Mobile</td>
<td>140 characters</td>
<td><a href="mailto:0123456789@tmomail.net">0123456789@tmomail.net</a></td>
</tr>
<tr>
<td>Verizon</td>
<td>160 characters</td>
<td><a href="mailto:0123456789@vtext.com">0123456789@vtext.com</a></td>
</tr>
<tr>
<td>Verizon PCS</td>
<td></td>
<td><a href="mailto:0123456789@myvzw.com">0123456789@myvzw.com</a></td>
</tr>
</tbody>
</table>
8.7.2 Email Addresses

Selecting the ‘Email Addresses’ tab allows the user to view the list of addresses entered into the Orion-M. By using the scroll bar at the bottom of the list box, you can view the name, addresses, and notification selections for each user. To delete a user, touch the name of the user in the list box and press the ‘Delete’ button. This will permanently remove the user from the list.

8.7.3 Email Settings

The ‘Email Settings’ tab provides access to the email server configuration, which is how the Orion-M is able to connect and send email messages over its Ethernet connection. Each field may have up to 50 characters.

The Login Name is the name required for the Orion-M to log into your company’s mail server. You can use your login if one is not set up specifically for the Orion-M on your network. Contact your network administrator for assistance.

The Return Address is the address given for the Orion-M on your company’s mail server. The Orion-M does not accept email messages; however, this field is required for proper email delivery for security/anti-spam purposes. If using your personal login name, you can also use your personal email address if one is not set up specifically for the Orion-M on your network. Contact your network administrator for assistance.

The Password field is used for entering a password, if required by your network server, to send email. Contact your system administrator for assistance.
This **SMTP Server** field is for entering the address of the email server used for sending emails. This must be a valid mail server for which the above settings allow the Orion-M access. Contact your system administrator for assistance.

This **Email Subject** field is used to enter a subject line for emails and/or SMS text messages. It can be used to provide an identifier to the recipients of the alarm message to know which chamber it is coming from.

**NOTE:** *It is recommended to put some form of entry in this field. It can be left blank; however, many firewalls and spam filters will filter out messages without subject lines. That may prevent recipients from receiving the email. It can also be useful for identifying a particular unit on the factory floor.*

Once all settings have been made, be sure to press the ‘Save’ button to store the values so that on the next power up, they settings will be retained. The body of the email/SMS text message will contain the description of the alarm condition on the Orion-M as would appear on the alarm monitor screen of the Orion-M. If the mail server is down, or the Orion-M is not connected to the network, the message will not be sent and a local alarm on the Orion-M will indicate a transmission failure.

**NOTE:** *The Orion-M must have a valid connection to your network for the email server to operate. The Orion-M receives its IP address from DHCP on your network and this only occurs during boot. Therefore, make sure the Orion-M is properly connected to your network and cycle power to the Orion-M in order to obtain a valid IP address and be properly connected to the network.*

### 8.7.4 Sending Email Messages

The Orion-M provides the user with the ability to send short email messages to users configured in the Orion-M’s email server. To send a message, select ‘New Email Message’ from the Email menu.

Press the ‘Compose’ button to create a brief message using the pop-up text keypad (up to 100 characters). The completed message will be shown in the message window. Press the ‘Send’ button to select the email recipients you wish to receive the message and send the message to them.
9 Offline Setup

The Offline Setup options are available from the Setup menu. These settings do not include the OEM setup of the Orion-M. Refer to the documentation provided by your OEM regarding any loop control and monitor point setup. Note that prior to entering offline setup, profile operation and data logging must be manually stopped. When in offline mode, all Orion-M digital and analog outputs will be turned off.

To assist in setup and documentation of the Orion-Mi, see the “Orion-M Configuration and Setup Worksheets” Excel file provided on the Future Design Controls website (http://www.futuredesigncontrols.com/Orion-M.htm). This document provides setup and configuration forms and templates for all of the Orion-Mi features including those provided under Offline Setup.

The offline ‘Setup’ menu provides the following functions:

<table>
<thead>
<tr>
<th>Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degrees C/F: Setting for temperature units.</td>
</tr>
<tr>
<td>Maintenance Items: View system output operational information (cycles, hours on).</td>
</tr>
<tr>
<td>Maintenance Items Setup: Settings for system output maintenance data.</td>
</tr>
<tr>
<td>Set Date/Time: Settings for system date and time</td>
</tr>
<tr>
<td>Calibrate Touch Screen: Access to touch screen calibration.</td>
</tr>
<tr>
<td>Help/Voice Assistance: Settings for voice assisted help.</td>
</tr>
<tr>
<td>Import/Export Setup: Access to the Orion-M configuration and back-up utilities.</td>
</tr>
<tr>
<td>Exit Application: Exit Orion-M application and access to the Orion-M configurator.</td>
</tr>
</tbody>
</table>

The offline ‘I/O’ menu provides the following functions:

<table>
<thead>
<tr>
<th>I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor Input Offset: Settings for input offset calibration (process monitor inputs).</td>
</tr>
<tr>
<td>Analog Input Setup: Settings for optional analog input operation.</td>
</tr>
<tr>
<td>Analog Output Setup: Settings for optional analog output operation.</td>
</tr>
<tr>
<td>Digital Input Setup: Settings for digital input operation.</td>
</tr>
<tr>
<td>Digital Output Setup: Settings for digital output operation.</td>
</tr>
<tr>
<td>Digital IO Monitor/Force: View current digital input status and force digital outputs on (troubleshooting).</td>
</tr>
</tbody>
</table>
9.1 Degrees C/F Units Selection

The Orion-M can display temperatures in either degrees C or F. To change the temperature display units, select ‘Degrees C\F’ from the offline Setup menu.

![Temperature Units]

Press the desired units button, and then press ‘Yes’ to make the selection. The button for the selected temperature units will be illuminated green once selected.

**NOTE:** When changing display units, profile set points will not be converted between units. Separate profiles are required for each temperature range. Operating the Orion-M with profiles that have been written using alternate units, could cause property damage or personal injury.

The temperature units selection only affects control loops and monitor inputs configured as temperature, i.e., controllers or monitor input cards with a temperature input device such as a thermocouple or RTD. The units display for loop controls and monitor input cards configured with linear inputs (mA or Vdc) will not be affected by this selection.

9.2 Maintenance Items

The maintenance counters provide service interval alerts and life total service numbers for each of the digital outputs available on the Orion-M. The maintenance intervals (counter set points) are adjustable and can be set to match service intervals for equipment operated by the Orion-M.

![Maintenance Items]
Two service alert set points are provided for each output of the Orion-M. One service alert is available for the number of times each output turns on and is adjustable from 0 to 4,000,000,000 cycles. The second service alerts is for ‘on’ time and is adjustable from 0.0 to 4,000,000.0 hours. To adjust a counter set point, select the output from the list by touching its description. The current set point for that output will be shown below the output list as the ‘Current Counter Setpoint’. Enter the desired set point for the output in the ‘New Setpoint’ field and press the ‘Enter’ button.

**NOTE:** To adjust the cycle counter, you must be viewing the elapsed interval or life total counts for the outputs. To adjust the set point for hours of operation, you must be viewing the elapsed run or total life hours of the outputs. See section 9.2.1, Maintenance Items Setup.

When a maintenance interval is exceeded, a ‘maintenance alert’ can be set to appear on the alarm monitor screen. This alert will notify the operator that service should be performed at the next available down period. However, the alert will not be able to be cleared until the service counter that has been exceeded is reset. In order to determine which service counter has been elapsed, check the ‘Exceeded’ column for the cycle count and run hours of each output. If the count has been exceeded, it will be indicated in this column. To clear the maintenance interval count, you must select the count that has been exceeded by touching its description on the Maintenance Items screen. Press the ‘Clear’ button in the lower right of the screen and select ‘Yes’ to reset the interval count.

### 9.2.1 Maintenance Items Setup

The Maintenance Items display options as well as alert action can be adjusted from the 'Maintenance Items Setup' screen.

The Interval/Total Setup list box provides the available maintenance items display selections. The selected item will be indicated by the green LED next to the item. The selections are for interval and life total cycle counts and hours on. The interval counts and hours are what generate the maintenance alert when the set point is exceeded for the output. These are the counts that must be reset to clear the maintenance alert from the alarm monitor screen.

The Enable/Disable Maints Alarms list box provides the available maintenance alert options, on or off. Service alerts are turned off by default.

To make changes, set the desired user state by touching the item in the list box. Note that the interval/total selections are mutually exclusive, i.e., only one can be selected at a time. Touching another item in the list will turn its user state on and turn all others off. Once the desired selections have been made, press the ‘Accept’ button to save the new selections. The green LED next to the newly selected items will then illuminate to indicate that the setting has been saved.
9.3 Set Date and Time

The date and time can be adjusted by selecting ‘Set Date/Time’ from the offline Setup menu. The current date and time will be displayed in the field entry windows under the ‘set time’ tab.

To make adjustments, touch the desired field entry box. The pop-up keypad will appear allowing a new value to be entered. Once all corrections are made, press the ‘Set Time’ button. An alert window will appear stating that setting the date/time will reset all trends back to zero. Press ‘Yes’ to continue or ‘No’ to not accept the new time changes.

NOTE: The time is entered in a 24 hour time format. To convert time from a 12 hour format (AM/PM) into 24 hour format, add 12 to the hours for PM time. For example, 1pm will be a value of 13 (1 + 12) for hours. A time of 5:30pm will be 17 hours, 30 minutes.

9.3.1 Time Options

Select the ‘Time Options’ tab to configure the time zone and national time server clock settings. If the Orion-M is connected to the internet, these settings can be used to have the Orion-M automatically synchronize its time with one of the many nationally provided time servers.

To enable the national time server, select your time zone and which time server you wish to use from the drop down menu selections. Place a check in the check box by touching it and press the ‘Save’ button. The Orion-M will synchronize its time with the selected national time server at 2:00AM each day. If the Orion-M is
not connected to the internet, a local alarm message will occur, ‘NTS Ping Failed. Check Cable’, to indicate that the time server could not be located.

**NOTE:** The Orion-M must have a valid connection to your network for the timer server to operate. The Orion-M receives its IP address from DHCP on your network and it only occurs during boot. Therefore, make sure the Orion-M is properly connected to your network and cycle power to the Orion-M in order to obtain a valid IP address and be properly connected to the network.

### 9.3.2 DST Settings

Select the ‘DST Settings’ tab to configure daylight saving time options. The daylight savings time options allow the user to set the start date and end date for daylight savings time.

```plaintext
If your area utilizes daylight saving time, set the start and stop dates for daylight savings and check the ‘Daylight Savings Enabled’ checkbox. Press the ‘Save’ button to store the settings. The Orion-M will then automatically update its clock for daylight savings time.

**NOTE:** If the NTS time server setting is enabled, and the selected time zone uses daylight savings time, daylight savings must be enabled or the clock will not be set correctly.
```
9.4 Touch Screen Calibration

After extended use and many hours of operation, it may be necessary to recalibrate the touch screen of the Orion-M. A typical sign that the screen may be out of adjustment, is inaccurate responses when attempting to press buttons, check boxes or adjust fields on the display. The calibration utility is provided in order to readjust the screen when this happens.

**NOTE:** Even after calibration, some fields may require finesse to operate. Check boxes require precise presses even when the screen is in full calibration. Use the tip of your finger or a stylus if necessary to operate the unit.

To access the screen calibration utility, select ‘Calibrate Touch Screen’ from the offline Setup menu. An alert message will appear stating that the application will be disabled, press ‘Yes’ to continue.

From the ‘CECP’ window, touch the ‘Touch Screen’ icon to start the calibration utility. A ‘Touch Screen Settings’ message box will appear with a choice of either ‘Calibrate’ or ‘Test’. To begin calibration, press the ‘Calibrate’ button. If you just wish to verify the screen calibration, then press the ‘Test’ button.

When calibration is started, crosshairs will appear on the screen. At each crosshair position, touch the screen at the center of the crosshairs and hold position until the crosshairs move to the next calibration point. Repeat this for each position in order to set the calibration. The calibration requires five points, the center and four corners.
Once complete, the calibration utility will exit and return to the System settings window. Press the ‘Quit’ icon at the lower right corner of the CECP window to close the window and return to the Orion-M application and resume normal operation.

9.4.1 Backlight

The CECP window also provides access to the backlight adjustment of the Orion-M touch screen. To access these settings, perform the procedure noted in section 9.4 for touch screen calibration to access the CECP utilities; however, do not perform the calibrate touch procedure.

To adjust the backlight setting, select the ‘Screen Saver’ icon from the CECP window. Using the drop down menu or left and right arrow buttons, select the time period for which the backlight should turn off after no activity. The life of the display will be extended by allowing the backlight to turn off after a period of inactivity.

Once the selection has been made, press the ‘OK’ button to accept the entry and close the Screen Saver window. Press the ‘Quit’ icon to exit the CECP utility and return to the Orion-M application to resume normal operation.
9.5 Import\Export Setup

The ‘Import\Export Setup’ screen provides access to the import\export setup utility of the Orion-M. This utility allows the user to back-up the entire configuration of the Orion-M and save it to a file for ‘safe keeping’ in case of system damage due to a lightning strike, etc. The utility also allows the Orion-M to be configured with a push of a button by selecting from a list of preconfigured setups that could be created and saved on an I-Stick, for loading a configuration to a new Orion-M system.

When the Export button is pressed, the Orion-M configuration data will be written to the I-Stick. The export file function will use the name entered in the text box to the right of the export button and create a directory on the I-Stick with that name, to contain the configuration data. The filename can be entered with up to 10 characters which permits multiple configurations to be identified and saved for later retrieval.

NOTE: The I-Stick must first be inserted into the USB port prior to starting the export function.

The export file will be saved with a name format of ‘cfg_filename_mm_dd_yy_hh_mm_ss’ to identify the configuration according to the date and time it was created. This prevents multiple configuration files with the same name from overwriting previous files. It also allows the user to identify a backup of the Orion-M so that it could be reconfigured to a previous date if multiple back-ups are created.

The Import button is used to write the configuration data to the Orion-M from the currently loaded file. To load a configuration file, the I-Stick must first be inserted into the USB port. When the Load Config File button is pressed, a list of available configuration files from the I-Stick will be shown. Select the desired file from the list and press ‘Open’ to load the file. Once the file is loaded, the import process can begin. Pressing the ‘Import’ button will begin the process. When the import is complete, you must cycle power to the Orion-M so that the new configuration is loaded into the runtime memory for proper operation.

IMPORTANT: When importing a configuration file to the Orion-M, all of the current settings in the Orion-M will be overwritten. Do not import files that are not intended for use with the current hardware configuration of the Orion-M.

Once the import is complete, you must cycle power to the Orion-M so that the new configuration data is properly loaded into the Orion-M runtime memory and proper settings are used for loop controls and monitor inputs.
9.6 Help/Voice Assistance

The ‘Help/Voice Assistance’ screen is used to select the language for all of the online help and turn the voice assistance feature on and off.

9.7 Exit Application

The ‘Exit Application’ screen allows the user to quit the Orion-M runtime software and return to the CE.Net operating system. This operation is NOT recommend with the exception of users who are in charge of configuration of the system, due to the danger of editing or removing files by accident.
9.8 Monitor Input Offset

The monitor option provides up to 15 additional process inputs, which can be configured from any combination of thermocouple, analog and RTD inputs from the optional monitor input modules. The monitor input option can also be configured to display the second input from compatible loop controllers attached to the system (one from each available control loop up to the maximum of 15).

The calibration range is fixed within the thermocouple, analog and RTD monitor input cards; however, the user can input a linear offset in order to adjust for sensor tolerances and lead affects. When the second input of the control loops is used for the monitor inputs, the loop controllers provide calibration, range and input bias adjustments. The input bias of the loop control can be used to set the linear offset for the input, or the monitor input offset of the Orion-M can be used.

To enter an offset, enter the number of the input in the 'Input Num' field. Valid entries are from 0 up to 14 for a total of 15 monitor inputs (depending upon number configured). The current reading from the input will be shown in the Cur PV' field.

To adjust the input reading, enter the offset value in the ‘+- Offset’ field and verify the reading. The offset range is -32760 to 32760 for a decimal point resolution of zero, -3276.0 to 3276.0 for a decimal point of one, -327.60 to 327.60 for a decimal point of two and -32.760 to 32.760 for a decimal point resolution of three. Be sure to press the 'Accept' button to save the new offset value before proceeding onto other inputs or exiting the monitor inputs screen or the offset value will be lost.

**NOTE:** The inputs associated with the control loops, are not accessible through this menu item. They must be accessed directly from the loop controllers. Refer to the loop control’s operating manual on Calibration or entering a bias adjustment as described above for the monitor inputs.

*If using the monitor input offset of the Orion-M to offset the reading for the second input of a loop control, the value for the monitor input as shown on the Orion-M will not match that of the loop controller’s display. The monitor input offset of the Orion-M only offsets the reading on the Orion-M display, not on the loop control. Therefore, to avoid confusion when using the second input of the loop controls for monitor points, it is recommended that any input offset is applied through the loop controller’s input bias setting and not the monitor input offset of the Orion-M.*
9.9 Analog Inputs

The Orion-M can have up to 14 analog inputs which are used for remote set point inputs. This menu item will appear if the Orion-M is equipped with analog inputs for remote set point operation.

To configure an input, first select the input number (0-13) by entering the value in the ‘Analog Input #’ field. Upon entering the value, the inputs current configuration will be loaded and indicated by the LED’s next to the selected type and loop selection. The minimum and maximum values will be shown in the ‘Input Min’ and ‘Input Max’ fields.

To make changes to the analog input’s configuration, select the desired input type by pressing the ‘Volts’ or ‘Current’ button to select a 2-10V or a 4-20mA input signal. Select the desired loop by changing its user state to ‘On’ and enter the desired minimum and maximum values for the loop set point that the input is to represent. The input range is -32760 to 32760 for a decimal point resolution of zero, -3276.0 to 3276.0 for a decimal point of one, -327.60 to 327.60 for a decimal point of two and -32.760 to 32.760 for a decimal point resolution of three. Once all modifications have been made, press the ‘Accept’ button to save the changes. If you do not press the ‘Accept’ button, all changes will be lost if you leave the screen or enter a new analog input number.

The Input Use selection buttons, ‘None’ and ‘Remote SP’ enable and disable the analog input. This allows the analog input configuration to be maintained, but disable its operation until it is required. Elect ‘None’ to prevent the analog input from taking set point control over the selected loop. Press the ‘SP’ button to enable the analog input set point control override.

**NOTE:** If the analog input type is changed from voltage to current or vice versa, power must be cycled to the Orion-M controller in order for the input to switch signal types.

9.9.1 Remote Set Point Operation

Once an input is configured for loop set point control, as the analog input signal is varied, it will provide a linear set point change from the minimum to maximum value over the range of the input (2-10Vdc for voltage input and 4-20mA for current selection).

Signals below 2Vdc for the voltage input type, and below 4mA for the current input type, will disable remote setpoint control so that the loop setpoint can be changed manually at the Orion-M. It also prevents the remote set point control from setting a false input if the signal wires are cut or the signal is lost from the remote set point source device.
NOTE: When remote set point control is activated, it will override the local set point as well as the profile set point if a profile is running. Once deactivated, the loop set point will return to the previous local set point of the loop, i.e., the value prior to the remote setpoint being activated and taking control of the loop’s set point, or the current profile set point if a profile is running.

If the minimum or maximum range exceeds the set point limits for the loop as set in the Orion-M configuration, the Orion-M will limit the set point to the minimum or maximum value as defined under the loop’s configuration.
9.10 Analog Outputs

The Orion-M can support up to seven analog outputs which can be used to retransmit set points, process variables or percentage of output from the installed control loops. If the Orion-M is equipped with optional analog outputs, this menu item will appear in the I/O menu list.

The analog outputs can be configured to retransmit signals either in a 0-10V or 4-20mA range. The minimum and maximum values of the output can be set to correspond to a specific value of the retransmitted source. The output will retransmit this source linearly from the minimum to maximum range. To configure an analog output, select ‘Analog Outputs’ from the I/O menu.

To configure an output, first select the output number by entering the value in the ‘Retransmit Output #’ field. Valid selections are from 0 to 6. Upon entering the value, the output’s current configuration will be loaded and indicated by the LED’s next to the selected type and source. The minimum and maximum values will be shown in the ‘Out Min’ and ‘Out Max’ fields.

To make changes to the output’s configuration, select the desired output type by pressing the ‘Volts’ or ‘Current’ button to select a 0-10V or a 4-20mA output signal. Select the desired loop source by setting its user state to on and enter the new minimum and maximum values for which the output is to retransmit. The output range is -32760 to 32760 for a decimal point resolution of zero, -3276.0 to 3276.0 for a decimal point of one, -327.60 to 327.60 for a decimal point of two and -32.760 to 32.760 for a decimal point resolution of three. Once all modifications have been made, press the ‘Accept’ button to save the changes. If you do not press the ‘Accept’ button, all changes will be lost if you leave the screen or enter a new analog output number.

**NOTE:** If the analog output type is changed from voltage to current or vice versa, power must be cycled to the Orion-M controller in order for the output to switch types.

*When the Orion-M is offline, the outputs will go to their minimum output state, 0Vdc or 4mA.*

9.10.1 Retransmitting Loop Percentage of Output

Depending upon the loop control being used, the percentage of output value for bimodal control (heat/cool) is represented differently. For example, FDC 100 and 300 series controls represent heat output as a value from 0% to 100% while the cool output is represented as a value from 0% to -100%. Other controls supported by the Orion-M may split the standard 0% to 100% range and use 50% to 100% for heating and 50% to 0% for cooling.

If the analog output is being used to control the position of a cooling valve or SCR power controller of a heater bank for example, it is important that the analog output supply only the signal for the proper heating or cooling range in order to properly control the amount of cooling or heating applied to a process.
The Orion-M provides the ability to supply only the heating output, cooling output or a combination of heating and cooling outputs from its analog outputs. For example, if an FDC 300 series control is used, setting an ‘Out Min’ to ‘Out Max’ range of 0% to 100% will result in an analog output of 0-10Vdc or 4-20mA for an output of 0% to 100% heating. If a different model of controller is used that represents heating as 50% to 100% with cooling from 50% to 0%, setting an ‘Out Min’ to ‘Out Max’ range of 50% to 100% will result in an analog output of 0-10Vdc or 4-20mA for an output of 0% to 100% of the heat output.

In order to retransmit a cooling percentage of output, the Orion-M allows the analog output range to be inverted relative to the value representing the cooling percentage of output. This allows the positoner of a cooling valve for example, to receive a 0-10Vdc or 4-20mA signal representing 0% (full closed) to 100% (full open) of cooling even if the cooling percentage represented by the controller is 50% (no cooling output) to 0% (full cooling output).

For example, if 0% to -100% represents no cooling to full cooling, setting the ‘Out Min’ field to 0% and the ‘Out Max’ field to -100% will produce an analog output of 0-10Vdc or 4-20mA for an output of 0% to 100% cooling. If a model of controller is used that represents cooling as 50% to 0% while heating is represented as 50% to 100%, setting an ‘Out Min’ to ‘Out Max’ range of 50% to 0% will result in an analog output of 0-10Vdc or 4-20mA for an output of 0% to 100% of the cool output.

**NOTE:** The analog outputs always treat the ‘Out Min’ field as the 0Vdc or 4mA output value and the ‘Out Max’ field as the 10Vdc or 20mA output value. This allows any portion of a control loop’s output range to be retransmitted and represented as a range of 0% to 100% of output or 100% to 0% of output.
9.11 Digital Inputs

The Orion-M provides eight digital inputs standard, and is configurable up to 16. The inputs can be used as alarm inputs, used to start and stop a profile, start and stop data logging or even disable communications to the Orion-M control loops. The digital inputs can be configured to work on either a low to high transition or a high to low transition. Upon seeing the selected transition, the input will perform the action selected from the input mode list. To configure a digital input, select 'Digital Inputs' from the I/O menu.

To configure an input, first select the input number by entering the value in the 'Digital Input #' field. Valid selections are 0 up to 15. Upon entering the value, the input's current configuration will be loaded and indicated by the LED's next to the selected transition mode and function.

To make changes to the input's configuration, select the desired transition mode and function for the input. Once all changes have been made, press the 'Accept' button to save the changes. If you do not press the 'Accept' button, all changes will be lost if you leave the screen or enter a new digital input number.

NOTE: More than one digital input can be configured for the same function. If more than one is set for the same function, make sure that they do not interfere with each other or the selected function they are to perform may not operate as expected.

The Transition mode selects the change in input state that makes the input perform the required function.

Off to On: This setting sets the input up to perform the desired function when the input goes from an off state to an on state. This requires the application of 24Vdc power to the input.

On to Off: This setting sets the input up to perform the desired function when the input goes from an on state to an off state. That requires the removal of 24Vdc power from the input.

The Digital Input Function defines what event is to happen when the input meets the transition state.

* Alarm Input: When selected, the input will provide a visual alarm notification on the Orion-M's alarm monitor screen. Using the ‘I/O Defeat’ selection, the input can be configured to disable specific digital outputs of the Orion-M. The alarm condition will be maintained as long as the input is activated. The alarm will not clear until the input returns to its deactivated state and the alarm is silenced on the Orion-M alarm monitor screen or through a digital input configured as ‘Remote Alarm Silence’.
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Start Profile:</strong></td>
<td>When selected, the input will start the currently loaded profile at step one. If a profile is currently running, no action will occur. This is a 'single-shot' activation in which the input must make the required transition state in order to activate the function.</td>
</tr>
<tr>
<td><strong>Pause Profile:</strong></td>
<td>When selected, the input will put a running profile, into the hold state. If a profile is not currently running, no action will occur. This is a 'single-shot' activation in which the input must make the required transition state in order to activate the function.</td>
</tr>
<tr>
<td><strong>Resume Profile:</strong></td>
<td>When selected, the input will put a profile that is in hold, into the run state. If a profile is not running or the profile is not currently in hold, no action will occur. This is a 'single-shot' activation in which the input must make the required transition state in order to activate the function.</td>
</tr>
<tr>
<td><strong>Terminate Profile:</strong></td>
<td>When selected, the input will terminate the profile. This will also turn off all system events. If a profile is not running, no action will occur and event status will not be affected. This is a 'single-shot' activation in which the input must make the required transition state in order to activate the function.</td>
</tr>
<tr>
<td><strong>Wait for Event:</strong></td>
<td>When selected, the input acts as a trigger for the profile wait for function. The input can then be selected in the profile to pause the current step until the input is activated.</td>
</tr>
<tr>
<td><strong>Advance Previous Step:</strong></td>
<td>When selected, the input will advance the profile to the previous step. The profile must first be placed in hold prior to input activation in order for the step change to take place. This is a 'single-shot' activation in which the input must make the required transition state in order to carry out the function. For each subsequent transition, the profile will advance to the previous step until the first step of the profile is reached.</td>
</tr>
<tr>
<td><strong>Advance Next Step:</strong></td>
<td>When selected, the input will advance the profile to the next step. The profile must first be placed in hold prior to the input turning on in order for the step change to take place. This is a 'single-shot' activation in which the input must make the required transition state in order to carry out the function. For each subsequent transition, the profile will advance to the next step until the last step of the profile is reached.</td>
</tr>
<tr>
<td><strong>Digital Output Control:</strong></td>
<td>When selected, the input will act as a switch that can be used to directly control a digital output of the Orion-M. In order to use the input as a switch for an output, the digital output must be configured to use the input for control. See Section 9.12, Digital Outputs for more information.</td>
</tr>
<tr>
<td><strong>Digital Output Defeat:</strong></td>
<td>When selected, the input will cause digital outputs selected under 'I/O Defeat' to turn off. The operation is similar to the alarm input function, but no alarm message is displayed.</td>
</tr>
<tr>
<td><strong>Start Data Logging:</strong></td>
<td>When selected, the input will start and stop the data logging operation of the Orion-M.</td>
</tr>
<tr>
<td><strong>Disable Loop SP Comms:</strong></td>
<td>When selected, the input will disable set point communications from the Orion-M to all loop controls attached to the system. This allows for direct, manual adjustment of the loop set point(s) on the process controllers. The input acts as a manual override, but still allows the Orion-M to gather process data for proper display and data logging purposes.</td>
</tr>
</tbody>
</table>
When activated the loop set point on the Orion-M will reflect the set point of the loop control as long as the loop is not under profile control. If a change is made to the set point at the loop control, the new set point will be updated on the Orion-M. If the loop is under profile control, the set point indicated on the Orion-M will remain at the value as defined by the running profile even though it is not being sent to the loop control. If the profile is put into hold; however, the set point on the Orion-M will match that on the loop control since the loop set point change at the Orion-M is allowed when a profile is in hold.

*Disable All Loop Comms:* When selected, the input will disable all communications from the Orion-M to its loop process controllers as well as the process monitor input card. When active, the Orion-M will not gather any process information or have any direct control over the process loops.

REMOTE ALARM SILENCE: When selected, the input will silence any active alarms on the alarm monitor screen. If a digital output is set to ‘System/Audible Alarm’, the output will be turned off. Note that the input will not clear any alarms from the list on the alarm monitor screen, and the screen background will retain its red alarm background color.

This is a ‘single-shot’ activation in which the input must make the required transition state in order to carry out the function. Thus, for each new alarm, the input must be re-activated to silence the new alarm. Leaving the input in an activated state will not clear alarms when they occur.

*Digital Input Defeat:* When selected, the input will disable the digital inputs selected under ‘I/O Defeat’. The selected inputs will not perform their function until the input defeat is deactivated.

*NOTE:* For the input control functions listed with an asterisk (*), the ‘on’ state for the input is defined by the transition mode. If ‘off to on’ is selected, the input is on when voltage is applied to the input. If ‘on to off’ is selected, the input is on when voltage is removed from the input.

The Input Delay is used to delay the input function for a period of time (in seconds) once the input transition state is detected (and maintained). It can be used to ‘debounce’ an input or act as an alarm delay to prevent false alarms. The time is configurable from 0.0 to 3276.0 seconds.
9.12 Digital Outputs

The Orion-M provides 8 digital outputs standard, and is configurable up to 32. The outputs can be used as system event outputs, alarm outputs or for other signaling needs.

To configure an output, first select the output number by entering the value in the ‘Digital Output #’ field. Valid values are 0 up to 31 (for a total of 32 outputs). Upon entering the value, the output’s current configuration will be loaded and indicated by the LED’s next to the selected function. To make changes to the output’s configuration, set the user state for the desired function of the output to ‘ON’ and set any necessary delay times. Once all changes have been made, press the ‘Accept’ button to save them. If you do not press the “Accept” button, the change will be lost if you leave the screen or enter a new digital output number.

The system ring-back time, Sys RingBack, is used when the digital output is configured as a ‘System/Audible Alarm’. It can be used to re-sound the alarm after a period of time, if the alarm is still present. If the system ring-back time is set to zero, the feature is disabled. When disabled, once the alarm sounds and the alarm is silenced, it will not sound again for the same alarm condition. The ring-back time can be set from 0 to 32,760 seconds.

The on delay, On DLY (Secs), delays the output from coming on for the period of time entered, based on any output function selected. The on delay time can be set from 0.0 to 3276.0 seconds.

The off delay, Off Dly (Secs), maintains the output for the time period entered once the condition requiring the output to be on, is removed. The off delay time can be set from 0.0 to 3276.0 seconds.

The cycle time, Cycle (Secs), can be used to pulse the output on and off when the condition requiring the output to be on is present. The cycle time is used for both the on period and off period. For example, if the cycle time is set to 1 second, the output will be on for 1 second, then off for 1 second, and so on. A value of zero indicates a constant period (output does not cycle). The cycle time can be set from 0.0 to 3276.0 seconds.

The digital input selection, Dig In Select, is only available when the output is set for the ‘Digital Input Control’ function. The selected input will then act as the switch to turn the output on and off.

The Digital Output Function defines what condition causes the output to turn on and off. All digital outputs are configured as system event outputs by default.

NOTE: More than one output can be set for the same function. Each output is independent of the others, thus they each perform their own task.
**System Event Output:** When selected, the output is controlled directly from the Manual System Events screen. When the event is selected, the output turns on. When the event is not selected, the output turns off.

**Profile Running:** When selected, the output will turn on when a profile is operating. The operating condition is defined as a ramp, soak, guaranteed soak or wait for condition. The output will not be on if the profile is in autostart, since it has not yet started, or when it is placed in hold by an operator.

**Profile Hold:** When selected, the output will turn on when the profile is in hold. When the profile is in any other condition, the output will be off.

**Profile Step Change:** When selected, the output will provide a one-shot pulse each time the profile changes steps. This also includes an output pulse each time the profile is manually advanced to the previous or next step while in hold. When used in conjunction with the off delay time, this can be used for a brief audible/visual alert signal to tell operators that a step of the process has completed and the next one is starting.

*NOTE:* When a profile is started, the output will pulse when the first step of the profile is started.

**System/Audible Alarm:** When selected, the output acts as a general fault output. Any alarm in the Orion-M, will activate this output. A common use would be for connection to an audible/visual alarm to alert operators of a problem. When the alarm ‘Silence’ button is pressed on the Alarm monitor screen, the output will be turned off. When used in conjunction with the ring-back delay setting, the output will automatically turn back on, after the ring-back delay period, if any alarm is still present.

**Process Alarm:** When selected, the output can be controlled directly by a loop/monitor alarm. The alarm must be configured to control the output. See Section 8.4, Alarm Settings for information on assigning the alarm to the digital output.

*NOTE:* If more than one loop/monitor alarm is assigned to the output, the output will not operate correctly and may cycle on and off uncontrollably. Do not assign more than one alarm to an output.

**Digital Input Alarm:** When selected, the output will turn on when the selected digital input alarm occurs. The output will stay on until the alarm is silenced. The selected digital input must be configured as an input alarm or the output will not operate.

**Digital Input Control:** When selected, the output will turn on and off based on the selected input status. The input acts as the switch to turn the digital input on and off. The selected digital input must be configured for digital output control or the output will not operate.

*Remote Alarm (NC):* When selected, the output acts as a ‘fail-safe’ fault output. When no alarm is present, the output will be energized. Any alarm in the Orion-M will de-activate the output. When the alarm ‘Silence’ button is pressed on the alarm monitor screen, the output will turn back on. When used in conjunction with the ring-back delay setting, the output will automatically turn back off, after the ring-back delay period, if any alarm is still present.

*NOTE:* For the output control functions listed with an asterisk (*), the output is not activated for failed FTP or email transmissions, NTS clock synchronization or communication alarms between the HMI and control module.
9.13 Digital IO Monitor/Force

The Digital IO Monitor/Force screen, accessed from the I/O menu, provides the on/off status of all digital inputs available on the Orion-M. It is useful for offline troubleshooting to verify input operation. The user also has the ability to force on any of the digital outputs of the Orion-M. This allows the operator to test output functionality and verify proper operation of equipment controlled by the output.

![Digital IO Monitor/Force Screen](image)

The Max Force Output Time setting limits the maximum amount of time the output can be forced on. The force time can be set from 0 to 32,760 seconds. This provides an automatic method to help prevent ‘runaway’ conditions in case an operator leaves an output on, but has to walk away to accomplish another task and forgetting to turn the output off. To force on an output, set the user state for the output to ‘ON’ and press the ‘Update’ button to set the new output status. Multiple outputs can be forced on at the same time.

**NOTE:** Since not all outputs can be shown at once in the list view, it is important that the operator use the slide bar on the right side of the display to view all available digital outputs to insure only the appropriate outputs will be forced on when pressing the ‘Update’ button. Each time a new selection is made, the output force delay timer is reset. The automatic force disable time begins from the moment the ‘Update’ button is pressed.
10 Communications

This section provides instruction on how to use the Orion-M communications interfaces. As a standard, the Orion-M is equipped with an Ethernet interface and has provisions for adding an RS232 or RS485 serial interface to the Control Module for user communications.

10.1 Ethernet Communications

The Orion-M provides two forms of Ethernet communication interfaces for monitoring and controlling the system across a network. The web server interface provides a monitor only connection, while the VNC server interface allows a user to manipulate and control the Orion-M remotely by viewing the Orion-M display directly on their PC screen.

NOTE: In order to use Ethernet communications, the Orion-M must be properly connected to a network. To connect the Orion-M to a network, connect the touch screen’s Ethernet port to your network using a standard CAT5 cable connection. After connecting the network cable, you must cycle power to the Orion-M.

The Orion-M receives its IP address using DHCP and this only occurs during power-up. Therefore, make sure the Orion-M is properly connected to your network and cycle power in order to obtain a valid IP address or the Ethernet communications will not operate.

The ‘COM’ LED on the Orion-M display flashes to indicate that communications are taking place. However, this LED not only indicates Ethernet communications, but also indicates the normal serial communications that take place between the HMI and the CM. This indicator can be used as a tool to verify that communications are operating; however, it does not necessarily indicate that data is being transmitted over the Ethernet link.
10.1.1 Guide to Smart Networking Practices

The expansion of Ethernet onto the industrial floor has brought forth a new realm of possibilities from the gathering of information to the inherent control of equipment from anywhere around the world. The flexibility and convenience that this provides makes it a very desirable feature for new equipment. The Orion-M provides this ability, but there are considerations that should be taken by the end user to protect their equipment and investment.

Just like placing a personal computer on the internet opens it up to outside attack, placing your Orion-M on a network poses the same risk. The first thing to remember is this: The most likely cause of problems is not a hacker trying to sabotage your equipment, but more often to be related to the ubiquity of PCs with Ethernet cards, the ease with which your own co-workers can ‘hang stuff on the network,’ and careless or nonexistent internal security measures. Accidental problems are more common than deliberate ones.

Allowing anyone access to the Orion-M, by placing it on the office LAN, also opens the door for accidental shutdown, damage to equipment, loss of data, lost time, etc. This is possible even by the most well-intentioned co-workers. Thus, there are several steps that should be taken to minimize this risk.

The most important and best advice, is to never mix your office LAN with your control LAN. The control LAN should be a separate network that consists of your Orion-M and possibly any other equipment that you may have, that is related to the operation of your system. It should be separated from your office LAN by a firewall, or at minimum, a bridge or router. A control network and a business network have two entirely different purposes and their interaction should be closely controlled.

Another hazard is connecting consumer ‘plug and play’ devices to your control LAN. A printer, for example, might flood the network with traffic in a ‘broadcast storm’ as it tries to self-configure or advertise its presence to all nodes on the network. Faulty devices, for example defective NIC cards, can transmit large amounts of bad packets (i.e., runts, which are abnormally short Ethernet frames) into your network. Using switches instead of hubs limits the effect of such problems.

The most commonly overlooked source of problems is cabling. Not all cables are created equal. Electrical noise generated by factory equipment or other electrical equipment in the area, could easily corrupt transmitted data over the network and cause devices to ‘lock up,’ which then requires the machine to be shut down and restarted to clear the problem.

Select the right cable for the environment. Shielded twisted pair (STP) cable is naturally more noise immune and is preferable to unshielded twisted pair or UTP in noisy situations. STP should have at least 40dB CMRR and less than 0.1pF capacitance unbalance per foot. Ground STP cable, making sure the ground is connected only at one end. CAT5 STP patch panels normally provide a grounding strip or bar. Hubs and switches don’t provide grounding, use cables.

It’s wise to be pessimistic about a cable’s ability to reject noise from 230 VAC and 460 VAC power lines and electrically ‘noisy’ equipment in the area. Capacitance imbalance in cables greater than 70pF per 100m can introduce harmonic distortion, resulting in bit errors. The cost of cable is quite small compared to total equipment cost, so if you’re looking to save money, this is not a place to do it. Choose a well designed cable to minimize bit-error rate after installation and that will give faster throughput and fewer glitches.
10.1.2 Obtaining the Orion-M's MAC Address

For certain network configurations, the MAC address of the Orion-M may be required for proper routing of information to/from the Orion-M. The MAC address of the Orion-M can be obtained from the CECP settings window. To do this, enter Offline Setup from the Orion-M’s Setup menu.

Select ‘Calibrate Touch Screen’ from the offline setup menu as if you were going to calibrate the screen in order to open the CECP window. Press the ‘System Information’ icon. The ‘MAC Address’ will be shown near the bottom of the system information window.

When finished, press the ‘OK’ button to close the window and press the ‘Quit’ icon to return to the Orion-M application and resume normal operation.

10.1.3 Setting a Static IP Address

Under some situations, it may be necessary to set a static IP address for the Orion-M on a network. A static IP address can be set in the Orion-M; however, it requires exiting the Orion-M application and entering the ‘Network and Dial-up Connections’ settings of the CE operating system.

**IMPORTANT:** It is recommended that only personnel charged with configuring and maintaining the Orion-M perform this procedure. Do not alter, change or delete any other files or settings of the system. Doing so may render the Orion-M inoperable.

To begin, you must exit the Orion-M application. To do so, proceed to the ‘Exit Application’ screen under the offline setup menu. Press the ‘Exit and start runtime on next power up’ button to exit the Orion-M runtime application. Follow the on screen prompts to stop the application and exit to the Windows CE desktop.
From the desktop, touch the narrow, gray bar at the bottom of the screen to show the taskbar. Before proceeding and further, enable the CE keyboard so that it will be available to enter in the IP address. If you do not enable it now, you will not be able to access the taskbar later once in the Ethernet Drivers screen.

To enable the keyboard, touch the keyboard icon at the lower right of the taskbar and select keyboard from the menu. This will make the keypad visible. Next, press the ‘Start’ button and select ‘Settings’ then ‘Network and Dial-up Connections’ to show the connections window.
From the ‘Connection’ window, select the current network connection by ‘double-tapping’ the connection icon to enter its property window. DO NOT create a new connection.

The ‘Ethernet Drivers’ property window will allow you to set the IP address as well as name primary and secondary DNS and WINS servers from the ‘servers’ tab if necessary. Select ‘Specify IP Address’ and enter in the desired IP address and subnet mask and/or default gateway as required.

You can move the keyboard around on the screen to position it as necessary to access the different fields. Once complete, close the ‘Ethernet Drivers’ window by pressing the ‘OK’ button located at the top right of the window. Next, close the Connection window by pressing the ‘X’ button at the top right of the window.

Access the taskbar and hide the keyboard by pressing the keyboard button at the bottom right of the taskbar and select ‘Hide Input Panel’. DO NOT cycle power at this time. You must first save these changes to the registry or they will be lost and the Orion-M will not use the IP address you specified to connect to the network.

To save the registry, you must access the CECP utility. To do this, press the ‘Start’ button on the taskbar, select ‘Programs’ and then select ‘CECP’. This will open the ‘CECP’ window.
Press the ‘Registry Save’ icon on the CECP window to open the utility.

Press the ‘Save Registry’ button to save the network settings to the Windows CE registry. When the registry save is complete, press the ‘X’ button in the top right of the window and then press the ‘Quit’ icon in the CECP utility. Cycle power to the Orion-M and when once it boots up, it will be running with the new network configuration settings.

10.1.4 Using the Web Server

The Orion-M’s web server allows a user to remotely monitor operations anywhere via a PC’s standard web browser. When enabled, the web server provides a detailed status page of the Orion-M’s current operating conditions. The web server can be enabled and disabled by touching the ‘Web Server On/Off’ button.

You must use the assigned IP address to access the Orion-M. The IP address is listed as the ‘Device IP Address’ shown on the Web Server/Modbus/VNC screen. Write down the IP address so you will have it later to enter into your web browser.
NOTE: Contact your network administrator prior to enabling the web server of the Orion-M. Company policy may prohibit the use of web servers for security reasons. Future Design is not responsible for the use of, nor makes any claims as to the security of the web server interface over your network. The use of the web server is the responsibility of the end user.

To access and view the Orion-M status web page, enter the following link in your PC's browser address window: [http://IPaddress/orion.html](http://IPaddress/orion.html) From the example address shown on the screen above, [http://192.168.1.107/orion.html](http://192.168.1.107/orion.html). The following example is typical of the Orion-M web page appearance. The web page updates automatically every 30 seconds and provides information on each individual control loop and monitor input, profile status, alarm status and system event status.
10.1.5 Using the VNC Server

The Orion-M VNC server allows a user to remotely monitor and control the Orion-M by directly viewing and manipulating the Orion-M’s touch screen over the network. All activity performed by either local or remote operators over the network will be viewed as if the user was actually touching the Orion-M screen. The VNC server can be enabled and disabled by touching the ‘VNC Server On/Off’ button.

You must use the assigned IP address to access the Orion-M. To obtain the correct IP address, go to the Web Server/Modbus/VNC screen selection under the Setup menu. Write down the IP address so you will have it to enter into your VNC viewer.

**NOTE:** Contact your network administrator prior to enabling the VNC server of the Orion-M. Company policy may prohibit the use of VNC servers and/or viewers for security reasons. Future Design is not responsible for the use of, nor makes any claims as to the security of the VNC server interface over your network. The use of the VNC server is the responsibility of the end user.

10.1.5.1 Accessing the Orion-M through a VNC Viewer

There are many types of VNC viewers on the market. Future Design uses and recommends the use of RealVNC’s viewer. A free version can be obtained from [http://www.realvnc.com/](http://www.realvnc.com/). Once installed, run the VNC viewer and enter the address for the Orion-M in the ‘Server’ field (see the following examples).

**Intranet Example:** If the IP address assigned is 192.168.1.107 and the configured VNC Address is 0, from the PC’s VNC Viewer address field, enter ‘192.168.1.107:0’ to access the device (address 0 relates to port 5900, address 1 to port 5901, etc., which is the port opened by the VNC interface in order to allow communications with the Orion-M over the network).
Internet Example: Internet connection typically requires a qualified network System Administrator. Typically a permanent IP address and specific port address to the Orion-M are assigned; support on this action is beyond the scope of this manual. Consult your network system administrator for assistance in setting up an Internet connection.

If the IP address of the LAN is 69.216.64.69 and the configured VNC Address is 0 (port 5900 has been opened and assigned to this specific Orion-M), from the remote PC (outside of the site Servers LAN), in the VNC Viewer address field enter ‘69.216.64.69::5900’ to access the device (5900 relates to address 0, 5901 to address 1, 5902 to address 2, etc., note the double colon). The IP address shown on the Web Server/Modbus/VNC screen is the LAN address and would not typically be used for an Internet connection.

Security Example: If the VNC server password is enabled on the Orion-M, for either example above, upon pressing the ‘OK’ button to make the connection, the VNC viewer will prompt for the proper password. The connection will only be established once the valid password is entered.

Once the connection is established, the current Orion-M display will be shown on your desktop. The image will be a duplicate of what is on the Orion-M. As you manipulate the screen, the display of the Orion-M will also be manipulated so that any local operator will be able to see what is happening and vice versa.
Multiple instances of the VNC viewer can be started on your PC. By running multiple viewers, you can have access to multiple Orion-M’s right from your desktop. The heading of each VNC viewer window will use the ‘VNC Device Name’ entry for the header. By entering a unique name for each Orion-M, you can identify each VNC connection and know which system you are accessing.

The VNC viewer should be closed when it is not being used to operate the Orion-M. If continuous monitoring of the system is desired, the web server interface is the recommended means of doing so. Leaving a VNC connection open to the Orion-M for extended periods of time is not recommended. Accidental manipulation of the control or erroneous network activity could cause connection problems over the VNC interface and result in malfunction of the Orion-M.

**NOTE:** Some viewers contain additional features for file transfer and other high level functions. These functions are NOT compatible with the Orion-M. Any attempt to use them may cause the Orion-M touch screen display to malfunction and require power to be cycled in order to reboot the system.

All viewers should be used ONLY to monitor and manipulate the Orion-M as if you were standing directly in front of it. Future Design can not take responsibility for other manufacturer’s software and will only provide support, within the boundaries of Future Design’s own discretion, for connection issues arising from using any software other than those recommended by Future Design.

10.1.5.2 **Recommended VNC Viewer Settings**

This section applies to setup of the RealVNC viewer recommended by FDC. These settings have been tested and evaluated in order to provide the best performance and quickest response to user input when using the VNC viewer with the Orion-M. After installing the VNC viewer software on your PC, it is recommended that the following changed be made to the default viewer settings and then saved as the default configuration for the viewer.

To begin, start the VNC viewer to open the connection details window. Click on the ‘Options’ button in order to open the ‘VNC Viewer Options’ window. On the ‘Colour & Encoding’ tab, make sure the ‘Auto Select’ check box is checked for the encoding method and the ‘Colour Level’ is set to ‘Full” as shown below.
Next, select the ‘Inputs’ tab and deselect all entries except for ‘Send pointer events to server’ and ‘Rate-limit mouse move events’.

On the ‘Miscellaneous’ (Misc) tab, deselect all entries except for the ‘Shared connection (do not disconnect other viewers)’ and ‘Offer to automatically reconnect’ options.

Finally, proceed to the ‘Load/Save’ tab and click on the ‘Save’ button under the defaults heading. This will set the preferred options selections to the default start settings for the VNC viewer. Once complete, press the ‘OK’ button to exit the options window. The VNC viewer will then connect to the Orion-M using the optimized settings each time it is started.
10.2 Serial Communications Option

The Orion-M's optional serial interface uses Modbus RTU protocol. Any device used to communicate with the Orion-M over the serial interface must use this protocol.

![Modbus Configuration Interface]

The Orion-M's communication address can be set on the Web Server/Modbus/VNC. All other communication settings are fixed. The port settings of the device used to communicate with the Orion-M must be set to match in order for the communications to take place.

- **Address:** 1-31 (user selectable)
- **Baud Rate:** 9600
- **Data Bits:** 8
- **Stop Bits:** 1
- **Parity:** Even
- **Timeout:** 1 second

The address is used to identify the Orion-M on the serial link. When a multi-drop connection is used, each controller on the link must have a different address so that each one can be identified separately. If two or more Orion-M's have duplicate addresses, communications with those controllers will fail because they will all try to respond to the same message. For single Orion-M connections, the address only needs to match that of the commands being sent from the host device.
# 11 Alarm Codes and Troubleshooting

This section provides explanations of standard Orion-M alarms and help in diagnosing and resolving the alarm conditions. Note that the information provided here covers standard alarms only, and not alarms configured by the OEM for system. If you are unable to diagnose a problem through the use of this guide, contact your OEM for further assistance.

Some of the troubleshooting procedures may require access to live circuitry. Dangerous accidental contact with line voltage may be possible. Only qualified service personnel should be allowed to perform these procedures.

<table>
<thead>
<tr>
<th>Alarm Monitor Description</th>
<th>Explanation/Corrective Action</th>
</tr>
</thead>
</table>
| Comm alm at CM. Check Cable. | Communication wiring between the Orion-M touch screen and CM faulty or not properly connected. If alarm will not clear, check communication wiring between the touch screen and port 1 of the CM.  

*NOTE:* Intermittent alarms do not affect the operation of the Orion-M or shut down the system. The system will continue to operate according to its last given commands, including profile operation. Data logging may be affected depending upon the logging rate selected. No audible alert is associated with this alarm.  

Frequent alarms indicate a problem that should be resolved. Insure that the communication wiring is properly shielded and routed away from control and power wiring. |
| Email Error! Check cable or server down. | Indicates that the Orion-M was unable to send an alarm message through the mail server. Verify that the Orion-M is properly connected to the network and that the email settings and addresses are valid.  

*NOTE:* This alarm does not affect system operation. It is an indication only alarm. No audible alert is associated with this alarm. |
| FTP! Check cable or server down. | Indicates that the FTP back-up attempt of the data files failed. Verify that the Orion-M is properly connected to the network and that the FTP settings are valid.  

*NOTE:* This alarm does not affect system operation. It is an indication only alarm. No audible alert is associated with this alarm.  

*If the Orion-M is not connected to a network, disable the FTP data back-up to prevent seeing this alarm.* |
| "tagname" Comms Error | Check communication wiring between port 2 of the CM and the loop control indicated by "tagname". Verify that the loop control has the proper communications address and communications settings. Verify that setpoint ranges set in the Orion-M configurator for the loop do not exceed the input range.  

*NOTE:* A tagname of “CM RS485” indicates that the communications to the optional input monitor module is at fault. |
<table>
<thead>
<tr>
<th>Alarm Monitor Description</th>
<th>Explanation/Corrective Action</th>
</tr>
</thead>
</table>
| NTS Ping Failed. Check Cable. | Indicates that the Orion-M was unable to synchronize its clock with the selected national time server. Verify that the Orion-M is properly connected to the network and the selected time server is accessible.  

**NOTE:** This alarm does not affect system operation. It is an indication only alarm. No audible alert is associated with this alarm.  

*If the Orion-M is not connected to a network, disable the NTS clock to prevent seeing this alarm.* |
| “tagname” SENSOR BREAK | Check sensor wiring for the indicated “tagname”. This alarm applies to all control loop and optional monitor input points. Verify lead connections. If sensor requires power, verify power to sensor.  

**NOTE:** Often times, the loop control will indicate an error code regarding input trouble. Reference the specific loop controller manual for information regarding its error codes for further diagnostics. |
Appendix
# FDC-2107i Touch Screen Interface Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>FDC-2107i</th>
</tr>
</thead>
</table>

## Picture
![FDC-2107i Touch Screen Interface](image)

<table>
<thead>
<tr>
<th>Display</th>
<th>7&quot; TFT LCD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brightness</td>
<td>300cd/m²</td>
</tr>
<tr>
<td>Color</td>
<td>65536 color</td>
</tr>
<tr>
<td>Contrast Ratio</td>
<td>500:1</td>
</tr>
<tr>
<td>Resolution</td>
<td>800 x 480</td>
</tr>
<tr>
<td>Life Time</td>
<td>LED</td>
</tr>
<tr>
<td>Life Time</td>
<td>30,000 hr.</td>
</tr>
<tr>
<td>Touch Panel</td>
<td>4 wires resistive type</td>
</tr>
<tr>
<td>I/O Port</td>
<td>Com1(RS232/RS485 2w/4w), Com2(RS232), Com3(RS232/RS485 2w)</td>
</tr>
<tr>
<td>Ethernet Port</td>
<td>10/100 Base-T</td>
</tr>
<tr>
<td>USB Host</td>
<td>USB 1.1 host, USB 2.0 high speed</td>
</tr>
<tr>
<td>Audio</td>
<td>Line Out x 1</td>
</tr>
<tr>
<td>Processor</td>
<td>32 Bit RISC CPU 400MHz</td>
</tr>
<tr>
<td>Flash Memory</td>
<td>128MB</td>
</tr>
<tr>
<td>DRAM</td>
<td>64MB DDR2</td>
</tr>
<tr>
<td>Removable Storage</td>
<td>SD card slot</td>
</tr>
<tr>
<td>IDE Interface</td>
<td>N/A</td>
</tr>
<tr>
<td>RTC</td>
<td>Built-in Real Time Clock</td>
</tr>
</tbody>
</table>

## General Specification

<table>
<thead>
<tr>
<th>Input Voltage</th>
<th>24VDC ± 20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Consumption</td>
<td>250mA</td>
</tr>
</tbody>
</table>
| CE/FCC          | Complies with EN 55022:2006, Class A  
EN 61000-3-2:2006  
| Protection Structure | IP65 Front Panel (O ring seal) |
| Vibration endurance | 10 to 25 Hz (X,Y,Z direction 2G 30minutes) |
| Relative Humidity     | 10% -- 90% @ 40°C, non-condensing |
| Operating Temperature | 0–45°C (32–113°F) |
| Storage Temperature   | -20–60°C (-4–140°F) |
| Enclosure         | Plastic    |
| VESA screw holes   | 75mm       |
| Dimensions WxHxD   | 200x146x42.5mm |
| Panel Cutout Dimensions | 192x138mm(7.56x5.43") |
| Weight            | Approx. 0.85 Kg(1.87lbs) |
| Operating System   | Windows CE.net 5.0 |
# FDC-2110i Touch Screen Interface Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>FDC-2110i</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Display</strong></td>
<td>10&quot; TFT LCD</td>
</tr>
<tr>
<td><strong>Brightness</strong></td>
<td>350cd/m²</td>
</tr>
<tr>
<td><strong>Color</strong></td>
<td>65536 color</td>
</tr>
<tr>
<td><strong>Contrast Ratio</strong></td>
<td>300:1</td>
</tr>
<tr>
<td><strong>Resolution (WxH dots)</strong></td>
<td>800 x 480</td>
</tr>
<tr>
<td><strong>Life Time</strong></td>
<td>LED</td>
</tr>
<tr>
<td><strong>Life Time</strong></td>
<td>30,000 hr.</td>
</tr>
<tr>
<td><strong>Touch Panel</strong></td>
<td>4 wires resistive type</td>
</tr>
<tr>
<td><strong>I/O Port</strong></td>
<td>Com1(RS232/RS485 2w/4w), Com2(RS232), Com3(RS232/RS485 2w)</td>
</tr>
<tr>
<td><strong>Ethernet Port</strong></td>
<td>10/100 Base-T</td>
</tr>
<tr>
<td><strong>USB Host</strong></td>
<td>USB 1.1 host, USB 2.0 high speed</td>
</tr>
<tr>
<td><strong>Audio</strong></td>
<td>Line Out x 1</td>
</tr>
<tr>
<td><strong>Processor</strong></td>
<td>32 Bit RISC CPU 400MHz</td>
</tr>
<tr>
<td><strong>Flash Memory</strong></td>
<td>128MB</td>
</tr>
<tr>
<td><strong>DRAM</strong></td>
<td>64MB DDR2</td>
</tr>
<tr>
<td><strong>Removable Storage</strong></td>
<td>SD card slot</td>
</tr>
<tr>
<td><strong>IDE Interface</strong></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>RTC</strong></td>
<td>Built-in Real Time Clock</td>
</tr>
</tbody>
</table>

## General Specification

| **Input Voltage** | 24VDC ± 20% |
| **Power Consumption** | 300mA |
| **CE/FCC** | Complies with EN 55022:2006, Class A  
| | EN 61000-3-2:2006  
| **Protection Structure** | IP65 Front Panel (O ring seal) |
| **Vibration endurance** | 10 to 25 Hz (X,Y,Z direction 2G 30minutes) |
| **Relative Humidity** | 10% -- 90% @ 40°C, non-condensing |
| **Operating Temperature** | 0–45°C (32–113°F) |
| **Storage Temperature** | -20–60°C (-4–140°F) |
| **Enclosure** | Plastic |
| **VESA screw holes** | 75mm |
| **Dimensions WxHxD** | 271x212x50mm |
| **Panel Cutout Dimensions** | 192x138mm(7.56x5.43") |
| **Weight** | Approx. 1.45 Kg(3.1lbs) |
| **Operating System** | Windows CE.net 5.0 |
FDC-2107i/2110i Touch Screen Interface Ports

The 9 Pin, Female, SUB-D, COM1 [RS-485], COM3 [RS-485] and COM3 [RS-232] Port on the back of the unit is the RS-232 and RS485/422 communications port for connecting to a controller.

<table>
<thead>
<tr>
<th>Pin#</th>
<th>Symbol</th>
<th>Com1 [RS485]2w</th>
<th>Com1 [RS485]4w</th>
<th>Com3 [RS485]</th>
<th>Com3 [RS232]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rx-</td>
<td>Data-</td>
<td>Rx-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Rx+</td>
<td>Data+</td>
<td>Rx+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Tx-</td>
<td>Tx-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Tx+</td>
<td>Tx+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td></td>
<td></td>
<td>Signal Ground</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Data-</td>
<td></td>
<td></td>
<td></td>
<td>Data-</td>
</tr>
<tr>
<td>7</td>
<td>TxD</td>
<td></td>
<td></td>
<td></td>
<td>Transmit</td>
</tr>
<tr>
<td>8</td>
<td>RxD</td>
<td></td>
<td></td>
<td></td>
<td>Receive</td>
</tr>
<tr>
<td>9</td>
<td>Data+</td>
<td></td>
<td></td>
<td></td>
<td>Data+</td>
</tr>
</tbody>
</table>

**NOTE:** The FDC-2010-M Orion only uses the wiring for RS232 communications. Do not use or attach any of the other pins on this connector.

The USB Master ports (2) are used to attach the “Plug and Play” I-Stick memory device and/or a compatible printer. The “I-Stick” and printer can be connected to either port.
### Main CPU Specifications

#### Normal Operating Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPU Module</strong></td>
<td>P05A-D16851</td>
</tr>
<tr>
<td><strong>Operating Temperature</strong></td>
<td>0 to 55°C (operating ambient temperature)</td>
</tr>
<tr>
<td><strong>Storage Temperature</strong></td>
<td>-25 to +70°C</td>
</tr>
<tr>
<td><strong>Relative Humidity</strong></td>
<td>10 to 95% (non-condensing, operating and storage humidity)</td>
</tr>
<tr>
<td><strong>Pollution Degree</strong></td>
<td>2 (IEC 60664-1)</td>
</tr>
<tr>
<td><strong>Degree of Protection</strong></td>
<td>IP20 (IEC 60529)</td>
</tr>
<tr>
<td><strong>Corrosion Immunity</strong></td>
<td>Atmosphere free from corrosive gases</td>
</tr>
<tr>
<td><strong>Altitude</strong></td>
<td>Operation: 0 to 2,000m (0 to 6,565 feet); Transport: 0 to 3,000m (0 to 9,840 feet)</td>
</tr>
<tr>
<td><strong>Vibration Resistance</strong></td>
<td>When mounted on a DIN rail or panel surface: 5 to 9 Hz amplitude 3.5 mm, 9 to 150 Hz acceleration 9.8 m/s² (1G) 2 hours per axis on each of three mutually perpendicular axes (IEC 61131-2)</td>
</tr>
<tr>
<td><strong>Shock Resistance</strong></td>
<td>147 m/s² (1G); 11 ms duration, 3 shocks per axis on three mutually perpendicular axes (IEC 61131-2)</td>
</tr>
<tr>
<td><strong>ESD Immunity</strong></td>
<td>Contact discharge: ±4 kV, Air discharge: ±8 kV (IEC 61000-4-2)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>230g</td>
</tr>
</tbody>
</table>

#### Power Supply

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated Power Voltage</strong></td>
<td>24V DC</td>
</tr>
<tr>
<td><strong>Allowable Voltage Range</strong></td>
<td>20.4 to 25.4V DC (including ripple)</td>
</tr>
<tr>
<td><strong>Maximum Input Current</strong></td>
<td>700 mA (26.4V DC)</td>
</tr>
<tr>
<td><strong>Maximum Power Consumption</strong></td>
<td>CPU module + 7 I/O modules + expansion module + 8 I/O modules 19W (26.4V DC)</td>
</tr>
<tr>
<td><strong>Allowable Momentary Power Interruption</strong></td>
<td>10 ms (at 24V DC)</td>
</tr>
<tr>
<td><strong>Dielectric Strength</strong></td>
<td>Between power and @ terminals: 5000V AC, 1 minute Between I/O and @ terminals: 1500V AC, 1 minute</td>
</tr>
<tr>
<td><strong>Insulation Resistance</strong></td>
<td>Between power and @ terminals: 10 MΩ minimum (500V DC megger) Between I/O and @ terminals: 10 MΩ minimum (500V DC megger)</td>
</tr>
<tr>
<td><strong>Noise Resistance</strong></td>
<td>DC power terminals: 1.0 kV, 50 ns to 1 μs I/O terminals (coupling clamp): 1.5 kV, 50 ns to 1 μs</td>
</tr>
<tr>
<td><strong>Inrush Current</strong></td>
<td>50A maximum (24V DC)</td>
</tr>
<tr>
<td><strong>Grounding Wire</strong></td>
<td>UL1015 AWG22, UL1007 AWG18</td>
</tr>
<tr>
<td><strong>Power Supply Wire</strong></td>
<td>UL1015 AWG22, UL1007 AWG18</td>
</tr>
<tr>
<td><strong>Effect of Improper Power Supply Connection</strong></td>
<td>Reverse polarity: No operation, no damage Improper voltage or frequency: Permanent damage may be caused Improper lead connection: Permanent damage may be caused</td>
</tr>
</tbody>
</table>
Main CPU Input Specifications

DC Input Specifications

<table>
<thead>
<tr>
<th>CPU Module</th>
<th>FC5A-D16RS1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Points and Common Lines</td>
<td>8 points in 1 common line</td>
</tr>
<tr>
<td>Terminal Arrangement</td>
<td>24V DC sink/source input signal</td>
</tr>
<tr>
<td>Input Voltage Range</td>
<td>20.4 to 26.4 VDC</td>
</tr>
<tr>
<td>Rated Input Voltage</td>
<td>24V DC</td>
</tr>
<tr>
<td>Rated Input Current</td>
<td>4.5 mA/point (24V DC)</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>4.9 kΩ</td>
</tr>
<tr>
<td>Turn ON Time</td>
<td>10, 11, 13, 14, 16, 17: 35 µs + filter value</td>
</tr>
<tr>
<td></td>
<td>12, 15: 40 µs + filter value</td>
</tr>
<tr>
<td>Turn OFF Time</td>
<td>10, 11, 13, 14, 16, 17: 150 µs + filter value</td>
</tr>
<tr>
<td></td>
<td>12, 15: 250 µs + filter value</td>
</tr>
<tr>
<td>Isolation</td>
<td>Between input terminals: Not isolated</td>
</tr>
<tr>
<td></td>
<td>Internal circuit: Photocoupler isolated</td>
</tr>
<tr>
<td>Input Type</td>
<td>Type 1 (IEC 61131)</td>
</tr>
<tr>
<td>External Load for I/O interconnection</td>
<td>Not needed</td>
</tr>
<tr>
<td>Signal Determination Method</td>
<td>Static</td>
</tr>
<tr>
<td>Effect of Improper Input Connection</td>
<td>Both sinking and sourcing input signals can be connected. If any input exceeding the rated value is applied, permanent damage may be caused.</td>
</tr>
<tr>
<td>Cable Length</td>
<td>3m (9.84 ft) in compliance with electromagnetic immunity</td>
</tr>
<tr>
<td>Connector on Mother Board</td>
<td>MC1.5/13-S-3.81BK (Phoenix Contact)</td>
</tr>
<tr>
<td>Connector Insertion/Removal Durability</td>
<td>100 times minimum</td>
</tr>
</tbody>
</table>

Input Operating Range

The input operating range of the Type 1 (IEC 61131-2) input module is shown below:

**Inputs 10, 11, 13, 14, 16, and 17**

<table>
<thead>
<tr>
<th>Input Operating Range (V)</th>
<th>ON Area</th>
<th>Transition Area</th>
<th>OFF Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Current (mA)</td>
<td>0</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>Input Voltage (V)</td>
<td>0</td>
<td>0.6</td>
<td>24</td>
</tr>
</tbody>
</table>

**Inputs 12, 15, and 110 to 117**

<table>
<thead>
<tr>
<th>Input Operating Range (V)</th>
<th>ON Area</th>
<th>Transition Area</th>
<th>OFF Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Current (mA)</td>
<td>0</td>
<td>1.2</td>
<td>7.7</td>
</tr>
<tr>
<td>Input Voltage (V)</td>
<td>0</td>
<td>2.6</td>
<td>26.4</td>
</tr>
</tbody>
</table>

**Input Internal Circuit**

Inputs 10, 11, 13, 14, 16, and 17

![Internal Circuit Diagram]

**I/O Usage Limits**

When using the FC5A-D16RK1/0SL at an ambient temperature of 55°C in the normal mounting direction, limit the inputs and outputs, respectively, which turn on simultaneously on each connector along line (1).

**Input 12, 15, and 110 to 117**

<table>
<thead>
<tr>
<th>Input Operating Range (V)</th>
<th>ON Area</th>
<th>Transition Area</th>
<th>OFF Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Current (mA)</td>
<td>0</td>
<td>0.6</td>
<td>4.5</td>
</tr>
<tr>
<td>Input Voltage (V)</td>
<td>0</td>
<td>0.6</td>
<td>24</td>
</tr>
</tbody>
</table>

**Internal Circuit**

![Internal Circuit Diagram]

**I/O Simultaneous On Ratio (%)**

When using at 40°C, all I/0s on every slim type CPU module can be turned on simultaneously at 26.4 V DC as indicated with line (3).
## Main CPU Output Specifications

### Relay Output Specifications

<table>
<thead>
<tr>
<th>CPU Module</th>
<th>FC5A-16GSR1</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Outputs</td>
<td>8 points including 2 transistor output points</td>
</tr>
<tr>
<td>Output Points per Common Line</td>
<td></td>
</tr>
<tr>
<td>COM0</td>
<td>(2 points transistor source output)</td>
</tr>
<tr>
<td>COM1</td>
<td>3 NO contacts</td>
</tr>
<tr>
<td>COM2</td>
<td>2 NO contacts</td>
</tr>
<tr>
<td>COM3</td>
<td>1 NO contact</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum Load Current</th>
<th>2A per point</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8A per common line</td>
</tr>
<tr>
<td>Minimum Switching Load</td>
<td>0.1 mA/0.1V DC (reference value)</td>
</tr>
<tr>
<td>Initial Contact Resistance</td>
<td>30 mΩ maximum</td>
</tr>
<tr>
<td>Electrical Life</td>
<td>100,000 operations minimum (rated load 1,800 operations/hour)</td>
</tr>
<tr>
<td>Mechanical Life</td>
<td>20,000,000 operations minimum (no load 18,000 operations/hour)</td>
</tr>
<tr>
<td>Rated Load</td>
<td>240V AC/2A (resistive load, inductive load cos θ = 0.4)</td>
</tr>
<tr>
<td></td>
<td>30V DC/2A (resistive load, inductive load L/R = 7 ms)</td>
</tr>
<tr>
<td>Dielectric Strength</td>
<td>Between output and a terminals: 1,500V AC, 1 minute</td>
</tr>
<tr>
<td></td>
<td>Between output terminal and internal circuit: 1,500V AC, 1 minute</td>
</tr>
<tr>
<td></td>
<td>Between output terminals (COMs): 1,500V AC, 1 minute</td>
</tr>
<tr>
<td>Connector on Mother Board</td>
<td>MCI.5/15-G-3.81BK (Phoenix Contact)</td>
</tr>
<tr>
<td>Connector Insertion/Removal Durability</td>
<td>100 times minimum</td>
</tr>
</tbody>
</table>

### Output Delay

- **ON Delay:** 6 ms minimum
- **OFF Delay:** 10 ms maximum
- **Chatter:** 6 ms maximum

![Output Delay Diagram](image)
## DC Input Module Specifications

<table>
<thead>
<tr>
<th>Type No.</th>
<th>FC4A-N08B1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Points and Common Lines</td>
<td>8 points in 1 common line</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rated Input Voltage</th>
<th>24V DC sink/source input signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage Range</td>
<td>20.4 V to 28.8 V DC</td>
</tr>
<tr>
<td>Rated Input Current</td>
<td>7 mA point (24V DC)</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>3.4 kΩ</td>
</tr>
<tr>
<td>Turn ON Time (24V DC)</td>
<td>4 ms</td>
</tr>
<tr>
<td>Turn OFF Time (24V DC)</td>
<td>4 ms</td>
</tr>
</tbody>
</table>

### Isolation
- Between input terminals: Not isolated
- Internal circuit: Photocoupler isolated

### External Load for I/O Interconnection
- Not needed

### Signal Determination Method
Static

### Effect of Improper Input Connection
Both sinking and sourcing input signals can be connected. If any input exceeding the rated value is applied, permanent damage may be caused.

### Cable Length
3m (9.84 ft.) in compliance with electromagnetic immunity

### Connector on Mother Board
MC1 5/10-G-3.81BK (Phoenix Contact)

### Connector Insertion/Removal Durability
100 times minimum

<table>
<thead>
<tr>
<th>Internal Current Draw</th>
<th>All Inputs ON</th>
<th>All Inputs OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25 mA (5V DC)</td>
<td>5 mA (5V DC)</td>
</tr>
<tr>
<td></td>
<td>0 mA (24V DC)</td>
<td>0 mA (24V DC)</td>
</tr>
</tbody>
</table>

### Input Operating Range

The input operating range of the Type 1 (IEC 51131-2) input module is shown below:

![Input Operating Range Diagram]

### Input Internal Circuit

![Input Internal Circuit Diagram]

### Input Usage Limits

When using the FC4A-N08B1, all inputs can be turned on simultaneously at 55°C, input voltage 28.8V DC.
## Digital Input Card Specifications (page 2 of 2)

### AC Input Module Specifications

<table>
<thead>
<tr>
<th>Type No.</th>
<th>FC4A-N08A11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Points and Common Lines</td>
<td>8 points in 2 common lines</td>
</tr>
<tr>
<td>Rated Input Voltage</td>
<td>100 to 120V AC (50/60 Hz)</td>
</tr>
<tr>
<td>Input Voltage Range</td>
<td>85 to 132V AC</td>
</tr>
<tr>
<td>Rated Input Current</td>
<td>15 mA/point (120V AC, 60 Hz)</td>
</tr>
<tr>
<td>Input Type</td>
<td>AC input, Type 1, 2, 3 (IEC 61131-2)</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>0.8 kΩ (60 Hz)</td>
</tr>
<tr>
<td>Turn ON Time</td>
<td>25 msec</td>
</tr>
<tr>
<td>Turn OFF Time</td>
<td>30 msec</td>
</tr>
<tr>
<td>Isolation</td>
<td>Between input terminals in the same common: Not isolated Between input terminals in different commons: Isolated Between input terminals and internal circuits: Photocoupler isolated</td>
</tr>
<tr>
<td>External Load for I/O Interconnection</td>
<td>Not needed</td>
</tr>
<tr>
<td>Signal Determination Method</td>
<td>Static</td>
</tr>
<tr>
<td>Effect of Improper Input Connection</td>
<td>If any input exceeding the rated value is applied, permanent damage may be caused.</td>
</tr>
<tr>
<td>Connector on Mother Board</td>
<td>MC1.5/11-G-3.81BK (Phoenix Contact)</td>
</tr>
<tr>
<td>Connector Insertion/Removal Durability</td>
<td>100 times minimum</td>
</tr>
<tr>
<td>Internal Current Draw</td>
<td>All Inputs ON: 60 mA (5V DC) 0 mA (24V DC) All Inputs OFF: 30 mA (5V DC) 0 mA (24V DC)</td>
</tr>
<tr>
<td>Weight</td>
<td>80g</td>
</tr>
</tbody>
</table>

### Input Operating Range

The input operating range of the Type 1, 2, 3 (IEC 61131-2) input module is shown below:

![Input Operating Range Diagram](image)

### Input Internal Circuit

![Input Internal Circuit Diagram](image)

### Input Usage Limits

When using the FC4A-N08A11, all inputs can be turned on simultaneously at 55°C, input voltage 132V AC.
Analog I/O Module Specifications

General Specifications

<table>
<thead>
<tr>
<th>Type No.</th>
<th>FC4A103A1</th>
<th>FC4A103AP1</th>
<th>FC4A1J2A1</th>
<th>FC4A1K1A1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Power Voltage</td>
<td>24V DC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable Voltage Range</td>
<td>20.4 to 28.8V DC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminal Arrangement</td>
<td>See Analog I/O Module Terminal Arrangement on pages 247 and 248.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connector on Mother Board</td>
<td>MC1.5/11G-3.81BK (Phoenix Contact)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connector Insertion/Removal Durability</td>
<td>100 times minimum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal Current Draw</td>
<td>50 mA (5V DC) 0 mA (24V DC)</td>
<td>50 mA (5V DC) 0 mA (24V DC)</td>
<td>50 mA (5V DC) 0 mA (24V DC)</td>
<td>50 mA (5V DC) 0 mA (24V DC)</td>
</tr>
<tr>
<td>External Current Draw (Note)</td>
<td>45 mA (24V DC) 40 mA (24V DC)</td>
<td>35 mA (24V DC) 40 mA (24V DC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>85g</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The external current draw is the value when all analog inputs are used and the analog output value is at 100%.

Analog Input Specifications

<table>
<thead>
<tr>
<th>Analog Input Signal Type</th>
<th>Voltage Input</th>
<th>Current Input</th>
<th>Thermocouple</th>
<th>Resistance Thermometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Range</td>
<td>0 to 10V DC</td>
<td>4 to 20 mA DC</td>
<td>Type K (0 to 1300°C) Type J (0 to 1200°C) Type T (0 to 430°C)</td>
<td>Pt 100 3-wire type (~100 to 1000°C)</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>1 MΩ minimum</td>
<td>10Ω</td>
<td>1 MΩ minimum</td>
<td>1 MΩ minimum</td>
</tr>
<tr>
<td>Allowable Conductor Resistance (per wire)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>200Ω maximum</td>
</tr>
<tr>
<td>Input Detection Current</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1.0 mA maximum</td>
</tr>
<tr>
<td>Sample Duration Time</td>
<td>20 msec maximum</td>
<td>20 msec maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample Repetition Time</td>
<td>20 msec maximum</td>
<td>20 msec maximum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Input System Transfer Time</td>
<td>105 msec + 1 scan time (Note 1)</td>
<td>200 msec + 1 scan time (Note 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Input</td>
<td>Single-ended input</td>
<td>Differential input</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Mode</td>
<td>Self-scan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conversion Method</td>
<td>Σ-1 type ADC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Input Error

| Temperature Coefficient | ±0.006% of full scale/°C |
| Repeatability after Stabilization Time | ±0.5% of full scale |
| Non-linearity | ±0.2% of full scale |
| Maximum Error | ±1% of full scale |

Digital Resolution

4096 increments (12 bits)

Input Value of LSB

<table>
<thead>
<tr>
<th>2.5 mV</th>
<th>1 μA</th>
</tr>
</thead>
<tbody>
<tr>
<td>K: 0.325°C</td>
<td>J: 0.300°C</td>
</tr>
<tr>
<td>T: 0.100°C</td>
<td></td>
</tr>
</tbody>
</table>
### Analog Input/Output Card Specifications (page 2 of 3)

#### Analog Input Signal Type Specifications

<table>
<thead>
<tr>
<th>Data Type in Application Program</th>
<th>Voltage Input</th>
<th>Current Input</th>
<th>Thermocouple</th>
<th>Resistance Thermometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 4995 (12-bit data)</td>
<td>0 to 10 V DC</td>
<td>4 to 20 mA DC</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Common Mode Voltage</td>
<td>15 V DC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Filter</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable</td>
<td>Twisted pair shielded cable recommended for improved noise immunity</td>
<td>--</td>
<td>2 LSB maximum</td>
<td></td>
</tr>
</tbody>
</table>

#### Isolation

- Isolated between input and power circuit
- Photocoupler-isolated between input and internal circuit

#### Effect of Improper Input Connection

- No damage

#### Maximum Permanent Allowed Overload (No Damage)

<table>
<thead>
<tr>
<th>Voltage Output</th>
<th>Current Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 V DC</td>
<td>40 mA DC</td>
</tr>
</tbody>
</table>

#### Selection of Analog Input Signal Type

- Using software programming

#### Calibration or Verification to Maintain Rated Accuracy

- Impossible

---

#### Analog Output Specifications

<table>
<thead>
<tr>
<th>Analog Output Signal Type</th>
<th>Voltage Output</th>
<th>Current Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Output Signal Type</td>
<td>Voltage Output</td>
<td>Current Output</td>
</tr>
<tr>
<td>Analog Output Signal Type</td>
<td>Voltage Output</td>
<td>Current Output</td>
</tr>
<tr>
<td>Analog Output Signal Type</td>
<td>Voltage Output</td>
<td>Current Output</td>
</tr>
<tr>
<td>Analog Output Signal Type</td>
<td>Voltage Output</td>
<td>Current Output</td>
</tr>
</tbody>
</table>

#### Output Error

- Maximum Error at 25°C: ±0.2% of full scale
- Temperature Coefficient: ±0.015% of full scale/°C
- Repeatability after Stabilization Time: ±0.5% of full scale
- Output Voltage Drop: ±1% of full scale
- Non-linearity: ±0.2% of full scale
- Output Ripple: 1 LSB maximum
- Overshoot: 0%
- Total Error: ±1% of full scale

#### Digital Resolution

- 4096 increments (12 bits)

#### Output Value of LSB

- 2.5 mV
- 4 µA

---

#### Data Type in Application Program

- 0 to 4995 (12-bit data)
- ~32768 to 32767 (optional range designation) (Note 2)
### Analog Input/Output Card Specifications (page 3 of 3)

<table>
<thead>
<tr>
<th>Analog Output Signal Type</th>
<th>Voltage Output</th>
<th>Current Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monotonicity</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Current Loop Open</td>
<td>—</td>
<td>Not detectable</td>
</tr>
</tbody>
</table>

#### Noise Resistance

<table>
<thead>
<tr>
<th></th>
<th>Maximum Temporary Deviation during Electrical Noise Tests</th>
<th>±3% maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable</td>
<td>Twisted pair shielded cable is recommended for improved noise immunity</td>
<td></td>
</tr>
<tr>
<td>Crosstalk</td>
<td>No crosstalk because of 1 channel output</td>
<td></td>
</tr>
</tbody>
</table>

#### Isolation

<table>
<thead>
<tr>
<th>Effect of Improper Output Connection</th>
<th>Isolated between output and power circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Photocoupler-isolated between output and internal circuit</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Selection of Analog Output Signal Type</th>
<th>Using software programming</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibration or Verification to Maintain Rated Accuracy</td>
<td>Impossible</td>
</tr>
</tbody>
</table>

---
## Digital Output Card Specifications (page 1 of 2)

### Transistor Source Output Module Specifications

<table>
<thead>
<tr>
<th>Type No.</th>
<th>PC4A-T0851L</th>
<th>PC4A-T1653</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Type</td>
<td>Transistor source output</td>
<td>Transistor source output</td>
</tr>
<tr>
<td>Output Points and Common Lines</td>
<td>8 points in 1 common line</td>
<td>16 points in 1 common line</td>
</tr>
<tr>
<td>Rated Load Voltage</td>
<td>24V DC</td>
<td>24V DC</td>
</tr>
<tr>
<td>Operating Load Voltage Range</td>
<td>20.4 to 28.8V DC</td>
<td>20.4 to 28.8V DC</td>
</tr>
<tr>
<td>Rated Load Current</td>
<td>0.3A per output point</td>
<td>0.1A per output point</td>
</tr>
<tr>
<td>Maximum Load Current (at 28.8V DC)</td>
<td>0.3A per output point</td>
<td>0.1A per output point</td>
</tr>
<tr>
<td>Voltage Drop (ON Voltage)</td>
<td>1V maximum (voltage between COM and output terminals when output is on)</td>
<td>1V maximum (voltage between COM and output terminals when output is on)</td>
</tr>
<tr>
<td>Inrush Current</td>
<td>1A maximum</td>
<td>1A maximum</td>
</tr>
<tr>
<td>Leakage Current</td>
<td>0.1 mA maximum</td>
<td>0.1 mA maximum</td>
</tr>
<tr>
<td>Clamping Voltage</td>
<td>39V±1V</td>
<td>39V±1V</td>
</tr>
<tr>
<td>Maximum Lamp Load</td>
<td>8W</td>
<td>8W</td>
</tr>
<tr>
<td>Inductive Load</td>
<td>L/R = 10 ms (28.8V DC, 1 Hz)</td>
<td>L/R = 10 ms (28.8V DC, 1 Hz)</td>
</tr>
<tr>
<td>External Current Draw</td>
<td>100 mA maximum, 24V DC (power voltage at the -V terminal)</td>
<td>100 mA maximum, 24V DC (power voltage at the -V terminal)</td>
</tr>
<tr>
<td>Isolation</td>
<td>Between output terminal and internal circuit: Photocoupler isolated</td>
<td>Between output terminals: Not isolated</td>
</tr>
<tr>
<td>Connector on Mother Board</td>
<td>MC1.5/10G-3.81BK (Phoenix Contact)</td>
<td>FL20A2MA (Oki Electric Cable)</td>
</tr>
<tr>
<td>Connector Insertion/Removal Durability</td>
<td>100 times minimum</td>
<td>100 times minimum</td>
</tr>
<tr>
<td>Internal Current Draw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Outputs On</td>
<td>10 mA (5V DC)</td>
<td>10 mA (5V DC)</td>
</tr>
<tr>
<td>All Outputs Off</td>
<td>5 mA (5V DC)</td>
<td>5 mA (5V DC)</td>
</tr>
<tr>
<td>Internal Power Consumption (at 24V DC while all outputs ON)</td>
<td>0.55W</td>
<td>1.03W</td>
</tr>
<tr>
<td>Output Delay</td>
<td>Turn On time: 300 μs maximum</td>
<td>Turn Off time: 300 μs maximum</td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>85g</td>
<td>70g</td>
</tr>
</tbody>
</table>

### Output Internal Circuit

![Internal Circuit Diagram](image)
## Relay Output Module Specifications

<table>
<thead>
<tr>
<th>Type No.</th>
<th>FC4A-R061</th>
<th>FC4A-R161</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output Points and Common Lines</strong></td>
<td>8 NO contacts in 2 common lines</td>
<td>16 NO contacts in 2 common lines</td>
</tr>
<tr>
<td><strong>Maximum Load Current</strong></td>
<td>2A per point</td>
<td>7A per common line</td>
</tr>
<tr>
<td><strong>Minimum Switching Load</strong></td>
<td>0.1 mA/0.2V DC (reference value)</td>
<td></td>
</tr>
<tr>
<td><strong>Initial Contact Resistance</strong></td>
<td>30 mΩ maximum</td>
<td></td>
</tr>
<tr>
<td><strong>Electrical Life</strong></td>
<td>100,000 operations minimum (rated load 1,800 operations/hour)</td>
<td></td>
</tr>
<tr>
<td><strong>Mechanical Life</strong></td>
<td>20,000,000 operations minimum (no load 16,000 operations/hour)</td>
<td></td>
</tr>
<tr>
<td><strong>Rated Load</strong></td>
<td>240V AC/2A (resistive load, inductive load cos Φ = 0.4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30V DC/2A (resistive load, inductive load L/R = 7 ns)</td>
<td></td>
</tr>
<tr>
<td><strong>Dielectric Strength</strong></td>
<td>Between output and @ or © terminals: 1,500V AC, 1 minute</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Between output terminal and internal circuit: 1,500V AC, 1 minute</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Between output terminals (COMs): 1,500V AC, 1 minute</td>
<td></td>
</tr>
<tr>
<td><strong>Connector on Mother Board</strong></td>
<td>MC1.5/11-G-3.81BK (Phoenix Contact)</td>
<td>MC1.5/10-G-3.81BK (Phoenix Contact)</td>
</tr>
<tr>
<td><strong>Connector Insertion/Removal Durability</strong></td>
<td>100 times minimum</td>
<td>100 times minimum</td>
</tr>
<tr>
<td><strong>Internal Current Draw</strong></td>
<td><strong>All Outputs ON</strong></td>
<td>30 mA (5V DC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40 mA (24V DC)</td>
</tr>
<tr>
<td></td>
<td><strong>All Outputs OFF</strong></td>
<td>5 mA (5V DC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0 mA (24V DC)</td>
</tr>
<tr>
<td><strong>Internal Power Consumption</strong></td>
<td>(at 24V DC while all outputs ON)</td>
<td>1.15W</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>110g</td>
<td>145g</td>
</tr>
</tbody>
</table>

### Output Delay

- **Command**: UN
- **Output Relay Status**: ON
- **ON delay**: 10 ms maximum
- **OFF delay**: 10 ms maximum
- **Chatter**: 6 ms maximum
- **ON delay**: 6 ms maximum
RS232/485 Communications Card Specifications

<table>
<thead>
<tr>
<th>Communication Adapter and Communication Module Type Numbers</th>
<th>Name</th>
<th>Termination</th>
<th>Type No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RS232C Communication Adapter</td>
<td>Mini DIN connector</td>
<td>FC4A-PC1</td>
</tr>
<tr>
<td></td>
<td>RS485 Communication Adapter</td>
<td>Mini DIN connector</td>
<td>FC4A-PC2</td>
</tr>
<tr>
<td></td>
<td>RS232C Communication Module</td>
<td>Screw Terminal Block</td>
<td>FC4A-PC3</td>
</tr>
<tr>
<td></td>
<td>RS485 Communication Module</td>
<td>Mini DIN connector</td>
<td>FC4A-HPC1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screw Terminal Block</td>
<td>FC4A-HPC2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication Adapter and Communication Module Specifications</th>
<th>Type No.</th>
<th>FC4A-PC1</th>
<th>FC4A-HPC1</th>
<th>FC4A-PC2</th>
<th>FC4A-HPC2</th>
<th>FC4A-PC3</th>
<th>FC4A-HPC3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standards</td>
<td>EIA RS232C</td>
<td></td>
<td></td>
<td>EIA RS485</td>
<td></td>
<td>EIA RS485</td>
<td></td>
</tr>
<tr>
<td>Communication Method</td>
<td>Asynchronous</td>
<td>Asynchronous</td>
<td>Asynchronous</td>
<td></td>
<td></td>
<td>Asynchronous</td>
<td></td>
</tr>
<tr>
<td>Port No.</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Connectable Quantity</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Baud Rate</td>
<td>57,600 bps</td>
<td>57,600 bps</td>
<td>57,600 bps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance Communication (Computer Link)</td>
<td>Possible</td>
<td>Possible</td>
<td></td>
<td>Possible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>User Communication</td>
<td>Possible</td>
<td>—</td>
<td>Possible</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modern Communication</td>
<td>Possible</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Link Communication</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Possible</td>
<td>(31 slaves max.)</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Modbus Communication</td>
<td>Possible (Note 1)</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Cable Length</td>
<td>Special cable (Note 2)</td>
<td>Special cable (Note 2)</td>
<td>200m (Note 2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolation between Internal Circuit and Communication Port</td>
<td>Not isolated</td>
<td>Not isolated</td>
<td>Not isolated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1: 1:1 Modbus communication only

Note 2: Recommended cable for RS485: Twisted-pair shielded cable with a minimum core wire of 0.3 mm². Conductor resistance 85 Ω/km maximum, shield resistance 20 Ω/km maximum.

The proper tightening torque of the terminal screws on the RS485 communication adapter and RS485 communication module is 0.22 to 0.25 N-m. For tightening the screws, use screwdriver SZS 0,4 x 2,5 (Phoenix Contact).
## Power Supply 24VDC 60-Watt Specifications (page 1 of 2)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Number</td>
<td>PS5R-S024</td>
</tr>
<tr>
<td>Output Capacity</td>
<td>60W</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>85 to 264 VAC, 100 to 570 VDC</td>
</tr>
<tr>
<td>Input Current (typical)</td>
<td>1.2A</td>
</tr>
<tr>
<td>Input Current (cold start)</td>
<td>5A maximum at 260V AC</td>
</tr>
<tr>
<td>Leakage Current (at no load)</td>
<td>0.75 mA maximum</td>
</tr>
<tr>
<td>Typical Efficiency</td>
<td>24VDC 92%</td>
</tr>
<tr>
<td>Voltage Adjustment</td>
<td>±10% (±1V on AC control board)</td>
</tr>
<tr>
<td>Output Rating</td>
<td>260mA minimum (at rated input and output)</td>
</tr>
<tr>
<td>Starting Time</td>
<td></td>
</tr>
<tr>
<td>Rise Time</td>
<td>100ms maximum (at rated input and output)</td>
</tr>
<tr>
<td>Line Regulation</td>
<td>0.4% maximum</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>1.0% maximum</td>
</tr>
<tr>
<td>Temperature Regulation</td>
<td>0.05° C/orientation</td>
</tr>
<tr>
<td>Ripple Voltage</td>
<td>7% peak to peak maximum (including noise)</td>
</tr>
<tr>
<td>Overcurrent Protection</td>
<td>185% on surge, auto reset</td>
</tr>
<tr>
<td>Overvoltage Protection</td>
<td>120% min. SHUTDOWN</td>
</tr>
<tr>
<td>Parallel Operation</td>
<td>No</td>
</tr>
<tr>
<td>Dielectric Strength</td>
<td>Between input and ground 2000 VAC, 1 minute™</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>Between Input &amp; Output Terminals 100 MΩ Min.</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-10 to 80°C (94 to 18°F)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-25 to 70°C (-13 to 160°F)</td>
</tr>
<tr>
<td>Operating Humidity</td>
<td>20 to 90% relative humidity (no condensation, no heating)</td>
</tr>
<tr>
<td>Vibration Resistance</td>
<td>Frequency 10 to 550 Hz, Amplitude 0.02ms</td>
</tr>
<tr>
<td>Shock Resistance</td>
<td>500m/s² 2ms shock within 5 areas</td>
</tr>
<tr>
<td>Approvals</td>
<td>UL60601-1/UL60950, CE, CB, PSE, TUV, ERP, KS610801, Mot, LV10540485, KCC 13451-1, CCMC 22.2 No. 14</td>
</tr>
<tr>
<td>Harmonic Directive (EN50081-3-2)</td>
<td>NA</td>
</tr>
<tr>
<td>Weight (approx.)</td>
<td>235g</td>
</tr>
<tr>
<td>Terminal Screw</td>
<td>M3.5 Allen-Phillips head screws (screw terminal type)</td>
</tr>
<tr>
<td>IP protection</td>
<td>IP20 flanged</td>
</tr>
<tr>
<td>Dimensions H x W x D (mm)</td>
<td>95 x 95 x 108</td>
</tr>
<tr>
<td>Dimensions H x W x D (inches)</td>
<td>3.74 x 3.74 x 4.25</td>
</tr>
</tbody>
</table>
Power Supply 24VDC 60-Watt Specifications (page 2 of 2)

[PS5R-SD24 24VDC/60Watt]

**Temperature Derating Curves**

### PS5R-SD

<table>
<thead>
<tr>
<th>Output Current (A)</th>
<th>Ambient/Operating Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>70</td>
</tr>
<tr>
<td>3.0</td>
<td>65</td>
</tr>
<tr>
<td>4.5</td>
<td>60</td>
</tr>
<tr>
<td>6.0</td>
<td>55</td>
</tr>
<tr>
<td>7.5</td>
<td>50</td>
</tr>
<tr>
<td>9.0</td>
<td>45</td>
</tr>
<tr>
<td>10.5</td>
<td>40</td>
</tr>
<tr>
<td>12.0</td>
<td>35</td>
</tr>
<tr>
<td>13.5</td>
<td>30</td>
</tr>
<tr>
<td>15.0</td>
<td>25</td>
</tr>
<tr>
<td>16.5</td>
<td>20</td>
</tr>
<tr>
<td>18.0</td>
<td>15</td>
</tr>
<tr>
<td>19.5</td>
<td>10</td>
</tr>
<tr>
<td>21.0</td>
<td>5</td>
</tr>
</tbody>
</table>

**Condition Natural Air Cooling**

(Operating temperature means temperature in surrounding PSSR)

Make sure of convection in consideration of sufficient heat radiation. Do not block the opening or the switching power supply.

Keep at least 20mm clearance around the switching power supply, except for the opening.

All DECA power supplies are listed to UL 508 which allows operation at 100% capacity inside a panel. This eliminates the need to use oversize power supplies or utilize two power supplies derated 50% of their rated output.

The chart above shows that the PS5R Slim 60W (at 55°C) meet the ambient temperature required by the UL 508 and EN60950 standards to operate at an output current of 100%.

The output current starts to derate beyond the required temperature.

### A Mounting

Mounting Style A (standard)

### B Mounting

Mounting Style B (Facing upward)

**Dimensions**

PS5R-SD24 (60W)

- Height: 95.0 mm
- Width: 36.0 mm
- Depth: 108.0 mm
### Power-On Delay Relay Specifications

**[GE1A-C10MA110]**

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Operating Voltage</td>
<td>24V AC/DC, 100 to 120V AC, 220 to 240V AC</td>
</tr>
<tr>
<td>Voltage Tolerance</td>
<td>AC: 85 to 110%, DC: 90 to 110%</td>
</tr>
<tr>
<td>Contact Rating</td>
<td>240V AC10A, 24V DC10A</td>
</tr>
<tr>
<td>Contact Form</td>
<td>DPDT or SPDT+ instantaneous SPDT</td>
</tr>
<tr>
<td>Repeat Error</td>
<td>±0.2% ±±10μsec maximum</td>
</tr>
<tr>
<td>Voltage Error</td>
<td>±0.5% ±±10μsec maximum</td>
</tr>
<tr>
<td>Temperature Error</td>
<td>±3% maximum</td>
</tr>
<tr>
<td>Setting Error</td>
<td>±10% maximum</td>
</tr>
<tr>
<td>Reset Time</td>
<td>0.1 sec maximum</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>1000MΩ (minimum 500V DC megger)</td>
</tr>
<tr>
<td>Dielectric Strength</td>
<td>Between power and output terminals: 1500V AC, 1 minute Between contact circuits: 750V AC, 1 minute</td>
</tr>
<tr>
<td>Vibration Resistance</td>
<td>Damage limits: Amplitude 0.75mm, 10 to 50 Hz Operating extremes: Amplitude 0.5mm, 10 to 55 Hz</td>
</tr>
<tr>
<td>Shock Resistance</td>
<td>Damage limits: 500m/s² (Approx. 5G)</td>
</tr>
</tbody>
</table>

**Power Consumption**

- **GE1A-B**
  - 24V AC type: 1.6 VA<br>24V DC type: 1.0W<br>110V AC type: 2.6VA<br>220V AC type: 7.7 VA<br>

- **GE1A-C**
  - 24V AC type: 2.0 VA<br>24V DC type: 0.8W<br>110V AC type: 3.5 VA<br>220V AC type: 8.0VA

**Electrical Life**

- 100,000 operations minimum (at full rated load)

**Mechanical Life**

- 10,000,000 operations minimum

**Operating Temperature**

- -10 to +65°C (without freezing)

**Operating Humidity**

- 35 to 85% RH (without freezing)
Power-On Delay Relay Specifications (page 2 of 2)

<table>
<thead>
<tr>
<th>Item</th>
<th>Terminal Number</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td>2 - 7 (SP)</td>
<td></td>
</tr>
<tr>
<td>Delayed</td>
<td>5 - 8 (SP)</td>
<td>(N.C)</td>
</tr>
<tr>
<td>Contact</td>
<td>6 - 8 (SP)</td>
<td>(N.O)</td>
</tr>
<tr>
<td>Indicator</td>
<td>POWER</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OUT</td>
<td></td>
</tr>
</tbody>
</table>

8-Pin Screw Terminal (SR2P-06)
### 1. Graphic User Interface (GUI) & Control Module (CM)

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDC-2107i</td>
<td>Windows CE 7&quot; iSeries Color Touch Screen</td>
</tr>
<tr>
<td>FDC-2110i</td>
<td>Windows CE 10&quot; iSeries Color Touch Screen</td>
</tr>
</tbody>
</table>

Control Module (CM) includes the following components:
- FC5A-D16RS1: Control Module CPU with on-board 8-digital input (24Vdc) and 8-digital outputs (6-relay/2TTL)
- FC4A-PM64: 64KB Memory Card
- FC4A-P1: Real Time Clock
- FC4A-HPC3: Modbus port (connect loop controls and monitor point cards to CM)
- CA2011-8A: Cable from FC5A CPU to display (8ft)
- GE1A-C10MA110 / SR2P-06: Reset Timer and socket (DIN Rail)
- 2GB SD Memory Card (holds Orion-Mi application software)
- 2GB High Capacity USB Memory Stick (3VDC)
- PS5R-SD24: Power Supply (Input 85-264Vsc/Output 24Vdc 60 Watt (2.5 amp))

### 2. Graphic User Interface (GUI) Application Software

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDCi:</td>
<td>standard iSeries software for 7&quot; and 10&quot; displays</td>
</tr>
<tr>
<td>FD30:</td>
<td>standard iSeries software for 7&quot; and 10&quot; displays</td>
</tr>
</tbody>
</table>

### 3. Control Module (CM) Application Software (loop control type)

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD10:</td>
<td>CM software for FDC 100 Series</td>
</tr>
<tr>
<td>FD30:</td>
<td>CM software for FDC 300 Series (note 2)</td>
</tr>
<tr>
<td>HWSL:</td>
<td>CM software for Honeywell 2500/3200 (note 2)</td>
</tr>
<tr>
<td>HWDL:</td>
<td>CM software for Honeywell 3500 (note 3)</td>
</tr>
<tr>
<td>WTSD:</td>
<td>CM software for Watlow SD</td>
</tr>
<tr>
<td>WTPL:</td>
<td>CM software for Watlow PM</td>
</tr>
<tr>
<td>DHL:</td>
<td>CM software for DanaherWest/Partlow Plus</td>
</tr>
<tr>
<td>YKGS:</td>
<td>CM software for Yokogawa UT Green Series</td>
</tr>
<tr>
<td>FDSR:</td>
<td>CM software for FDC 300 Series Orion-M SR (note 2)</td>
</tr>
</tbody>
</table>

Software - Future Release
- YKXX: CM software for Yokogawa UT Advanced
- ER20: CM software for Eurotherm 2000 Series
- ER30: CM software for Eurotherm 3000 Series
- ERM8: CM software for Eurotherm Mini 8 Series

### 4. Monitor Inputs (Note 2) (DIN Rail Mount – serial connection to CM)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8-digital input (24Vdc)</td>
</tr>
<tr>
<td>2</td>
<td>8-digital output (240Vac 2-amps)</td>
</tr>
<tr>
<td>3</td>
<td>8-digital output (4-20mA or 0-10Vdc IO)</td>
</tr>
<tr>
<td>4</td>
<td>8-digital output (4-20mA or 0-10Vdc IO)</td>
</tr>
</tbody>
</table>

### 5. Monitor Inputs (Note 2) (DIN Rail Mount – serial connection to CM)

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
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<td>3</td>
<td>8-digital output (4-20mA or 0-10Vdc IO)</td>
</tr>
<tr>
<td>4</td>
<td>8-digital output (4-20mA or 0-10Vdc IO)</td>
</tr>
</tbody>
</table>

### 6. Digital Inputs (Note 1) (DIN Rail Mount – plug into CM)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>FC4A-N08B1: (8-digital input card (24Vdc))</td>
</tr>
<tr>
<td>2</td>
<td>FC4A-N08A11: (8-digital input card (120Vac))</td>
</tr>
</tbody>
</table>

Note: The above optional digital inputs (DI) are in addition to the eight 24Vdc digital inputs that are standard on the CM; system maximum of 16 digital inputs.

### 4. Digital Inputs (Note 1) (DIN Rail Mount – plug into CM)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>FC4A-T08S1 (8-digital output - TTL 24Vdc (source))</td>
</tr>
<tr>
<td>2</td>
<td>FC4A-R08B1 (8-digital output - Relay (240Vac 2-amps))</td>
</tr>
<tr>
<td>3</td>
<td>FC4A-T16S3 (16-digital output - TTL 24Vdc (source))</td>
</tr>
<tr>
<td>4</td>
<td>FC4A-R161 (16-digital output - Relay (24V0c 2-amps))</td>
</tr>
</tbody>
</table>

### 7. Analog I/O (Note 1) (DIN Rail Mount – plug into CPU)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>A-IO card FC4A-L03A1 (4-20mA or 0-10Vdc IO)</td>
</tr>
<tr>
<td>2</td>
<td>A-IO cards FC4A-L03A1 (4-20mA or 0-10Vdc IO)</td>
</tr>
<tr>
<td>3</td>
<td>A-IO cards FC4A-L03A1 (4-20mA or 0-10Vdc IO)</td>
</tr>
<tr>
<td>4</td>
<td>A-IO cards FC4A-L03A1 (4-20mA or 0-10Vdc IO)</td>
</tr>
<tr>
<td>5</td>
<td>A-IO cards FC4A-L03A1 (4-20mA or 0-10Vdc IO)</td>
</tr>
<tr>
<td>6</td>
<td>A-IO cards FC4A-L03A1 (4-20mA or 0-10Vdc IO)</td>
</tr>
<tr>
<td>7</td>
<td>A-IO cards FC4A-L03A1 (4-20mA or 0-10Vdc IO)</td>
</tr>
</tbody>
</table>

### 8. Serial Communication (Note 1) (DIN Rail Mount – plug into CM)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>FC5A-SIF4 (RS485 Modbus RTU port (slave))</td>
</tr>
<tr>
<td>2</td>
<td>FC5A-SIF2 (RS232 port for Barcode Reader)</td>
</tr>
</tbody>
</table>

Note: If Item 2 is specified, Item 1 is included and must be counted in the total number of modules.

*RS485 Modbus RTU port allows R/W access by FDC EnVision & 3rd party software.

**Bar Code Reader input is compatible for serial based barcode readers. System will accept up to 16 characters of data from the bar code scanner. Data from the bar code reader will be inserted as operator events in the Historical Data File; there is no limit to the number of events that may be entered manually or with a bar code scanner.

### 9. Special

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>CM Assembled &amp; wired on DIN Rail</td>
</tr>
</tbody>
</table>

Note: Each I/O card has qty 2 Remote Setpoint input and quantity 1 Retransmission reader will be inserted as operator events in the Historical Data File; there is no limit to the number of modules.

Note: If Item 2 is specified, Item 1 is included and must be counted in the total number of modules.

*RS485 Modbus RTU port allows R/W access by FDC EnVision & 3rd party software.

**Bar Code Reader input is compatible for serial based barcode readers. System will accept up to 16 characters of data from the bar code scanner. Data from the bar code reader will be inserted as operator events in the Historical Data File; there is no limit to the number of events that may be entered manually or with a bar code scanner.
NOTES: SCADA (Supervisory Control & Data Acquisition)

FDC-Orion-M iSeries Graphic User Interface (GUI) is available in 7" and 10" color touch screens. The GUI provides a full SCADA feature set providing ease of use, data acquisition, alarm manager, operator audit trail, multi-level Security with user rights, LAN connections and more.

The GUI provides ease of configuration, use & support.
- System Configuration for loop, monitor point, alarm, digital input & outputs assignment / logic, Help language selection and more, all without an external device or PC.
- Loop Views: multiple view Loop and/or Monitor Points in single or All View; Trend, Bar Graph and Digital views also available
- Profile: Virtually unlimited number of profiles with each profile having up to 99 steps with up to 32 events.
- File Management: View, print, copy/move Profile, Alarm, Historical Data (data log files) and operator audit trail files.
- Support: View loop & digital IO status, force loop & digital outputs and more.
- Print: Print directly from GUI via USB port
- LAN: Remote Access & touch screen operation (VNC), email/SMS on alarm, email historical, alarm & audit trail files on-demand, Web Page (view only) and FTP of historical data files automatically or on-demand.

Data Acquisition:
- Data log up to 15 control loops (PV, SP & % out) & 8 Monitor Points (specific dual input loop controls may allow up to 30 PV inputs)
- Log interval: configurable 6 seconds to 31 minutes with configurable number of days to auto start & name next file (1 to 31 days).
- File Start/Stop: Configurable; operator on-demand, on system boot.
- Profile ramp-soak start/end or digital inputs
- File Interval: Once started a data log file is configurable to auto end and start new file with the same name as previous file with an appended time/date name. Configurable time interval is from 1 to 31 days.
- File name: Operator entered file name, batch & lot number or if running a profile, file name same as profile name.
- Operator Comments/Events: Unlimited operator comments/events linked to each file entered manually or via Bar Code Scanner.
- Digital Signatures: full support for user based digital signatures for each data file (data encryption).
- Historical Data File: View & print the data directly from the display (auto scale on X & Y axis with each channel selectable for right or left axis values), from a PC after data is copied/moved via LAN (FTP or email) or USB Flash Memory card provided.

NOTES: Monitor Inputs – Optional

Monitor Inputs:
The FDC-IO modules are DIN rail mount 8-channel isolated thermocouple, RTD (6-channel) or 8-channel linear mA or Vdc input modules. Each monitor point is configurable for Alarm setpoints and segment advance “wait for” logic (SP logic & loop Delta function).

2 Monitor input cards may be specified. Orion system configuration allows up to 15 monitor points including input #2 of specific loop controls.

Information on the FDC-IO modules may be found at the following link: http://www.futuredesigncontrols.com/FDC-IO_Modules.html

NOTES: Power Supply – Standard (DIN Rail Mount)

Power Supply:
DIN Rail mount 24VDC 60 watt power supply (2.5-amps) to power the FDC-2107i or 2110i GUI, control module CPU, optional IO and FDC-IO monitor modules.

NOTES: Configurable Control Logic

Ramp/Soak Profiles (Global Profile configurable as Time or Ramp Rate based): The FDC-Orion-M provides for a virtually unlimited number of profiles each with up to 99 steps and up to 32 configurable events per step. Step Advance, Hold, Stop, and other “Wait For” logic per step is standard. The “Wait For” step advance logic includes digital inputs, loop / monitor points achieving a “wait for SP” and Delta SP logic.

Configurable Loop Control:
Each of the DIN control loops may be configured via the operator interface as single loop controls or as components in Cascade or %RH values. Each control loop is configurable to run Ramp/Soak profiles or as steady state controls (non-profile) per profile.

Alarm Configuration:
System Alarms
System Alarms include loss of communication with loop & monitor points, configurable call back, audible and more; may be mapped to one of the standard or optional digital outputs

DIN Control Loop Alarms (a maximum of 30 alarms for loop & monitor)
The loop controls (up to 15) may have up to 30 alarms configured per loop. The alarms may be configured as soft/audible, latching or not, inhibit logic and/or to defeat any digital output. Alarms may be mapped to one or more of the standard or optional digital outputs (maximum of 32 digital outputs). Alarm types include:
- Process, Deviation, Percent Output and Rate of Change (ROC) low, high or both

Monitor Input Alarm (a maximum of 30 alarms for Loop & Monitor)
Each channel may be configured with Process or Rate of Change (ROC), soft/audible, latching or not, inhibit and/or to defeat any digital output. Alarms may be mapped to one or more of the standard or optional digital outputs (max of 32 digital outputs)

Digital IO Configuration
Digital Outputs (DO): CPU includes 8-digital output (6-relay & 2-TTL) with optional 8 & 16 output cards (24VDC or relay); max of 32 DO.
DO are configurable as:
- Loop, monitor point or digital input alarms
- Event output used in ramp soak profiles
- Event output for profile status: run, hold & step change
- Event outputs as a result of Digital Inputs
- Configurable cycle times to pulse an output or no cycle - on 100%
- Configurable time delay to automatically turn DO off
- Configure DO with counter & alarm message

Digital Inputs (DI): CPU includes 8-digital inputs with optional 8- digital input card for maximum of 16 digital inputs. DI may be configured:
- Configurable time delay (timers)
- System Run
- Alarm Input
- Data Acquisition start and stop
- Profile functions; start, stop (all off), hold, advance previous/next step
- Defeat Logic; disable specific or groups of DO
- Disable Communication to loop controls SP or All components
- SP communication disabled: SP values may be changed at loop controls while still monitor & data log all values.
- All communication disabled: SP values may be changed at loop controls but no loop, monitor alarms or data log occurs.

NOTES: Analog I/O – Optional (DIN Rail Mount to CM)

Analog I/O (Input/Output):
Remote Setpoint: Cards accept two 4-20mA or 2-10Vdc inputs to be transmitted as SP values via the serial link to specific DIN controllers.

Retransmission: Cards have one 4-20mA or 0-10Vdc signals configurable as PV, Setpoint or % Out values from specific DIN controllers

Maximum number of cards is 7: 14 remote setpoint inputs and 7 retransmitted PV, Setpoint or %Output values.
NOTES: System Configuration

Orion-M has an embedded configuration program and normal runtime allowing full customization & configuration directly from the GUI. Simple Import/Export function allows complete configurations to quickly & easily imported to other Orion-M iSeries control systems.

Configuration Program allows:
- Number of Loop Controls, Monitor Points, Digital Inputs, Digital Outputs and Analog I/O.
- Assign Tag Names to Loop, Monitor, Alarms, System Events, Digital Input & Outputs.
- Profile Setup: Time or Ramp Rate based Ramp configuration.
- Main View: Select Start up/Main View (home page).
- Menu System: Enable/disable specific Menu items & functions not required or desired for the application.
- System Event Configuration to allow multiple DO from one Event

Runtime Configuration allows:
Profile Power Recovery logic, Setpoint Limits, Alarm Settings, LAN settings (VNC, Modbus, web server, email, FTP, alarm email / text), Barcode Reader, degrees C/F, DO counter, Date/Time, Help/Voice language selection. I/O mapping & logic. Monitor Point offset, Analog I/O configuration, export/import configuration & more.

NOTES: Loop Controls (Serial connection to CM)

Control Module (CM) Software for Loop Controls:
The software allows connection up to 15 loop controls and one FDC-I/O monitor input module (8-T/C, 6-RTD or 8-mA or VDC inputs). (specific dual input loop controls may allow up to 30 PV inputs)

The software and the appropriate loop control model is identified by the character description on the part number matrix. Note that the appropriate software must be specified for the Control Module memory.

The FD30 & FD10 CM software allows connection to Future Design Controls 300 & 100 Series DIN controllers. Both Series are available in 1/32, 1/16, 1/8 and 1/4 DIN sizes with DIN rail mounting available for both the 1/32 and 1/16 DIN sizes. Information on these Series controllers may be found at the following links:
http://www.futuredesigncontrols.com/300.HTM
http://www.futuredesigncontrols.com/100.HTM

CM software supporting Honeywell, Watlow, Danaher, Eurotherm, Yokogawa and other controller products are, or will be available. Refer to the specific FDC brochure available for each control brand as there may be limitations depending upon control brand.

NOTES: Serial Communications (Serial connection to CM)

RS485 Modbus RTU (slave) and RS232 (barcode input) modules

RS485 Modbus RTU input module:
The RS485 module allows 3rd party software / hardware R/W access to specific registers within the Control Module. Contact Future Design Controls technical support for the register/address listing for specific software versions.

RS232 Serial input for barcode readers:
The RS232 serial input option allows the Orion to receive up to 16 characters from a standard compatible serial Barcode reader. Data from the bar code reader will insert operator events into the historical data file; there is no limit to the number of events that may be entered manually or with a bar code scanner.

Note: If Serial Communication is used the RS485 module must be included; i.e. if bar code reader is used both the RS485 and the RS232 (used for bar code reader) modules must be specified.

NOTES: Control Module (CM) components, I/O & other options

USB Memory Stick:
A high capacity USB Memory Card is provided to facilitate file transfer to and from the FDC-2107/2110 display. The USB memory card power requirement is 3VDC matching the display’s USB port 3VDC power supply (note: many USB memory sticks require 5VDC and will not work with the FDC-2107/2110 display)

CM: CM components includes the following hardware:
- FC5A-D16RS1: CPU I/O includes 8-digital output & 8 input (DO 6-relay & 2-TTL 24VDC) & (DI 8 24VDC)
- CA2011-8A: Cable (8ft) to connect CPU to GUI
- FC4A-PM64: CPU memory card (CM application software pre-installed)
- FC4A-PT1: CPU Real Time Clock (RTC)
- FC4A-HPC3: Modbus port to connect control module to loop and monitor input devices
- PSSR-SD24: 24VDC power supply for Display & CPU
- USB Memory: high capacity USB memory stick (3VDC)
- GE1A-C10MA110/SRP-06: Reset Timer with Mounting Socket

Optional Digital I/O (plugs into CPU) (*note 1)
- FC4A-T16S3: 16-digital output card (24Vdc source)
- FC4A-R161: 16-digital output card (relay 240Vac 2A)
- FC4A-T08S1: 8-digital output card (24Vdc source)
- FC4A-H081: 8-digital output card (relay 240Vac 2A)
- FC4A-N08B1: 8-digital input card (24Vdc)
- FDC4-N08A11: 8-digital input card (120Vac)

Maximum Digital IO Summary for CPU & optional IO modules:
- Digital Output: 32 Digital Outputs
- CPU 8-digital output (6-relay & 2-transistor) Optional 24-digital output (relay or 24Vdc)
- Digital Inputs: 16 Digital Inputs
- CPU 8-digital in (24Vdc) Optional 8-digital in (120Vac or 24Vdc)

Optional Analog I/O (Remote SP & Retransmission) (*note 1)
- FC4A-L03A1: Two mA or Vdc inputs & one mA or Vdc out

Optional Serial Communication Modules (*note 1)
- FC5A-SIF2: RS232 port for Barcode Reader
- FC5A-SIF3: RS485 Modbus RTU (slave)

Optional Monitor Point 8-channel (8-channel RTD) input module
System supports one Monitor Input Module (serial connection to CM):
- IO-8TCS: 8-thermocouple input module (isolated)
- IO-6RTD: 6-RTD input module
- IO-8A00: 8- input module 0-20 / 4-20mA (isolated)
- IO-8A10: 8- analog input 0-10 / 2-10VDC (isolated)

*Note 1: CM will support up to 7 expansion modules. (The Monitor Point Input modules are not a CM expansion module)
SOFTWARE VERSIONS FOR FDC- Orion-M Control System

The software version levels for the Orion-M Control system can be viewed in the Setup\Offline Section, from the Help drop down menu; select “About Orion-M”. Both the HMI (Human Machine Interface – color touch screen) and Control Module (Idec PLC) firmware and software versions will be displayed.

When obtaining replacement parts or to get assistance for setup and/or troubleshooting purposes, it is important to have this information available to insure that your request is processed properly and in a timely manner. It is recommended that this information be written down and kept in a readily accessible location along with this manual, so that it is available when required.

HMI Version: ________________  CM Program Version: ________________

CE Net Version: ________________  CM Firmware Version: ________________

The CE Net version of the HMI, and firmware versions of the Control Module and FDC 300 series controllers of the Orion-M control system are proprietary and only available directly from Future Design.

Using similar or like components obtained from a source other than Future Design will cause unexpected operation and/or malfunction of the Orion-M control system. Any attempts to do so will be at the user’s own risk and void any and all claims or warranties with Future Design.

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