

Evolution DX2

Evolution DX2 **USER MANUAL**

**SUN or RAIN,
We're in Control**



RAIN MASTER



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Chapter 1

Introduction

Congratulations... You have just acquired the worlds most advanced, trouble free, solid state irrigation controller.

Rain Master is pleased to offer the first irrigation controller with expandable capabilities that can grow your needs become more complex and demanding.

As you become acquainted with the Evolution DX2's total capabilities, you will realize how simple it is to program and operate.

Thank you for choosing Rain Master Irrigation Systems.

About This Manual

This manual is designed to serve as a User Manual, Reference Source, and Maintenance Guide. The procedures are presented in systematic steps to easily complete a specific task. The menus throughout these chapters are identified with a sequential listing that starts out with a pointing finger icon (as shown below). This presentation is intended to quickly indicate the menus in the proper order to arrive at the correct programming display screen.



F1=Main Menu
F2=Program
F3=New Program



Figure 1: Evolution DX2 Pedestal Enclosure

Every attempt has been made to show the appropriate screen display throughout the step-by-step process. In cases where a sub-menu is not shown, refer back to the preceding pointing finger icon. Following the listing from that point will easily direct you to the correct sub-menu.

The Evolution DX2 Controller was designed to accommodate a wide range of features and capabilities with unequalled versatility and performance. At the same time, it remains extremely simple to use.

In addition to being the detailed definitive source for all facets of the controller operation, this manual contains extensive troubleshooting information required to resolve field maintenance issues.

Some features of this manual are highlighted below:

Chapter 2: System Basics introduces you to the irrigation controller's front panel by defining basic key operations.

Chapter 3: Getting Started is designed as a quick reference guide. This chapter allows you to initialize a controller and enter a new program in less than 5 minutes.

Chapter 10: Troubleshooting includes field troubleshooting flow charts as well as detailed alarm warning information. Specific appendices have been provided with emphasis on troubleshooting techniques as they relate to the irrigation controller.

Appendix G: Troubleshooting Basics addresses basic troubleshooting principles including an introduction to volt/ohm meter concepts.

Features and Capabilities

Microprocessor-based control of irrigation systems is no longer a luxury. Today's culture is environmentally sensitive, exact control of precious water resources is a must. Even with low precipitation irrigation, excessive run times mean wasted water. Rain Master believes in minimizing waste by maximizing water application efficiency.

The Evolution DX2 is designed to provide precise control of irrigation delivery systems. The water savings realized from these control efficiencies will help ensure an adequate supply of clean water for personal needs, as well as for landscapes, which are so important to the quality of our lives.

Evolution DX2 Features and Specifications

Hardware Features

- Configuration options 6, 12, 18, 24, 30, 36, 42 or 48 stations. Dedicated outputs for 2 Normally Closed Master Valves, 1 normally Open Master Valve, 1 Pump, and auxiliary 24 VAC.
- Connectivity for 4 input sensing devices. 4 pulse input type devices e.g. flow sensors, flow meters, ET device, rain gauge, and anemometer.
- 80 character Liquid Crystal Display (LCD) with 24-key membrane keypad.
- Built-in remote control jack. Adaptor for permanent remote internal mount available.
- Built-in transient protection.
- Optional lightning protection available.

- Audible tone(s) for valid or invalid operator entry.
- Lifetime retention of the user's program and date/time, without the use of batteries.
- All outputs are protected from field wiring short circuits.
- Built in amperage meter to accurately measure and diagnose valve solenoid electrical problems.
- Modular architecture. Modular output boards (6 or 12 station) facilitate maintenance and eliminates total controller down time.
- Available in painted or stainless steel wall mount cabinet or pedestal enclosure.

Scheduling Capabilities

- Operation of 12 conventional programs with 8 start times, 48 ISC (individual station control) or a combination of each
- Watering based upon 14-day schedules, skip day schedules, or 31-day schedules
- Continuous cycling of programs based upon user established start and end times, with a programmable delay/soak time
- Water budget per program from 0 to 999% in 1% increments for adjustment of program run times
- Program by time

- Programmable monthly total water usage, program terminates upon over budget irrigation
- Quick station programming allows groups of stations to be programmed with the same runtime
- Programmable water window

Program Setup Options

- Program overlap protection or concurrent operation
- Irrigation programs, lighting programs, security, etc. (Non-irrigation programs are independent of rain shutdown mode)
- Inter-station delay from 0 to 255 seconds
- Runtimes from 1 second to 24 hours programmable in hours/minutes or minutes/seconds
- Master valve selections: 2 Normally Closed Valves or Normally Open Valves, with programmable delay from 0 to 600 seconds

Maintenance and Alarm Diagnostic Capabilities

- Flow monitoring. Automatic alarm processing (which provides station and/or master valve shut down and program advance as required) diagnosing and reporting station underflow and overflow, mainline breaks, and unscheduled flow. Maximum Upper Flow Limit is 2000 GPM.

- Electrical field wire monitoring. Automatic alarm processing (which provides station shutdown and program advance) for station over current, short circuits, broken field wiring or faulty solenoids.
- Power monitoring. Automatic alarm processing/ reporting for power outages and power restoration. Intelligent program resumption for all outages or power glitches, no lost cycles or water window violations.
- Communication monitoring. Automatic alarm generation/ reporting for lost communications or restoration when using hardwire communications. Automatic fault isolation of communication wiring problems to wire path between controllers.
- Diagnostic lights (LEDs) for all station outputs as well as the dedicated outputs:
 - MV1(Master Valve #1)
 - MV2 (Master Valve #2)
 - N.O (Normally Open Master Valve)
 - PUMP

Lights indicate when 24 VAC is at output terminal.

- Built-in Test (BIT) functions allow selected controller circuitry to be field-tested.
- Manual test mode. Allows user to automatically advance from station to station using manual run time while displaying valve solenoid electrical current for each station as well as station flow in GPM.
- Manual station and Manual multi-station modes. Turns

on any station for user entered runtime and automatically selects usage of the proper Master Valve and/or Pump for this station. Valve solenoid electrical current is displayed. Multi-station mode allows any single station or output to be turned on individually or in combination with any other station(s). Valve solenoid electrical current is displayed.

- Manually entered program. Allows user to enter a one-time program to be run immediately or scheduled for later in the day. The manual program is independent of automatic programs and will start only one time.
- Manual start of automatic programs (1-12). Start any program independent of the scheduled start time and water day.

Miscellaneous Features

- English/Spanish language selection.
- Automatic limit setup (learn mode) for flow and current. Global percentages adjust for limit establishment.
- Omit by date allows the user to enter up to 15 dates to exclude irrigation.
- Operates as a stand-alone or under Central Computer System.
- Fertilizer injector station with programmable delay from 0 to 255 seconds.

- **Flow Max.** This exclusive feature allows controllers with a single point of connection to share a pump, master valves, and flow meters without the need for peripheral wiring/relays. All flow limits are dynamically managed as stations across controller's transition off and on. Features include:
 - Automatic protection and report for main line breaks, unscheduled flow, station high and low flow
 - Read flow at any controller
 - Dynamic monitor shows system status at all times
 - Pump protection during exception conditions

Electrical Specifications

- **Input Power Required:** 117 VAC +/- 15%, 60 HZ, 20 VA, plus load current.
- **Maximum load current per station or master valve output:** 1 AMP.
- **Maximum combined load current:** 2 AMPS.
- **No batteries required.**

Chapter 2

System Basics

The Evolution DX2 Controller contains a comprehensive feature set to support virtually any conceivable irrigation system/configuration. In addition to the more traditional irrigation features, the controller supports multiple sensor inputs, central communications control, extensive fault diagnostics and specialized electronics to insure that product reliability is not compromised. Through use of selected “setup” options, the controller can be adapted to a specific irrigation application.

Although the controller provides numerous features and options, the user interface remains extremely simple. Consequently the operation of the controller remains “user friendly.”

Evolution DX2 Controller Front Panel

The Evolution DX2 Controller Touch Key Front Panel provides all the necessary functions and control to operate and program the Evolution DX2 Controller.

Figure 2-1: Evolution DX2 Controller Front Panel identifies the location of all touch keys and features.

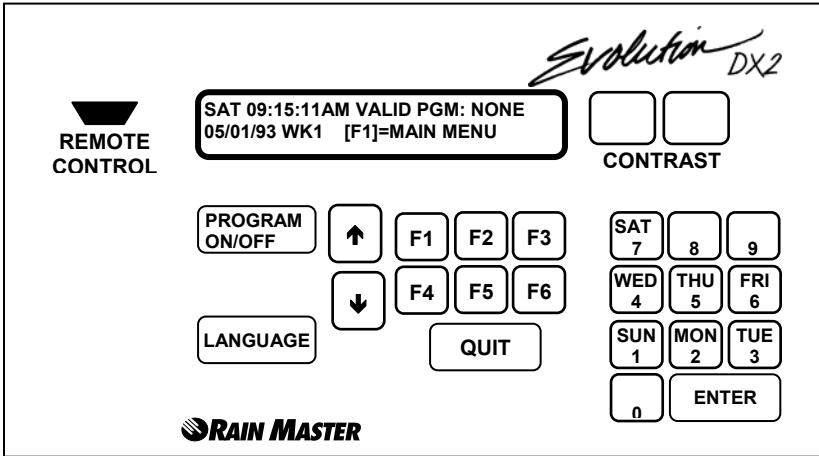


Figure 2: Evolution DX2 Controller Face Panel

The Evolution DX2 Controller Front Panel provides the following features:

- The display contains 2 lines, each line capable of displaying 40 characters.
- Combination Day/Numeric Key Pad.
- Enter Key - Executes all keypad entries.
- Six Function keys used to select all program menus.
- Full Range Display Contrast Control.

- Program On/Off - Executes or stops any program.
- Ability to select English or Spanish language.
- Up/Down Arrow Keys allow advancement through menus.
- Immediate return to the base screen, using the Quit key.
- Distinctive beep validates each key entry (Touch Tone).
- Built-in Remote Control Connector.

The display screen changes accordingly to the activity being performed.

Base Screen

After controller initialization (see Chapter 3), the base screen, depicted in Figure 2-2, is displayed.



Figure 3: Base Screen

- To alter the contrast of the display, use the Contrast keys.
- The base screen displays the day, time, date and additional information, depending upon how the controller is configured.
- The VALID PGM: section of the screen alternates every seven seconds, displaying either the program number(s) or the satellite address. All existing programs will be listed.

Dashed program numbers such as (2 -5) indicate a range of programs which includes all numbers within the range.

Numbers separated by commas such as (2, 4, and 6) indicate individual program numbers.

- When the Evolution DX2 controller displays the base screen information, the controller functions in the "automatic mode," meaning that any valid program(s) will automatically start at established program start time(s).
- The manual function (see Chapter 8) disables the automatic mode. The controller has a built in time-out function (2 hour time-out) which returns the controller to the base screen (automatic mode) if the user inadvertently leaves the controller in some other screen.

- User prompts for valid keystroke entry are designated by | | (vertical bars) with the key name appearing between the bars.
- The entry | F1 | =MAIN MENU prompts the user to press the F1 key to access the Main Menu.
- From the base screen, pressing F1 will display the main menu.

Main Menu

The main menu indicates five of the function keys used to access different functions.

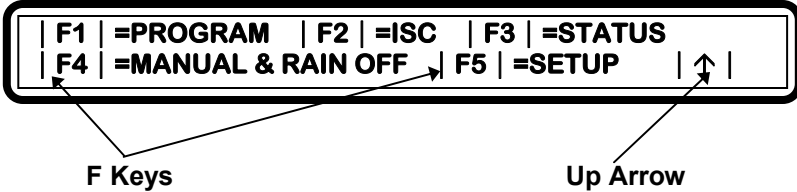


Figure 4: Main Menu

Note: *The F1 key, which was previously used to select the main menu, is now used to select the Program option. The use of the function keys changes depending upon the contents of the screen display.*

| ↑ |

This symbol in the main menu indicates you press the up arrow key on the controller to return to the previous display.

In this case, the previous display is the base screen. The previous screen would change depending upon which menu options (function keys) you had previously chosen.

Using the Controller Keys

Throughout this manual, the following symbols are used to represent the controller keys you use to move through the menu options and to view or change the settings of your Evolution DX2 controller.



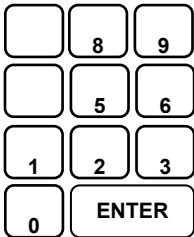
Press the associated function key (F1 to F6) to select the option shown on the display screen.



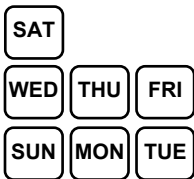
Press the up arrow key to move to the previous screen.



Press the down arrow key to move to the next screen.



Use the numeric keypad section to enter numbers.



Use the keypad section to enter days of the week.

Function Keys (continued):



Press the DARK key to increase display contrast and the LIGHT key to decrease display contrast.

Note: Maximum LIGHT setting will appear as a blank display.



The ENTER key is used to complete entry of a number or day of the week. For example, to ENTER the number 1, press the 1 key and then press the ENTER key.



Press the QUIT key to immediately go to the base screen. The QUIT key bypasses any previous screens and displays the base screen.



Press LANGUAGE to change from English to Espanol or from Espanol to English.



Press the PROGRAM ON/OFF key to immediately turn a program on or off.

"Beep" Responses

To provide user feedback for keyboard entry, two different beeps or tones are omitted. A single beep indicates a valid or correct entry. Rapid successive beeps indicate an invalid entry. For example, from the base screen, select | F1 | and a single beep is heard. This indicates | F1 | is a valid selection. However, from the base screen select the down arrow and multiple beeps are heard.

System Configuration

The DX2 Evolution Controller is housed in an all weather enclosure containing the following assemblies:

- Keyboard Main Panel Assembly
- Main Power Switch Box Assembly
- Master Valve/Pump/Power Board Assembly
- Station Output Board Assembly
(Quantity varies depending on station configuration)
- Communication Board Assembly (Optional)
- Sensor Terminal Board Assembly (Optional)

Keyboard Main Panel

The Keyboard Main Panel assembly consists of a main microprocessor control board and an optional sensor control board, which would be attached to the main board. Four cables from this assembly provide the connections to the additional internal assemblies which include the Master Valve/Pump/Power board, the Communications board (optional), the Sensor Terminal (optional), and the Station Output board(s).

Main Power Switch Box

The Main Power Switch Box assembly contains the controller main power switch, a dual ground fault interrupter receptacle and a step-down transformer delivering 12 VAC and 24 VAC.

The ground fault interrupter (GFI) provides an exclusive safety feature against electrical power hazards. The GFI can sense and detect any degree of power line shorts and will immediately shut down the power preventing electrical damage or injury. The GFI includes a Test switch and a Reset switch. When the Test switch is pressed, all power will shut down indicating proper operation of the internal control circuitry. Pressing the Reset switch will restore power operation. The diagram of Figure 2-5: identifies the Main Power Switch Box and associated wiring.

Master Valve/Pump/Power Board

The Master Valve/Pump/Power board provides the four outputs for Master Valve 1, Master Valve 2, Normally Open Valve and Pump. Additionally, the assembly distributes the 12 VAC and 24 VAC through their respective fuses to the associated controller assemblies. Figure 2-6: illustrates typical connections for Master Valve and Station connections.

Station Output Board

The Station Output board delivers the 24 VAC required operating valve solenoids, lighting systems, security systems, etc. A Station Output board may be configured with six stations or 12 stations. The controller enclosure will accept a maximum of four output boards providing control for a total of up to 48 stations.

Each board is equipped with two common terminals used for circuit ground return. All common terminals of a multiple station configuration are essentially identical and may be interchanged among the boards for wiring convenience.

Communication Board (optional)

The Communication Board provides the means for communication among controllers and/or the Central Computer. The available communication options are Hardwire, Radio or Phone, communication provides the capability for any number of configurations.

Sensor Terminal Board (optional)

The Sensor Terminal board provides the direct link between the flow sensors, and/or weather station devices and the controller.

The flow and weather sensing option provides four sets of terminal connections; two inputs for flow sensors (or one flow and one ET), one input for a rain sensor and one input for a wind sensor. All inputs are dedicated and calibrated to their respective weather devices.

DX2 Pedestal Controller Assembly Layout

The assembly layout location within the controller enclosure is depicted in Figure 2-4.

- 1 - Keyboard Main Panel
- 2 - Main Power Switch Box
- 3 - MV/Pump/Power Bd.
- 4 - Station Output Bd.
- 5 - Communications Bd.
- 6 - Sensor Terminal Bd.

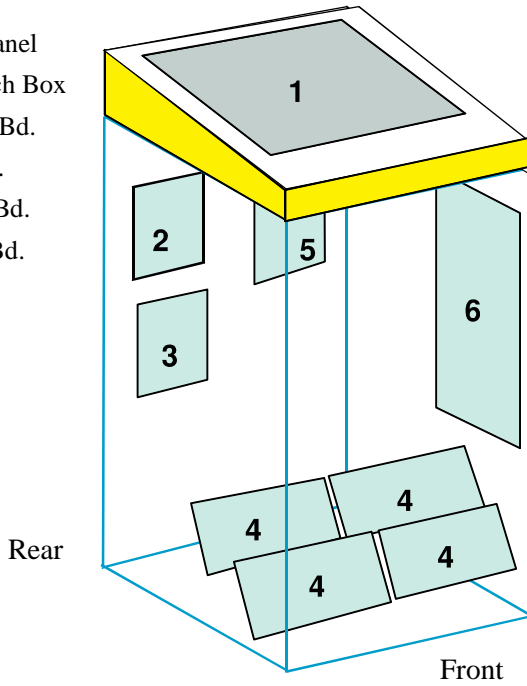


Figure 5: Pedestal Controller Assembly Layout

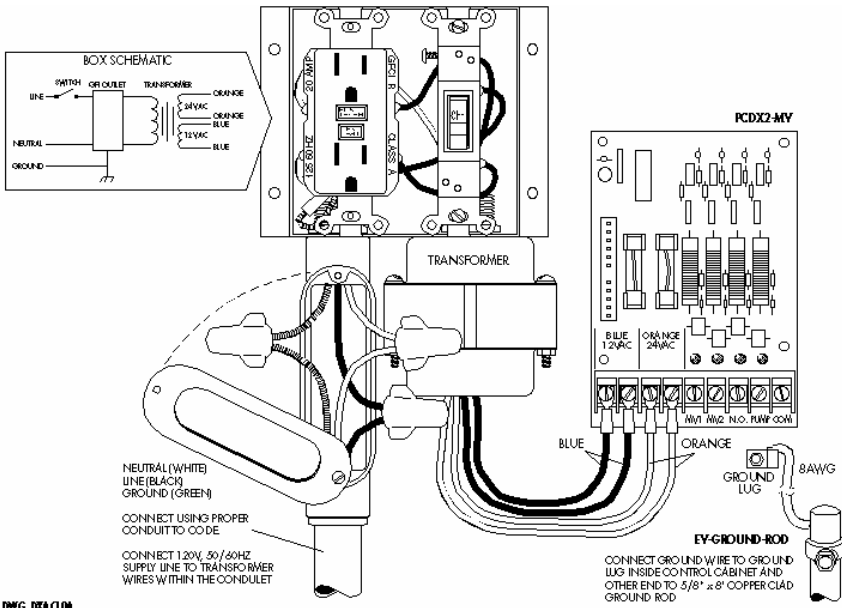
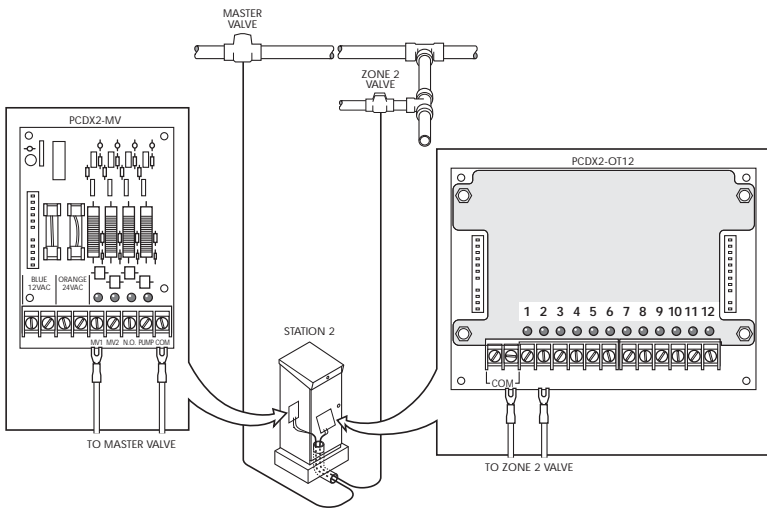


Figure 6: AC Power Supply Wiring Diagram



DWG DXMV10A

Figure 7: Master Valve and Station Connection

Chapter 3

Getting Started

When a controller is new from the factory, when it is repaired, or updated, the controller must be initialized. This process must be performed before any programming or operations take place.

The initialization process is unique in that the sequence of entries provides default settings for all programs of the controller.

When all entries are completed, the initialization screens will no longer be available; however, settings may be changed later by referring to the instructions given in Chapter 4: Setup. Alternatively, changes to initialization are also possible (assuming it has not completed), by turning the power off then on, this restarts the entire procedure.

Initialization Procedure

Step 1 Apply power to the controller and the Language options are displayed.

Note: *It may be necessary to adjust the contrast in the display by using the DARK and LIGHT front panel keys.*

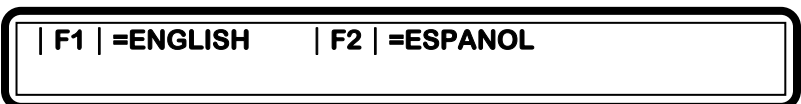


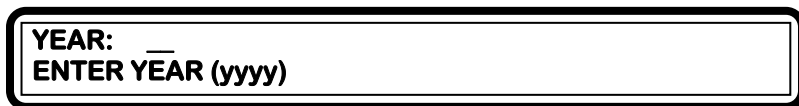
Figure 8: Language Selection

There are two options:

- F1=ENGLISH - displays all controller menus and settings in English.
- F2=ESPAÑOL - displays all controller menus and settings in Spanish.

Step 2 Select F1=ENGLISH. The menu changes to the YEAR Entry display.

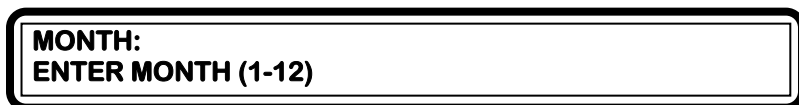
Step 3 Enter the YEAR, and then press ENTER. Four numbers must be entered, as depicted in Figure 3-2.



YEAR: ___
ENTER YEAR (yyyy)

Figure 9: Year Entry

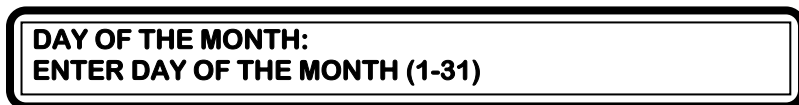
Step 4 Enter the MONTH. Use 1 for January, 2 for February, etc., and then press ENTER, as depicted in Figure 3-3.



MONTH:
ENTER MONTH (1-12)

Figure 10: Month Entry

Step 5 Enter the DAY OF THE MONTH. The day must be between 1 and 31, and then press ENTER, as depicted in Figure 3-4.



DAY OF THE MONTH:
ENTER DAY OF THE MONTH (1-31)

Figure 11: Day of the Month Entry

- Step 6** Select the DAY of the week from the keypad numbers 1 through 7 (Sun through Sat), then press ENTER, as depicted in Figure 3-5.



DAY:
ENTER DAY OF THE WEEK | SUN | - | SAT |

Figure 12: Day of the Week Entry

- Step 7** Enter the TIME in hours and minutes (HH:MM). Select function key F1 to toggle from AM to PM, as depicted in Figure 3-6.



TIME: : AM
ENTER TIME (HH:MM) | F1 | = AM/PM

Figure 13: Time of Day Entry

Then press ENTER to advance to the Master Valve Options.

Master Valve/Pump Program Default Options

The final initialization screens establish default options for usage of a particular Master Valve and/or Pump. Once established, all 12 programs and all ISC's will be affected. Individual programs or ISC settings may be modified at any time by following the procedures given in Chapter 4: Setup. The Master Valve selections are as follows:

- F1=MV1 - Master Valve 1 (Normally Closed)
- F2=MV2 - Master Valve 2 (Normally Closed)

- F3=N.O. - Normally Open Master Valve
- F4= NONE - Master Valve Not Used

Step 8 Select the appropriate Master Valve configuration for a particular irrigation system, as depicted in Figure 3-7.

IS THERE A MASTER VALVE

| F1 | = MV1 | F2 | = MV2 | F3 | = N.O. | F4 | = NONE

Figure 14: Master Valve Options

Note: If F4=NONE is selected, the Pump display will not appear.

Step 9 Select the appropriate Pump configuration.

F1 = Uses Pump

F2 = No Pump Used

USES NO PUMP

| F1 | = PUMP | F2 | =NONE

Figure 15: Pump Options

Step 10 This completes the initialization procedure. Verify the default base screen display has the correct information.

TUE 04:53:06PM VALID PGM: NONE

06/18/96 WK1 | F1 | = MAIN MENU

Figure 16: Base Screen Display

The default base screen displays the current day, time and date. In addition, VALID PGM: NONE, | F1 | =MAIN MENU and the current week of a 2 week watering schedule are also shown.

- VALID PGM: NONE - indicates that there are currently no valid programs in the controller. See Chapter 5 for details on entering and changing Evolution DX2 irrigation programs.
- | F1 | =MAIN MENU - indicates you are to press the F1 key to display Evolution DX2's Main Menu. Background information about menus and navigating through the menu displays is given in Chapter 2: System Basics. Complete details on using the menus are given in the subsequent sections of this manual.

Creating a New Program

To create a program, the following parameters must be set:

- Program Number
- Watering Day cycle
- Start times
- Station Run times

Using the 2 week (14 day cycle), this sample program sets up the parameters as follows:

Program 1

| Water Days | Start Times | Stations | Run Time |
|---------------------|-------------|----------|----------|
| Week 1: Mon-Wed-Fri | 2:00 AM | 1 | 5 min. |
| Week 2: Mon-Fri | 10:00 PM | 2 | 10 min. |
| | | 3 | 7 min. |

- 1

SAT 09:15:11AM VALID PGM: NONE
 05/01/96 WK1 |F1|= MAIN MENU

F1
- 2

| F1|=PROGRAM | F2|=ISC | F3|=STATUS
 | F4|=MANUAL & RAIN OFF | F5|=SETUP |↑|

F1
- 3

|F1|=MODIFY PROGRAM |F2|=REVIEW PROGRAM
 |F3|=NEW PROGRAM |F4|=CLEAR PROGRAM |↑|

F3
- 4

PROGRAM NUMBER: P
 ENTER PROGRAM NUMBER (1-12) |↑|

F1
ENTER
- 5

P1 |F1|=14 DAY CYCLE |F2|=SKIP BY DAY
 |F3|=31 DAY CYCLE NOW=F1 |↑|

F1

| | | | | | | | | |
|----|--|-----------|----------|----------|-------|----|-------|---|
| 6 | P1: NONE TODAY: TUE WK2 ENTER WEEK 1 WATER DAYS SUN - SAT ↓ ↑ | MON 2 | WED 4 | FRI 6 | ENTER | ↓ | | |
| 7 | P1: NONE TODAY: SAT WK1 ENTER WEEK 2 WATER DAYS SUN - SAT ↓ ↑ | MON 2 | FRI 6 | ENTER | ↓ | | | |
| 8 | P1: START TIME 1: : AM ENTER TIME (HH:MM) F1 =AM/PM ↓ ↑ | MON 2 | 0 | 0 | ENTER | | | |
| 9 | P1: START TIME 2: : AM ENTER TIME (HH:MM) F1 =AM/PM ↓ ↑ | MON 2 | 0 | 0 | 0 | F1 | ENTER | ↓ |
| 10 | P1 F1 = STATION RUN TIME F2 = QUICK STATION PROGRAMMING ↓ ↑ | F1 | | | | | | |
| 11 | P1 STATION NUMBER: ENTER STATION NUMBER (1-48) ↑ | SUN 1 | ENTER | | | | | |
| 12 | P1 STATION 01 RUN TIME: : ENTER TIME (HH:MM) ↑ | THUR 5 | ENTER | | | | | |
| 13 | P1 STATION 02 RUN TIME: : ENTER TIME (HH:MM) ↑ | F1 | 0 | ENTER | | | | |
| 14 | P1 STATION 03 RUN TIME: : ENTER TIME (HH:MM) ↑ | SAT 7 | ENTER | QUIT | | | | |

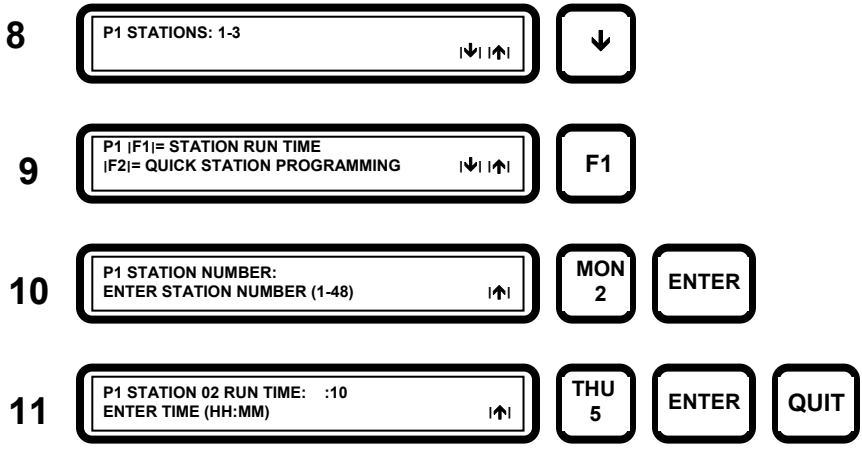
This completes Program 1 entry. Program 1 will start on its scheduled water days and start times. The base screen display will now show "VALID PGM: 1."

Modify a Program

This example demonstrates the methods of changing the parameters of an existing program.

Example: To change start time#1 of program 1 to 3:15 A.M. and change the run time on station 2 to 5 minutes, perform the following entries:

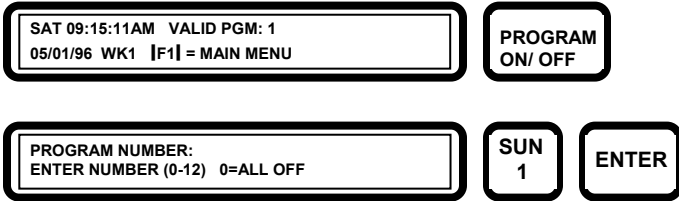
| | | | | | | |
|---|---|----------|----------|----------|-------|---|
| 1 | SAT 09:15:11AM VALID PGM: 1 05/01/96 WK1 F1 = MAIN MENU | F1 | | | | |
| 2 | F1 = PROGRAM F2 =ISC F3 =STATUS F4 = MANUAL & RAIN OFF F5 =SETUP ↑ | F1 | | | | |
| 3 | F1 = MODIFY PROGRAM F2 =REVIEW PROGRAM F3 =NEW PROGRAM F4 = CLEAR PROGRAM ↑ | F1 | | | | |
| 4 | PROGRAM NUMBER: P ENTER PROGRAM NUMBER (1-12) ↑ | SUN 1 | ENTER | | | |
| 5 | P1 F1 = PROGRAM START F2 =WATER DAYS F3 =STATIONS F4 =PERCENT F5 =SEND ↑ | F1 | | | | |
| 6 | P1: START TIME1: 2:00 AMENTER TIME (HH:MM) F1 =AM/PM ↓ ↑ | TUE 3 | SUN 1 | THU 5 | ENTER | ↓ |
| 7 | P1 F1 = PROGRAM START F2 = WATER DAYS F3 = STATIONS F4 = PERCENT F5 = SEND ↓ ↑ | F3 | | | | |



Program On/Off

This example demonstrates how to activate or deactivate a single program.

Example: To activate Program 1, perform the following entries:



Note: To deactivate a running program, repeat the same key strokes.





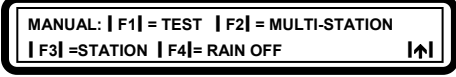




Manual Station Test Cycle

To test stations manually:

All manual operations are performed through the Manual & Rain Off Menu.

Note: Pressing QUIT will cease all manual operations.

Example: Turn on all stations for 5 minutes.

- 1  
- 2  
- 3  
- 4   

Each station will operate one at a time in sequential order for the specified period of 5 minutes.

Rain Shutdown

Example: To place all irrigation programs in rain shutdown, perform the following:

- 1

| | |
|---|----|
| SAT 09:15:11AM VALID PGM: 1 05/01/96 WK1 F1 = MAIN MENU | F1 |
|---|----|

- 2

| | |
|--|----|
| F1 = PROGRAM F2 =ISC F3 =STATUS F4 = MANUAL & RAIN OFF F5 =SETUP ↑ | F4 |
|--|----|

- 3

| | |
|--|----|
| MANUAL: F1 = TEST F2 = MULTI-STATION F3 =STATION F4 = RAIN OFF ↑ | F4 |
|--|----|

- 4

| | |
|--|----|
| F1 = RAIN SHUTDOWN F2 = NO WATER WINDOW F3 =PROGRAMMABLE RAIN SHUTDOWN ↑ | F1 |
|--|----|

- 5

| | | |
|--|----|------|
| RAIN SHUTDOWN: OFF F1 = ON F2 = OFF (AUTOMATIC MODE) ↑ | F1 | QUIT |
|--|----|------|

Note: The Rain Shutdown message will appear in the base screen.

Chapter 4

Setup

Because all irrigation applications are not identical, the Evolution DX2 controller has been designed to allow users to establish a wide variety of individual programmable options. These options include changing configuration of programs, Individual Station Control (ISC), irrigation stations, the controller, and sensors. The setup function provides the mechanism for tailoring the Evolution DX2 controller operation to a specific irrigation application.

Note: Factory defaults have been established to allow most users to skip the setup options and proceed to basic programming (Chapter 5: Program Entry). The following table summarizes the setup options and factory default values.

System Defaults

Table 1: Setup Options and System Defaults

| Setup | Function | Options | Defaults |
|------------------------------------|---|--|---|
| Program | Cycle Mode | start times, continuous cycle | start times |
| | Overlap Protection | on, off | on |
| | Irrigation Program | yes, no | yes |
| | Omit by Date | on, off | on |
| | Station Delay Time | 0-255, 0=Off | 0 |
| | Time Format | HH:MM, MM:SS | HH:MM |
| | Water Limit Reached | give warning, stop watering | give warning |
| | Master Valve Used | MV1, MV2, normally open MV, none | Dependent upon power-on initialization (see Chapter 3) |
| | Uses Pump | uses a pump, uses no pump | Set at initialization (see Chapter 3) |
| | State of Master Valve between Stations | on, off | on |
| Master Valve Delay Turn On Time | 0-600 seconds | 0 | |

Table 1: Setup Options and System Defaults (continued)

| Setup | Function | Options | Defaults |
|------------------------------------|---|--|--|
| ISC | Cycle Mode | start times, continuous cycle | start times |
| | Overlap Protection | on, off | on |
| | Irrigation Program | yes, no | yes |
| | Omit by Date | on, off | on |
| | Station Delay Time | 0-255, 0=Off | 0 |
| | Time Format | HH:MM, MM:SS | HH:MM |
| | Water Limit Reached | give warning, stop watering | give warning |
| | Master Valve Used | MV1, MV2, normally open MV, none | Set at initialization (see Chapter 3) |
| | Pump | uses pump, uses no pump | Set at initialization (see Chapter 3) |
| | State of Master Valve between Stations | on, off | on |
| Master Valve Delay Turn On Time | 0-600 seconds | 0 | |

Table 1: Setup Options and System Defaults (continued)

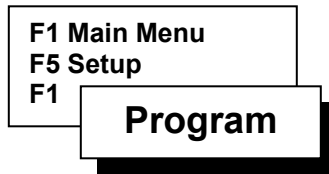
| Setup | Function | Options | Defaults |
|--------------|---------------------------|------------------------------|-----------------|
| Stations | Low Limit Flow Checking | enable, disable | disable |
| | Upper Limit Flow Checking | enable, disable | disable |
| | Low Limit Current Check | enable, disable | disable |
| | Upper Limit Current Check | enable, disable | enable |
| | Maximum Current Limit | 0.0 to 1.0 amps | 1.0 |
| | Minimum Current Limit | 0.0 to 1.0 amps | 0.05 |
| | Maximum Flow Limit | 0 to 2000 gallons per minute | 500 |
| | Minimum Flow Limit | 0 to 2000 gallons per minute | 0 |
| | Type | normal, injector | normal |

Table 1: Setup Options and System Defaults (continued)

| Setup | Function | Options | Defaults |
|--------------|---------------------------------------|---|-----------------|
| Controller | Main Line Flow Limit | 0 to 2000 gallons per minute | 2000 |
| | Monthly Water Limit | 1-9,999,999 gallons, none | none |
| | Flow Meter used for Limit Comparisons | meter 1, meter 2, sum of meters 1 and 2 | meter 1 |
| | Flow Delay before Limit Checks | 1-6 minutes | 2 minutes |
| | Unscheduled Limit | (0-2000) gallons | 200 |
| | Omit by Date (15 allowed) | any day of the year | none |
| | Time | 12 hour, 24 hour | 12 hour |
| | Date | month/day/year, day/month/year | month/day/year |
| | Language | English, Espanol | English |
| | Access Code | none/set | none |

Table 1: Setup Options and System Defaults (continued)

| Setup | Functions | Options | Defaults |
|---------------|--|-----------------------------------|------------|
| Configuration | Operational Modes | satellite, submaster, Flow Max | satellite |
| | Communications Type (If submaster is selected mode) | Radio/ wire Phone Trunk | Radio/wire |
| | Address (If submaster is selected mode) | 0-255 | 239 |
| Sensors | Program Assignment Moisture Sensor | 1- 12 | none |
| | Trip Points (1-12) | 0-200 | 0 |
| | Sensor Status | enabled disabled | disabled |
| | Flow 1- K Value | 0-56000 | 0 |
| | Flow 1- Offset Value | 0-26000 | 0 |
| | Flow 2- K Value | 0-56000 | 0 |
| | Flow 2- Offset Value | 0-26000 | 0 |



Program

Setup Program is used to specify operational controls for the programs used by the Evolution DX2. The following parameters and options are available in the Setup Program:

- Cycle Mode: Select start times or continuous cycle
- Overlap Protection: Select station start time overlap
- Irrigation Program: If NO is selected for a program, then the controller Rain Shutdown mode will not affect program operation.
- Omit By Date Enable: Select non-watering dates.
- Station Delay Time - Set delay time between station watering start times.
- Time Format - Select time in hours and minutes or minutes and seconds.
- At Water Limit - Select water control option to stop watering or give warning if water limit is exceeded.
- Master Valve - Select master valve configuration.
- Pump - Select pump configuration.
- Master Valve On Between Stations - On or Off.
- Master Valve Delay Turn On Time - Set delay of turn on time.

The Evolution DX2 Controller allows each program to have its own unique set of setup parameters. Individual setup parameters on a per program basis provide absolute programming independence.

Program Setup Procedure

Step 1 Advance to the program entry screen through the following sequence:



F1=Main Menu
F5=Setup
F1=Program



Figure 17: Program Entry

Step 2 Enter the program number, the program number must be between 1 and 12, then press ENTER.

Step 3 **Cycle Mode**

Press F1=CHANGE OPTION to select one of the two following options:

- **START TIMES** - Start a program based upon user-defined (programmed) start times (up to 8 start times available).
- **CONTINUOUS CYCLE** - Allows a program to be run continuously during a user defined water window (start/end time). Upon completion of the first cycle, a user defined soak delay occurs and the program starts again. Operation repeats in this fashion until the end time is reached.



P # CYCLE MODE: START TIMES
| F1 | =CHANGE OPTION

| ↓ | | ↑ |

Figure 18: Cycle Mode

Step 4 Overlap Protection

Press the Down Arrow to display the Overlap Protection option screen.

Overlap protection prevents multiple stations from being on simultaneously if the station start times overlap.

Select one of the two following options:

- ON - Allows only one station to be on at a time, regardless of programmed start times.
- OFF- Allows multiple stations to be on simultaneously if station start times overlap.



P # CYCLE MODE: START TIMES
| F1 | =CHANGE OPTION

| ↓ | | ↑ |

Figure 19: Overlap Protection

Step 5 Irrigation Program

An Irrigation Program is defined as a watering program responding to rain shutdown features and Flow Max control.

The IRRIGATION PROGRAM: YES option sets a program to respond to rain shutdown and features such as stop watering.

The IRRIGATION PROGRAM: NO option disables commands associated with rain shutdown or stop watering. This option is primarily used for controlling lighting, security gates, water fountains, etc.

Note: Selecting IRRIGATION PROGRAM: YES does not place the program into the Rain Shutdown mode. Refer to "Rain Off" page to place the controller into Rain Shutdown.

Warning:



Irrigation programs should be set to the Yes option for any watering configuration.

Press the Down Arrow to display the Irrigation Program option screen, and select the appropriate option.



Figure 20: Irrigation Program

Step 6 Omit By Date Enable

OMIT BY DATE allows you to enter up to 15 dates, on which watering will NOT occur. The steps required to add/delete dates are detailed in the Omit By Date section. The Omit By Date option determines whether or not a program will run for the omitted dates entered into the controller.

There are two options:

- ON - Enables omitting by date (Program will not start on any omitted date).
- OFF- Disables omitting by date (Program start will not be affected by Omit By Date entries).

Press the Down Arrow to display the Omit By Date Enable option screen.

Press F1=CHANGE OPTION to select the appropriate option.

P # OMIT BY DATE ENABLE OPTION: OFF
| F1 | =CHANGE OPTION

| ↓ | | ↑ |

Figure 21: Omit By Date Option

Step 7 Station Delay Time

Use STATION DELAY TIME to specify "dead" time between stations being controlled by a program. For example, assume a program controls three stations and there is a station delay time of 10 seconds. After station 1 has completed its watering, the controller will wait 10 seconds before turning on station 2. When station 2 completes, the controller will delay another 10 seconds before starting station 3.

The available delay is 0 to 255 seconds.

Press the Down Arrow key to display the Station Delay Time screen.

P # CYCLE MODE: START TIMES
| F1 | =CHANGE OPTION

| ↓ | | ↑ |

Figure 22: Station Delay Time Display

Enter the Station Delay Time.

Step 8 Time Format

The time format for station run times can be established on a per program basis.

There are two options, HH:MM (hours and minutes) and MM:SS (minutes and seconds).

The MM:SS option allows precise station run time control, since the station can be programmed to the second.

Press the Down Arrow key to display the Time Format screen.

Select the Time Format using the F1=CHANGE OPTION toggle key.



Figure 23: Time Format

Step 9 At Water Limit

There are two options.

- Select GIVE WARNING to continue watering when the monthly water limit is reached. If the limit is exceeded, an entry is made in the Warning/Report list and irrigation continues (see Chapter 10).
- Select STOP WATERING to cease watering when the monthly water limit is reached. If the limit is exceeded, an entry is made in the Warning/Report list and irrigation is stopped (see Chapter 10). No further irrigation occurs until a new month begins (and the monthly water total is reset).

Press the Down Arrow key to display the At Water Limit screen.

Select either Stop Watering or Give Warning using the F1=CHANGE OPTION toggle key.



Figure 24: At Water Limit

Step 10 Master Valve

There are four options:

- MV1 (Master Valve 1)
- MV2 (Master Valve 2)
- Normally Open MV
- None

Press the Down Arrow key to display the Master Valve selection screen.



Figure 25: Master Valve Selection

Advance through the four selections using the F1=CHANGE OPTION key and select the appropriate Master Valve configuration.

Note: If the NONE option is selected for Master Valve, no further Master Valve/Pump options will follow.

Note: *If a Normally Open Master Valve is selected, it will not be activated with the program. It will be energized only if the controller detects a main line or unscheduled overflow condition. In this condition, 24 VAC appears at the N.O. terminal board output, which turns the valve off.*

Step 11 Pump

There are two options:

- Select Pump if the program is to operate with a pump.
- Select No Pump if the program is to operate without a pump.

Press the Down Arrow key to display the Pump selection screen.

Select the Pump configuration using the F1=CHANGE OPTION toggle key.



Figure 26: Pump Selection

Step 12 Master Valve On Between Stations

There are two options, ON and OFF.

Select the appropriate configuration.



Figure 27: Valve On/Off Between Stations

Step 13 Master Valve Delay Turn On Time

Use MASTER VALVE DELAY TURN ON TIME to delay the activation of the master valve by 0 to 600 seconds from the program starts time (one time delay).

Press the Down Arrow key to display the Master Valve Delay Turn On Time entry screen.

Enter the delay time then press ENTER. The time must be between 0 and 600 seconds.

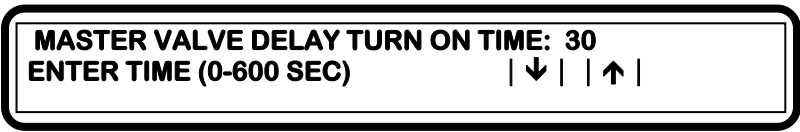


Figure 28: Valve Delay Turn On Time

To end the Program Setup procedure, press the Down Arrow to return to the Setup Main Menu.

To make changes or to configure another program number, press F1=PROGRAM and repeat Setup Program procedure. Advance through all menu screens using the Down Arrow.

ISC (Individual Station Control)

ISC is used to specify operational settings for the Individual Station Control (ISC) programs used by the Evolution DX2.

The ISC setup options are given below. The options are identical to those given in the previous section, Setup Programs. Refer to the Setup Programs section for details on the ISC options.

- Cycle Mode
- Overlap Protection
- Rain Shutdown
- Omit By Date
- Time Format
- Water Limit Checking
- Master Valve
- Pump
- Master Valve Delay Turn on Time

Station Number Procedure

Step 1 Advance to the ISC program number entry screen through the following sequence:

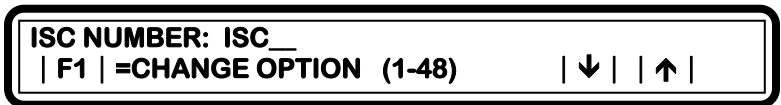
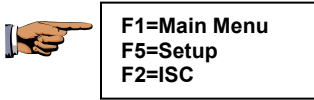


Figure 29: ISC Program Number

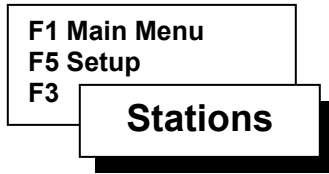
Step 2 Enter the station number then press ENTER. The station number must be between 1 and 48.

Note: The maximum number of stations is determined by the total stations installed in the controller. The maximum number will appear on the Station Number Entry Display screen.

Step 3 The ISC Options are identical to the Setup Program options. Refer to the Setup Program procedure to complete all ISC options.

This completes the ISC procedure.

Press the QUIT key to return to the base menu.



Stations

Setup Stations is used to enable/disable flow and current limit checking and to specify operational controls for the programs used by Evolution DX2.

Flow checking is used to determine if a pipe has failed (broken, clogged) or if the monthly watering limit (budget) has been exceeded. Current checking is used to determine if there is a short or break in field wiring or if an out-of-tolerance or marginal field wiring problem exists. See Appendix A for complete details on flow limit checking and Appendix B for details on current limit checking. The following station options are:

- **Limit Checking** - Enables or disables upper and lower limits of both Water Flow and Current.
- **Limits/Type** - Enter upper and lower limits of Flow and Current. Select Type as Normal or Injector. Injector type is defined as a fertilizer application station.
- **Auto Limits** - Establishes upper and lower limits of Flow and Current by measuring each station. An upper and lower percentage of the measurements

are calculated to automatically set the limits for each station.

Stations Setup

Enable/Disable Limit Checking Procedure

Step 1 Advance to the Limits Option Menu through the following sequence:



F1=Main Menu
F5=Setup
F2=ISC

Flow and Current Limit Checking is enabled or disabled with this option.



Figure 30: Station Limits Options

Step 2 Select F1=Enable/Disable Limit Checking.

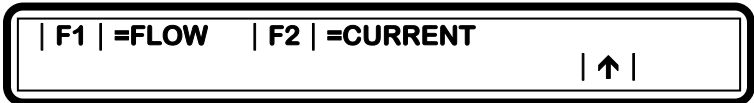


Figure 31: Flow/Current Selection

There are two options:

- Select FLOW to enable or disable water flow limit checking.
- Select CURRENT to enable or disable electrical current limit checking.

Step 3 Select F1=FLOW.

There are two options:

- Select UPPER LIMIT to enable or disable Upper Limit Flow Checking.
- Select LOWER LIMIT to enable or disable Lower Limit Flow Checking.

Step 4 Select F1=UPPER LIMIT.



Figure 32: Upper Limit Check

There are two options:

- ENABLED
- DISABLED

Step 5 Change the option displayed using the F1=CHANGE OPTION toggle key.

Step 6 Press the Up Arrow key to return to the Limit Selection screen and select F2=LOWER LIMIT.



Figure 33: Lower Limit Check

There are two options:

- ENABLED
- DISABLED

Step 7 Change the option displayed using the
F1=CHANGE OPTION toggle key.

If Electrical Current (enable/disable options) requires modification, use the Up Arrow key to select the previous screen.

Repeat the Limit Checking procedure for Current Limits options by selecting Current rather than Flow.

At the end of Limit Checking procedure, press the QUIT key to return to the base screen.

Limits/Type Procedure

This procedure applies to either the Station Number outputs or the Master Valve/Pump outputs. Either parameter may be configured at any time independently of each other.

The Station/Master Valve Number Entry screen is a dual purpose menu which accepts two separate entries. The Station Number output is selected by entering any number between 1 and 48 (maximum number is limited by the number of stations installed).

The Master Valve/Pump output configuration is selected by any number between 1 and 4 which is preceded by a 0 (zero). The Master Valve/Pump selections are:

- MV1=01
- MV2=02
- N.O.=03
- Pump=04

***Note:** Entries from 05 to 09 will be accepted as station number outputs.*

Step 1 Advance to the Station Number/Master Valve Entry screen through the following sequence:



F1=Main Menu
F5=Setup
F3=Stations
F2=Limits/Type



Figure 34: Limits/Type

Note: The Station Numbers relate to the individual station outputs whereas the Master Valve selection relates to the complete irrigation system configuration. These entries should be considered as two independent parameters.

Step 2 Enter the station number then press ENTER. The Number must be between 1 and 48.

Note: The maximum number of stations is determined by the total stations installed in the associated satellite controller. The maximum number will appear on the Station Number Entry Display screen.

Step 3 Select F1=CURRENT LIMIT from the three options in the following display:

| | | | |
|----|----------------|----|-------------|
| F1 | =CURRENT LIMIT | F2 | =FLOW LIMIT |
| F3 | =TYPE | ↑ | |

Figure 35: Limit Options

The three options are:

- **CURRENT LIMIT** - Set up limits for electrical current checking.
- **FLOW LIMIT**- Set up limits for flow checking.
- **TYPE** - Select station type (NORMAL, or INJECTOR).

Step 4 Enter the maximum current limit for the station. The limit must be between 0.0 and 1.0 amp, and then press ENTER.

| |
|---|
| STATION ## MAX CURRENT LIMIT: 1.00 |
| ENTER LIMIT (0.0-1.0 AMPS) ↑ |

Figure 36: Max Current Limit

Step 5 Enter the minimum current limit for the station in the Minimum Current display screen. The limit must be between 0.0 and 1.0 amp, and then press enter.

Note: A nominal value of 0.05 amps of quiescent current is recommended for the Minimum Current entry to ensure that an open output circuit would be detected.



Figure 37: Min Current Limit

Controller returns to the limit options display.

Step 6 Select F2=FLOW LIMIT from the three option menu.

Enter the maximum flow limit for the station. The limit must be between 0 and 2000 gallons per minute (GPM). Press ENTER.

Controller returns to the Limit Options display



Figure 38: Max Flow Limit

Step 7 Enter the minimum flow limit for the station. The limit must be between 0 and 2000 gallons per minute (GPM), then press ENTER.



Figure 39: Min Flow Limit

Controller returns to the Limit Options display.

Step 8 Select F3=TYPE. The present setting for the station is displayed.



Figure 40: Station Type

There are two options:

- NORMAL
- INJECTOR

Step 9 Select F1=NORMAL to change station type to Normal.

Select F2=INJECTOR to change station type to Injector.

Step 10 Press the Up Arrow to return to the Station/Master Valve Number menu. Repeat as necessary.

End of Limits/Type procedure.

Press QUIT to return to the base screen.

Note: Injector Station Operation

The typical use of an injector station is to apply fertilizer to wet ground.

When the user includes an injector assigned station in one or more programs, the controller will prompt for an injector delay time. The operation of a program using the injector delay time is best described with an example.

Assume Program 1 uses injector station 10 with a programmed injector delay = 1 minute. Also assume program 1 has three NORMAL stations (1, 2, 3) each with a run time of 5 minutes.

Example: Injector station operation with a program start time of 7:00 A.M.

| | | |
|---------|---------------------|-----|
| 7:00 AM | Master Valve | ON |
| | Station 1 | ON |
| 7:01 | Station 10 | ON |
| 7:05 | Station 1 | OFF |
| | Station 2 | ON |
| 7:10 | Station 2 | OFF |
| | Station 3 | ON |
| 7:15 | All Stations and MV | OFF |

Main Flow Procedure

This procedure establishes the maximum flow limit for the complete controller irrigation system. The accepted flow limit range is 0-2000 gallons per minute (GPM). The GPM value is determined by the user by calculating the expected amount of water usage at any given time in the watering configuration. A safety margin of 20% above the determined value is recommended.

Calculation Example:

For an irrigation system that delivers a maximum flow of 1000 GPM at any given time throughout the complete watering program, the Main Flow Limit would be 1200 GPM. $(1000 + 20\%) = (1000 + (1000 \times 0.20 = 200)) = 1200$

Flow Max Main Line Limits

In a Flow Max system, the total GPM of all participating controllers is calculated into the overall Main Flow Limit value. The Main Flow Limit is entered at the submaster controller only. For any number of controllers within a Flow Max group, there will only be one main flow limit. Remember that the main flow limit must be higher than an expected flow under normal operation yet low enough to react when a main break occurs.

Procedure

Step 1 Advance to the Station Number/Master Valve Entry screen through the following sequence:



F1=Main Menu
F5=Setup
F3=Stations
F2=Limits/Type



Figure 41: Main Flow Limit Entry

Step 2 Enter 01 (zero 1) then press ENTER. The main limit option menu is depicted in Figure 4-26:

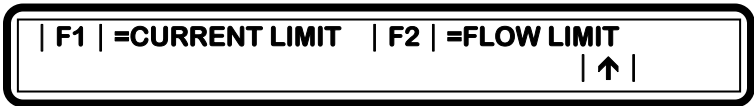


Figure 42: Main Limit Options

Step 3 Select F2=FLOW LIMIT. The maximum main flow limit is displayed (the default value is 2000 GPM).



Figure 43: Main Flow Maximum Limit

Step 4 Enter the determined value for your system and then press the ENTER key. Press QUIT to return to the base screen.

This completes the Main Flow Limit procedure.

Auto Limits Procedure

The Auto Limits feature establishes upper and lower limits of Flow and Current by constantly measuring each station. An upper and lower percentage of the measurements are calculated to automatically set the limits for each station.

The current upper default percentage is set at 20% above the measured value (If the measured value is .50 Amps, the calculated value for the upper limit would be .60 Amps). The lower default percentage is set at 50% below the measured value (If the measured value is .50 Amps, the calculated value for the lower limit would be .25 Amps).

The default values may be changed at any time using the F2=SET LIMIT (%) option. The percentage value ranges are given on the percentage entry display screen.

Note: *If the default values are not suitable for your application, the SET LIMITS percentages must be entered prior to running the Auto Limits. Select F2=SET LIMIT and set your percentages accordingly.*

Step 1 Advance to the Limits/Type menu Auto Limits two options are displayed through the following key sequence:



F1=Main Menu
F5=Setup
F3=Stations
F2=Limits/Type



Figure 44: Auto Limits

Step 2 Select F1=RUN AUTO LIMITS and verify the following three option display:



Figure 45: Auto Limits

There are three options:

- Flow Only
- Current Only
- Both Flow and Current

Step 3 Select F1=Flow Only and enter the station number. The station number must be between 1 and 48. To measure all stations, enter station number 1, and then press ENTER.

Note: *The maximum number of stations is determined by the total stations installed in the controller. The maximum number (1-xx) will appear on the Station Number Entry Display. Each station will run for the full time period of the flow check delay time (1 to 6 minutes) before proceeding to the next station.*

The following display, as depicted in Figure 4-30, indicates the station number, run time count-down timer, station current measurement (I) and flow measurement (GPM). The upper and lower limits of flow are automatically calculated based on these measured parameters.

When the count-down timer is zero, the station number will increment to the next station and the measurement process is repeated. When all stations are complete, the display returns to the three option selection screen. At this point, all upper and lower percentage values have been calculated.

Note: The default measuring time for each station is two minutes. This time period accounts for the Flow Delay time allowing water flow pressure to stabilize.

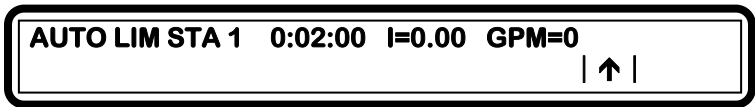


Figure 46: Auto Limits

Step 4 Select F2=CURRENT ONLY and enter the station number. The station number must be between 1- 48. To measure all stations, enter station number 1, and then press ENTER.

The Current measuring default time is 5 seconds for each station. The calculating program is identical to the Flow mode. In addition to sequencing through all stations, MV1, MV2 and the N.O. output currents are also established.

Note: The pump is not calculated and therefore should be established by the user manually.

When completed, the Auto Limits Options menu will be displayed.

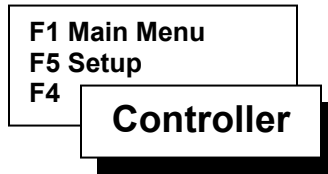
Step 5 Repeat procedure selecting F3=BOTH FLOW AND CURRENT.

This selection is identical to the previous steps with the Current measurements taking place on the first pass through the stations and the Flow measurements are taken on the second pass.

When the flow measurement pass is completed, the Auto Limits Options will be displayed.

This completes the Auto Limits procedure.

Press QUIT key to return to the base screen.



Setup Controller

Setup Controller is used to specify operational controls for the controller. The following options are available in the Controller Setup:

- **FLOW OPTIONS** - Set monthly limits, select meters for flow checking, specify the amount of time to delay before checking limits, and set unscheduled flow limits. See Appendix A for complete details on flow meter operation.
- **OMIT BY DATE** - Select up to 15 dates, on which watering will not occur.
- **USER OPTIONS** - Change the time and date, select the language for the display, and enter or change access codes (passwords) for using the controller. See Appendix E for additional details on access codes.

- CONFIGURATION - Specify communications mode of the satellite, submaster or the Flow Max group.

Flow Options Procedure

Step 1 Advance to the Controller Flow Options menu through the following sequence:



F1=Main Menu
F5=Setup
F4=Controller

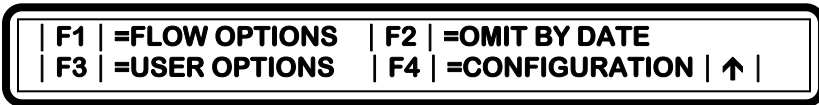


Figure 47: Controller Options

Step 2 Select F1=Flow Options to display the following Limit options:

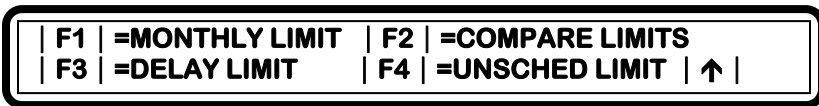


Figure 48: Limit Options

Four options are displayed:

- MONTHLY LIMIT
- COMPARE LIMITS
- DELAY LIMIT
- UNSCHED LIMIT

Step 3 To change monthly water limit, select
F1=MONTHLY LIMIT.

The current monthly water limit of the controller is displayed.



**CONTROLLER MONTHLY WATER LIMIT: NONE
ENTER LIMIT (1-9999999) F1=NONE | ↑ |**

Figure 49: Monthly Water Limit

Note: If the monthly watering limit is reached, the controller can be programmed to either:

- 1. Give Warning*
- 2. Stop Watering*

See "At Water Limit"

Step 4 Enter the limit, or press F1=NONE to enter no limit.
The limit must be between 1 and 9999999.

Note: Water units are specified in gallons.

Press the Up Arrow to return to the Limit Options screen.

Step 5 Flow Meter Compare Limit Selection

Select F2=COMPARE LIMITS. The flow meter currently being used is displayed.

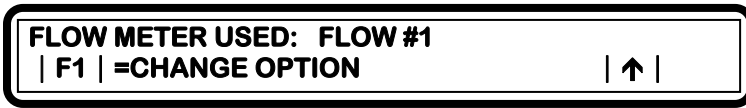


Figure 50: Flow Meter Selection

There are three options:

- FLOW METER #1- Station flow rate limit checking will use data provided by FLOW METER #1. Accumulated water totals by FLOW METER #1 are used for comparison to the Monthly Water Limit specified in the previous step.
- FLOW METER #2 - Operation is identical to Flow Meter #1. Accumulated water totals by FLOW METER #2 are compared to the specified Monthly Water Limit.
- SUM OF FLOW #1 + FLOW #2 - Selecting sum of both meters indicates that the controller will take the accumulation total of FLOW METER #1 and add it to the accumulation total of FLOW METER #2. The result will be compared to the Monthly Water Limit. Additionally, station flow rates (measured in GPM) will also be summed and compared.


Step 6 Select the appropriate option using the F1=CHANGE OPTION key.

Press the Up Arrow key to return to the Limit Options display.

Step 7 Delay Limit

The Delay Limit sets a delay time (in minutes) prior to taking measurements to allow for stabilization of water lines.

Select F3=DELAY LIMIT from the Limit Options display.



DELAY TIME: 3
ENTER TIME (1-6 MIN) | ↑ |

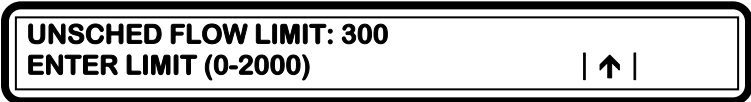
Figure 51: Delay Limit Time

Step 8 Enter the delay time. The delay must be a value between 1 and 6 minutes. Press ENTER to return to Limit Options screen.

Step 9 Unsheduled Limit

The Unsheduled Limit option sets the maximum unsheduled water flow which can occur before an alarm or shut-down occurs.

Select F4=UNSCHED LIMIT to display the following screen:



UNSCHED FLOW LIMIT: 300
ENTER LIMIT (0-2000) | ↑ |

Figure 52: Unsheduled Flow Limit

Step 10 Enter the Unsheduled Limit value. The limit must be between 0 and 2000 gallons then press ENTER.

This completes the Flow Options procedure.

Press the QUIT key to return to base menu.

Omit By Date Procedure

Step 1 Advance to the Controller Omit By Date Options menu through the following sequence:



F1=Main Menu
F5=Setup
F4=Controller
F2=Omit By Date



Figure 53: Omission Dates

The date entered last is displayed. All prior dates may be viewed by pressing the Down Arrow key.

Step 2 Deleting dates

Using the arrow keys to display the date to be deleted, then press the F1=DELETE key. Repeat procedure as necessary.

Step 3 Adding Dates

Press the F2=ADD key. Enter the number of the month. Use 1 for January, 2 for February, etc., and then press ENTER.



Figure 54: Month Entry

- Step 4** Enter the day of the month. The day must be between 1 and 31, and then press ENTER.

DAY OF THE MONTH: 15
ENTER DAY OF THE MONTH (1-31)

Figure 55: Day of the Month

- Step 5** Repeat the F2=ADD DATE sequence to add additional dates, up to 15 dates may be entered.
- Step 6** To review entered dates, use the Up Arrow key. This completes the Omit By Date procedure. Press QUIT to return to base screen.

User Options Procedure

The three available User Options are:

- Time/Date
- Language
- Access Code

- Step 1** Advance to the User Options menu through the following sequence:



F1=Main Menu
 F5=Setup
 F4=Controller
 F3=User Options

| F1 | =TIME/DATE | F2 | =LANGUAGE
 | F3 | =ACCESS CODE | ↑ |

Figure 56: User Options

Step 2 Time/Date

Select F1=TIME/DATE to display the two following options:

- 12 HOUR display
- 24 HOUR display



Figure 57: Time Format

Step 3 Press F1 to select 12 Hour (AM/PM) Time Display, or F2 to select 24 hour time display.

Step 4 Enter the current time in hours and minutes.

If 12 hour format was selected, press the F1=AM/PM toggle key to select AM or PM.

If you selected 24 hour format, 1 PM is 13:00, 2 PM is 14:00, etc.

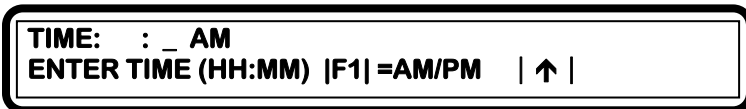


Figure 58: Time Entry Format

Step 5 Press ENTER to advance to the Year Entry screen.

Enter the year. Four digits must be entered

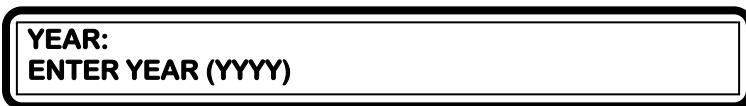


Figure 59: Year Entry Format

- Step 6** Press ENTER to advance to the Month Entry screen.
Enter the month. Use 1 for January, 2 for February, etc.

| | |
|--|---|
| MONTH: ENTER MONTH (1-12) | ↑ |
|--|---|

Figure 60: Month Entry Format

- Step 7** Press ENTER to advance to the Day of the Month Entry screen.
Enter the day of the month. The day must be between 1 and 31.

| | |
|--|---|
| DAY OF THE MONTH: ENTER DAY OF THE MONTH (1 – 31) | ↑ |
|--|---|

Figure 61: Date of the Month Entry

- Step 8** Press ENTER to display the two Date Format options.

| | |
|--|---|
| F1 =MONTH / DAY / YEAR DISPLAY F2 =DAY / MONTH / YEAR DISPLAY | ↑ |
|--|---|

Figure 62: Date Format Options

- Step 9** Press F1 to select Month/Day/Year display, or press F2 to select Day/Month/Year display.



Figure 63: Date Format Options

The selection advances the display to the Day Entry screen.

Step 10 Enter the present day of the week using keypad numbers 1 through 7 (SUN-SAT).



Figure 64: Day of Week Entry Format

Pressing ENTER returns to the User Options display.

Step 11 Language

Select F2=LANGUAGE to display the two following options:

- English - Displays all menus in English
- Espanol - Displays all menus in Spanish

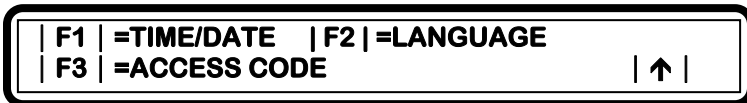


Figure 65: User Options

Step 12 Select the appropriate Language option. Either selection will return screen to the menu options.

Step 13 Access Code

Select F3=ACCESS CODE.

Access Codes are used to restrict unauthorized access to the controller's sensitive program data. Please refer to Appendix D for additional details on setting and using an access code.

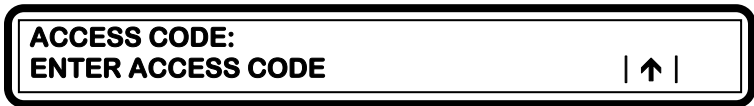


Figure 66: Access Code

Step 14 Enter the new access code. The access code must be three digits (numbers).

Note: The first time an access code is entered, any three digits may be used. Thereafter, the access code you enter is checked against the code stored in the controller. The code you enter must match the stored code, or access is denied to certain menu options, as shown in the table in Appendix D.

Caution: Do not forget your access code.

Step 15 Access Enable/Disable

If the access code is correct, it is accepted and three options are displayed.



Figure 67: Access Code

- Use ENABLE/DISABLE ACCESS to turn on and off the use of the access code feature.
- Use CHANGE LEVEL to change the access code level.
- Use CHANGE CODE to enter a new access code.

Step 16 Select F1=Enable/Disable Access.



Figure 68: Access Restriction

There are two options:

- Select RESTRICT ACCESS by using the access code to control use of the controller.
- Select NO RESTRICTIONS to not use the access code.

Step 17 Press F1 to select RESTRICT ACCESS or press F2 to select NO RESTRICTIONS. The previous menu is then displayed.

Step 18 Access Code Level

Select F2=CHANGE LEVEL to advance to the Select Level screen.



Figure 69: Select Access Level

There are two options:

- LEVEL 1
- LEVEL 2

Step 19 Press F1 to select Level 1 or press F2 to select Level 2. The previous menu is then displayed.

Step 20 Access Code

Select F3=CHANGE CODE and enter the new access code. The code must be three digits.

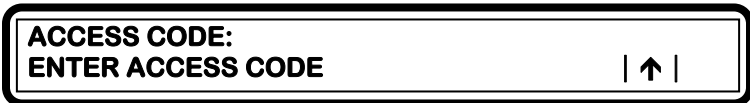


Figure 70: Select Access Level

Step 21 Press the Up Arrow to return to the previous menu. Repeat as necessary.

This completes the User Options procedure.

Press QUIT key to return to base menu.

Configuration Procedure

The Configuration Options allow a controller to be set up to operate as a submaster or satellite and with or without Flow Max, in a Central Control System.

For Flow Max operation, refer to Flow Max Appendix E. This appendix describes Flow Max in detail with full procedures on setting up a Flow Max system.

Step 1 Advance to the Configuration Options menu through the following sequence:

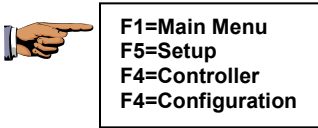


Figure 71: Configuration Options

There are three options:

- Select F1=ACTS AS SATELLITE if:
The controller operates in stand-alone mode or the controller operates in Central Control Mode, but is not a submaster.

- Select F2=ACTS AS SUBMASTER if:
 - The controller is to operate as a submaster (A submaster controller has direct communications with a Rain Master Central Control System via radio, telephone or direct wiring).
 - A submaster is also required in a self-contained Flow Max configuration performing as the management controller over the system.

- Select F3=FLOW MAX if:

This controller is part of a Flow Max setup.
See Appendix F for full details on Flow Max.

Note: *These option configurations will be required on all controllers in a Flow Max system. The controllers must be assigned as satellites with the first controller as the submaster. Participating units will need to be set up for sharing the flow sensor, master valve or pump.*

Step 2 Select F1=ACTS AS SATELLITE. When selected, the base screen is displayed.

The controller is now assigned as a satellite.

Step 3 From the Configuration Options menu, select F2= ACT AS SUBMASTER. The following communication screen is displayed:



Figure 72: Submaster Communication

There are three options:

- Radio Wire
- Phone
- Trunk

Select the appropriate communication option, for your system.

Step 4 Enter the submaster address in the following screen:

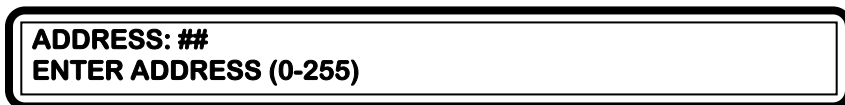


Figure 73: Submaster Address

If the submaster is hardwired to one or more satellites, these satellites will be automatically assigned addresses immediately after connecting to the hardwire link.

Step 5 From the Configuration Options menu, select F3= FLOW MAX. The following Flow, Pump and Master Valve selection screen is displayed:

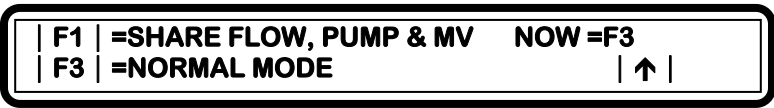


Figure 74: Shared Devices

There are two options:

- Share Flow, Pump, and MV
- Normal Mode

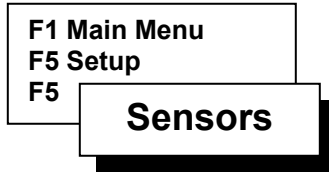
If no devices are shared, select F3=NORMAL MODE.

In a Flow Max system, shared devices must be selected in the Submaster and all participating controllers.

Refer to Flow Max Appendix E for full configuration procedures.

This completes the Configuration procedure.

Press the QUIT key to return to the base screen.



Sensors

Setup Sensors is used to prepare the controller for use of flow sensors. See Appendix A for details on flow sensors.

Moisture Procedure

Step 1 Proceed to the Sensor Option Selection menu as follows:

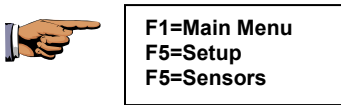


Figure 75: Sensor Options

Step 2 Select F1=MOISTURE to display the following options:



Figure 76: Sensors Setup

Note: Moisture sensors are no longer supported by the Evolution DX2 Controller.

Press the QUIT key to return to the base menu.

Flow Procedure

Step 1 Proceed to the Sensor Option Selection menu as follows:



F1=Main Menu
F5=Setup
F5=Sensors



Figure 77: Sensor Options

Step 2 Select F2=FLOW. The following menu is displayed:



Figure 78: Flow Meter Selection

There are two options:

- FLOW METER 1
- FLOW METER 2

Step 3 Select F1=FLOW METER 1.

There are two options:

- SET K VALUE
- SET OFFSET VALUE

The K and offset values provide the calibration data required for the controller to compensate for supply line pipe size and flow meter used. Use SET K VALUE to enter the K value.

Refer to Appendix A to select the proper K value for your installation. Use SET OFFSET VALUE to enter the OFFSET value. Refer to Appendix A to select the proper OFFSET value for your installation.

- Step 4** Select F1=SET K VALUE. The current K Value is displayed.

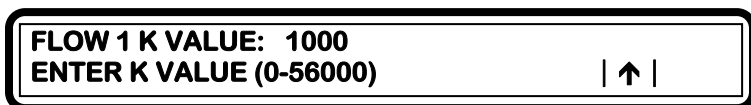


Figure 79: K Value Entry

- Step 5** Enter the K Value. The value must be between 0 and 56000. Press ENTER.
- Step 6** Select F2=SET OFFSET VALUE. The current Offset Value is displayed.

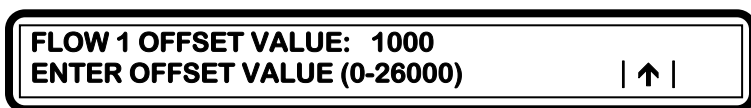


Figure 80: Offset Value Entry

- Step 7** Enter the Offset Value. The value must be between 0 and 26000. Press ENTER.
- Step 8** Press the Up Arrow to return to the Flow Meter selection screen. Select F2=FLOW METER 2.
- Repeat the procedure as described for Flow Meter 2.

Note: *Weather Center installation requires that the K and Offset values be set to zero (default values) on Flow Meter 2. K=0, Offset=0*

This completes the Flow procedure.

Press QUIT key to return to the base menu.

Chapter 5

Program Entry

The Evolution DX2 controller allows the user to enter program data for up to 12 individual programs. A program provides a way of grouping stations with similar irrigation characteristics so that the start/stop of irrigation cycles can be automatically controlled.

All programs must contain the following basic information:

The station number(s) associated with the program

The time(s) during the day when the program is executed
(start time)

The days of the week when the program is to be executed
(water days)

The amount of time each station remains on
(station run time)

Warning:



Operation of a program may be altered depending upon the setup options selected. Refer to Chapter 4: Setup for additional details.

Example of Program Execution

The following example demonstrates the actions which occur when a program runs. This program uses the factory default setup options defined in Chapter 4, Table 1 and a 14 day (two week) cycle.

Assume that Program 1 contains the following information:

Table 2: Program 1 Watering Schedule

| WATER DAYS | | | | | | | |
|------------|-----|-----|-----|-----|-----|-----|-----|
| | SUN | MON | TUE | WED | THU | FRI | SAT |
| Week 1 | | X | | X | | X | |
| Week 2 | X | | X | | X | | X |

| START TIMES | |
|--------------|---------|
| Start Time 1 | 1:00 AM |
| Start Time 2 | 4:00 AM |

| RUN TIMES | |
|-----------|--------|
| Station 1 | 10 min |
| Station 2 | 15 min |
| Station 3 | 20 min |

Assume the current date/time is Monday 1:00 AM of Week 1.
Execution of program 1 begins.

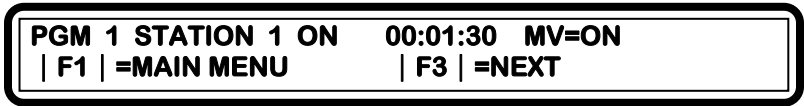


Figure 81: Program 1

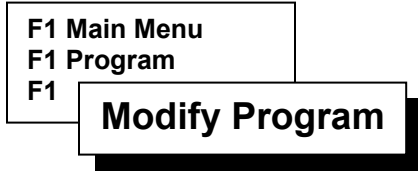
The F1=MAIN MENU option allows the user to go to the main menu while the program continues to run. The F3=NEXT option advances the station number to the next station in the program.

Upon program completion for the 1:00 AM start time, the following events would have occurred:

| | | |
|---------|-----------------|------------------|
| 1:00 AM | Master Valve On | Station 1 ON |
| 1:10 AM | Station 1 OFF | Station 2 ON |
| 1:25 AM | Station 2 OFF | Station 3 ON |
| 1:45 AM | Station 3 OFF | Master Valve Off |

At 4:00 AM the program would repeat itself in an identical fashion.

On Wednesday of Week 1, the irrigation cycle would repeat, same as Monday. Program execution would occur on the Week 1 and Week 2 specified days. The net effect of program 1 would be to irrigate every other day, and two times each scheduled water day, forever.



Modify Program

Overview

Modify Program is used to alter a program stored in the Evolution DX2. The following five options are available for modification; and depicted in Figure 5-2.

- PROGRAM START:** Specifies start time for the program.
- WATER DAYS:** Specifies the days to water.
- STATIONS:** Selects irrigation stations and the corresponding runtimes of that station.
- PERCENT:** Changes the percentage (0% to 999%) of run time in a program (increase or decrease base run time).
- SEND:** Transmits program modifications to the Central Control System. See Chapter 9 (Central Control Mode) for additional details.



Figure 82: Modify Program

Program Start Time Procedure

Overview

Start Time is defined as the precise time of day that a given program starts its watering routine.

The Program Start Time feature provides the ability to set up as many as 8 start times for each of the 12 available programs.

Note: A program number must be entered to advance to the Program Start Menu.

Procedure

Step 1 Advance to the START TIME menu through the following key sequence:



F1=Main Menu
F1=Program
F1=Modify Program
Enter P #
F1=Program Start

P# START TIME 1: :__AM
ENTER TIME (HH:MM) F1=AM/PM | ↓ | | ↑ |

Figure 83: Start Time Entry

Step 2 Enter the first start time in the START TIME 1 Entry display, and then press ENTER after each time entry.

Enter start times in 12 hour or 24 hour format.

If 12 hour format is selected, use the F1=AM/PM toggle key to select AM or PM.

Note: *To use Continuous Cycle rather than Start Times, go to Setup Programs, Cycle Mode. Refer to Chapter 4: Setup.*

Step 3 With the first start time entered, the display will advance to the Start Time 2 display. Enter the second start time, if required.

Repeat as necessary to enter up to eight start times, or press the down arrow key to advance through the remaining start time menus.

Upon completion, the Modify Program Option menu will be displayed.

This completes the Program Start Time Procedure.

Watering Day Options

The Water Day options screen offers three modes of watering routines to accommodate virtually any configuration of irrigation watering systems.

The three available options are:

- 14 DAY CYCLE - Creates a program utilizing a two week water cycle.
- SKIP BY DAY - Selects a number of days between watering.
- 31 DAY CYCLE - Creates a program utilizing a one month water cycle.

Water Days Procedure (14 Day Cycle)

Overview

The F1=14 DAY CYCLE option provides the ability to select the watering days for a two week period. When programmed, the 14 Day Cycle will water as specified for two weeks and will continue to do so in the same manner in all subsequent 2 week periods. The water days will remain consistent indefinitely until the program is changed.

Procedure

Step 1 Advance to the F1=14 DAY CYCLE selection menu through the following key sequence:



F1=Main Menu
 F1=Program
 F1=Modify Program
 Enter P #
 F2=Water Days

| | | | | |
|-----------|-----------|----------------------|---------------|---------------------|
| P1 | F1 | =14 DAY CYCLE | F2 | =SKIP BY DAY |
| | F3 | =31 DAY CYCLE | NOW=F1 | ↑ |

Figure 84: Water Days Options

Note: NOW=F1 indicates the currently selected option.

Step 2 Select F1=14 DAY CYCLE to display the following Week 1 Entry screen, as depicted in Figure 5-5.

The first line of the display indicates: the program number (P#), the week 1 water days which have been programmed, the current day (TODAY:), and the current week (either WK1 or WK2).

The current week display located in the upper right corner indicates the status of the 14-DAY CYCLE. If WK1 is displayed, WK2 will not appear until week 2 starts. Each new week starts on Sunday 12:00 AM. This feature easily identifies the week in which the program is currently running at any given time.

| | |
|--------------------------------|--------------------------------|
| P#: NONE | TODAY: MO WK1 |
| ENTER WEEK 1 WATER DAYS | SUN - SAT ↓ ↑ |

Figure 85: Week 1 Entry

Use the Day Pad keys and the Enter key to select the days of the week.

Example: Select Sunday and Monday as water days, press the SUN key followed by the MON key and then press the Enter key. SU and MO appear in the display.

To delete a day, press the day key and verify that it blinks, and then press ENTER, the water day is removed.

Step 3 Enter the water days for Week one. The entries will blink on and off until the ENTER key is pressed.

Step 4 When complete: press the Down Arrow key to advance to Week 2.

Enter the desired water days for Week 2, and then press the Down Arrow key to return to the Modify Program option display menu.

This completes the 14 DAY WATER CYCLE Procedure.

Water Days Procedure (Skip By Day)

Overview

The F2=SKIP BY DAY feature offers an alternative method of watering over the standard water day selection schedule. This option selects a number of days between watering regardless of the actual day of the week or date.

If the number of days between watering cycles is specified as two days, the program will not water for two days and will then water for one day. The next two days will not water and then watering will occur again. This watering sequence will continue indefinitely until the program is changed.

The available number of skip days ranges from 1 to 90 days. The user also specifies when the first water day will occur.

Procedure

Step 1 Advance to the F2=SKIP BY DAY selection menu through the following key sequence:



F1=Main Menu
F1=Program
F1=Modify Program
Enter P #
F2=Water Days
F2=Skip By Day



Figure 86: Skip By Day Entry

- Step 2** Enter the number of days between watering and then press ENTER. The number of days must be between 1 and 90.
- Step 3** Enter the number of days until the first watering and then press ENTER. The number of days before watering must be between 0 and 90 days.



Figure 87: Start Water Day

To start watering today, enter 0 (zero) as the number of days until first watering, and then press ENTER.

The controller returns to the Modify Program Option display menu.

This completes the SKIP BY DAY procedure.

Water Days Procedure (31 Day Cycle)

Overview

The F3=31 DAY CYCLE option provides the ability to select the watering dates (from 1 - 31) for a monthly period. When programmed, the 31 Day Cycle will water on the dates specified for the month period and will continue to do so in the same manner in all subsequent months. The watering routine will remain indefinitely until the program is changed.

Procedure

Step 1 Advance to the F3=31 DAY CYCLE selection menu through the following key sequence:

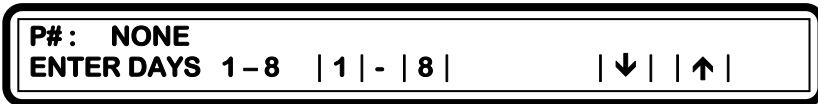
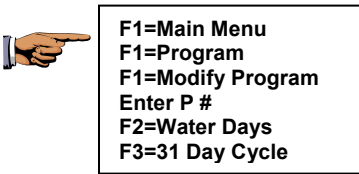


Figure 88: 31 Days Cycle Entry

Step 2 Enter water dates 1 through 8 and then press ENTER. To delete a date, press the corresponding number key and verify that it blinks, and then press ENTER.

Step 3 Press the Down Arrow key to advance to the next 8 dates of the month (9-16).

Step 4 Enter water dates 9 through 16 and then press ENTER.

Note: Keypad numbers 1-8 will record dates 9-16 respectively in the display.

Step 5 Press the Down Arrow key to advance to the next 8 dates of the month (17-24).

Step 6 Enter water dates 17 through 24 and press ENTER.

Note: Keypad numbers 1-8 will record dates 17-24 respectively in the display.

Step 7 Press the Down Arrow key to advance to the remaining 7 dates of the month (25-31).

Step 8 Enter the water dates 25 - 31 and press ENTER.

Note: Keypad numbers 1-7 will record dates 25-31 respectively in the display.

Note: The 31 day cycle entries are programmed to accept all dates regardless of the month. Months with less than 31 days are automatically adjusted in the program to disregard non-existent dates.

Step 9 Press the Down Arrow key to return to the Modify Program Option display.

Press QUIT key to return to the base menu.

This completes the 31 DAY WATER CYCLE procedure.

Stations

Overview

Every valid program must have one or more stations assigned to it. Additionally, each station must have a programmed runtime (the amount of time that the station is active). The Evolution DX2 Controllers can be configured from 6 stations up to 48 stations in increments of 6 stations. The number of stations available will be displayed in the select station number screen, as depicted in Figure 5-10.

Stations are specified through the Run Time options menu, which selects the station number and its run time.

Procedure

Step 1 Advance to the Run Time Options selection menu through the following key sequence:

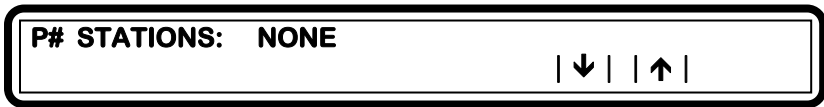
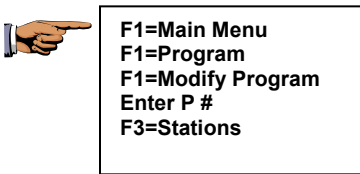


Figure 89: Stations

This screen lists which stations are active for the given program.

Step 2 Press the Down Arrow to advance to the Run Time options menu.



Figure 90: Station Run Time Options

The Station Run Time Options are displayed.

There are two options:

Station Run Time - Programs individual station run times.

Quick Station Programming - Enter the same run times for groups of stations.

Station Run Time Option

Programming Individual Stations with Different Run Times

Procedure

Step 1 Advance to the Station Number Entry screen through the following key sequence:



F1=Main Menu
 F1=Program
 F1=Modify Program
 Enter P #
 F3=Stations
 Down Arrow
 F1=Station Run Time



P# STATION NUMBER: ___
ENTER STATION NUMBER (1-48) | ↑ |

Figure 91: Select Station Number

Step 2 Enter the Station Number. The number must be between 1 and 48. Press ENTER.

Note: The maximum number of stations is determined by the total stations installed in the associated controller. The maximum number will appear on the Station Number Entry Display screen.

Step 3 Enter the Run Time in the format indicated, then Press ENTER.



P# STATION# RUN TIME: : ___
ENTER TIME (HH:MM) | ↑ |

Figure 92: Station Run Time Entry

The formats are HH:MM (hours: minutes) and MM:SS (minutes: seconds).

Note: Time formats may be changed for each program. Go to Setup Programs, Time Format to change the format. (Refer to chapter 4, page 12)

Step 4 The next station number is displayed. Repeat the process entering the Run Time for each station, as necessary, press ENTER after each entry.

Step 5 Press the Up Arrow key to return to the Station Number Entry menu, enter a different station number. Repeat as required.

This completes the Station Run Time Entry procedure.

Quick Station Programming Option

Programming Station Groups with Identical Run Time

Procedure

Step 1 Advance to the Beginning Station Number Entry screen through the following key sequence:



F1=Main Menu
F1=Program
F1=Modify Program
Enter P #
F3=Stations
Down Arrow
F2=Quick Station Programming

P# BEGINNING QUICK STATION NUMBER:
ENTER STATION NUMBER (1-48) | ↓ | | ↑ |

Figure 93: Quick Station Number Entry

- Step 2** Enter the Beginning Station Number. The number must be between 1 and 48 and then press ENTER.
- Step 3** Enter the Ending Station Number and then press ENTER. The number must be between the beginning station number and 48.
- Step 4** Enter the Run Time Per Station.

P# RUN TIME PER STATION: :
ENTER TIME (HH:MM) | ↑ |

Figure 5-14: Quick Station Run Time

Step 5 Press the Down Arrow to view the total run time for the entire program.



Figure 94: Quick Station Total Runtime

This completes the Quick Station Programming procedure.

Press QUIT to return to the base menu.

Percent

Overview

The Percent feature provides the ability to alter the run times of all stations in a given program. Reducing the percentage factor will shorten all run times, i.e. a station run time programmed for 10 minutes would run for 5 minutes when the percentage is set to 50%. Conversely, the station would run for 20 minutes when the percentage is set to 200%.

The available percentage range is between 0 and 999%.

Procedure

Step 1 Advance to the Percentage Run Time Entry screen through the following sequence:



F1=Main Menu
 F1=Program
 F1=Modify Program
 Enter P #
 F4=Percent

P# PERCENTAGE OF STATION RUN TIME: 100
ENTER PERCENTAGE (0-999) | ↑ |

Figure 95: Percentage Run Time

Step 2 Enter the percentage of station run time and then press ENTER. The percentage must be between 0 and 999.

Percentage Example:

Assume station 1 has a runtime of 10 minutes, station 2 has a run time of 20 minutes and station 3 has a run time of 30 minutes.

Percent is used to change the run time of all three stations. For example, set the percent to 50%. The run time for station 1 becomes 5 minutes (50% of the original run time of 10 minutes), station 2 becomes 10 minutes and station 3 the run time is 15 minutes.

Change the percent to 200 percent and the run times for stations 1 through 3 become, 20, 40 and 60 minutes, respectively.

Note: *Changing the percent does not change the displayed run time station value as shown when stations are reviewed or modified. The controller automatically re-computes (adjusts for percent) when the program executes.*

This completes the Percent procedure.

Press the QUIT key to return to the base menu.

Send (Applies to Central Control Systems only)

Overview

Send provides a warning only, to indicate that a program has been changed. When used with the Evolution Central Control System, the warning will automatically appear at the Central Computer. The Central Computer may then elect to "upload" the modified program. See Chapter 9 for additional details on Central Control operations.

Procedure

Step 1 Advance to the Modify Program Option screen through the following sequence:



F1=Main Menu
F1=Program
F1=Modify Program
Enter P #

| | | | | |
|----|----|----------------|----|-------------|
| P# | F1 | =PROGRAM START | F2 | =WATER DAYS |
| | F3 | =STATIONS | F4 | =PERCENT |
| | F5 | =SEND | ↑ | |

Figure 96: Modify Program

Step 2 Select F5=SEND. The following message is displayed:

| |
|---------------------------|
| P# PROGRAM UPLOAD REQUEST |
| ↑ |

Figure 97: Program Upload Request

When the Central Control System Computer contacts the Evolution DX2 controller, the program may be uploaded and the entry is cleared from the report list.

This completes the Send procedure.

Press the QUIT key to return to the base menu.



New Program

Overview

The F3=New Program feature is used to create a new controller program. The user is prompted for all necessary data required in order to create a valid program. A new program session will sequentially display the following settings:

Program Number

Day Cycle Watering Routine For Each Station
(14 Day, Skip by Day, 31 Day)

Start Time For Each Station

Run Time For Each Station

All remaining parameters of the program are automatically set to the default settings. Refer to Chapter 4: Setup for a listing of all default settings.

To make any additional changes or modifications to the program, refer to the Modify Program section in this chapter.

Extensive program changes require the use of the Setup Menu as described in Chapter 4: Setup.

New Program Procedure

Step 1 Advance to the Program Entry Number screen through the following sequence:



| |
|--|
| <p>F1=Main Menu F1=Program F3=New Program Enter P #</p> |
|--|

| | | | | |
|-----------|-----------|----------------------|---------------|---------------------|
| P# | F1 | =14 DAY CYCLE | F2 | =SKIP BY DAY |
| | F3 | =31 DAY CYCLE | NOW=F1 | ↑ |

Figure 98: Water Day Cycle Options

Note: Entering programming data for all screens under New Program insures that a valid program exists upon completion of the functions.

Note: NOW=F1 indicates the currently selected option.

Step 2 Select the Watering Cycle Mode then press ENTER.

There are three options:

14 DAY CYCLE - selects water days based on a 14 day (two week) cycle.

SKIP BY DAY- selects the number of days skipped between watering days.

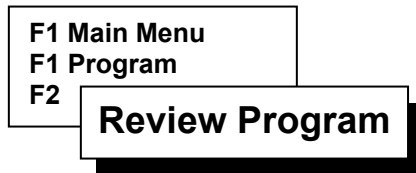
31 DAY CYCLE - selects water days based on a 31 day (monthly) cycle.

Refer to the "Water Day Options" procedure located in this chapter for programming of individual water days.

Step 3 Follow the Station Run Time Options procedure located in this chapter to complete the New Program procedure.

This completes the New Program procedure.

Press the QUIT key to return to the base menu.



Review Program

Review Program is used to view the parameters of a program stored in the Evolution DX2. The settings are made available only for viewing and may not be changed or altered. Review Program displays the following program settings:

Program Number

Water Days

- 14 Day Cycle or
- 31 Day Cycle or
- Skip by Day Cycle

Start Times

Stations

Station Duration Time

Total Run Time

Percent

In addition to run times, many other parameters may be established on a per station basis. Use Setup Stations to establish these parameters, which include current limits, flow limits and station type.

Review Program Procedure

Step 1 Advance to the Review Program View screen through the following sequence:



F1=Main Menu
F1=Program
F2=Review Program



Figure 99: Program Entry

Step 2 Enter the program number and then press ENTER. The program number must be between 1 and 12.

Step 3 Review watering days.

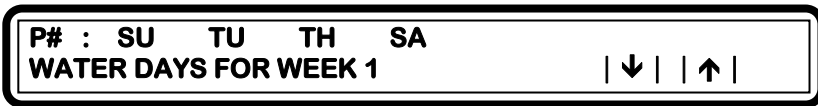


Figure 100: Week 1 Water Days

The display shown is a 14 day cycle.

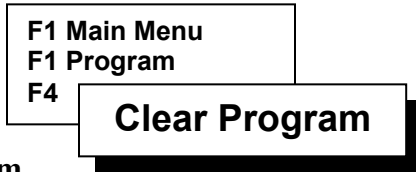
Note: *It may be necessary to press the Down Arrow one or more times to view the complete water day's schedule.*

- Step 4** Press the Down Arrow and review Start Time 1. Repeat as necessary to review additional start times.
- Step 5** Press the Down Arrow and review stations for the program.
- Step 6** Press the Down Arrow and review Station Duration times. Repeat as necessary to review additional run times.
- Step 7** Press the Down Arrow and review total program Run Time.
- Step 8** Press the Down Arrow and review program Percent.
- Step 9** Press the Down Arrow to enter a new program number for review.
- Step 10** Press the Up Arrow to return to the previous menu. Repeat as necessary.

This completes the Review Program procedure.

To make any changes, refer to the Modify Program section.

Press QUIT to return to the base menu.



Clear Program

Clear Program is used to remove an existing program that is no longer used or a program that is to be replaced by a new program. All program start, station run times, and water days are removed. Percentage is reset to 100%.

Note: Clear Program does not change the Setup information for the program.

Clear Program Procedure

Step 1 Advance to the Clear Program Number screen through the following sequence:



F1=Main Menu
F1=Program
F4=Clear Program



Figure 101: Program Clear Number

- Step 2** Enter the program number to be cleared.
- Step 3** Press ENTER to clear the program.
- Step 4** To clear additional programs, repeat entry of the program numbers.
- This completes the Clear Program procedure.
- Press QUIT to return to the base menu.



Program On/Off

Program On/Off

The Program On/Off feature is an extremely useful tool for testing, running or stopping any given program. This front panel touch key is a toggle action switch, which when pressed the first time, acts upon the program accordingly (turns on or off) and when pressed again restores the program to its original state.

The following lists various situations when the Program On/Off features might be used:

Unexpected rainfall - When a program is watering during a sudden rainfall uses the Program On/Off to stop watering. The program will remain off until its next regularly scheduled water day and start time.

Excessive hot, dry weather conditions - When a program is set to water every other day, additional watering may be required. Activate the Program On/Off to water on the off day. The program will start immediately and run through its normal routine until complete. When complete, the program will resume its normal watering days.

Testing a program - A program that is set to water in upcoming days may be immediately tested to evaluate its performance. When complete, the program will start at its regular time.

Program On/Off Procedure

Stopping a program

Note: The Program On/Off feature is only effective on existing programs. If no programs exist, the Program On/Off is inoperative.

This procedure assumes that a program is currently running.

Step 1 A running program will be displayed on the base screen indicating the program number, station number, and the station runtime remaining.

Step 2 Press the Program On/Off key. Enter the program number and then press ENTER.

Note: Multiple programs may be simultaneously turned off by entering 0 followed by ENTER.

Step 3 The program will stop and the base menu will be displayed.

Step 4 The program will resume operation on its next scheduled water day and start time.

Starting a Program

Step 1 Verify a valid program is available by observing the base screen. All valid programs will be listed in the Valid Pgm: section.

Step 2 Press the Program On/Off key. Enter the program number and then press ENTER.

The program start time and water day will be disregarded and the program will immediately start running.

The complete program watering routine will be executed. When completed, the program will resume on its next regularly scheduled water day and start time.

This completes the Program On/Off procedure.

Press the QUIT key to return to the base menu.

Chapter 6

Individual Station Control

Individual Station Control (ISC) is used to obtain a high degree of control over single stations. ISC is typically applied to uses such as lighting, operation of water fountains and certain specialized irrigation applications.

ISC operation may be best illustrated by the following example:

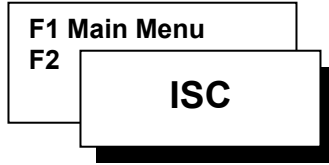
Assume water fountains are to be turned on each day from 8:00 AM until 5:00 PM. However on each Wednesday, the fountains must remain off so maintenance and cleaning can be performed. Similarly, assume that lighting is to be turned on each day from 6:00 PM until 6:00 AM.

Separate ISCs are programmed to control the two different functions. The program to control the water fountains, ISC 1, would operate each day except Wednesday with a start time of 8:00 AM and would use a "runtime" of nine hours. The program to control the lighting, ISC 2, would be on each day with a start time of 6:00 PM and a run time of 12 hours.

Individual Station Control (ISC) is quite similar to creating and operating a program, as described in Chapter 5. In fact, ISC can be thought of as 48 programs each of which share a common runtime. ISC and basic programs can be intermixed as desired to meet your control needs for special circumstances.

To use ISC, you need the following information:

- The station number to be controlled
- The cycle type (14 day, skip by day, 31 day)
- The days for the station to be operated (referred to as "water days")
- Station start times (up to eight start times can be accommodated)
- The run time of the station



ISC

Individual Station Control (ISC) is used for obtaining a high degree of control over single stations.

Use the programming steps described in Chapter 5 to create, modify, review and clear ISCs. As noted previously, ISC and basic programming steps are virtually identical.



Figure 102: ISC

Press the QUIT key to return to the base menu.

Chapter 7

System Status

There are four System Status options:

- **COMM STATUS** is used by Rain Master Irrigation Systems (RMIS) field service personnel for diagnostic purposes when the controller is connected to a RMIS Central Control System.
- Select **MEASUREMENTS** to review flow, current, EvapoTranspiration (ET), wind and rain.
- Select **WATER TOTAL** to review the total water consumption for the current and past month.
- Select **REVIEW ALL** to review all settings for all programs.

The System Status screen is available through the following menus:

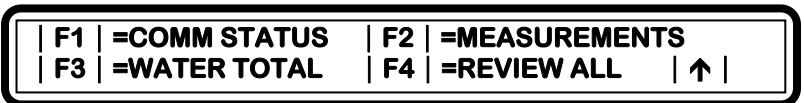
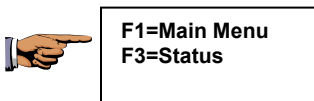
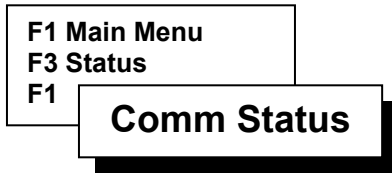


Figure 103: System Status Options

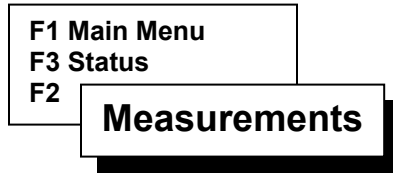


Comm Status

Communication Status is used by Rain Master Irrigation Systems (RMIS) field service personnel for diagnostic purposes.



Figure 104: Comm Status



Measurements

Use Measurements to review flow, current, EvapoTranspiration (ET), wind and rain.

There are five options.

DYNAMIC DISPLAY:

- Select FLOW METER to view the flow meter readings.
- Select CURRENT METER to view the current measurements.
- Select MOISTURE SENSOR READINGS to view moisture sensor readings.

Note: *Use of moisture sensors are no longer supported by Rain Master Irrigation Systems.*

- Select RAIN/WIND to view instantaneous wind and rainfall.

STATIC DISPLAY:

- Select ET to view the current day's EvapoTranspiration.

Note: *DYNAMIC DISPLAY indicates that the information is updated continuously in the display.*

STATIC DISPLAY *indicates that the display is only updated once (upon initial entry to the function).*

Measurements Procedure

Step 1 Advance to the Measurements Option screen as follows:

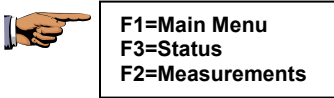


Figure 105: Measurements Option

Step 2 Select F1= FLOW. The real time readings for flow meters 1 and 2 are shown in Gallons Per Minute (GPM). The total for both meters is also shown. The display is updated every 10 seconds.

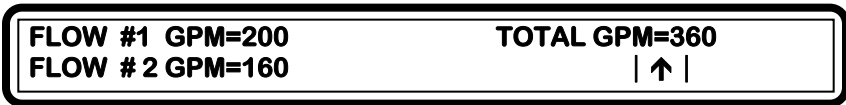


Figure 106: Flow Meter Measurements

Note: If the Flow Max feature has been set up and the controller operates as a Submaster, the display will contain additional information as described in Appendix E: Flow Max.

Return to Measurement Option screen using the Up Arrow key.

Step 3 Select F2=CURRENT. The current meter shows the electrical current in amps being drawn by active stations including the master valve and pump (The measurement is the sum of all field valve solenoids which are on).

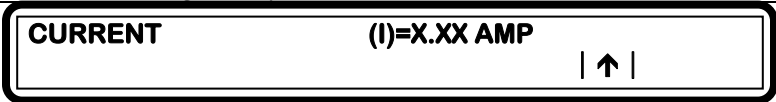


Figure 107: Current Meter Measurements

Press the Up Arrow to return to the Measurement Options screen.

Step 4 Select F3=Moisture.

Note: Use of moisture sensors are no longer supported by Rain Master Irrigation Systems.

Press the Up Arrow to return to the Measurement Options screen.

Step 5 Select F4=ET. The ET readings are displayed for the last seven days. The current day of the week (today) indicates the current ET accumulated since 12:00 midnight. Completed days show the total ET value for the 24 hour period starting and ending at midnight.

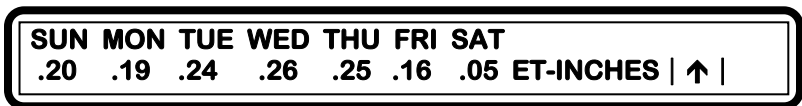


Figure 108: ET

Press the Up Arrow key to return to the Measurement Option screen.

Step 6 Select F5=RAIN/WIND. The current day's rain fall accumulation and wind speed is displayed.



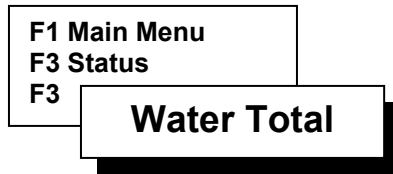
Figure 109: Rain/Wind Readings

The rain shows the total number of counts measured from the tipping bucket rain gauge since midnight. Each count represents 1/100 of an inch of rain.

Note: This rain count is cleared every day at midnight.

This completes the System Status procedure.

Press the QUIT key to return to base menu.



Water Total

Use Water Total to review the consumption for the current and past month.

There are two options:

- TOTALS PAST MONTH - Displays total gallons of water used during the previous month.
- TOTALS PRESENT MONTH - Displays the total gallons of water used to date during the current month.

Water Total Procedure

Step 1 Proceed to the Water Total screen as follows:

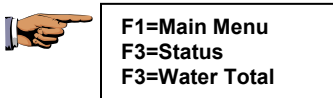


Figure 110: Water Totals

Step 2 Select F1=TOTALS PAST MONTH. The total gallons (G) of water for flow meter 1 and 2 are displayed.

The sum of both meters is also displayed.



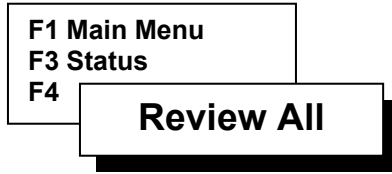
Figure 111: Past Month Water Totals

Press the Up Arrow to return to Water Totals menu.

- Step 3** Select F2=TOTALS PRESENT MONTH. The total gallons (G) for flow meter 1 and 2 are displayed. The sum of both meters is also displayed.

This completes the Water Total Procedure.

Press the QUIT key to return to the base menu.



Review All

Use Review All to review all settings for all programs.

Procedure

Step 1 Proceed to the first Review All screen as follows:

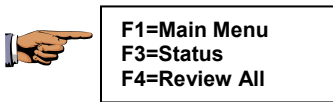


Figure 112: Review Water Days

Watering days are shown for the lowest numbered program (The display shown is a 14-day water cycle).

Note: It may be necessary to press the Down Arrow key several times to view all watering days.

Step 2 Press Down Arrow key. The program Start Time 1 is displayed.

Repeat as necessary to display additional start times.

- Step 3** Press Down Arrow key. The Defined Stations for the program are displayed.
- Step 4** Press Down Arrow key. The Station Run Time for each station within the program is displayed. Repeat as necessary to display run time for all defined stations.
- Step 5** Press Down Arrow key. The program Total Run Time is displayed.
- Step 6** Press Down Arrow key. The program Percent value is displayed.
- If the controller has more than one program defined, the data for additional programs will be automatically displayed by pressing the Down Arrow key.
- ISC data appears after all program data has been reviewed.
- Step 7** Press Down Arrow key. The Injector Station, if any, is displayed.
- Step 8** Press Down Arrow key. The version of the Evolution Controller software, the date of the software release and the time are displayed.

Note: *If the Flow Max feature is utilized, configuration information showing device connections verses controller addresses is displayed.*

This completes the Program Review procedure.

Press the QUIT key to return to the base menu.

Chapter 8

Manual System Control

Manual control is used to operate a program, a single station, group of stations or all stations. Manual control is also used to select the rain shutdown option, which stops watering for an indefinite amount of time.

There are four options.

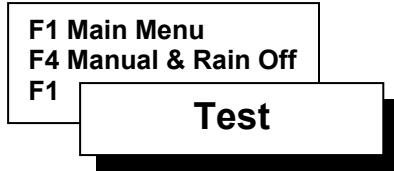
- Select TEST to operate all stations sequentially for a selected length of time. The TEST mode provides extensive information showing both the electrical current and the gallons per minute used.
- Select MULTI-STATION to manually control several stations at once. This mode allows independent control of the station and the master valve and/or pump.
- Select STATION to manually control a single station. This mode turns on any station and automatically selects the proper master valve and pump.
- Select RAIN OFF to stop watering for up to an indefinite amount of time.



F1=Main Menu
F4=Manual & Rain Off

| | | | | |
|----------------|-----------------|--------------|------------------|-----------------------|
| MANUAL: | F1 | =TEST | F2 | =MULTI-STATION |
| F3 | =STATION | F4 | =RAIN OFF | ↑ |

Figure 113: Manual Main Menu



Test

Manual test mode allows the user to automatically advance from station to station using manually entered run time, while displaying valve solenoid electrical current for each station, as well as station flow in GPM.

Use Test to operate all stations sequentially for a specified length of time.

Procedure

Step 1 Advance to the Test Time Per Station screen as follows:

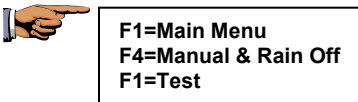
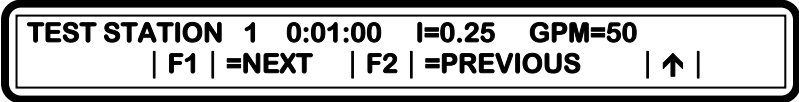


Figure 114: Operation Time

Step 2 Enter the run time. Enter the run times in Hour: Minutes (HH:MM) format.

Press ENTER key.

The test starts with the following display:



```
TEST STATION 1 0:01:00 I=0.25 GPM=50
| F1 | =NEXT | F2 | =PREVIOUS | ↑ |
```

Figure 115: Program Testing

The screen displays:

- Test Station Number
- Count-down of the specified run time
- Electrical current in amps (I=X.XX) drawn by the field valve solenoid
- Flow in Gallons Per Minute (GPM)

When completed, the controller is incremented to the next station and the test is repeated. The completion of the last station returns to the Manual Main Menu screen.

Step 3 Press F1=NEXT anytime during the test routine to turn off the current station and turn on the next sequential station, if any.

Step 4 Press F2=PREVIOUS anytime during the test routine to turn off the current station and turn on the previous station, if any.

Note: *Prior to a station turning on, the station is analyzed by the controller to determine if the station is used in an existing program.
If the station is used in a program and the program includes a master valve or pump, the controller will activate the master valve/pump with the station.
If the station is not used by any program, no master valve or pump will be activated for that station.*

This completes the Manual Test procedure.

Press the QUIT key to return to the base menu.



Multi-Station

Manual multi-station mode allows any single station or output to be turned on individually or in combination with any other station(s). Valve solenoid electrical current is displayed. Use Multi-Station to manually control several stations at once. Multi-Station can also be used to operate stations independent of any Master Valve or Pump.

Multi-Station is additionally useful in analyzing problems by locating defective stations or devices (refer to Multi-Station Diagnostics procedure, page 8-9).

Procedure

Step 1 Proceed to the Multi-Station option display as follows:

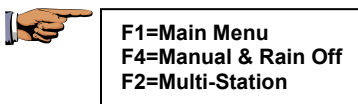


Figure 116: Multi-Station Options

The screen displays two options:

- Select STATION ON CONCURRENTLY to operate several stations at the same time or to run a station independent of any Master Valve and/or Pump.
- Select STATION ON SEQUENTIALLY to operate each station in sequential order.

Step 2 Select F1=STATION ON CONCURRENTLY.

Step 3 Enter the Run Time, then press ENTER. Run time must be between 0 and 59 minutes.

Step 4 Enter the station number. The number must be between 1 and 48, then press ENTER. The station will turn on.

Step 5 Enter zero (0X) to select the master valve/pump.

01 = MV1

02 = MV2

03 = N.O. MV

04 = Pump

Step 6 Enter additional station numbers as necessary. Stations selected are shown on the display.

Note: Stations may be alternately turned On/Off (toggled) by re-entering the station number followed by the ENTER key.

At the end of the run time, the Multi-Station Option menu is displayed, or presses the Up Arrow key to display the previous menu.

Step 7 **Manually Entered Program**

Allows user to enter a one-time program to be run immediately or scheduled for later in the day. The

manual program is independent of automatic programs and will start only one time. To manually enter a consecutive list of stations to sequentially run one after the other:

Select F2=STATION ON SEQUENTIALLY.



Figure 117: Station on Sequentially

Note: This one-time program will execute either immediately or at a future time. Once executed, the stations must be re-entered in order to operate again.

Four options are given:

- Select ENTER STATIONS to enter the station numbers to be turned on.
- Select CLEAR ALL to remove all stations from sequential manual control.
- Select START NOW to start manual operation immediately.
- Select START LATER to enter a time for the stations to be operated.

Step 8 Select F1=ENTER STATIONS.
Enter the station number. The number must be between 1 and 48. Then press the ENTER key.

Note: *The maximum number of stations is determined by the total stations installed in the associated satellite controller. The maximum number will appear on the Station Number Entry Display screen.*

- Step 9** Enter the Run Time. Run time must be in Hour: Minutes (HH:MM) format, then press the ENTER key.

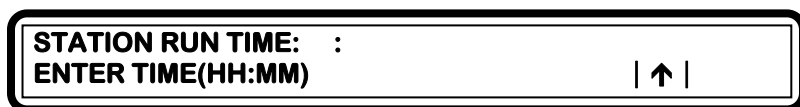


Figure 118: Station Run Time

- Step 10** Enter additional station numbers and run times, as necessary.
You may enter up to 10 stations. If the station is not used by a program or ISC, you are then prompted to select whether the Master Valve is to be used with the station.
- Step 11** If required; choose a selection from the four Master Valve options:
F1=MV1
F2=MV2
F3=N.O.
F4=None
- If a Master Valve is selected, select one of the two Pump options:
F1=Pump
F2=None
- Step 12** Press the Up Arrow key to return to the Station On Sequentially menu.

Clear All- If a programming error is made, select:
F2=CLEAR ALL.
All station numbers and run times are cleared.

Return to F1= ENTER STATIONS and re-enter the correct stations and run times.

Step 13 The Start Now option immediately executes the entered stations.
Select F3=START NOW. The stations selected are run in numerical order.
When completed, the screen returns to the previous menu.

Step 14 Start Later postpones or delays the manual execution.
Select F4=START LATER.

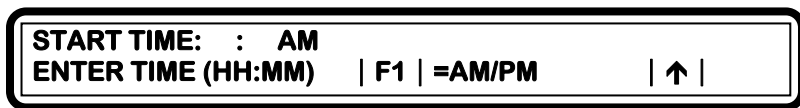


Figure 119: Start Later Time

Step 15 **Enter the start time.**
Enter times in 12 hour or 24 hour format.
If 12 hour time format is selected, use the F1=AM/PM toggle key to select AM or PM.

To change time format, go to Setup Controller, User Options, Time/Date.
Press ENTER. The base menu is displayed.
The stations will turn on at the specified time in a sequential fashion.

Multi-Station Diagnostics

Using Multi-Station for diagnostics is an effective tool in locating station field wiring problems. Detected problems that produce warning messages may be checked and isolated through manual testing. Warning messages displaying failures in stations, Master Valves/Pump, etc. will indicate the specific stations and devices that were running at the time of failure. The Multi-Station feature exercises the stations or devices which isolates the specific problem area.

Example: Assume a warning condition occurred as the result of running an automatic program. The warning appears in the display as follows:

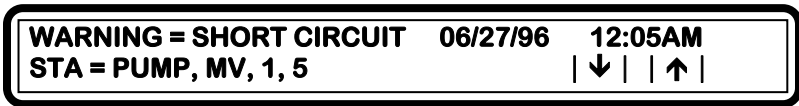


Figure 120: Warning, Short Circuit

The warning indicates that the Pump, Master Valve 1, station 1 and station 5 were all running at the time of failure. A short circuit condition may exist in any of the listed items. The following procedure provides a way to isolate which output is shorted:

Diagnostic Procedure

- Step 1** Examine the warning message to identify station numbers, Master Valves/Pump, etc. Record all identified items.
- If multiple short circuit warnings appear, the problem is most likely a short in the Master Valve and/or Pump circuit.

Step 2 Advance to the Multi-Station option display as follows:



F1=Main Menu
F4=Manual & Rain Off
F2=Multi-Station



Figure 121: Multi-Station Options

Step 3 Select F1=STATION ON CONCURRENTLY. The following screen is displayed:



Figure 122: Run Time Entry

Step 4 To run for 10 minutes, enter 10 then press ENTER. The following screen is displayed:

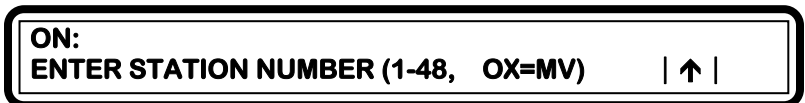


Figure 123: Station/Device Entry

Step 5 The Master Valve/Pump is selected by any number between 1 and 4 which is preceded by a 0 (zero). The Master Valve/Pump selections are:

- MV1=01

- MV2=02
- N.O.=03
- Pump=04

Enter the station or device numbers from the warning display, one at a time. Press the ENTER key after each entry. As each entry is made, the result appears on the display, as depicted in Figure 8-12.

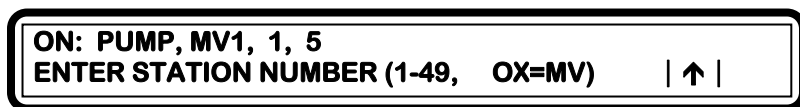


Figure 124: Station/Device Entry

Example: Enter the following short circuit warnings:

```
04 <ENTER> (pump)
01 <ENTER> (MV1)
  1 <ENTER> Station 1
  5 <ENTER> Station 5
```

When a problem is detected in a station or device, the Multi-Station operation is immediately aborted and the display returns to the base menu. The base menu will then display the warning.

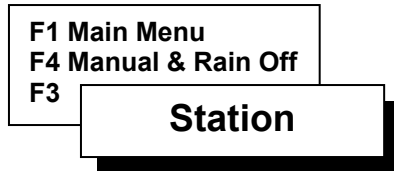
Step 6 The station or device is now identified and can be corrected accordingly.

Step 7 **IMPORTANT:** To clear all warnings from the base screen, select the F2=WARNING to display the first problem in the list. Continue to press the Down Arrow to display any additional warnings, if present.

After the last warning is displayed, press F1=CLEAR REPORT MESSAGES to Clear Report Messages. All problems in the list are erased.

This completes the Multi-Station Diagnostic procedure.

Press the QUIT key to return to the base menu.



Station

Manual station feature turns on any station for a specified time and automatically selects usage of the proper Master Valve and/or Pump for this station. The valve solenoid electrical current is displayed.

Use Station to manually control a single station and/or sequence through the stations using the next/previous station key prompts.

Procedure

Step 1 Advance to the station Number Entry screen as follows:

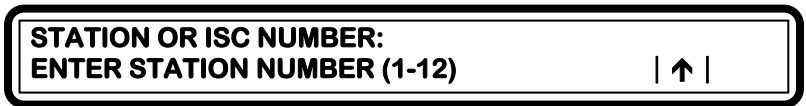
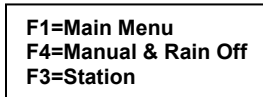


Figure 125: Station Number Entry

Step 2 Enter the station or ISC number then press ENTER. The following option screen is displayed:



Figure 126: Station Options

There are two options.

- Select TURN ON STATION to turn on the selected station.
- Select CANCEL ISC STATION to cancel operation of an Individual Station Control (ISC) station.

Step 3

Select F1=TURN ON STATION.
Enter the run time in Hour: Minutes (HH:MM) format. Then press ENTER.

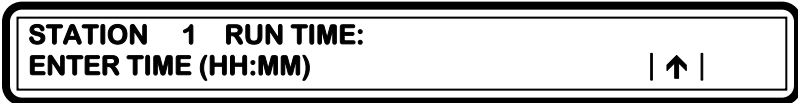


Figure 127: Run Time Entry

The station will start. The screen displays the following information:

- Station Number
- Station On/Off Status
- Count-down of Run Time
- Master Valve/Pump (if applicable)
- Electrical current in amps (I=X.XX)

| | | |
|----------------------------|--------------------------|---|
| STATION 1=ON | 0:04:25 | I=0.05 |
| F1 =ON/OFF | F2 =NEXT | F3 =PREVIOUS ↑ |

Figure 128: Station Run Status

Note: Prior to a station turning on, the station is analyzed by the controller to determine if the station is used in an existing program.

If the station is used in a program and the program includes a Master Valve or Pump, the controller will activate the Master Valve or Pump with the station.

If the station is not used by any program, no Master Valve or Pump will be activated for that station.

Step 4 F1=ON/OFF

The F1=ON/OFF toggle key alternately turns the station on and off.

Press F1=ON /OFF and verify that the station status changes accordingly.

The run time will continue to count down whether the station is on or off.

Step 5 F2=NEXT

The F2=NEXT key turns off the current station and turns on the next station. The process continues until the last station of the controller is reached.

Press the F2=NEXT key and verify that the next station turns on.

The Run Time will continue to count down regardless of station number.

Controllers are equipped with station configurations that range from 6 to 48 in increments of six stations. If the last station is displayed, the F2=NEXT key advances to station 1.

Step 6 F3=PREVIOUS

The F3=PREVIOUS key turns off the current station and turns on the previous station. If currently at station 1, the F3=PREVIOUS key decrements to the last station in the controller configuration. The Run Time will continue to count down regardless of the station number.

Step 7 Press the Up Arrow to return to the Manual On/Off menu options.

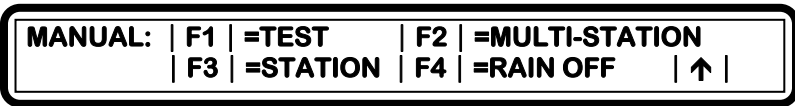


Figure 129: Manual Operations Menu

This completes the Manual Operations procedure.

Press the QUIT key to return to the base menu.



Rain Off

Use the Rain Off mode to stop watering for either a programmed amount of days or to turn off the controller for an indefinite amount of time.

Procedure

Step 1 Proceed to the Rain Off Option menu as follows:

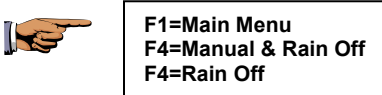


Figure 130: Rain Off

There are three options:

- Select RAIN SHUTDOWN to stop all watering indefinitely until manually returned to the automatic mode.
- Select NO WATER WINDOW to enter a period of time (up to 23 hours and 59 minutes) to establish a time period during the day when watering is not allowed.
- Select PROGRAMMABLE RAIN SHUTDOWN to stop watering from one to seven days.

Step 2 Select F1=RAIN SHUTDOWN.



Figure 131: Rain Shutdown

Press F1=ON to place the controller in rain shutdown mode.

Warning:



When rain shutdown is ON, No Watering will occur (assuming the program has rain shutdown enabled. See Setup, Program, Rain Shutdown, Chapter 4).

Note: *During rain shutdown, the base screen displays "RAIN SHUTDOWN" in place of the valid programs list.*

To start automatic watering operations again, rain shutdown mode must be turned Off.

Step 3 Press F2=OFF to return the controller to automatic mode.

Step 4 If a no water window is desired, select F2=NO WATER WINDOW.

NO WATER WINDOW selects a period of time (up to 23 hours and 59 minutes) to establish a time period during the day when watering is not allowed.

Enter the start time for when the no watering period is to occur in Hour: Minutes (HH:MM) format.

If 12 hour time format is selected for the controller, use F1=AM/PM toggle key to select AM or PM, and then press ENTER.

START TIME FOR WINDOW: 5:00 PM
ENTER TIME (HH:MM) | F1 | =AM / PM | ↑ |

Figure 132: No Water Window Time

Enter the end time for no watering period to occur in Hour: Minutes (HH:MM) format, then press ENTER.

Note: Any scheduled start times which occur during the no water window period will be ignored. Also, attempting to start a program with the PROGRAM ON/OFF key will have no effect.

- Step 5** Programmable Rain Shutdown allows a controller to be off for a specified number of days. Select F3=PROGRAMMABLE RAIN SHUTDOWN.

NUMBER OF RAIN SHUTDOWN DAYS: 3
ENTER NUMBER OF DAYS (1-7) | ↑ |

Figure 133: Programmable Rain Shutdown

Enter the number of days for no watering (rain shutdown), then press ENTER.

The Manual On/Off menu options are displayed.

Press the QUIT key to return to the base menu.

Once programmable rain days have been entered, the base menu shows RAIN SHUTDOWN DAYS LEFT=X, where X is the number of programmed days entered.

This number automatically decrements at 12:00 AM each day.

Note: Non irrigation programs are not affected by rain shutdown and will continue to operate as programmed.

This completes the procedure for Manual Rain Off.

Chapter 9

Central Control

The Evolution DX2 controller may be used in either a stand-alone mode or under control of a Central Control System. Under this Central Control mode, a host computer provides direction and monitoring of the controller.

Any controller (directly or indirectly) connected to the Central Control Computer is called a "satellite." A "submaster" is a satellite controller with specific communications capability. The submaster may operate as a stand-alone unit, a communication control unit for multiple satellites or a communication management control unit within a Flow Max system.

The submaster can communicate directly with a Rain Master Irrigation Systems (RMIS) Central Control Computer in one of seven ways - via UHF radio, telephone, direct connection (wire), phone repeater, trunk radio, cellular, and Ethernet.

Each submaster can provide hardwire communications support to a maximum of 100 satellite controllers.

To help control communications, all controllers connected to the Central Control computer are given an "address." After the address is assigned, the base screen is changed to show the satellite address.

The purpose of this chapter is to provide general information about Central Control Mode setup and operation.

Controller as Submaster

If the controller is setup as a submaster, you are prompted to select a communications option.

The three options are:

- Radio/Wire
- Phone- supports cellular and Ethernet communications
- Trunk

You are also prompted to enter an "address" for the controller. The address is a unique identification number for the controller. Each submaster under Central Control must have a separate address.

Refer to the configuration procedure in Chapter 4: Setup. After the address is assigned, the base menu is modified to show the address of the controller.

For example, if address 2 is selected, the base menu displays:



Figure 134: Satellite Address Display

Note: The base menu display alternates every seven seconds between the satellite address data and the valid programs display.

Transferring Programs between the Central Control Computer and Submaster/Satellite Controllers

The purpose of Central Control is to have a single unit, the host computer, provide program information to all Evolution DX2 controllers connected to it. The Central Control Computer also monitors all controllers for possible field related problems and maintains complete water usage and maintenance accountability. The process of sending program information from the Central Control Computer to the controllers is called "downloading." Downloading is automatic when a controller is properly setup and connected to the Central Control Computer. No action on your part is necessary; all actions are handled by the Central Control Computer.

Programs downloaded from the Central Control Computer may be modified in the field at the local controller. To communicate any program modifications to the Central Control Computer, you must "upload" the new program.

To initiate an upload process from the base screen, follow these steps:

Upload Procedure

Step 1 Advance to the Modify Program Options menu as follows:



| |
|---|
| <p>F1=Main Menu F1=Program F1=Modify Program Enter Program #</p> |
|---|

| | | | | | | | | | | | | | | |
|-----|----|----|-----------|----------------|----|----|----------|-------------|----|--|-------|--|---|--|
| P # | | F1 | | =PROGRAM START | | F2 | | =WATER DAYS | | | | | | |
| | F3 | | =STATIONS | | F4 | | =PERCENT | | F5 | | =SEND | | ↑ | |

Figure 135: Modify Program

Note: Program Number entry must be between 1 and 12.

Step 2 Select F5=SEND. The following message is displayed:



Figure 136: Program Send

The display indicates a program upload is requested. In addition, an entry is made in the warning list.

When the Central Control Computer contacts the controller, the program is uploaded and the entry is cleared from the warning list. The time required before the upload is made depends upon a number of factors including the total number of controllers operated by the Central Control Computer, communications resources (such as an available telephone line) for the upload, and the configuration of the Central Control System.

Communications and Problem Reporting

Submaster

If the submaster loses communications with one of its hardwired satellites, a hardwire (HW) communications failure is detected. An entry is made in the submaster's warning list.

Example: Hardwire Warning entry



WARNING-HW COMM FAIL 05/17/96 2:55PM

Figure 137: Warning Report

Satellite

When a satellite loses hardwire communications, it is "off-line". When communications is re-established, it is "on-line". When a satellite becomes off-line or on-line, an entry is made in the satellite's warning list.

Example: Off-line Warning entry



WARNING=OFF LINE 05/15/96 6:20PM

Figure 138: Problem Off-Line

Example: On-line Warning entry



Figure 139: Problem On-Line

Note: For detailed information on these warnings, refer to

All warnings are systematically retrieved and recorded by the Central Control Computer. The reported warnings are listed on the computer screen with full descriptions and recommended corrective action for each warning.

Diagnostics

Inherent to the Evolution DX2 controller are several advanced tools for communications troubleshooting. These tools are used by RMIS service personnel to diagnose and correct field communications problems.

The COMM Status options are reserved for use by RMIS field service personnel.

Controller Logs

When a controller is operated in Central Control Mode, controller operations data is stored on the controller. The data is transferred automatically on command by the Central Control Computer.

Data logged includes all station start and stop times and flow totals. This data is automatically cleared from the satellite each time statistics are uploaded.

Weather Center Sensors

Weather Center installations are connected to one specific satellite controller covering a microclimate zone of an irrigation system. The sensors of a Weather Center are identified as follows:

- ET (EvapoTranspiration) – Calculated by a Weather Computer
- Rain Fall - Rain accumulation is measured by Tipping Bucket Rain Gauge
- Wind - Wind speed is measured by an anemometer

All data gathered at the controller is reported back to the Central Control Computer and stored in its database. This information is used by the Central Control System to adjust irrigation control base on weather conditions as reported. Current daily E.T., wind and rain fall data can also be observed directly at the satellite controller.

Specific review procedures are given in the Measurements section of Chapter 7: System Status, page 7-4.

Full details on Central Control using a Weather Center are provided in the Weather Center User Manual.

Figure 9-7: Weather Center Connections shows the physical connections between a station and the controller.

Chapter 10

Field Maintenance Activity and Troubleshooting

This chapter describes the resources available to maintain and troubleshoot field wiring problems, broken heads, pipes and mainlines, AC power problems, monitoring of water usage, and miscellaneous other items.

In order to take full advantage of all the capabilities of the Evolution DX2 controller as a maintenance tool, refer to the following manual sections for operational information and proper setup:

Flow monitoring:

- Appendix A: Single controller with one point of connection
- OR
- Appendix E: Multiple controllers sharing one point of connection

Broken field wiring, short circuits, and faulty valve solenoids:

- Appendix B: Current Monitor

AC Power input problems:

- Appendix C: Power Failure/Recovery (no special setup required)

Communications wiring issues:

- Chapter 9: Communications and Problem reporting (no special setup required)

Warning Report (Alarms)

The Evolution DX2 series controller has the ability to automatically notify the operator when problems occur, or certain conditions arise.

The mechanism used is known as the warning report. The Evolution DX2 controller may report on over 30 different conditions. Each condition is date/time stamped and includes additional information which may be helpful in troubleshooting the problem. Up to 15 warnings may be saved in the controller at one time. The user may delete the list of warnings at any time. Because the controller operates intelligently, immediate operator attention to alarms/warnings is not necessary. For example, consider a station with a broken head (FLOW UPPER LIMIT warning). Upon detection of this failure, the Evolution DX2 will:

- Turn the failed station off
- Advance to the next scheduled station in the program
- Mark this station as condemned (will not water again until the alarm/warning is cleared)
- Report the failed station as a warning

Upon review of the warning, maintenance personnel would repair the problem and then clear the warning at the controller (this re-enables all irrigation at the station).

Viewing the Warning List

Any time that a warning is generated by the controller, the base screen displays the F 2 =WARNING message as illustrated in the following base menu display:



WED 02:10:57PM VALID PGM: 1 06/05/96 WK1
| F1 | =MAIN MENU | F2 | =WARNING

Figure 141: Base Screen

Selecting the F2=WARNING displays the first problem in the list.

Press the Down Arrow to display additional problems, if any.

Press the Up Arrow to display problems previously listed, if any, and to move to the base screen.

After the last problem, press F1 =**CLEAR REPORT**

MESSAGES to Clear Report Messages. All problems in the list are erased.

Warning:



Pressing the F1 key deletes all messages from the list. The messages cannot be recovered. Do not select F1 if you wish to continue reviewing the current list of problems.

Press QUIT to return to the base menu.

The remainder of this chapter provides detailed information about each warning, possible causes, and most important, the recommended actions for problem solutions.

Note: The following warning illustrations include a numbering system (001-032) which corresponds to the warning number sequence generated in the Central Control Computer. This numbering system may be disregarded in installations that do not include a Central Control Computer.

Warning Display List

| Standard Warnings | Page |
|--|-------------|
| Warning = 001 -Flow Lower Limit..... | 10-5 |
| Warning = 002 -Flow Upper Limit..... | 10-6 |
| Warning = 003 -Water Limit..... | 10-7 |
| Warning = 004 -Current Upper Limit..... | 10-8 |
| Warning = 005 -Current Low Limit..... | 10-9 |
| Warning = 006 -Main Flow..... | 10-10 |
| Warning = 007 -Hourly Rain Limit..... | 10-11 |
| Warning = 008 -On Line..... | 10-12 |
| Warning = 009 -Off line..... | 10-13 |
| Warning = 010 -Hardwire Communication Failure... | 10-14 |
| Warning = 011 -Wind Lower Limit..... | 10-15 |
| Warning = 012 -Wind Upper Limit..... | 10-16 |
| Warning = 013 -Power Failure..... | 10-17 |
| Warning = 014 -Power On..... | 10-17 |
| Warning = 015 -Upload Request..... | 10-18 |
| Warning = 016 -Unscheduled Limit..... | 10-19 |
| Warning = 017 -Daily Rain Limit..... | 10-20 |
| Warning = 018 -Short Circuit..... | 10-21 |

| Flow Max Warnings | Page |
|---|-------------|
| Warning = 019 - FM Flow Low Limit..... | 10-22 |
| Warning = 020 - FM Flow Upper Limit..... | 10-23 |
| Warning = 021 - FM Multiple Flow Meter 1 Assign.... | 10-24 |
| Warning = 022 - FM Multiple Flow Meter 2 Assign.... | 10-25 |
| Warning = 023 - FM Multiple Pump Assignment..... | 10-26 |
| Warning = 024 - FM Multiple MV1 Assignment..... | 10-27 |
| Warning = 025 - FM Multiple MV2 Assignment..... | 10-28 |
| Warning = 026 - FM Multiple N.O. Assignment..... | 10-29 |
| Warning = 027 - FM Station Advance | 10-30 |
| Warning = 028 - FM Stop Water..... | 10-31 |
| Warning = 029 - Auto Limits Aborted..... | 10-32 |
| Warning = 030 - FM Hardwire Comm Failure..... | 10-33 |
| Warning = 031 - FM Communications Restored..... | 10-34 |
| Warning = 032 - FM Main Flow..... | 10-35 |

Standard Flow Warnings

001 - Station Flow Too Low



Figure 142: Warning 001 -Flow Lower Limit

This warning appears at any controller whenever the measured flow is less than the expected flow (lower limit failure). The warning displays the station number (2) which was on at the time of the lower limit violation, the Master Valve (MV1) and/or the Pump, as well as the GPM reading (12) as measured by the flow meter. Upon detection, the controller automatically terminates irrigation on the station and advances to the next station in the program. Condemned stations will not irrigate again until the warning has been cleared.

Action:

- Step 1** Alarm generation may be caused by:
- Mis-adjusted valve
 - Incorrectly established individual station limits
 - Large variations in static water pressure
 - Improper regulation
 - Line impediments
- Step 2** If station limits are suspected, manually turn each station on and observe the nominal GPM readings. To isolate the suspect station, refer to the Manual Test procedure, (8-2).
- Step 3** Compare the GPM reading with the limit setting to insure that adequate margin exists (typical: 50% below nominal).

Step 4 **IMPORTANT:** Upon resolution of problem,
CLEAR all warnings at the controller.

002 - Station Flow Too High

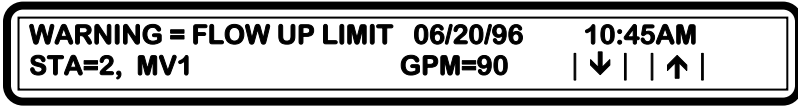


Figure 143: Warning 002-Flow Upper Limit

This warning appears at any controller whenever the measured flow is more than the expected flow (upper limit failure). The warning displays the station number (2) which was on at the time of the upper limit violation, the Master Valve (MV1) and/or Pump, as well as the GPM reading (90) as measured by the flow meter. Upon detection of this condition, the controller automatically terminates irrigation on the station and advances to the next station in the program. Condemned stations will not irrigate again until the warning has been cleared.

Action:

- Step 1** Check for:
- Stuck valve (from previous station)
 - Broken pipes/heads
 - Incorrectly established individual station limits
 - Large variations in system water pressure
- Step 2** If station limits are suspected, manually turn each station on and observe the nominal GPM readings. To manually turn on a station and read the flow, refer to the Manual Test procedure, (8-2)
- Step 3** Compare the GPM reading with the limit setting to insure that adequate margin exists (typical: 20% over nominal)

| Nominal | Upper Limit |
|---------|-------------|
| 50 | 60 |
| 80 | 96 |
| 100 | 120 |

Step 4 **IMPORTANT:** Upon resolution of problem, CLEAR all warnings at the controller.

003 - Monthly Water Limit Violation

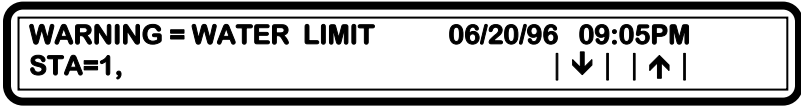


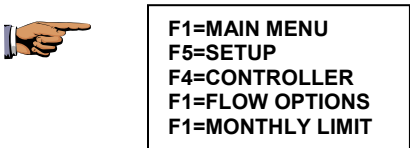
Figure 144: Warning 003-Water Limit

The controller has exceeded its monthly watering allocation. If the program has been set up to stop watering, no further irrigation will occur until day one of the next month. If the program has been set up to provide a warning only, and the alarm is cleared, then this warning will re-appear (watering continues).

When the option is set to "Stop Watering" and the limit is reached, the following action indicates how the warning can be circumvented so that irrigation may continue:

Action:

Step 1 The limit can be increased at the controller by entering:



Then enter a new monthly limit: OR

Step 2 The limit may be set to NONE, at the controller by entering:



F1=MAIN MENU
F5=SETUP
F4=CONTROLLER
F1=FLOW OPTIONS
F1=MONTHLY LIMIT

Select F1=NONE to disable monthly water total validation.

Step 3 **IMPORTANT:** Upon resolution of problem, CLEAR all warnings at the controller.

004 - Station Electrical Current Too High

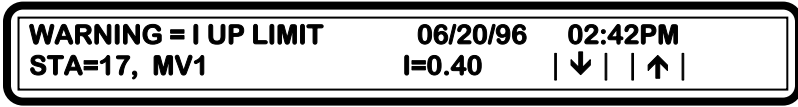


Figure 145: Warning 004-Current Upper Limit

The measured current upper limit value of electrical current is greater than the established limits. The warning lists the station number (17) which was on at the time of the upper limit violation, the Master Valve (MV1) and/or PUMP, as well as the measured electrical current in amps (.4). The current reading is the total or sum of all outputs which are on, including any Master Valve or Pump. Upon detection of this condition, the controller automatically terminates irrigation on the station and advances to the next station in the program. Condemned stations will not irrigate until the warning has been cleared.

Action:

- Step 1** Check field wiring for:
- Faulty solenoid
 - Field wiring which is exposed and submerged in water
 - Station to earth ground and/or common resistance path
 - Improper station limits
- Step 2** If station limits are suspected, manually turn each station on and observe the measured amperage (electrical current) in the display area I=X.XX. To assist in the isolation of the faulty station, refer to Multi-Station Diagnostics procedure.
- Step 3** Compare the amperage reading with the limit setting to insure that adequate margin exists (typical: 20% over nominal).

Step 4

IMPORTANT:

Upon resolution of problem, CLEAR all warnings at the controller.

005 - Station Electrical Current Too Low

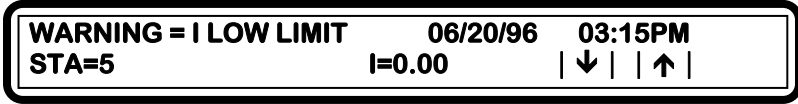


Figure 146: Warning 005-Current Low Limit

The measured current lower limit value of electrical current is less than the established limits. The warning lists the station number (5) which was on at the time of the lower limit violation, the Master Valve and/or Pump, as well as the measured electrical current in amps (0.00). The current reading is the total or sum of all outputs which are on. Upon detection of this condition, the controller automatically terminates irrigation on the station and advances to the next station in the program. Condemned stations will not irrigate again until the warning has been cleared.

Action:

- Step 1** Check field wiring for:
- Faulty solenoid (open coil)
 - No station connection at terminal output board
 - Improper field wire connections at valve solenoid
 - Poor common connection in field wiring
 - Improper station limits
- Step 2** If station limits are suspected, manually turn each station on and observe the measured amperage (electrical current) in the display area I=X.XX. (Refer to Multi-Station Diagnostics procedure.)
- Step 3** Compare the amperage reading with the limit setting to insure that adequate margin exists (typical: 50% under nominal).

Step 4

IMPORTANT:

Upon resolution of problem, CLEAR all warnings at the controller.

006 - Controller Main Line Break Occurred

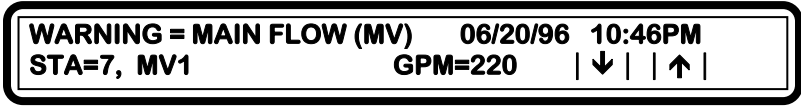


Figure 147: Warning 006-Main Flow

The maximum main line break flow rate was exceeded for the controller. The warning lists the station number (7) which was on at the time the controller Main Line Limit failure occurred as well as the measured flow in GPM (220). All irrigation for the controller is immediately terminated. In addition, the Normally Open Master Valve terminal (N.O.) is energized with 24 VAC. Any and all future automatic irrigation will not occur until this warning is cleared from the controller.

Action:

- Step 1** Inspect the main line as well as major branches for failure.
- Step 2** Inspect the station(s) which were operating at the time of the failure.
- Step 3** Turn on the station by using the Manual Test function, and observe the flow in GPM.
- Step 4** Compare the measured flow rate with the station limits as well as the controller Main Line Limit and verify proper operation. The Main Line Limit should be larger than the total of all simultaneously "On" stations.
- Step 5** Upon resolution of problem, CLEAR all warnings at the controller.

007 - Hourly Rain Limit Was Exceeded

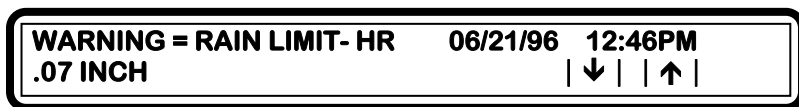
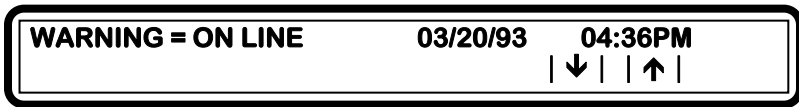


Figure 148: Warning 007-Hourly Rain Limit

The hourly rain limit has been reached. Upon receipt of this alarm condition, the Central Control System automatically places all satellites for the associated microclimate into the rain shutdown mode (if enabled). Rain shutdown affects all programs which have been set up as irrigation programs. If any irrigation programs are running, they are immediately terminated. The satellite display area will be updated to indicate that the satellite is in the rain shutdown mode. Programs scheduled for the future will not start. The satellites remain in the rain shutdown mode until the Central Control user decides it is time to resume irrigation (automatic mode). The hourly limit can be modified/reviewed at the Central Control Computer only. Non irrigation programs will not be affected by the rain shutdown mode.

Action: None. This feature is only applicable to Central Control Systems.

008 - Hardwire Communications Restored (On Line)**Figure 149: Warning 008-On Line**

A satellite has restored hardwire communications with its submaster. Upon restoration of communications, the satellite displays its address in the LCD display area. This message is only applicable when the satellite is using a hardwire communications line between itself and the submaster. This warning may be preceded by an OFFLINE warning which indicates when the hardwire communications were lost.

Note: The submaster automatically attempts to initiate as well as maintain hardwire communications at all times.

Action:

Step 1 Clear the warning at the satellite.

009 - Off Line

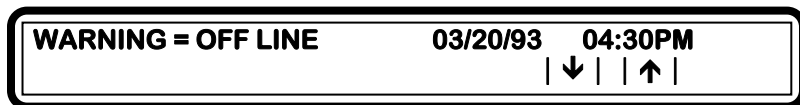


Figure 150: Warning 009-Off line

A satellite has lost hardwire communications with its submaster. Hardwire communications occur between the submaster and its satellites at the rate of once every 0.1 seconds. Loss of communications may be temporary (power glitch) or permanent (severed EV-CAB-COM communications cable). In either case, irrigation will continue at the satellites without interruption as long as the configuration does not utilize the Flow Max feature. This message will be accompanied by a corresponding message at its submaster, "HW COMM FAILURE."

Action:

- Step 1** Hardwire communications failures may be caused by any of the following: power failures, improper hardwire connections at the communications board, or broken/severed communications cable.
- Step 2** Starting with the first satellite which is connected to the submaster, examine the satellite address to verify address XX-01 appears in the LCD display. If there is no address and the controller is on, then a problem related to the communications cable or its connections has occurred somewhere between the submaster and this unit. If the address is OK, examine the satellite warning list for any related warning messages, e.g. momentary power failure. If address is OK and there are no related warnings, proceed to the next satellite and troubleshoot as above. Because the communications cable is wired

to each satellite in series, cable problems are isolated quickly.

If the previous satellite's address is OK but the current satellite has no address, the problem lies between the two units.

Step 3

IMPORTANT:

Upon resolution of problem, CLEAR all warnings at the satellites.

010 - Hardwire Communication Failure



Figure 151: Warning 010-Hardwire Communication Failure

A submaster has lost hardwire communications comm. with one or more satellites. Hardwire communications occur between the submaster and its satellites at the rate of once every 0.1 seconds. Loss of communications may be temporary (power glitch) or permanent (severed EV-CAB-COM communications cable). In either case, irrigation will continue at the satellites without interruption as long as the configuration does not utilize the Flow Max feature. This message will be accompanied by a corresponding message at one or more satellites, "OFFLINE."

Action:

- Step 1** Hardwire communications failures may be caused by any of the following: power failures, improper hardwire connections at the communications board, or broken/severed communications cable.
- Step 2** Starting with the first satellite which is connected to the submaster examine the satellite address to verify address XX-01 appears in the LCD display. If there is no address and the controller is on, then a problem related to the communications cable or its connections has occurred somewhere between the submaster and this unit. If the address is OK, examine the satellite warning list for any related warning messages, e.g. momentary power failure. If address is OK and there are no related warnings, proceed to the next satellite and troubleshoot as above. Because the communications cable is wired

to each satellite in series, cable problems are isolated quickly.

If the previous satellite's address is OK but the current satellite has no address, the problem lies between the two units.

Step 3

IMPORTANT:

Upon resolution of problem, CLEAR all warnings at the satellites.

011 - Wind Lower Limit Satisfied



Figure 152: Warning 011-Wind Lower Limit

The lower wind limit condition has been satisfied. Upon receipt of this alarm condition, the Central Control System automatically removes all satellites from wind shutdown mode (only those satellites within the confines of the wind microclimate are affected). Once removed from wind shutdown mode, the satellite (s) resume any program execution by enabling any station outputs which may be required.

Note: Programs which were in wind shutdown mode are not suspended in time. All programs continue to run as normal with the exception that their outputs (stations, MV's and Pump) are not active. Wind limits can be modified and reviewed at the Central Control Computer only.

Action: None. This feature is only applicable to Central Control Systems.

012 - Wind Upper Limit Exceeded

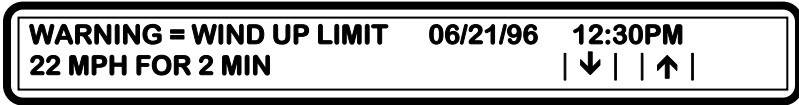


Figure 153: Warning 012-Wind Upper Limit

The wind upper limit has been reached. Upon receipt of this alarm condition, the Central Control System automatically places all satellites into the wind shutdown mode (only those satellites within the confines of the wind microclimate are affected). Programs which are running at the time the satellite goes into wind shutdown mode automatically turn all outputs off (stations, Master Valves, Pumps, etc.). These programs however, continue to advance in time and will resume if the wind lower limit conditions have been met. Wind limits can be modified and reviewed at the Central Control Computer only.

Action: None. This feature is only applicable to Central Control Systems.

013 - Power Failure



Figure 154: Warning 013-Power Failure

The AC power to the controller has been lost. Power failures may occur due to any of the following:

- Turning the AC switch off at the controller
- Power glitches or outages from the power company
- Improper AC connections at the controller or main distribution point

Action:

- Step 1** Infrequent minor interruptions in power from the power company may be a common occurrence, and therefore no action is required.
- Step 2** If power interruptions occur frequently, (several times per week) it may be indicative of an improper AC wiring connection to the controller, or improper service from the power company.
- Step 3** If power is out for an extended time, then the user may wish to schedule supplemental irrigation.
- Step 4** **IMPORTANT:**
Upon resolution of problem, CLEAR all warnings at the satellites.

014 - Power Restoration

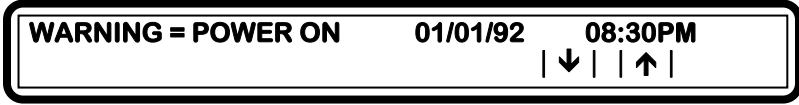


Figure 155: Warning 014-Power On

The AC power to the controller has been returned. This alarm is automatically generated by the controller upon detection of its AC input power.

Action:

Step 1 Clear the warning at the controller.

015 - Program Upload Request



WARNING = PROGRAM UPLOAD 10/30/96 04:21PM
PGM=5 | ↓ | | ↑ |

Figure 156: Warning 015-Upload Request

The user has requested the Central Control System to upload a specific program.

"PGM=" designates the program number.

Warning:



Uploading a program from the satellite to Central Control System should not be performed if the user is utilizing BASIC ET at this satellite. An upload in this instance would overwrite the BASE schedule at central with a field satellite program which has adjusted ET runtimes.

Action: None. This feature is only applicable to Central Systems.

016 - Unscheduled Flow



Figure 157: Warning 016-Unscheduled Limit

Flow was detected but the controller had no programs or manual stations running. The flow sensor however recorded unexpected flow "GPM=40." The controller will energize the N.O. Master Valve output. All future scheduled irrigation will be inhibited until this alarm has been cleared at the controller.

Action:

Step 1 Check for leaks, broken pipe(s), or physical damage.

Step 2 It is possible that a stuck valve from a previous scheduled irrigation caused the failure. Check for stuck valves.

Step 3 It is possible that the limit has been improperly established. If quick coupling devices were on at the time the alarm occurred, insure that there are enough margins for the unscheduled flow limit. Refer to section of Unscheduled Flow Limit.

Step 4 **IMPORTANT:**
Upon resolution of problem, CLEAR all warnings at the satellites.

017 - Daily Rain Limit Reached



Figure 158: Warning 017-Daily Rain Limit

The daily rain limit has been reached. Upon receipt of this alarm condition, the Central Control System automatically places all satellites for the associated microclimate into the rain shutdown mode (if enabled). Rain shutdown affects all programs which have been set up as irrigation programs. If any irrigation programs are running, they are immediately terminated. The satellite display area will be updated to indicate that the satellite is in the rain shutdown mode. Programs scheduled for the future will not start. The satellites remain in the rain shutdown mode until the Central Control user decides it is time to resume irrigation (automatic mode). Rain limits can be modified and reviewed at the Central Control Computer only. Non irrigation programs will not be affected by the rain shutdown mode.

Action: None. This feature is only applicable to Central Control Systems.

018 - Short Circuit



Figure 159: Warning 018-Short Circuit

A short circuit problem was detected on a station or device. The warning screen displays the stations and devices that were on at the time of short circuit detection. This alarm will occur whether or not station limits have been enabled or disabled. Upon detection, the controller immediately turns the station(s) off and advances to the next station in the program. This insures that no physical damage occurs to the controller by drawing too much current.

Action:

Step 1 Too much current for a station is caused by improper field wiring or valve solenoid failure.

- a. Examine the station field wiring and look for an inadvertent connection from the station field wire directly to the controller common
- b. Look for a direct connection from the station field wire to earth ground
- c. Look for a shorted solenoid in the valve
- d. For warnings displaying multiple stations, identify the defective station/device using the Multi-Station Diagnostics procedure

Step 2 **IMPORTANT:**

Upon resolution of problem, CLEAR all warnings at the satellites.

Flow Max Warnings

019 - Flow Max - Flow Lower Limit Violation



Figure 160: Warning 019-FM Flow Low Limit

This warning appears FM flow lower limit at the submaster whenever the measured flow is less than the expected flow (lower limit failure). "SAT=" lists the address(es) of any satellites which were irrigating at the time of the warning.

Example: Assume a submaster address of 35-00.

If the warning reads "SAT=1, 4, 5 GPM=90" then each of the satellites 35-01, 35-04, 35-05 had one or more stations which were on. Their combined measured flow was 90 GPM which is less than the programmed limit.

Action:

- Step 1** Examine the warnings at the listed satellites to determine which stations were on at the time of the warning. Stations can be identified by viewing the "FM STATION ADVANCE" warning at each of the satellites.
- Step 2** Alarm generation may be caused by mis-adjusted valves, incorrectly established individual station limits, large variations in static water pressure, improper regulation, or line impediments.
- Step 3** If station limits are suspected, manually turn each station on and verify the lower limits. To manually

turn on a station and read the flow, refer to the Manual Test procedure.

Step 4

IMPORTANT:

Upon resolution of the problem, CLEAR all warnings at all satellites. If warnings are not cleared, the stations will remain off indefinitely.

020 - Flow Max - Flow Upper Limit Violation

| | | |
|---------------------------------|-----------------|--------------------|
| WARNING = FM FLOW UP LIM | 05/30/96 | 04:45PM |
| SAT = 2, 5, | GPM=420 | ↓ ↑ |

Figure 161: Warning 020-FM Flow Upper Limit

This warning appears at the submaster whenever the measured flow is more than the expected flow (upper limit failure). "SAT=" lists the address(es) of any satellites which were irrigating at the time of the warning.

Example: Assume a submaster address of 01-00. If the warning reads "SAT=2,5 GPM=420" then satellites 01-02, 01-05 had irrigating stations and the sum of their measured flow was 420 GPM.

Action:

Step 1 Examine the warnings at the listed satellites to determine which stations were on at the time of the warning. Each satellite will have an "FM STATION ADVANCE" warning. This warning indicates which stations were on at the time the submaster detected the "FLOW UP LIM" violation.

Step 2 Check for:

- Stuck valve (from previous station)
- Broken pipes/heads
- Incorrectly established individual station limits
- Large variations in system water pressure

Step 3 **IMPORTANT:**
Upon resolution of the problem, CLEAR all warnings at all satellites. If warnings are not cleared, the stations will remain off indefinitely.

021 - FM - Multiple Flow Sensor 1 Assignment



Figure 162: Warning 021-FM Multiple Flow Meter 1 Assign

This warning appears at the submaster whenever the Flow Max feature has been incorrectly set up by the user. Using Flow Max, it is possible to assign a device (in this case Flow Sensor 1) to any of the Flow Max participants. If the user makes an error by assigning the flow sensor to more than one satellite, this warning will appear at the submaster. Devices must be installed at one physical location (controller) only.

Action:

Step 1 Review the Flow Max device connection list at the via the F4=REVIEW ALL selection. Look for two or more occurrences of Flow Sensor 1 throughout the Flow Max participants.

Step 2 Note the incorrect assignment and remove it from the location(s), which are in error.

Example:

Assume a flow sensor physical connection at the submaster (address 01-00) and an inadvertent assignment of Flow Sensor 1 at participant address 01-02.

To remove the incorrect assignment, go to the satellite address 01-02 (third controller on the hardwire link) and delete the entry using the Flow Max setup function.

Step 3 **IMPORTANT:** Upon resolution of problem, CLEAR all warnings at the satellites.

022 - FM - Multiple Flow Sensor 2 Assignment

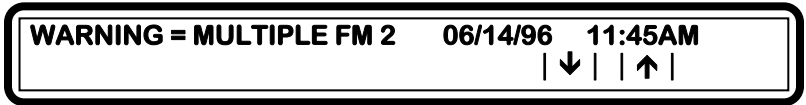


Figure 163: Warning 022-FM Multiple Flow Meter 2 Assign

This warning appears at the submaster whenever the Flow Max feature has been incorrectly setup by the user. Using Flow Max, it is possible to assign a device (in this case Flow Sensor 2) to any of the Flow Max participants. If the flow sensor is assigned to more than one satellite, this warning will appear at the submaster. Devices must be installed at one physical location (satellite) only.

Action:

- Step 1** Review the Flow Max device connection list at the submaster via the F4=REVIEW ALL selection. Look for two or more occurrences of Flow Sensor 2 throughout the Flow Max participants.
- Step 2** Note the incorrect assignment and remove it from the location(s) which are in error.

Example:

Assume a flow sensor physical connection at the submaster (address 01-00) and an inadvertent assignment of Flow Sensor 2 at participant address 01-03.

To remove the incorrect assignment, go to the satellite address 01-03 (fourth controller on the hardwire link) and delete the entry using the Flow Max setup function.

- Step 3** **IMPORTANT:** Upon resolution of problem, CLEAR all warnings at the satellites.

023 - FM - Multiple Pump Assignment

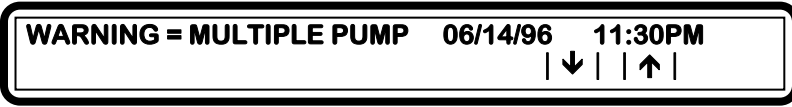


Figure 164: Warning 023-FM Multiple Pump

This warning appears at the submaster whenever the Flow Max feature has been incorrectly set up by the user. Using Flow Max, it is possible to assign a device (in this case the Pump) to any of the Flow Max participants. If the Pump is assigned to more than one controller, this warning will appear at the submaster. Devices must be installed at one physical location (satellite) only.

Action:

- Step 1** Review the Flow Max device connection list at the submaster via the F4=REVIEW ALL selection. Look for two or more occurrences of the Pump throughout the Flow Max participants.
- Step 2** Note the incorrect assignment and remove it from the location(s) which are in error.

Example:

Assume the pump's physical connection is at the submaster (address 01-00) and the pump was inadvertent assigned to the participant at address 01-03.

To correct this assignment, go to satellite address 01-03 (fourth controller on the hardwire link) and delete the entry using the Flow Max setup function.

Step 3 IMPORTANT:

Upon resolution of problem, CLEAR all warnings at the satellites.

024 - FM - Multiple Master Valve 1 Assignment

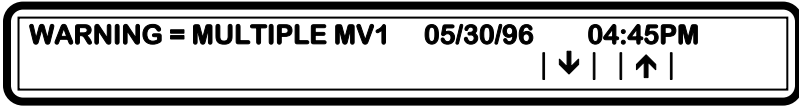


Figure 165: Warning 024-FM Multiple MV1 Assignment

This warning appears at the submaster whenever the Flow Max feature has been incorrectly set up by the user. Using Flow Max, it is possible to assign a device (in this case Master Valve 1) to any of the Flow Max participants. If Master Valve 1 is assigned to more than one satellite, this warning will appear at the submaster. Devices must be installed at one physical location (controller) only.

Action:

- Step 1** Review the Flow Max device connection list at the submaster via the F4=REVIEW ALL selection. Look for two or more occurrences of Master Valve 1 throughout the Flow Max participants.
- Step 2** Note the incorrect assignment and remove it from the location(s) which are in error.

Example:

Assume the Master Valve physical connection is at submaster (address 01-00) and the Master Valve was inadvertent assigned to participant address 01-02.

To remove the incorrect assignment, go to the satellite address 01-02 (third controller on the hardwire link) and delete the entry using the Flow Max setup function.

- Step 3** **IMPORTANT:** Upon resolution of problem, CLEAR all warnings at the satellites.

025 - FM - Multiple Master Valve 2 Assignment

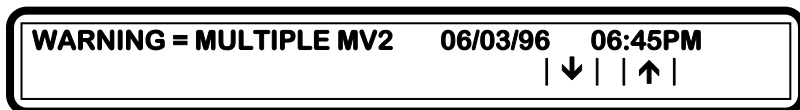


Figure 166: Warning 025-FM Multiple MV2 Assignment

This warning appears at the submaster whenever the Flow Max feature has been incorrectly set up by the user. Using Flow Max, it is possible to assign a device (in this case Master Valve 2) to any of the Flow Max participants. If Master Valve 2 is assigned to more than one satellite, this warning will appear at the submaster. Devices must be installed at one physical location (satellite) only.

Action:

- Step 1** Review the Flow Max device connection list at the submaster via the F4=REVIEW ALL selection. Look for two or more occurrences of Master Valve 2 throughout the Flow Max participants.
- Step 2** Note the incorrect assignment and remove it from the location(s) which are in error.

Example:

Assume the Master Valve physical connection is at submaster (address 01-00) and the Master Valve was inadvertent assigned to participant address 01-03.

To remove the incorrect assignment, go to the satellite address 01-03 (fourth controller on the hardwire link) and delete the entry using the Flow Max setup function.

Step 3

IMPORTANT:

Upon resolution of problem, CLEAR all warnings at the satellites.

026 - FM - Multiple Normally Open Master Valves

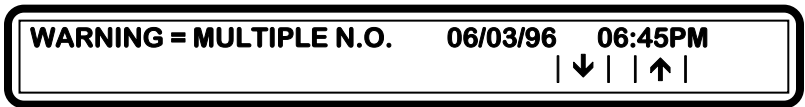


Figure 167: Warning 026 -FM Multiple N.O. Assignment

This warning appears at the submaster whenever the Flow Max feature has been incorrectly set up by the user. Using Flow Max, it is possible to assign a device (in this case the Normally Open Master Valve) to any of the Flow Max participants. If the user makes an error by assigning the N.O. MV to more than one satellite, this warning will appear at the submaster. Devices must be installed at one physical location (satellite) only.

Action:

- Step 1** Review the Flow Max device connection list at the submaster via the F4=REVIEW ALL selection. Look for two or more occurrences of the N.O. MV throughout the Flow Max participants.
- Step 2** Note the incorrect assignment and remove it from the location(s) which are in error.

Example:

Assume a N.O. MV physical connection is at submaster (address 01-00) and the N.O. MV was inadvertent assigned to participant address 01-03.

To remove the incorrect assignment go to the satellite address 01-03 (fourth controller on the hardwire link) and delete the entry using the Flow Max setup function.

Step 3

IMPORTANT:

Upon resolution of problem, CLEAR all warnings at the satellites.

027 - Flow Max - Station Advance



WARNING = FM STA ADVANCE 05/30/96 04:45PM
STA= 1, | ↓ | | ↑ |

Figure 168: Warning 027-FM Station Advance

This warning is issued to all Flow Max participants who have stations on whenever either a FLOW UP LIM or a FLOW LO LIM Warning (upper or lower limit failure) has occurred. The "STA=" information indicates which stations were on at the time the flow violation occurred. Upon receipt of this command, the satellite will terminate irrigation for the listed stations and automatically advance to the next station in the current program. Future irrigation will not occur at the listed stations until this alarm is CLEARED from the satellite/s.

Action:

- Step 1** Review the Action information listed under the FLOW UP LIM or the FLOW LO LIM warnings.
- Step 2** Investigate individual station operation for listed stations. (Refer to the Manual Test procedure) Manually turn on each station individually and visually inspect operation. Note the measured flow readings and compare to both the upper and lower limits which are set for this station. Check for any broken or restricted heads, etc.
- Step 3** **IMPORTANT:**
Upon resolution of problem, CLEAR all warnings at the satellites.

028 - Flow Max - Stop Water



Figure 169: Warning 028 -FM Stop Water

This warning is originated by the submaster whenever flow violations occur. It is sent to all Flow Max participants when any of the following conditions occur:

- Unscheduled Flow
- Main Line Break
- Hardwire Communications Failure
- Power Failures

"STA=" indicates which stations were on at the time the command was issued. Satellites which receive this warning terminate all irrigation.

Action:

- Step 1** Read the alarms at the submaster to determine the reason for the alarm.
- Step 2** Read the alarms at the satellites(s) for satellite specific information.
- Step 3** **IMPORTANT:**
Upon resolution of problem, CLEAR all warnings at all satellites.

029 - Auto Limits Aborted



Figure 170: Warning 029 -Auto Limits

The automatic calculation of the Auto Limits feature had to be stopped due to a potentially hazardous over current situation at this satellite. This warning only occurs when the Auto Limits feature is running. This alarm may be preceded by a SHORT CIRCUIT alarm, indicating the station with the short circuit condition.

Action:

- Step 1** Correct the short circuit (over current) condition at the station. The problem station may be identified by performing the Multi-Station Diagnostics procedure.
- Step 2** CLEAR all alarms.
- Step 3** Re-run the AUTO LIMITS function.
- Step 4** **IMPORTANT:**
Upon resolution of problem, CLEAR all warnings at the satellites.

030 - FM - Communications Failure

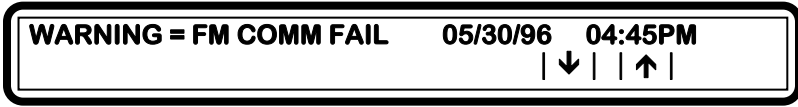


Figure 171: Warning 030 -FM Hardwire Comm Failure

This warning is generated at the submaster when using the Flow Max feature. It indicates that hardwire communications were lost or interrupted between one or more satellites which are Flow Max participants. The warning is immediately followed by a STOP WATER warning. This means that all irrigation at the time the communications failure occurred will be terminated.

Action:

Step 1 Hardwire communications failures may be caused by any of the following:

- Power failures
- Improper hardwire connections at the communications board of any Flow Max participant
- Broken or severed communications cable

Step 2 Starting with the first satellite which is connected to the submaster, examine the satellite address to verify address XX-01 appears in the LCD display (Address display should appear every seven seconds). If there is no address and the controller is on, then a problem related to the communications cable or its connections has occurred somewhere between the submaster and this unit.

If the address is OK, then examine the satellite warning list to see if there are any related warning messages, e.g. momentary power failure. If the address is OK and there are no related warnings, then proceed to the next satellite and troubleshoot as

above. Because the communications cable is wired to each satellite in a serial fashion, cable problems are isolated quickly.

If the previous satellites address is OK but the current satellite has no address, then the problem lies between the two units.

Step 3**IMPORTANT:**

Upon resolution of problem, CLEAR all warnings at the satellites.

031- FM - Communications Restored



Figure 172: Warning 031 -FM Communications Restored

This warning is issued after a previous Flow Max COMM FAIL warning. It indicates that the submaster has been able to re-establish hardwire communications with all the participants of the Flow Max link. Communications with all participants is required in order for any program to execute.

- Step 1: IMPORTANT:**
Upon resolution of problem, CLEAR all warnings at the satellites.

032 - Flow Max - Main Flow

| | | |
|-------------------------------|-----------------|----------------|
| WARNING = FM MAIN FLOW | 06/14/96 | 10:45AM |
| SAT=2, 5, | ↓ | ↑ |

Figure 173: Warning 032 -FM Main Flow

This alarm appears at the submaster whenever the measured flow is more than the Main Line Break Limit established at the submaster. It indicates that the sum of water from all Flow Max participants exceeds the Main Line Break Limit. The submaster automatically issues a STOP WATER warning to all participants, to insure that all irrigation at every satellite terminates. The NORMALLY OPEN MV terminal will be automatically energized at the submaster as well as at the shared location. **IMPORTANT:** All future scheduled irrigation for any of the Flow Max participants will not occur until this alarm has been cleared at the satellite.

"SAT=" lists the address(es) of any satellites which were irrigating at the time of the warning.

Example:

Assume a submaster address of 01-00. If the warning reads "SAT =2,5 GPM=620" THEN satellites 01-02, 01-05 had irrigating stations and the sum of their measured flow was 620 GPM.

Action:

- Step 1** Review the warnings at the listed satellites to determine which stations were on at the time of the warning.
Determine if any of these stations were responsible for the Main Line Limit failure.
- Step 2** Inspect the main line as well as major branches for failure.

- Step 3** Inspect the station(s) which were operating at the time of failure.

- Step 4** Turn on the station using the MANUAL TEST function, and observe the flow in GPM.

- Step 5** Compare the measured flow rate with the station limits as well as the satellite Main Line Limit and verify proper operation. The Main Line Limit should be larger than the total of all simultaneously "On" stations.

- Step 6** Upon resolution of problem, CLEAR all warnings at the satellites.

Troubleshooting

The following flow charts offer methods of diagnosing and correcting specific problems. Many of the resolutions refer to a page or section in this manual to serve as additional steps in solving the problem. The references are identified by chapter and page number.

For further assistance please consult our Rain Master technical support department at (805) 527-4498, Monday through Friday during the hours of 8:00 AM to 5:00 PM Pacific Time.

Warning:

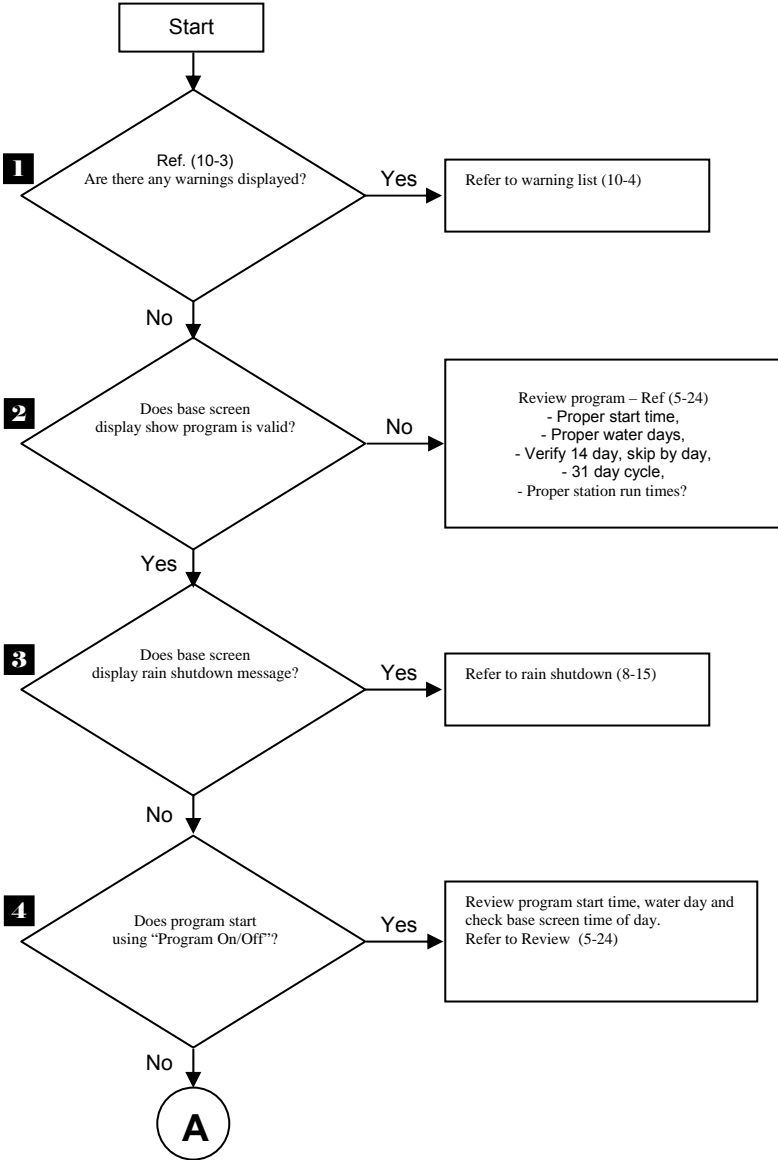


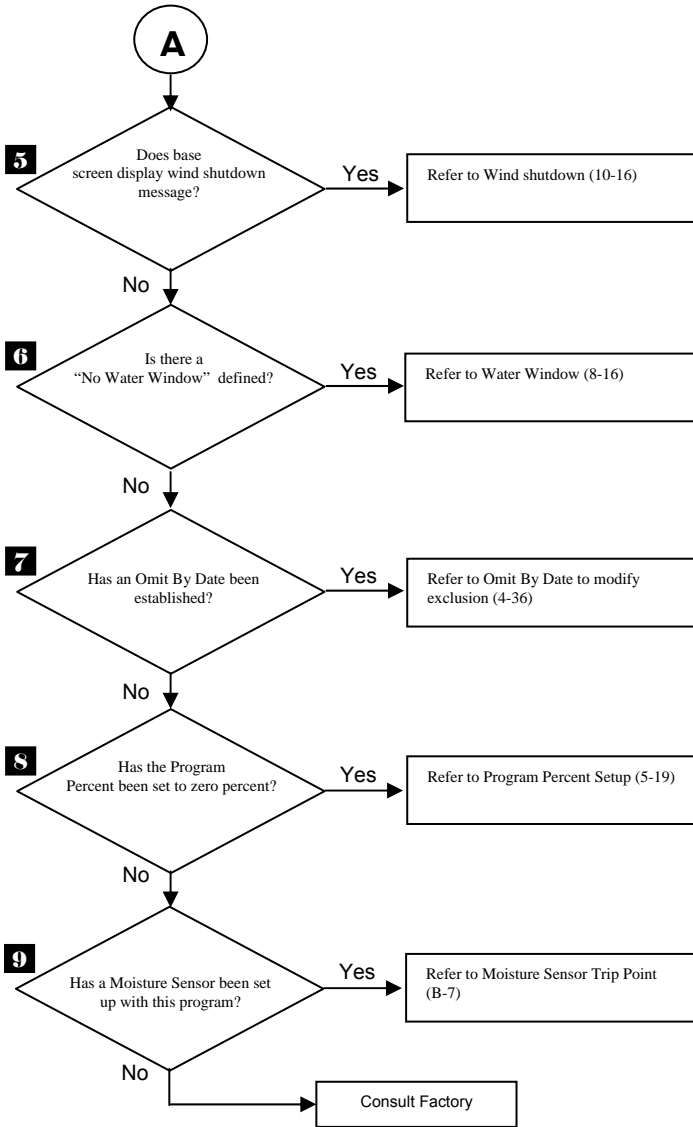
Before disconnecting ANY Evolution DX2 circuit board, ensure that all power has been removed from the system. Power can be removed by the main power switch. Ensure that all cables have been properly connected.

Directory of Flow Chart Diagnostic Problems

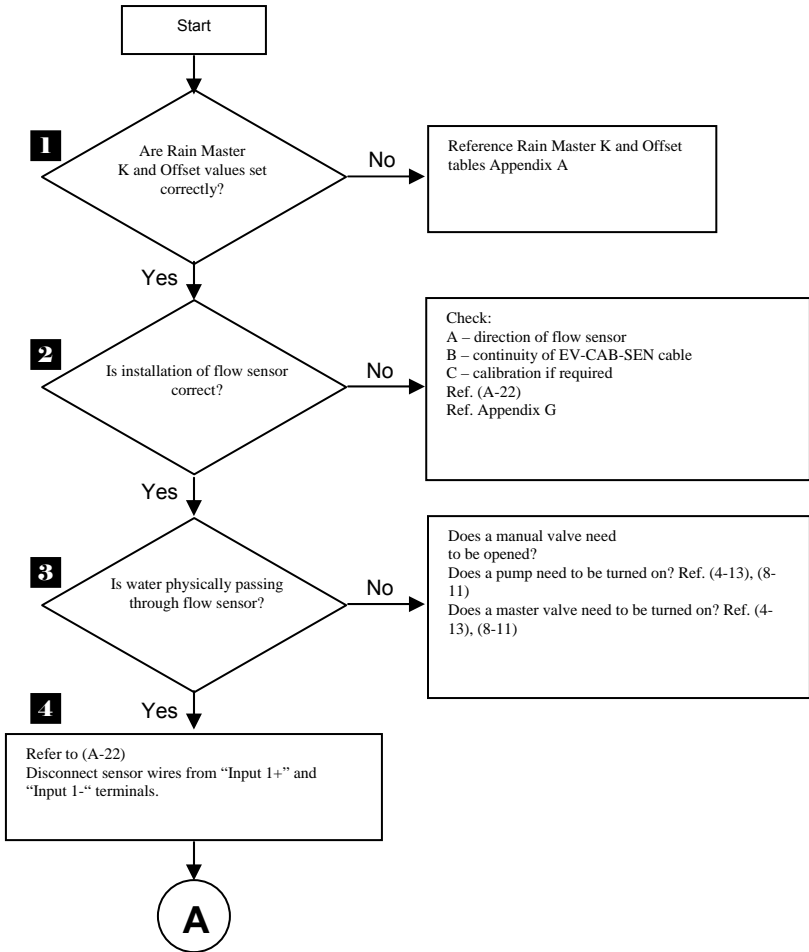
| Problem/Symptom | Page |
|--|-------------|
| Automatic Program Does Not Start | 10-38 |
| Flow Sensor Reading Always Zero | 10- 40 |
| A Station/Valve Does Not Water | 10-43 |
| Display is Blank | 10- 46 |
| Controller Emits a Constant Tone | 10-48 |
| Program Starts-But Does Not Water | 10- 49 |
| Program Starts-But Stations Shut Off Immediately- Diagnosis of Warnings | 10-50 |
| Monthly Flow Violation Occurred But Program Still Operates | 10-51 |
| Multiple Stations Do Not Water (Many station lights on) | 10-54 |

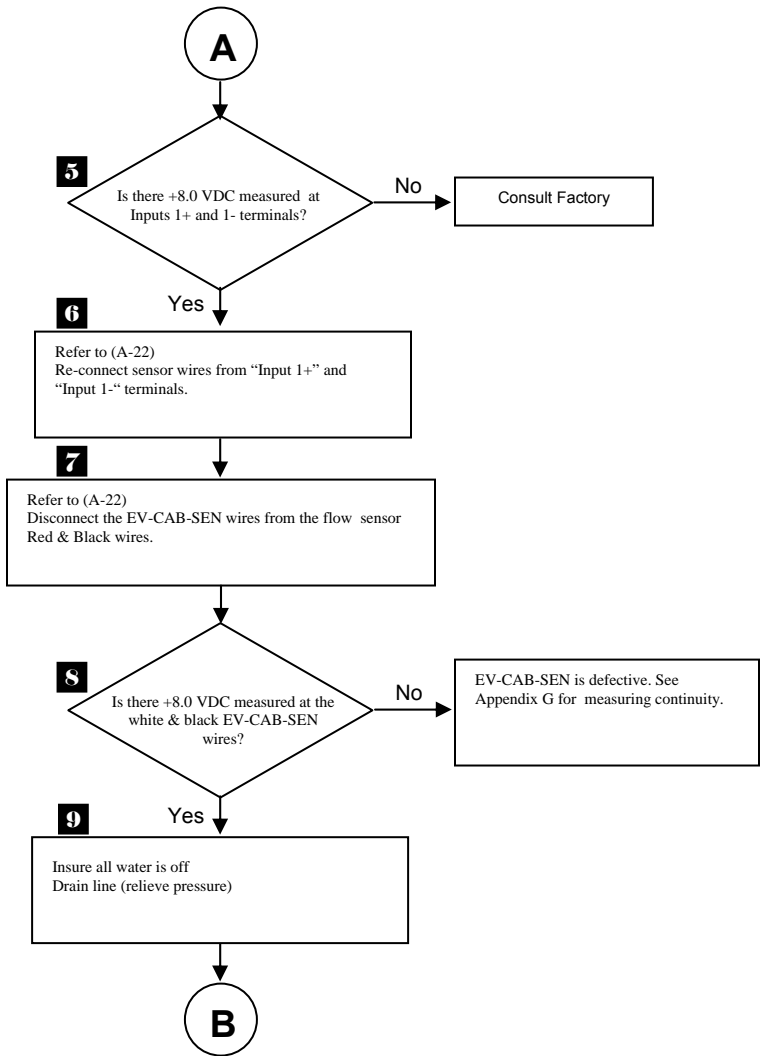
Automatic Program Does Not Start

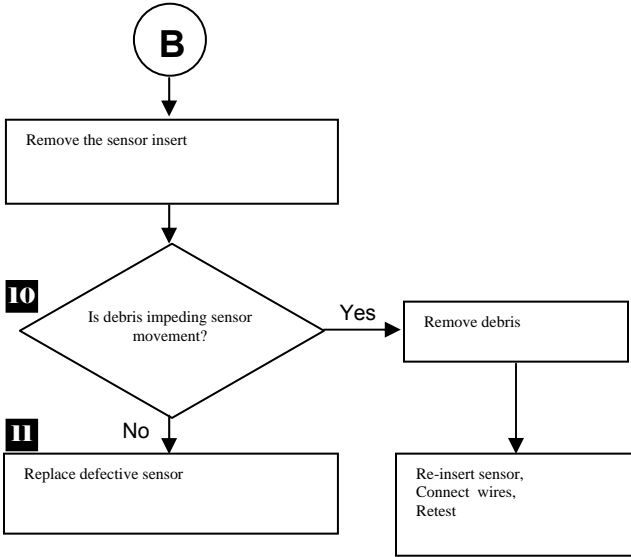




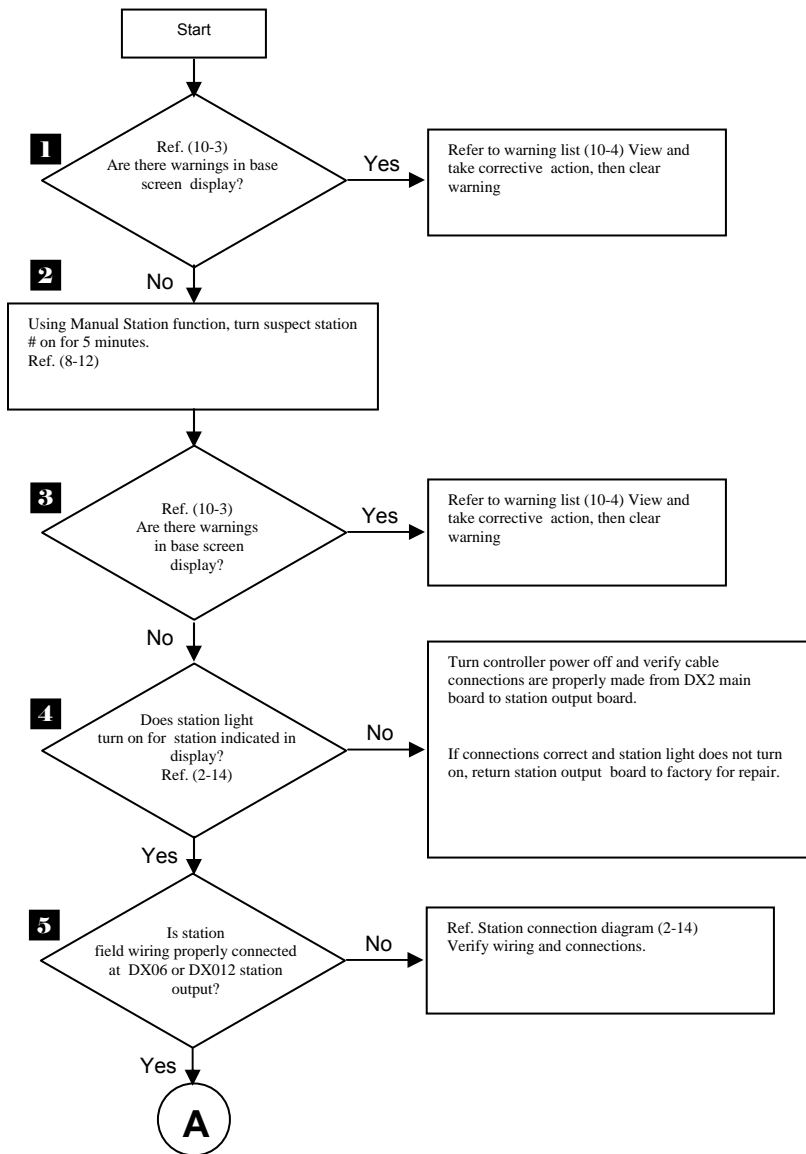
Flow Sensor Reading Always Zero

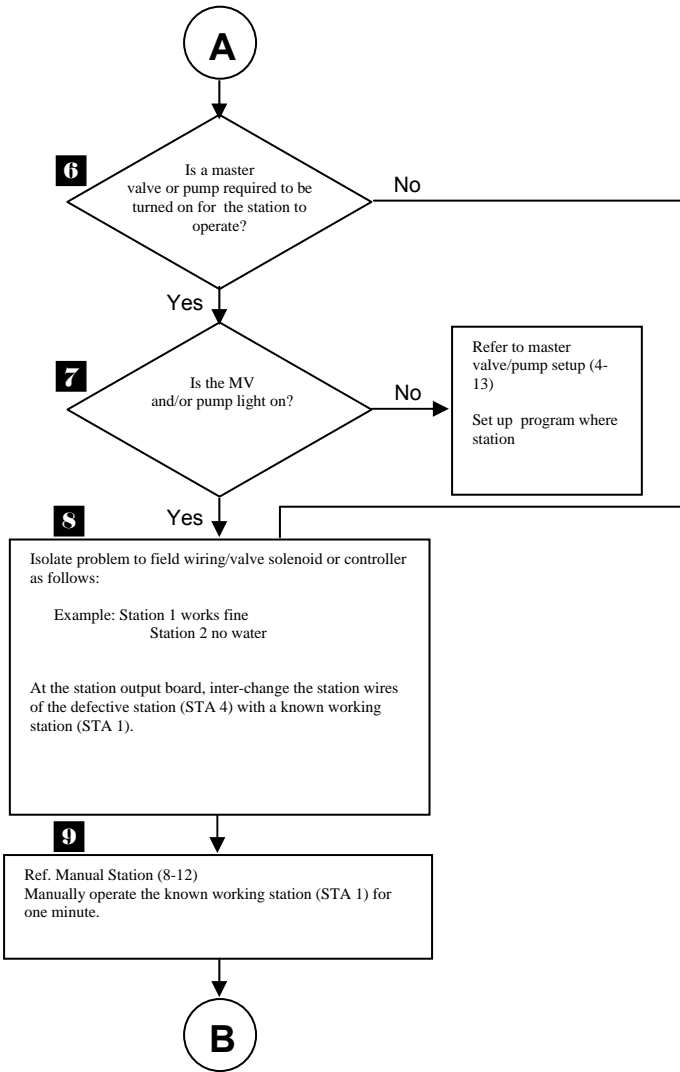


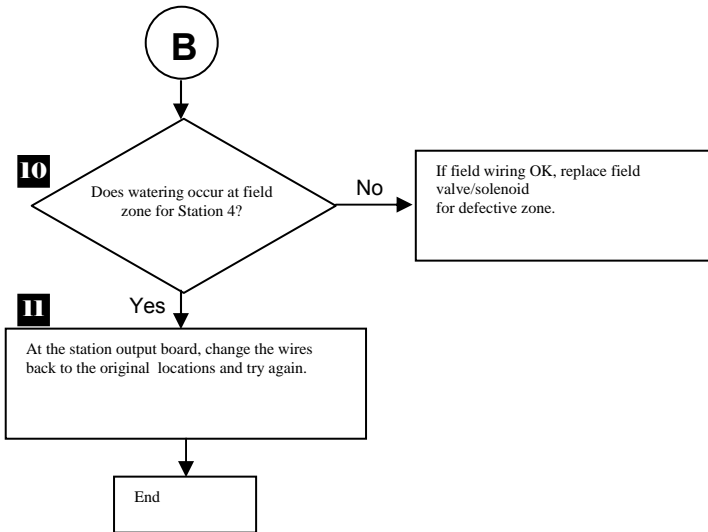




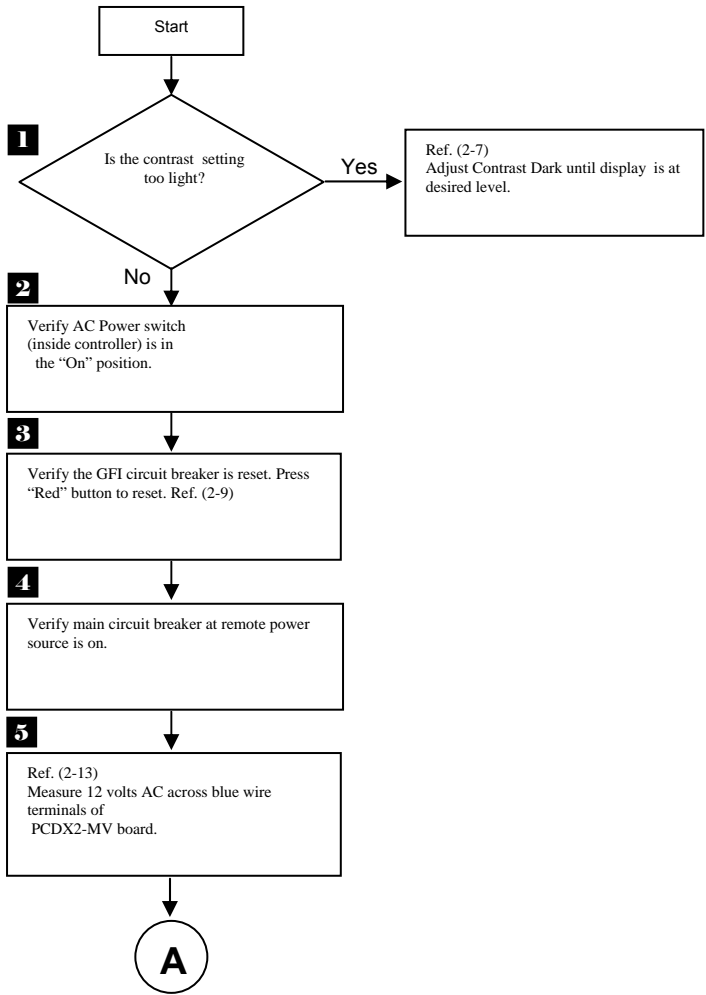
A Station/Valve Does Not Water

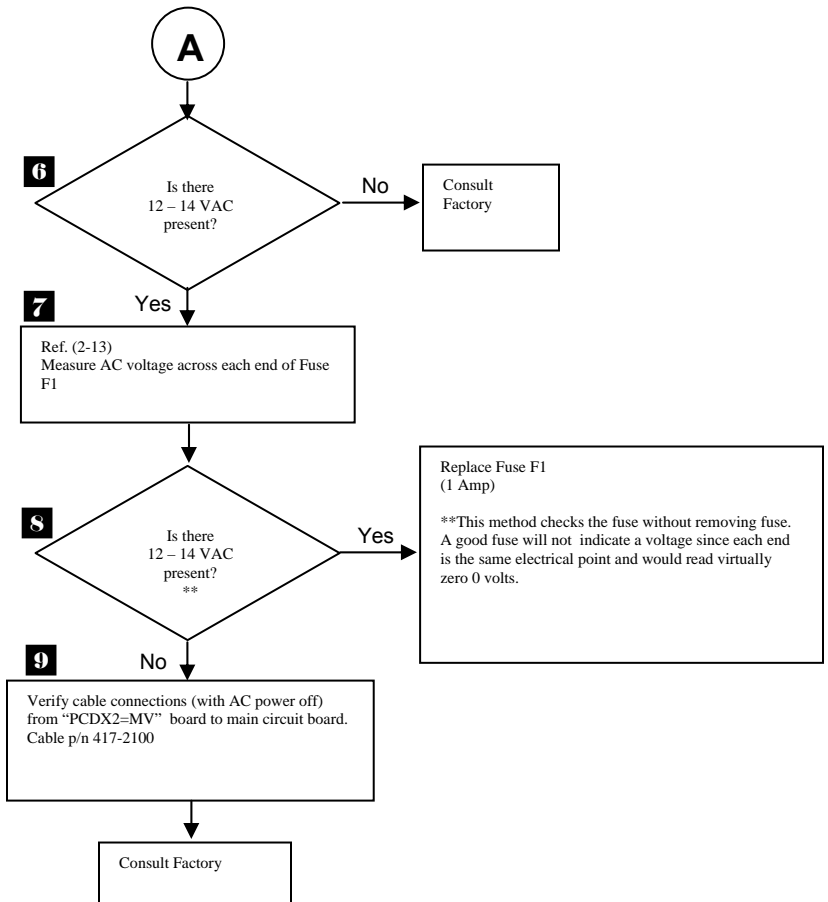




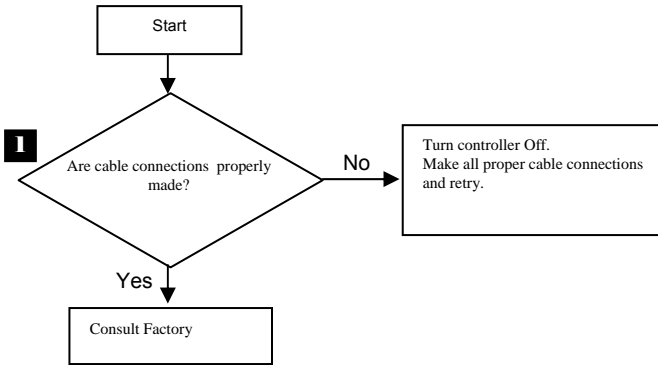


Display is Blank

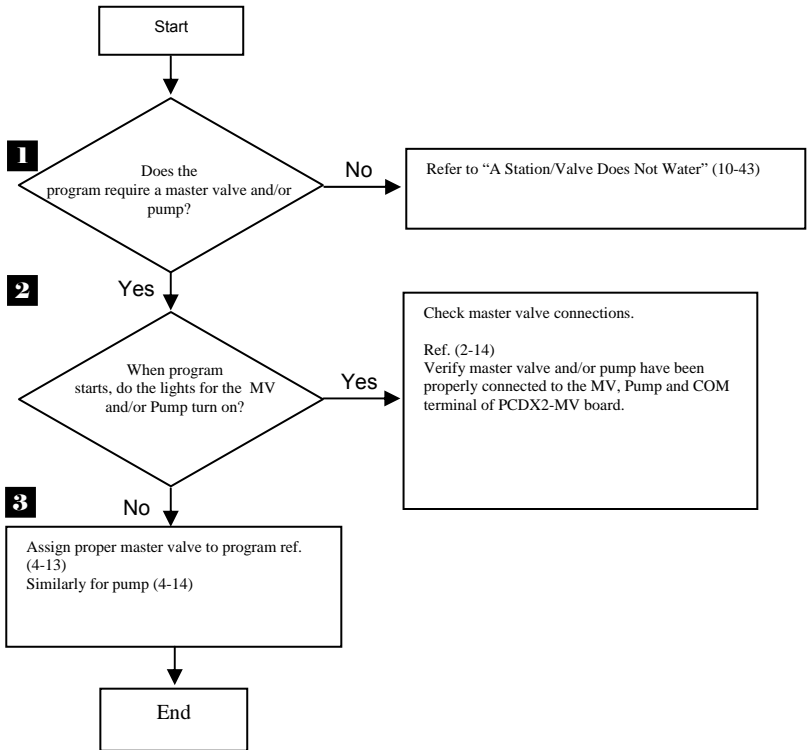




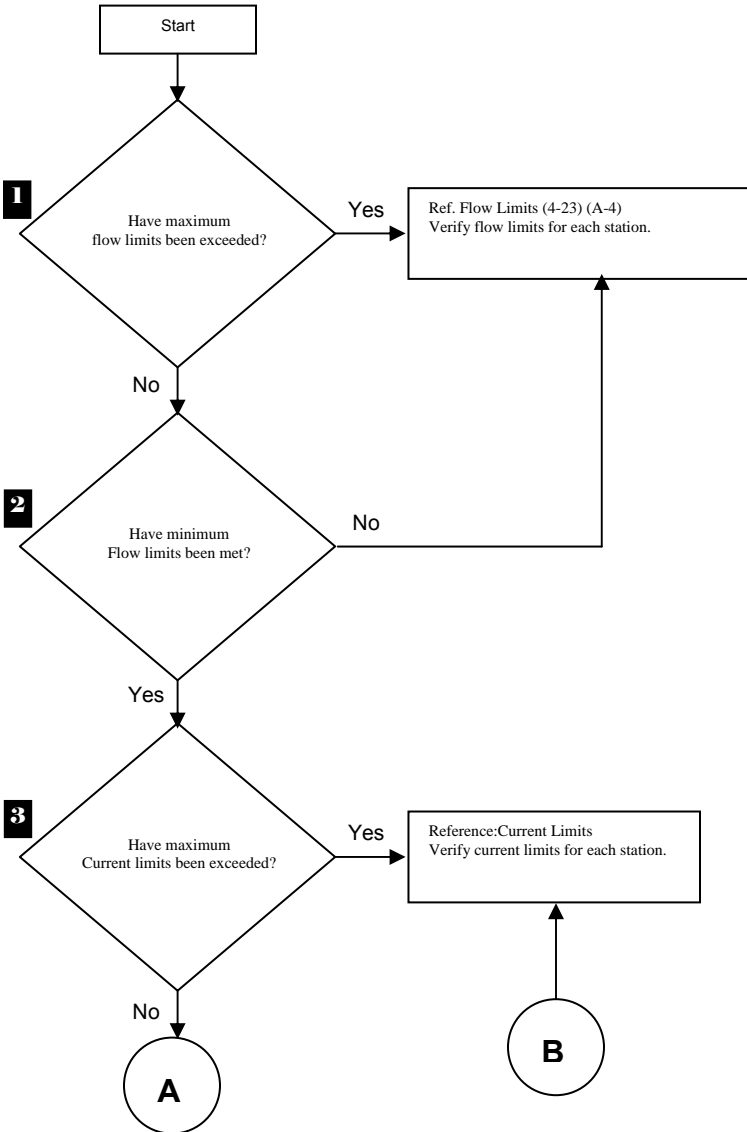
Controller Emits a Constant Tone

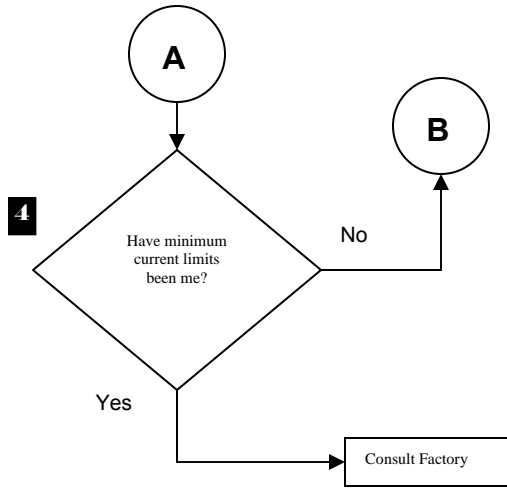


Program Starts - But Does Not Water

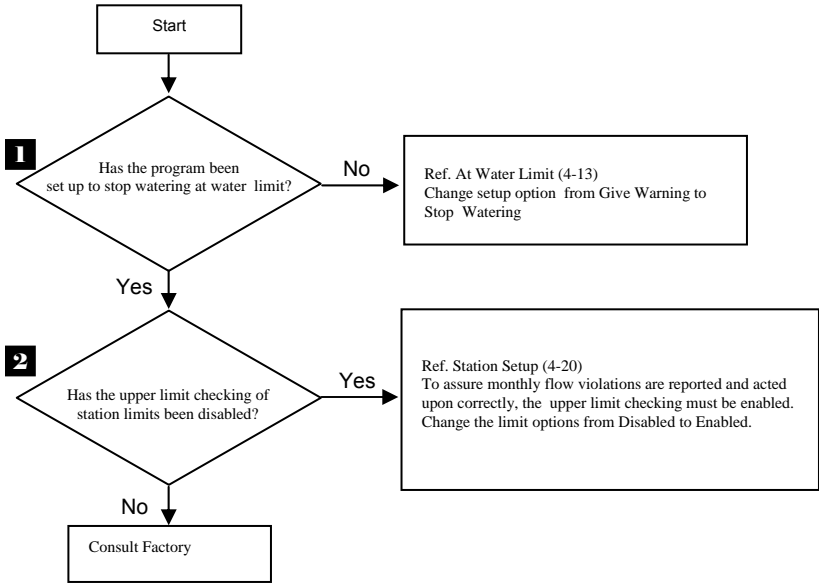


Program Starts – But Stations Shut Off Immediately





Monthly Flow Violation Occurred but Program Still Operates



Multiple Stations Do Not Water

Station LED for the suspect zone turns on and other station LEDs also turn on.

The Evolution DX2 Controller has the unique ability to detect and identify broken or missing "Common" valve solenoid wiring connections.

If a zone does not water but that station's red LED light turns on as well as other various LEDs for other stations, the field "common" wire for those stations is not connected (floating) to the controller.

Check the field wiring common connection at the controller and at the field junction where they may be tied together. Check for continuity of the common line from the controller to the field valve.

The following schematic diagram illustrates a sample wiring configuration of four solenoids connected to station outputs:

Controller Station Output Board

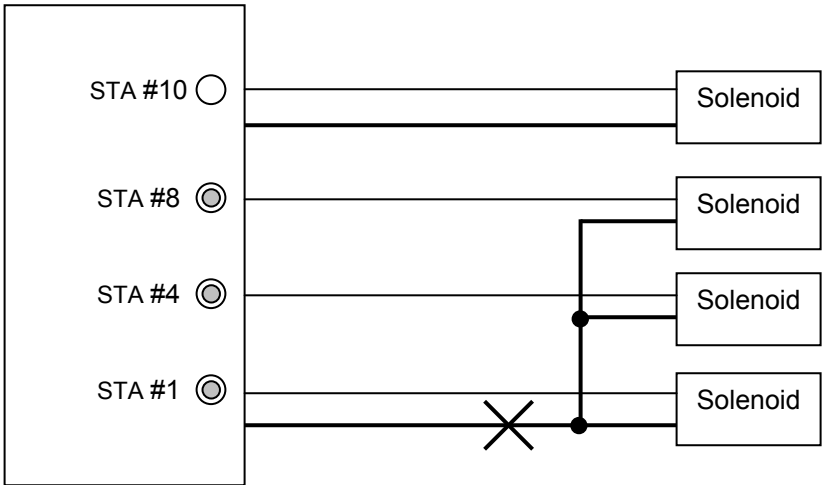


Figure 174: Output Board Station Connections

The solenoids connected to station outputs 1, 4, and 8 share one common line return to the station output board. Station #10 is shown as a normal operating station, which is connected independently from the other stations (not sharing the common connection).

When station one turns on, 24 VAC is applied to the solenoid and the LED illuminates. If the common line is broken or open, (as shown by the cross marks) current does not flow and the solenoid is not energized. However, a small amount of current flows through the solenoid coils back to each station output LED. This causes station LEDs # 4 and #8 to illuminate, creating the illusion that the stations are on when they are actually inoperative.

This condition may be further complicated if the stations associated with the common return line are located on another station output board within the controller.

This condition is possible whenever groups of field valve wiring configurations are tied together to one common return line.

Control Devices (Rain Sensors, Freeze sensors, Etc.)

Many commercial sensor devices available in today's market take advantage of the common ground configuration to control watering operations. Devices such as rain sensors, freeze sensors, moisture sensors, etc. employ a control system which interrupts the common ground line of watering stations to control the shutdown of stations.

These devices have inherent limitations:

- 1) They exhibit "contact bounce" or jitter when the on/off threshold is reached. This may have adverse affects on pump systems.
- 2) Since they interrupt common lines, non-irrigation programs such as lighting programs are also affected.
- 3) It may be difficult to identify/interrupt "the" common wire if multiple commons come in from the field.

When connecting a common interrupting device to the Evolution DX2 controller, certain conditions must be met prior to installation to prevent the aforementioned problems. The Rain Master custom interface cable kit provides the appropriate method for connecting control devices with continued operation integrity of the Evolution DX2 controller.

The interface kit is available (with full installation instructions) at no charge through the Rain Master Order department under part number "DXCID-KIT".

To request the interface kit, please contact Rain Master direct at (805) 527-4498.

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Appendix A

Flow Meters

The Evolution DX2 series controller provides a variety of user-configurable, flow-related features for either one or two flow sensors, referred to as Flow #1 and Flow #2.

The Evolution DX2 flow features/capabilities include:

- Display of instantaneous flow rate in gallons per minute (GPM) for Flow #1, Flow #2 and total (Flow #1 + Flow #2). Flow rates are updated every ten seconds.
- Display of monthly flow accumulations in gallons for Flow #1, Flow #2 and total (Flow #1 + Flow #2). Flow accumulation in gallons is updated every minute.
- Automatic termination of watering based upon flow limit violations:
 - Main line flow rate for controller (GPM)
 - Maximum flow rate per station (GPM)
 - Minimum flow rate per station (GPM)
 - Maximum flow accumulation per month (gallons)
 - Unscheduled flow rate for controller (GPM)
- Automatic condemnation and reporting of stations violating flow limits. Warning information is provided in the Field Maintenance Activity and Troubleshooting section of the manual.
- Automatic establishment of station upper and lower flow limits (learn mode).

Flow Meter Operation Overview

In order to display flow rate and/or flow accumulation data:

- a. Insure flow sensor/meter has been properly connected
Refer to Flow Sensor Installation Instructions
- b. Establish the appropriate flow calibration criteria, see
"Flow Meter Offset and K Values"

In order to establish flow limit checking either on a controller or individual station basis, verify the following:

- c. Steps a and b (above) have been performed.
- d. Station Upper Limits have been established, see "Max Flow Limit".
- e. Station Lower Limits have been established, see "Flow Limit" page or "Auto Limits".
- f. Main flow limits have been established, (see "Main Flow").
- g. Total Monthly Flow has been set, see "Flow Options".
- h. Unscheduled Flow Limit has been defined; see "Unscheduled Flow Limit".
- i. The upper and lower limit checking is enabled; see "Enable/Disable Limit Checking".
- j. The appropriate flow limit check delay has been established, see "Delay Limit".
- k. Selection of either one or two flow meters, see "Flow Meter Compare Limits".

Flow Reading Accuracy

Since the Evolution DX2 controller has been designed to work directly with flow sensors, the accuracy of the actual readings are limited only by the flow sensor devices. Typical accuracy values are approximately 1%.

Flow Meter Offset and K Values

Each flow meter installation must include entry of the "offset" value and "K" values for proper calibration of the meter. Use the following table to determine the appropriate values for your installation.

Table 3: Calibration Table
Tee Mounted Sensors – Flow Sensors

| RAIN MASTER FLOW SENSORS SELECTION CHART | | | | | | | | | |
|---|----------------------|---------------------------|------------------------|---|--------------|---|--------------------------------------|--|--|
| FLOW SENSOR MODEL NO. | PIPE CONNECTION SIZE | SUGGESTED OPERATING RANGE | MAXIMUM WATER PRESSURE | K VALUE | OFFSET VALUE | BODY MATERIAL | CONNECTION TYPE | | |
| FS-B100 | 1 Inch | 2-40 GPM | 400 PSI | 109 | 27 | Bronze | NPT female | | |
| FS-B125 | 1 ¼ Inch | 3-60 GPM | 400 PSI | 209 | 32 | Bronze | NPT female | | |
| FS-B150 | 1 ½ Inch | 4-80 GPM | 400 PSI | 291 | 24 | Bronze | NPT female | | |
| FS-B200 | 2 Inch | 10-100 GPM | 200 PSI | 750 | 0 | Bronze | NPT female with copper male adapters | | |
| FS-B250 | 2 ½ Inch | 16-160 GPM | 200 PSI | 1021 | 370 | Bronze | NPT female | | |
| FS-150 | 1 ½ Inch | 5-100 GPM | 100 PSI @ 68° F | 457 | 0 | PVC | Slip | | |
| FS-200 | 2 Inch | 10-200 GPM | 100 PSI @ 68° F | 776 | 104 | PVC | Slip | | |
| FS-300 | 3 Inch | 20-300 GPM | 100 PSI @ 68° F | 2268 | 483 | PVC | Slip | | |
| FS-400 | 4 Inch | 40-500 GPM | 100 PSI @ 68° F | 3752 | 834 | PVC | Slip | | |
| FS-INSERT-B | 3 to 40 Inches | Varies, Call Factory | 400 PSI | See attached table RMIS Part No. 500712 | RMIS 500712 | Requires pipe saddle with 2 Inch female NPT | Slip | | |

Data Industrial Tee Mounted Sensors

Complete calibration tables for Tee mounted sensors are listed at the end of this appendix.

Flow Limit Checking

To perform limit checking, the controller computes a Gallon-Per-Minute (GPM) flow rate based upon the total gallons used in the previous 60 seconds.

Limit checks are then performed on the following:

- Station upper limit
- Station lower limit
- Main flow limit
- Total monthly flow limit
- Unscheduled flow limit

Each station limit can be automatically established by the controller or manually entered.

Details about each limit are given below.

Warning: **Limit checking is only performed when either the upper and/or lower limits have been ENABLED.**



Station Upper Limit

Enter an upper flow limit for the station, as described in Chapter 4. The controller compares the flow meter reading to the station limit. If the meter value is larger than the limit, an error condition is detected.

The suggested upper limit flow rate should be set to the nominal flow rate for the station + 20%.

The system default value for upper station limit is 500 GPM. Obtain the nominal flow rate from the controller display (see Chapter 7, for the steps in displaying flow rate). You should allow adequate "settling time" for the flow meter readings before obtaining the nominal flow rate.

Upper station limits should be increased, if water pressure varies greatly.

Station Lower Limit

Enter a lower flow limit for the station, as described in Chapter 4. The controller compares the flow meter reading to the station limit. If the meter value is less than the limit, an error condition is detected.

To detect a mis-adjusted valve or clogged line, enter a relatively small (but non-zero) lower limit.

The system default value for lower station limit is 0 (zero) GPM.

Main Flow Limits

Enter the Main Flow Limit, as described in the Main Flow procedure in Chapter 4. The controller compares the flow meter reading to controller/main line station limit. If the meter value is greater than the limit, an error condition is detected.

The system default value for controller/main line limits is 2000 GPM.

The Main Flow upper limit should be set higher than the total of all simultaneously "on" stations. However, this limit should be lower than the anticipated flow rate from a main line break.

In Flow Max systems, the total water consumption of all participating controllers is calculated into the Main Flow limit.

Total Monthly Flow Limit

Enter a maximum monthly flow limit, as described in Chapter 4. The controller compares the accumulated monthly flow to maximum monthly flow limit. If the accumulated flow is greater than the limit, an error condition is detected.

The system default value for maximum monthly total is NONE. When NONE is selected, no monthly flow checking is performed.

If the monthly limit is exceeded, there are two options available, STOP WATERING and GIVE WARNING. See Chapter 4: Setup for details on selecting each option.

The system default is: GIVE WARNING.

If the stop watering option is selected, the problem is reported in the warning list and watering stops.

Watering is restarted when:

- The limit is changed to a larger value
- The limit is changed to None
- A new month begins

If the Give Warning option is selected, a warning is reported in the warning list and watering continues.

Unscheduled Flow Limit

Unscheduled Flow Limit is defined as any water flow that is not programmed or under the control of the controller. If a water flow is greater than the limit and no stations are on, the controller will shut down the water supply until the condition is corrected.

Unscheduled Flow conditions may be due to broken water lines, defective valves, faulty solenoids and etc.

The Unscheduled Flow procedure is given in the Controller Setup section of Chapter 4. The default limit is 200 GPM.

Enabling and Disabling Flow Limit Checking

Once the station limits have been established, the flow limit checking (upper and lower limits) may be enabled or disabled. When upper limits have been enabled, all station upper limits as well as the monthly water limit will be validated. When lower limits have been enabled, all station lower limits will be validated on an individual station basis. See Chapter 4 for the steps to enable or disable station flow limit checking.

The default setting for limit checking is DISABLED for all stations.

When they are disabled, no limit checking is performed. However, the GPM flow and total monthly flow readings are unaffected.

Delaying Flow Rate Limit Checking

Due to drainage of water lines, the initial flow rate for a station may be much higher than the station steady state condition. To prevent erroneous station fault detections, the controller delays a period of time after a station is turned on before making flow rate limit checks. This delay may be set from 1 to 6 minutes. The system default for delay of limit checking is two (2) minutes.

To establish the proper delay, monitor the GPM flow rate for each station in the irrigation program (s).

See Chapter 7 for details on monitoring GPM rates.

Observe which station takes the longest time for its GPM rate to "settle." Round this time period to the next minute and use this rounded value as the flow rate limit check delay.

Warning:



This delay value establishes the amount of time in which a main or station line break can be detected and subsequently shutdown.

Limit Checking with Two Flow Meters

When two flow meters are used, you may select which meter is used for limit checking. Alternately, you may check the total flow from both meters.

See Chapter 4: Setup for details.

Flow Meter Reading

Procedure

To observe flow meter readings, from the base menu:

Step 1 Advance to the Measurements Options screen as follows:



| |
|---|
| F1=Main Menu F3=Status F2=Measurements |
|---|



Figure 175: Measurement Options

Step 2 Select F1=FLOW METER.
The meter flow readings for Flow #1 and Flow #2 are shown in Gallons-Per-Minute. Readings are updated every 10 seconds.



Figure 176: Flow Meter Readings

Reading Monthly Water Totals

Procedure

To read the monthly water totals, from the base menu:

Step 1 Advance to the Status Options screen as follows:



F1=Main Menu
F3=Status

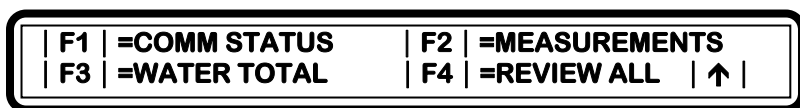


Figure 177: Status Options

Step 2 Select F3=WATER TOTAL then select F1=TOTALS PAST MONTH.

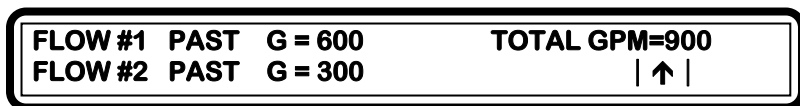


Figure 178: Water Total

The past month total gallons for Flow #1 and Flow #2 are shown.

Step 3 Select F2=TOTALS PRESENT MONTH. The total present month gallons for Flow #1 and Flow #2 are shown.

To update the totals, press the Up Arrow key and select F2 again.

When a Flow Limit Violation is Detected

Upon detection of a flow limit violation, Evolution DX2 performs the following actions:

1. Terminate Irrigation
 - For a faulty station, immediate termination of irrigation for that station. The program will automatically advance to the next station in the program.
 - If a main line fault is detected, immediate termination of all irrigation programs. The Normally Open (N.O.) Master Valve terminal is energized with 24 VAC. Any and all future automatic irrigation will not occur until this warning is cleared from the controller.
 - If the monthly watering allocation has been exceeded, immediate termination of all irrigation on a per program basis occurs.
 - If an unscheduled flow condition is detected, the Normally Open (N.O.) Master Valve terminal is energized with 24 VAC. Any and all future automatic irrigation will not occur until this warning is cleared from the controller.
2. Entry of the problem in the Warning/Report list.
3. All faulty stations are added to a "condemned" station list. No watering will occur until the problem is corrected.

To remove a station from the condemned list, delete the problem entry from the warning report, see Chapter 10.

Flow Limit Violation Examples

Overflow in Controller/Main Line Break

Assume the maximum controller flow rate is 500 GPM. A main line break occurs while attempting to water station 7. The break results in a flow of 750 GPM. The following warning message is displayed, as well as the station number and GPM reading.



WARNING = MAIN FLOW (MV) 5-20-96 11:48
STA = 7, MV1, GPM = 750

Figure 179: Warning, Main Flow

The MV1 in the second line represents the Master Valve #1. To access the warning report, from the base menu, press F2=WARNING.

Note: Break between Flow Sensor and First Station.

Assume that a line breaks between the flow sensor and the first valve. When the break occurs, no watering will take place. The following entry would be placed in the warning list.



WARNING = UNSCHED LIMIT 05/20/96 12:05
GPM = 65

Figure 180: Warning, Unsched Limit

Note: This situation may also be caused by a valve that fails to close.

Station Overflow

Assume station 2 has an upper limit of 300 GPM. A broken line occurs, resulting in a 400 GPM flow. The following entry is placed in the warning list.



Figure 181: Warning, Flow Up Limit

Station Under Flow

Assume station 2 has a lower limit of 100 GPM. The line to station 2 is clogged, resulting in a flow reading of 53 GPM. The following entry is placed in the warning list.



Figure 182: Warning, Flow Low Limit

Monthly Water Limit Exceeded

The controller has exceeded its monthly watering allocation. The Water Limit message is placed in the warning list.



Figure 183: Warning, Water Limit

This problem **cannot** be cleared from the report until the water limit is set to a higher value or until a new month begins.

Multiple Stations with Non-Overlap Protection

The Evolution DX2 controller allows the user the capability of turning "on" several stations simultaneously. When flow meters are used in this environment, the individual station limits are summed and compared to the total flow rate. Therefore, you must set up limits for each station to insure that flow limit checks are performed properly.

Example:

Assume the upper limit for station 1 is 80 GPM and the upper limit for station 2 is 50 GPM. If both stations are on, the controller adds these limits. A problem is reported if the flow exceeds the total of 130 GPM (80 GPM + 50 GPM).

Table 4: Rain Master K and Offset Value

**Rain Master K and Offset Value For Data Industrial Flow Sensors
CALIBRATION TABLE – TEE MOUNTED SENSORS (Current Production)
Models) (Series: 228PV, 228 BR, 228 CB, 228 CS, 228SS, 250BR)**

| Data Industrial Model | Apparent ID | Evolution Satellite K Value | Evolution Satellite Offset | Min Design Flow (GPM) | Max Design Flow (GPM) |
|------------------------------|--------------------|------------------------------------|-----------------------------------|------------------------------|------------------------------|
| 228PV-1.5 | 1.50 | 457 | 0 | 5 | 100 |
| 228PV-2 | 1.94 | 776 | 104 | 10 | 200 |
| 228PV-3 | 4.02 | 2268 | 483 | 20 | 300 |
| 228PV-4 | 5.15 | 3752 | 834 | 40 | 500 |
| | | | | | |
| 228BR-2 | 1.99 | 750 | 0 | 10 | 100 |
| 228BR-2.5 | 2.52 | 1021 | 370 | 16 | 160 |
| | | | | | |
| 228CB-2 | 2.07 | 777 | 199 | 12 | 120 |
| 150 PSI Tee | 2.07 | 777 | 199 | 12 | 120 |
| 400 PSI Tee | 2.10 | 711 | 167 | 12 | 120 |
| 228CB-2.5 | 2.51 | 1021 | 265 | 16 | 160 |
| | | | | | |
| 228CS-2 | 2.07 | 767 | 199 | 12 | 120 |
| | | | | | |
| 228SS-2 | 1.99 | 750 | 0 | 10 | 100 |
| | | | | | |
| 250BR-0.5 | None | 92 | 8 | 0.8 | 8 |
| 250BR-0.75 | None | 119 | 64 | 1 | 10 |
| 250BR-1 | 1.05 | 109 | 27 | 2 | 40 |
| 250BR-1.25 | 1.38 | 209 | 32 | 3 | 60 |
| 250BR-1.5 | 1.61 | 291 | 24 | 4 | 80 |
| | | | | | |

OBSOLETE OR OLDER MODEL FLOW SENSORS

(Series: 220P, 228B, 228CB, 250B, 228PF, 228PD, 228CS, 228SS, *IR220P, IR228B, IR228CB, IR250B, IR228CS, IR228SS)

| Data Industrial Model | Apparent ID | Evolution Satellite K Value | Evolution Satellite Offset | Min Design Flow (GPM) | Max Design Flow (GPM) | Minimum Recommended Full Scale (GPM) |
|-----------------------|---------------------|-----------------------------|----------------------------|-----------------------|-----------------------|--------------------------------------|
| 220P-1 | 0.96/FM-92D | 70 | 25 | 2 | 20 | 5 |
| 220P-1.5 | 1.50/FM-92D | 505 | 107 | 8 | 180 | 40 |
| 220P-2 | 1.94/FM-92D | 744 | 273 | 13 | 250 | 50 |
| 220P-3 | 4.02/Any | 2268 | 483 | 35 | 700 | 160 |
| 220P-4A | 5.15/Any | 4191 | 975 | 65 | 1200 | 300 |
| 220P-6A | | | | | | |
| 228PD-1 | 0.96/FM-92D | 70 | 26 | 2 | 20 | 5 |
| 228PD-1.5 | 1.50/FM-92D | 505 | 107 | 8 | 180 | 40 |
| 228PD-2 | 1.94/FM-92D | 744 | 273 | 13 | 250 | 50 |
| 228PF-1.5 | 1.71 | 569 | 279 | | | |
| 228PF-2 | 2.21 | 1075 | 185 | | | |
| 228PF-3 | 2.98 | 1512 | 841 | | | |
| 228PF-4 | 2.99 | 2814 | 1911 | | | |
| 228PF-6A | | | | | | |
| 228B-2 | 1.99/FM-92D | 750 | 0 | 10 | 250 | 50 |
| 228B-2.5 | 2.52 | 1022 | 370 | 16 | 400 | 75 |
| 228CB-2 | 2.07/FM-92D | 767 | 198 | 12 | 250 | 50 |
| 150 PSI Tee | 2.07/FM-93A | | | | | |
| 400 PSI Tee | 2.10/FM-91D | 711 | 167 | 12 | 250 | 50 |
| 228CB-2.5 | 2.51 | 1021 | 265 | 16 | 400 | 75 |
| 228CS-2 | 2.07/FM-92D, FM-93A | 767 | 198 | 12 | 250 | 50 |
| 228SS-2 | 1.99/FM-92D | 750 | 0 | 10 | 250 | 50 |
| 250B-1 | 1.05/FM-93A | 113 | 47 | 2 | 45 | 8 |
| 250B-1.25 | 1.38/FM-93A | 209 | 32 | 3 | 90 | 15 |
| 250B-1.5 | 1.61/FM-93A | 291 | 24 | 4 | 100 | 20 |

Rain Master K and Offset Value For Data Industrial Flow Sensors

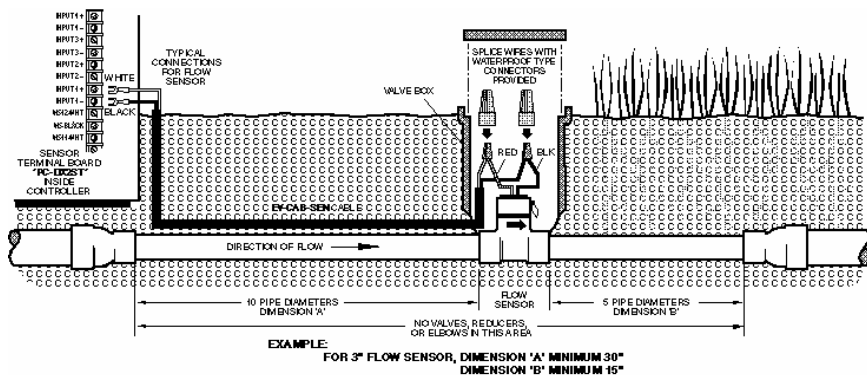
| Pipe Size | Pipe O.D. in Inches | Pipe I.D. in Inches | Evolution Satellite K Value | Evolution Satellite Offset | Min. Flow in GPM | Min. Flow in GPM for Full Scale |
|-------------------|---------------------|---------------------|-----------------------------|----------------------------|------------------|---------------------------------|
| 3 inch Sch 10S | 3.5 | 3.260 | 1368 | 115 | 12 | 400 |
| Std. Wt. Sch 40 | 3.5 | 3.068 | 1191 | 70 | 12 | 400 |
| Ex. Strong Sch 80 | 3.5 | 2.900 | 1053 | 42 | 12 | 400 |
| PVC Class 125 | 3.5 | 3.284 | 1391 | 121 | 12 | 400 |
| PVC Class 160 | 3.5 | 3.230 | 1338 | 107 | 12 | 400 |
| PVC Class 200 | 3.5 | 3.166 | 1278 | 91 | 12 | 400 |
| | | | | | | |
| | | | | | | |
| 4 inch Sch 10S | 4.5 | 4.260 | 2620 | 592 | 20 | 600 |
| Std. Wt. Sch 40 | 4.5 | 4.026 | 2277 | 489 | 20 | 600 |
| Ex. Strong Sch 80 | 4.5 | 3.826 | 2008 | 354 | 20 | 600 |
| PVC Class 125 | 4.5 | 4.224 | 2565 | 577 | 20 | 600 |
| PVC Class 160 | 4.5 | 4.072 | 2361 | 554 | 20 | 600 |
| PVC Class 200 | 4.5 | 4.072 | 2342 | 525 | 20 | 600 |
| | | | | | | |
| | | | | | | |
| 5 inch 10S | 5.563 | 5.295 | 4451 | 1044 | 30 | 900 |
| Std. Wt. Sch 40 | 5.50 | 5.047 | 4006 | 932 | 30 | 900 |
| Ex. Strong Sch 80 | 5.50 | 4.813 | 3594 | 829 | 30 | 900 |
| | | | | | | |
| | | | | | | |
| 6 inch 10S | 6.625 | 6.357 | 6576 | 1603 | 50 | 1500 |
| Std. Wt. Sch 40 | 6.5 | 6.065 | 5890 | 1419 | 50 | 1500 |
| Ex. Strong Sch 80 | 6.5 | 5.761 | 5312 | 1265 | 50 | 1500 |
| PVC Class 125 | 6.625 | 6.217 | 6239 | 1509 | 50 | 1500 |
| PVC Class 160 | 6.625 | 6.115 | 5997 | 1445 | 50 | 1500 |
| PVC Class 200 | 6.625 | 5.993 | 5752 | 1381 | 50 | 1500 |
| | | | | | | |
| | | | | | | |
| 8 inch Sch 10S | 8.625 | 8.329 | 11989 | 3215 | 80 | 2500 |
| Sch 20 | 8.625 | 8.125 | 11371 | 3018 | 80 | 2500 |
| Sch 30 | 8.625 | 8.071 | 11210 | 2975 | 80 | 2500 |
| Std. Wt. Sch 40 | 8.625 | 7.981 | 10943 | 2884 | 80 | 2500 |
| Sch 60 | 8.625 | 7.813 | 10453 | 2735 | 80 | 2500 |
| Ex. Strong Sch 80 | 8.625 | 7.625 | 9914 | 2566 | 80 | 2500 |
| PVC Class 125 | 8.625 | 8.095 | 11281 | 2994 | 80 | 2500 |
| PVC Class 160 | 8.625 | 7.961 | 10884 | 2868 | 80 | 2500 |
| PVC Class 200 | 8.625 | 7.805 | 10429 | 2729 | 80 | 2500 |
| | | | | | | |
| | | | | | | |

Rain Master K and Offset Value For Data Industrial Flow Sensors

| Pipe Size | Pipe O.D. in Inches | Pipe I.D. in Inches | Evolution Satellite K Value | Evolution Satellite Offset | Min. Flow in GPM | Min. Flow in GPM for Full Scale |
|-------------------|---------------------------|---------------------------|-----------------------------------|----------------------------------|------------------------|---|
| 10 inch Sch 10S | 10.75 | 10.420 | 19163 | 5768 | 125 | 4000 |
| Sch 20 | 10.75 | 10.250 | 18473 | 5509 | 125 | 4000 |
| Sch 30 | 10.75 | 10.136 | 18037 | 5345 | 125 | 4000 |
| Std. Wt. Sch 40 | 10.75 | 10.020 | 17622 | 5187 | 125 | 4000 |
| Ex. Strong Sch 60 | 10.75 | 9.750 | 16657 | 4827 | 125 | 4000 |
| Sch 80 | 10.75 | 9.564 | 16010 | 4594 | 125 | 4000 |
| PVC Class 125 | 10.75 | 10.088 | 17863 | 5276 | 125 | 4000 |
| PVC Class 160 | 10.75 | 9.924 | 17273 | 5054 | 125 | 4000 |
| PVC Class 200 | 10.75 | 9.728 | 16580 | 4804 | 125 | 4000 |
| | | | | | | |
| | | | | | | |
| 12 inch 10S | 12.75 | 12.390 | 28566 | 9831 | 175 | 5000 |
| Sch 20 | 12.75 | 12.250 | 27997 | 9556 | 175 | 5000 |
| Sch 30 | 12.75 | 12.090 | 27122 | 9156 | 175 | 5000 |
| Std. Wt. Sch 40S | 12.75 | 12.000 | 26638 | 8943 | 175 | 5000 |
| Sch 40 | 12.75 | 11.938 | 26309 | 8783 | 175 | 5000 |
| Sch 60 | 12.75 | 11.625 | 24690 | 8057 | 175 | 5000 |
| Extra Strong | 12.74 | 11.750 | 25328 | 8336 | 175 | 5000 |
| Sch 80 | 12.75 | 11.376 | 23457 | 7523 | 175 | 5000 |
| PVC Class 125 | 12.75 | 11.966 | 26457 | 8857 | 175 | 5000 |
| PVC Class 160 | 12.75 | 11.770 | 25430 | 8394 | 175 | 5000 |
| PVC Class 200 | 12.75 | 11.538 | 24254 | 7869 | 175 | 5000 |
| | | | | | | |
| | | | | | | |
| 14 inch 10S | 14.00 | 13.500 | 33390 | 12242 | 200 | 6000 |
| Sch 20 | 14.00 | 13.375 | 32819 | 11941 | 200 | 6000 |
| Std. Wt. Sch 30 | 14.00 | 13.250 | 32255 | 11645 | 200 | 6000 |
| Sch 40 | 14.00 | 13.124 | 31694 | 11353 | 200 | 6000 |
| Sch 60 | 14.00 | 12.814 | 30343 | 10699 | 200 | 6000 |
| Extra Strong | 14.00 | 13.00 | 31149 | 9639 | 200 | 6000 |
| Sch 80 | 14.00 | 12.50 | 29027 | 10041 | 200 | 6000 |

**Rain Master K and Offset Value
For Data Industrial Flow Sensors**

| Pipe Size | Pipe O.D. in Inches | Pipe I.D. in Inches | Evolution Satellite K Value | Evolution Satellite Offset | Min. Flow in GPM | Min. Flow in GPM for Full Scale |
|-------------------|---------------------|---------------------|-----------------------------|----------------------------|------------------|---------------------------------|
| 16 inch 10S | 16.00 | 15.500 | 43473 | 17937 | 300 | 9000 |
| Sch 20 | 16.00 | 15.375 | 42791 | 17495 | 300 | 9000 |
| Std. Wt. Sch 30 | 16.00 | 15.250 | 42115 | 17100 | 300 | 9000 |
| Ex. Strong Sch 40 | 16.00 | 15.000 | 40785 | 16331 | 300 | 9000 |
| Sch 60 | 16.00 | 14.688 | 39163 | 15388 | 300 | 9000 |
| Sch 80 | 16.00 | 14.314 | 37278 | 14332 | 300 | 9000 |
| | | | | | | |
| | | | | | | |
| 18 inch Sch 10S | 18.00 | 17.500 | 55348 | 25847 | 350 | 10000 |
| Sch 20 | 18.00 | 17.375 | 54553 | 25271 | 350 | 10000 |
| Sch 30 | 18.00 | 17.124 | 52979 | 24145 | 350 | 10000 |
| Std. Wt. | 18.00 | 17.250 | 53765 | 24705 | 350 | 10000 |
| Sch 40 | 18.00 | 16.876 | 51451 | 23110 | 350 | 10000 |
| Sch 60 | 18.00 | 16.500 | 49187 | 21632 | 350 | 10000 |
| Extra Strong | 18.00 | 17.000 | 52211 | 23599 | 350 | 10000 |
| Sch 80 | 18.00 | 16.126 | 46997 | 20140 | 350 | 10000 |
| | | | | | | |



Upon completion of the physical installation of the flow sensor, complete the wiring connection from the flow sensor to the DX2 controller by following the procedure below:

1. TURN THE POWER OFF AT THE CONTROLLER

2. At the Flow Sensor:

Connect the **BLACK** wire of the Flow Sensor to the **BLACK** wire of the "EV-CAB-SEN", sensor cable.

Connect the **RED** wire of the Flow Sensor to the **WHITE** wire of the "EV-CAB-SEN", sensor cable.

*Use the weather-proof connectors provided with the Flow Sensor to make the splice.

3. At the controller:

Connect **BLACK** wire of "EV-CAB-SEN" to "INPUT 1-" of the SENSOR TERMINAL BOARD (PC-DX2ST).

Connect **WHITE** wire of "EV-CAB-SEN" to "INPUT 1+" of the SENSOR TERMINAL BOARD (PC-DX2ST).

4. Turn POWER ON at the Controller.

5. Set the Rain Master "K" and "OFFSET" values for the Flow Sensor at the controller based on the type and size of the Flow Sensor installed.

REFER TO THE TABLE PROVIDED WITH THE FLOW SENSOR FOR CORRECT "K" AND "OFFSET" FOR YOUR APPLICATION.

DWG1510A

Figure 184: Flow Sensor Installation

Appendix B

Current Monitor

The Evolution DX2 series controller provides the ability to limit and view the controller's output current (Amps) usage. Establishing limits allows detection of field wiring problems associated with any station. Evolution DX2 current monitoring features include:

- Display of the total, instantaneous current on a per station basis
- Automatic termination of station output and reporting of station status when the preset maximum current is exceeded
- Automatic termination of station output and reporting of station status when current stays below the pre-set minimum
- Review of station status reports via the Warning/Alarm display
- Automatic current limit setup

Current Monitor Setup

The monitoring of current can be enabled or disabled. Even if it is disabled, the controller ensures that the maximum total current will not exceed 2 Amps. At this point the controller may shut down.

Special test circuits automatically check and calibrate the current monitor during start-up to ensure optimum accuracy.

Warning:**To properly monitor current levels:**

- You must enter minimum and maximum current levels to be monitored by the system.
- When setting limits, the controller automatically sums limits when multiple stations and/or the Master Valve are on. For example, assume station 1 has a .2 Amps limit and the Master Valve has a .4 Amps limit. When both are on, the controller adds (.2 Amps) + (.4 Amps) = .6 Amps. The measured value is then compared to .6 Amps.
- Current monitoring must be *enabled*.

Current Limit Detection

When a current limit is detected, the controller performs the following actions:

1. If the limit is for a station, operation of the station is immediately terminated.
2. The problem is listed as a warning/alarm.
3. The controller advances to the next station in the current program (if applicable).
4. The station is entered in a "condemned" list. No watering occurs for those stations in the "condemned list" until the problem is corrected.

To remove a station from the bad list, delete the problem from the warning report, refer to Chapter 10.

Auto Limits Procedure

The Auto Limits feature establishes upper and lower limits of current by automatically measuring each station. Upper and lower percentages of the measured values are calculated to establish the limits for each station.

The current upper default percentage is set at 20% above the measured value; a .50 Amps measurement percentage value for the upper limit would therefore be .60 Amps. The lower default percentage is set at 50% below the measured value; a .50 Amps measurement percentage value for the lower limit would therefore be .25 Amps.

The default values may be changed at any time using the F2=SET LIMIT(%) option. The percentage value ranges are given on the percentage entry display screen.

Note: If the default values are not suitable for your application, the SET LIMITS percentages must be entered prior to running the Auto Limits. Select F2=SET LIMIT and set your percentages accordingly.

Step 1 Advance to the Auto Limits Option display through the following sequence:



F1=Main Menu
F5=Setup
F3=Stations
F3=Auto Limits



Figure 185: Auto Limits

Step 2 Select F1=RUN AUTO LIMITS and verify the following three option menu:

| | | | | |
|----|------------------------|----|---------------|---|
| F1 | =FLOW ONLY | F2 | =CURRENT ONLY | ↑ |
| F3 | =BOTH FLOW AND CURRENT | | | |

Figure 186: Auto Limits

There are three options:

- Flow Only
- Current Only
- Both Flow and Current

Step 3 Select F2=CURRENT ONLY and enter the station number. The station number must be between 1 and 48. To measure all stations, enter station number 1, and then press ENTER.

Note: *The maximum number of stations is determined by the total stations installed in the satellite. The maximum number (1-xx) will appear on the Station Number Entry Display.*
The following resultant display indicates the station number, run-time count-down timer, station current measurement (I) and flow measurement (GPM).
The upper and lower limits of current are automatically calculated based on the measured parameters.
The current measuring default time is 5 seconds for each station. When the count-down clock runs down, the station number will increment to the next station and the measurement process is repeated.
With all stations completed, the display returns to the Auto Limits Options menu. At this point, all upper and lower percentage values are calculated.

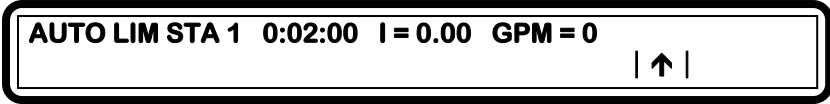


Figure 187: Auto Limits

In addition to sequencing through all stations, MV1, MV2 and the N.O. output currents are also established.

Note: The pump is not calculated and therefore should be established by the user manually.

When completed, the Auto Limits Options menu will be displayed.

Step 4 This completes the Auto Limits procedure.

Press the QUIT key to return to the base screen.

Enabling and Disabling Current Checking

After maximum and/or minimum current limits are entered, current checking (monitoring) must be enabled for upper and lower limit detection.

Procedure

Step 1 Advance to the Current Limit Options screen as follows:



F1=Main Menu
F5=Setup
F3=Stations
F1=Enable/Disable
F2=Current



Figure 188: Current Limit Options

- Step 2** Select Upper Limit. The limit checking status (enabled or disabled) is displayed.



Figure 189: Upper Limit Enable Option

Using the F1=CHANGE OPTION toggle key, enable/disable the Upper Limit check.

- Step 3** Press the Up Arrow and select the F2=LOWER LIMIT. Enable the Lower Limit check using the F1=CHANGE OPTION toggle key.

If a limit check (upper or lower) is disabled, current checking for that station is not performed and condemnation and reporting of stations violating that limit does not occur.

Station Current Limit Setup

The maximum current limit is used to detect shorted solenoid wiring or a faulty solenoid. A minimum limit value, equal to 50% of the measured station current, is used to detect an open or broken wire.

Current Limit Setup Procedure:

Step 1 Advance to the Limit Options menu as follows:



F1=Main Menu
F5=Setup
F3=Stations



Figure 190: Limit Options

Step 2 Select F2=LIMITS/TYPE and enter the station number. The station number must be between 1 and 48.

Note: *The maximum number of stations is determined by the total stations configured in the satellite controller. The maximum number will appear on the Station Number Entry Display screen.*

If the control output is for a Master Valve or Pump, enter the appropriate number from the following listing:

01 = MV1
 02 = MV2
 03 = N.O. MV
 04 = Pump

Press the ENTER key.

- Step 3** Select F1=CURRENT LIMIT. The following screen is displayed:



STATION # # MAX CURRENT LIMIT: 1.00
ENTER LIMIT (0.0 - 1.0 AMPS) | ↑ |

Figure 191: Current Limit Entry

The Station Number is displayed with a Max Current value. If a Master Valve/Pump was entered, it will be indicated as such in the station number area.

- Step 4** Enter the maximum current limit in Amps then press ENTER. The limit must be between 0 (zero) and 1.0 Amps. The default maximum limit is 1.0 Amps. The controller compares the station's AC current consumption to the station maximum limit. If, after the station is turned on, the measured current consumption is larger than the limit, an error condition is detected. The suggested maximum current limit is 20% above normal operating current consumption.
- Step 5** Enter the minimum current limit in Amps. The limit must be between 0 (zero) and 1.0 Amps. The default minimum current limit is 0.05 Amps. The controller compares the station's AC current consumption to the station minimum limit. If, after the station is turned on, the measured current consumption is less than the limit, an error condition is detected. A value of 0 (zero) indicates the station is **not** checked for minimum current violations. The suggested minimum current limit is 50% of the normal operating current consumption. Enter a relatively small, non-zero minimum limit to detect an open or broken wire. Press ENTER.

Example Current Limit Violations

Station Consumes Too Much Current

Assume the maximum station current for station 7 is set to .60 Amps. While watering on Station 7 (no Pump, Master Valve or other stations on) is in progress, .85 Amps of current are detected. Watering is stopped on Station 7. The base menu will now display F2=WARNING and an entry is made in the warning list.

See "Maximum Controller Current" section for additional details.

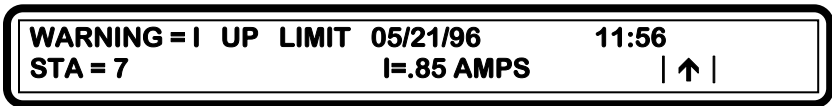


Figure 192: Warning, Up Limit

Station Consumes Too Little Current

Assume the minimum limit is set to 0.15 Amps. While watering on Station 2 is in progress, 0.00 Amps is detected. Watering on Station 2 is stopped. The base menu will now display F2=WARNING and an entry is made in the warning list.

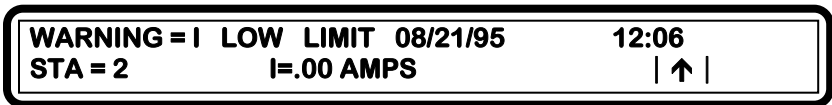


Figure 193: Warning, Low Limit

Multiple Stations with Non-Overlap Protection

The Evolution DX2 controller allows several stations to be on simultaneously. When current limit checking is used in this

situation, the limit checked by the controller is the sum of the individual station current limits.

Maximum Controller Current

The maximum rated current for any station or combination of stations is 2.0 Amps. If four devices (field valve solenoid, Master Valve, Pump, Relay, etc.) that each have current draw of .50 Amps were on simultaneously, the current would be 2.0 Amps. This is equal to the maximum controller allowance. Monitor individual station currents and program your stations accordingly. If you are using older solenoids which draw more than .50 Amps each, you may consider replacing them. The controller protects itself in the event that the solenoids draw more than the maximum allowable current. The associated station will shut down and the following message will be displayed:

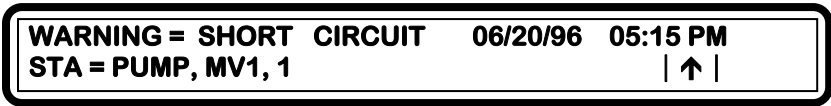


Figure 194: Short Circuit Warning

For further details on short circuit warning, refer to Chapter 10.

In addition to the built-in short circuit protection, a separate 24 VAC fuse exists (located on the Master Valve/Pump/Power Assembly board).

In the rare event that the 24 VAC fuse should blow, the controller has intelligence to detect the blown fuse and inform the operator with the following message:

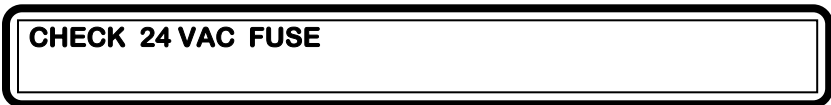


Figure 195: Fuse Display Message

The message will appear in the upper left corner over any given display screen.

Appendix C

Power Failure/Recovery

The Evolution DX2 controller contains non-volatile Random Access Memory (RAM), which allows all user watering schedules to be retained indefinitely in the event of power failure. This data is retained without the use of replaceable batteries. In addition, the controller has an internal clock which keeps track of calendar time without the need for AC power. Also, when AC power is lost or restored, the time and date of the occurrence is logged. No special setup is required of the user to take advantage of the power monitoring and recovery features.

Problem Reporting

Each power failure and recovery is reported on the warning/alarm list.

If a problem occurs, the base menu display reads: "WARNING=POWER FAILURE" or POWER ON, followed by the time and date of the occurrence.

See Chapter 10 in the viewing and clearing of the warning/alarm list.

Canceling and Continuing Watering Programs

When the power is lost and/or restored, the controller can be in one of several possible states. Continuing with the program depends on the duration of the scheduled watering time and the length of the power outage.

Warning:



When a program is running, and the power is lost and restored, the controller will enter a “catch-up” cycle to re-establish which program and stations to turn on, if any.

- **If no program is running and no stations are on, and the power is restored prior to the program start time:**

The program will start at its scheduled time.

- **If no program is running and power is out at the normal start time:**

The program will not start until the next scheduled program start.

- **If a program is running and a station is on when the power outage occurs, and the elapsed time of the outage is greater than the scheduled run time of the program:**

The problem list will indicate which station(s) were on at the time of the outage. Run time will not resume after the outage, and the program will not start until it's next scheduled start time.

- **If a program is running and a station is on when the power outage occurs, and power is restored prior to completion of the scheduled run time:**

The program will continue its scheduled cycle, resuming where it would have been if the outage had not occurred.

Example:

If a program was scheduled for 1:00PM to run stations 1 and 2 for 10 minutes each, and an outage occurred at 1:05 and restored at 1:12, station 2 will come on for the 8 remaining minutes of the schedule.

- **If the duration of the power outage is more than 24 hours:**

No attempt is made to restart a watering program. This only concerns a program that extends longer than 24 hours. All programs will start at their next scheduled times.

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Appendix D

Access Codes

Access codes are used to restrict unauthorized access to sensitive program data. There are two levels of access available, level 1 and level 2. Both levels prevent creation, modification and deletion of programs and ISCs, including setup data. In addition, level 1 code prevents the user from using "manual on/off" operations.

Entering an Access Code

Procedure:

Step 1 Advance to the Access Code Entry screen as follows:



F1=Main Menu
F5=Setup
F4=Controller
F3=User Option
F3=Access Code

**ACCESS CODE:
ENTER ACCESS CODE**



Figure 196: Access Code

Step 2 Enter the access code. The access code must be three digits. Press ENTER.

Note: *The first time an access code is entered, any three-digits may be used. Thereafter, the access code you enter is checked against the code stored in the controller. The code you enter must match the stored code, or access is denied to certain menu options, as shown in the table in the next section of this Step 4 Press F1=Restrict Access or F2=No Restrictions. The previous menu is displayed.*

If the access code is correct, the following three options are displayed:



Figure 197: Access Code Options

- Select ENABLE/DISABLE ACCESS to turn on and off the use of the access code.
- Select CHANGE LEVEL to change the access code level.
- Select CHANGE CODE to enter a new access code.

Step 3 Access Restriction

Select F1=ENABLE/DISABLE ACCESS. The following two options are displayed:



Figure 198: Access Restriction Status

The two options are:

- Select **RESTRICT ACCESS** to use the access code to control use of the controller.
- Select **NO RESTRICTIONS** to not use the access code.

Step 4 Press **F1=RESTRICT ACCESS** to select Restrict Access or **F2=NO RESTRICTIONS** to select No Restrictions, or No Access Code Required. The Access Code Options menu is displayed.

Step 5 **Access Change Level**
Select **F2=CHANGE LEVEL**.



Figure 199: Level Access Selection

There are two options, **LEVEL 1** and **LEVEL 2**. The Access Level Options table lists the restrictions applicable for each level.

Press **F1** to select Level 1 or **F2** to select Level 2. The Access Code Options menu is displayed.

Step 6 **Change Code**
Select **F3=CHANGE CODE**.
Enter the new access code (the code must be three digits), then press **ENTER**.

The Access Code Options menu is displayed.

Using Access Codes

After the access code is entered, access to the menu items shown in the following table is restricted.

Table 5: Access Level Options

| Menu | Access Level | Access Denied |
|-------------------------------|--------------|---|
| Main Menu | 1 | F1, Program F2, ISC F4, Manual Operation |
| | 2 | F1, Program F2, ISC |
| Set Up | 1,2 | F1, Program F2, ISC F3, Stations F5, Sensors |
| Setup Menu, F4, Controller | 1,2 | F2, Omit By Date |
| User | 1,2 | F1, Time/Date F2, Language |

When access codes are used, the menu items listed in the Access Level Options table are denied and the following screen is displayed:



Figure 200: Access Denied Display

Gain Access Procedure:

Step 1 To gain access to all controller menu options, from the base screen, advance to the Access Code Entry menu as follows:



- F1=Main Menu
- F5=Setup
- F4=Controller
- F3=User Option
- F3=Access Code



Figure 201: Access Code

Step 2 Enter the correct three-digit access code, then press ENTER.
If the access code is correct, the Access Code Options Menu is displayed:



Figure 202: Access Code Options

Step 3 Select F1=ENABLE/DISABLE ACCESS. The following two options are displayed:



Figure 203: Access Restriction Status

Step 4 Select F2=NO RESTRICTIONS if access code is not used.

This completes the Access Code procedure.

Press the QUIT key to return to the base screen.

Appendix E

Flow Max

Flow Max is a unique feature specifically designed to manage multiple Evolution DX2 controllers which share a common water source.

Figure E-1: “Hardwire Configuration” illustrates a typical installation.

***Note:** The Flow Max feature is not applicable for any controller which has exclusive use of its water source (One point of connection (POC) per controller). Please refer to Appendix A: "Flow Meters", whenever flow and flow control (Master Valve and Pump) is required for a single controller installation.*

Flow Max utilizes the intelligence of Evolution DX2 field satellite controllers to provide the following features:

- Operation of shared Master Valves, Pump or Flow Meters across controllers without the need for peripheral relays or complex wiring
- Shared devices may be wired in the conventional fashion to the nearest controller
- Dynamic adjustment/validation of station flow limits as stations turn on and off anywhere in the system
- Detection of system main line breaks
- Detection of system unscheduled flow
- Ability to read the flow GPM rates at any of the Flow Max participant controllers
- Automatic establishment of flow limits and current limits for all the controllers in the system

- Automatic system protection for the shared pump in partial power outages or communication failures
- Automatic generation of diagnostic system warning messages at each Flow Max unit
- Dynamic real time monitor shows system status at all times

Overview

Flow Max systems intelligently share resources and manage operations for satellites utilizing a single point of connection (POC). The shared resources may include a common pump, two Flow Meters, two Normally Closed Master Valves and one Normally Open Master Valve.

A Flow Max system is comprised of a number of identical DX2 Controllers (typically 3 to 5) with the first controller set up as the submaster and the remaining units set up as satellites.

Controllers that share any Pump, Master Valve or Flow Sensor are defined as Flow Max participants. As Flow Max participants, the Evolution DX2 controllers must be part of a serial hardware configuration. Controllers that are not Flow Max participants may reside on the hardware link and are defined as non-participants.

The serial hardware configuration requires a communications cable and the appropriate communications card at each controller, as depicted in Figure G-2.

Flow Max provides a means to detect station flow limits and main line breaks within design and programming limitations. All controllers participating within a Flow Max system must be programmed as Flow Max participants from each of their respective control panels.

Submaster

The Submaster Controller in the Flow Max group is the watchdog for the entire group. It monitors all participant device operations such as pumps and master valves. It also issues corrective action for flow violations, maintains the communication link status and accumulates all flow related status. The Submaster allows the user to review all pertinent shared device information from its control panel. The user can also monitor real time activity such as measured flow, upper and lower limit changes as stations transition, as well as flow delay status.

The Submaster allows flow limits and current limits for each station of all participant controllers to be established automatically from one location.

Devices

The devices in a Flow Max system are defined as follows:

- Master Valve 1 (MV1 - normally closed)
- Master Valve 2 (MV2 - normally closed)
- Normally Open Master Valve (N.O.)
- Pump
- Flow Meter 1 (FM1)
- Flow Meter 2 (FM2)

Flow Max allows any participant controller to utilize a shared device. When a Flow Max participant program/ISC reaches its "Start Time," the Submaster initiates a command to turn the device on. The device will remain on provided there is at least one program or ISC running that has been set up to share the use of the device.

The shared device may be connected to any Flow Max participant controller. Each device connection is made to one and only one controller. All other participant controllers that

share the use of the device must be programmed at the respective controller to select the appropriate option.

The Master Valve and Pump devices are physically connected to the respective controller Master Valve Power Board (Part # PCDX2-MV). The Flow Meters are connected to the respective controller Sensor Terminal Board (EV-SEN). Flow Meter installation instructions are included with the optional Flow Sensor kit.

Flow Sensors

Flow sensor operation must include the calibration factors of "K" and "Offset" values for accurate calculations. These values are required to compensate for the differences between pipe size and flow sensor used. Complete tables on K and Offset values are given in Appendix A: Flow Meters.

The satellite controllers that are physically connected to flow sensors must have the "K" and "OFFSET" values for the particular flow sensor programmed. The Submaster **MUST** also have the "K" and "OFFSET" value programmed identical to those programmed at the controllers where they are connected.

Caution:



K and Offset value difference between the submaster and satellites will cause severe errors in Flow Meter measurements. The results can virtually eliminate the over-limit protection features such as Main Flow, Unscheduled Flow, etc.

The Submaster must also be programmed to identify "Uses Flow 1," "Uses Flow 2," or "Uses Sum of Flow 1 and 2."

Flow Check Delay

The Flow Check Delay provides a specified amount of time before any limit comparisons or corrective action is taken by the system. This allows water lines and pressures to stabilize after station turn on and turn off transitions.

Assume the system has the default check delay of two minutes. When a station turns on, the flow measurement takes place immediately, however, the limits will not be checked or reacted upon until the first reading after the flow check delay has completed. Keep in mind, that the more station transitions that occur within the group of Flow Max participants, the more limits will go un-checked.

Main Line Limits

For any number of controllers within a Flow Max group, there will only be one Main Flow Limit. Remember that the main flow limit must be higher than an expected flow under normal operation yet low enough to react when a main break line occurs.

Flow Max Limitations

Although the number of controllers in a Flow Max system is not limited, the higher the number of participants, the less control there is to detect problems.

Assume a total of five controllers in a Flow Max group with all five controller programs running simultaneously. Each of the five programs operating has stations that under normal conditions use 100 Gallons Per Minute to irrigate. Each station allows for a 10% Upper Limit Tolerance. With a 10% tolerance, a station normally using 100 GPM would be allowed a maximum flow of 110 GPM before causing an alarm. With five stations operating under the same conditions, Flow Max, which sums all limits, will allow a maximum flow of 550 GPM before causing an alarm for a station upper limit violation. This means that a

broken head would require a 50 GPM measurable difference before causing an alarm, not a 10 GPM difference, which would be the case if only one station had been operating. Under the conditions above, normal operating flow would be 500 GPM with station limits allowing up to 550 GPM. The main flow limit must be higher than 550 GPM. The question is, does a main line break yield more than 550 GPM? That's where programming and scheduling can accommodate the ability to keep the main limit within an amount detectable by a real break.

Physical Configuration

The Hardwire Link provides the communication among all controllers of a standard irrigation system and/or a Flow Max system. All units are connected in a series configuration using direct burial EV-CAB-COM twin axial cable. The Hardwire Link provides reliable communication among the controllers at distances up to several thousand feet.

Figure E-1: See Hardwire Configuration illustrates a typical wiring configuration for a 3 controller system.

Caution:



Hardwire Link Cable installation must maintain polarity for proper operation.

The Controller Hardwire link requires the installation of the standard Evolution DX2 Communications Circuit Board, RMIS part # DX-HW.

In a stand-alone configuration, both submaster and satellite units may be equipped with the standard circuit board.

System configurations that include the Central Control Computer will require the submaster controller to operate with either a radio communication board or a phone communication board.

For radio operation, install the RF (radio frequency) Evolution DX2 Communication Circuit Board, RMIS part # DX-RF. The submaster will then communicate by radio to the Central Control

Computer and through the hardwire link to the controller satellites. The DX-RF board communicates to the Central Control Computer via the 25-pin RS=232 connected to J1.

For phone communication, install the phone DX2 Communication Circuit Board, RMIS part # DX-PH. The submaster will then communicate by phone (modem) to the Central Control Computer and through the hardwire link to the controller satellites. The DX-PH board communicates to the Central Control Computer via the RJ-11 phone connected to J5.

The following pictorial diagrams of Figures 1, 2 and 3 illustrate the wiring detail and connections of a typical system configuration:

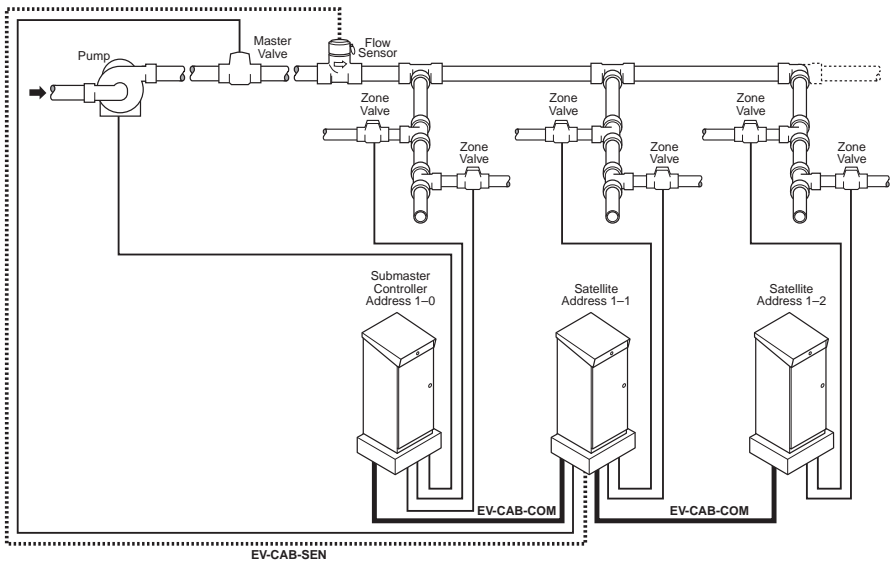


Figure 204: Flow Max Hardwire Configuration

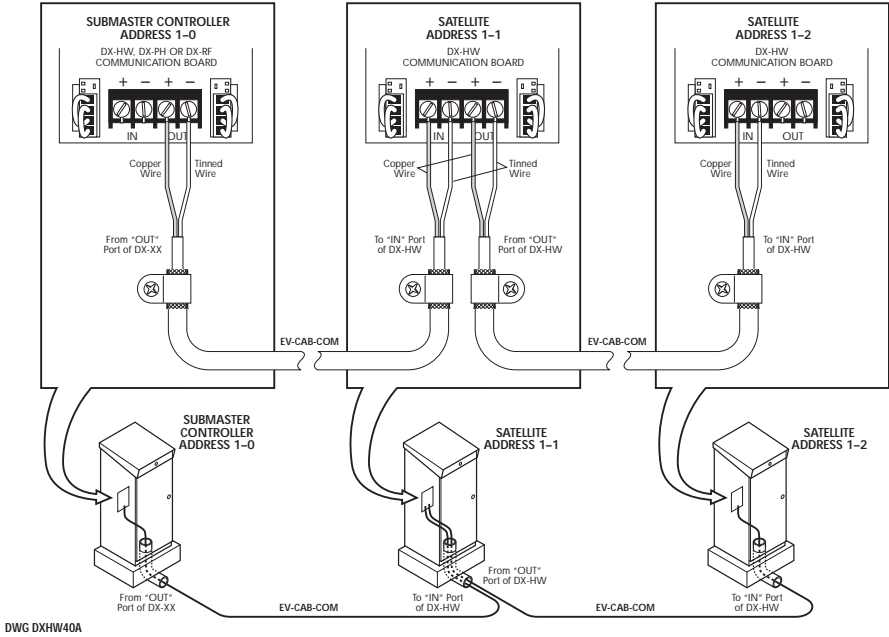
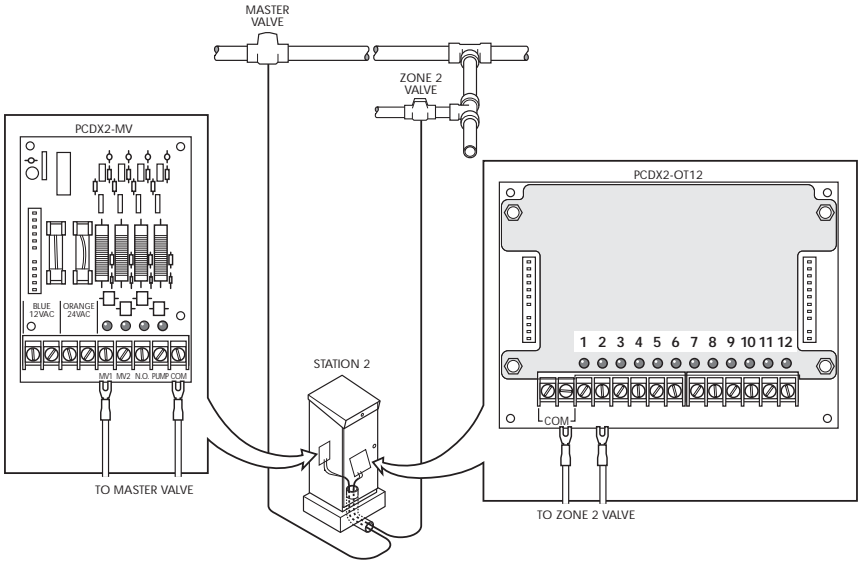


Figure 205: Detailed Hardwire Connections



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Figure 206: Detailed Master Valve and Station Connections

Master Valve/Pump Configuration

The Master Valve or Pump may be physically connected to any controller of the system, which is then shared by the remaining controller units. Any given valve/pump may be physically connected to only one controller.

The Master Valve Power Board (RMIS Part # PCDX2-MV) supplies the power and control for the Master Valves and Pump. Every controller is equipped with this board assembly, providing the ability to connect any given valve/pump to any controller. Connections are made to the screw terminals as depicted in Figure E-3. One wire of the valve/pump connects to its associated terminal and the other (common) wire connects to the COM terminal.

Flow Max Setup Procedure

Overview

The following section details the programming required in order to setup a Flow Max configuration. Programming must be performed at all controllers which are utilizing this feature. A typical Flow Max setup includes the following:

Submaster:

- Submaster Address Entry
- Share Mode Selection
- Share Devices Configuration
- Flow Meter K and Offset Values
- Station Number and Valve/Pump Assignments
- Unscheduled Flow Limits

Satellite:

Non-Participant

- Controller Configuration (Normal Mode)

Participant

- Share mode selection
- Share devices configuration
- Flow Meter K and Offset Values (if connected to this satellite)

This procedure utilizes the configuration depicted in Figure E-1: Hardwire Configuration with a submaster address of 1-0. The figure illustrates a system consisting of three controllers, a Pump, one Master Valve and one 2 inch Flow Sensor. The Pump is physically connected to the submaster and the Master Valve and Flow Sensor are physically connected to satellite

address 1-1. Table 1:Flow Max Sample Worksheet lists the parameters for each controller.

Submaster Setup Procedure

Step 1 Set up the first controller of the hardwire link as the Submaster by advancing through the following sequences:



F1=Main Menu
F5=Setup
F4=Controller
F4=Configuration
F2=Acts As Submaster
F1=Radio/Wire



Figure 207: Submaster Address Entry

Enter 1 then press ENTER to return to Main Menu.

Note: For further information on creating the Submaster, refer to Chapter 4: Setup.

Step 2 Select the devices which are to be shared in the Flow Max operation from the following menu sequence:



F1=Main Menu
F5=Setup
F4=Controller
F4=Configuration
F3=Flow Max



Figure 208: Master Valve/Pump Selection

Step 3 Select F1=SHARE FLOW, PUMP & MV.

Note: This selection specifies that the Flow Sensor, Pump and Master Valve will be shared by all participating controllers. All participant Satellite Controllers of a Flow Max system should be set up with:

- *F1=SHARE FLOW, PUMP & MV*
- *F3=NORMAL MODE*

Selection applies to non-participating units that reside within a hardwire link configuration.

Non Flow Max participants may utilize their local pump, master valves and flow meters in a conventional fashion. This operation will be independent of any Flow Max activity.

Step 4 Configure the Submaster in the Flow Max Mode, select F3=FLOW MAX and select the connected devices as follows:



| |
|--------------------------|
| F1=Main Menu |
| F5=Setup |
| F4=Controller |
| F4=Configuration |
| F3=Flow Max |
| F1=Share Flow, Pump & MV |



Figure 209: Flow Meter 1 Connection

Step 5 Select F2=NO.

Note: The NO response asserts that Flow Meter 1 is not physically connected to this controller and will not be under the control of this controller.

Step 6 Using the Down Arrow key, advance to the Flow Meter 2 Input display and select F2=NO.

Note: There is no second flow meter in our example procedure.

Step 7 Press the Down Arrow key to advance to the following display:



Figure 210: Pump Connection

Step 8 Press F1=YES.

Step 9 Press the Down Arrow key to advance to the following display:



Figure 211: Master Valve 1 Connection

Step 10 Press F2=NO.

Step 11 Press the Down Arrow key to advance to the following display:

IS SHARED MV2 CONNECTED TO THIS CLOCK?

| F1 | =YES | F2 | =NO | NOW=YES | ↑ |

Figure 212: Master Valve 2 Connection

- Step 12** Press F2=NO, this example procedure does not utilize MV2.
- Step 13** Press the Down Arrow key to advance to the following display:

IS SHARED N.O. CONNECTED TO THIS CLOCK?

| F1 | =YES | F2 | =NO | NOW=NO | ↑ |

Figure 213: Normally Open Valve Connection

- Step 14** Press F2=NO, this example procedure does not utilize a Normally Open Master Valve.
- Step 15** Using the Down Arrow key, advance to the following display and enter the least significant portion of the last address of the satellite configuration.

Note: If all satellite controllers are communicating properly, the last address will automatically appear in the display.



Figure 214: Last Address Entry

Step 16 In a three controller system, the address of the last unit is xxx-02. Enter 02 then press ENTER.

Note: If the correct address appears in the display, just press ENTER.

Press the QUIT key to return to the base menu.

Step 17 Flow Meter K and Offset Values

All Flow Meter K and Offset values of both Flow Meter 1 and Flow Meter 2 (if used) must be entered at the Submaster Controller, regardless of physical connection location. The values must also be entered at the Satellite Controllers that are physically connected to Flow Meter 1 or 2.

Set the K VALUE and OFFSET VALUE in the Submaster by advancing through the following menus:



- F1=Main Menu
- F5=Setup
- F5=Sensors
- F2=Flow

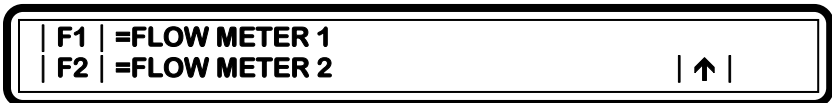


Figure 215: Flow Meter Selection

Select F1=FLOW METER 1.

Note: Refer to Appendix A to select the proper K value and Offset value for your installation.

- Step 18** From the Set Value display, press F1=SET K VALUE to advance to the K VALUE entry screen:

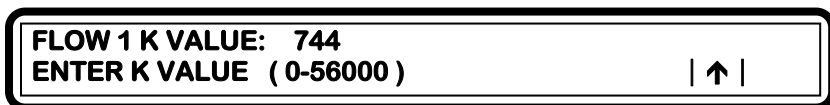


Figure 216: K Value Entry

Enter the appropriate K VALUE then press ENTER.

- Step 19** Select F2=SET OFFSET VALUE to advance to the following OFFSET parameter display.

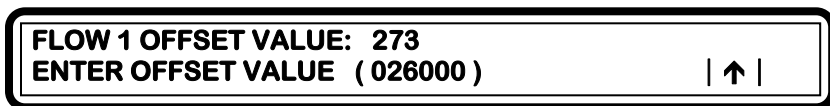


Figure 217: Offset Value Entry

Enter the appropriate OFFSET VALUE.

Note: For further information on K VALUE and OFFSET, refer to Chapter 4: Setup and Appendix A: Flow Meter.

- Step 20** This completes the Submaster Setup procedure.

Press the QUIT key to return to the base menu.

Flow Max Main Line Flow Limits Procedure

This procedure establishes the maximum flow limit for the complete Flow Max irrigation system.

In a Flow Max system, the total GPM of all participating controllers is calculated into the overall Main Line Flow Limit value. The Main Line Flow Limit is entered at the submaster controller only. For any number of controllers within a Flow Max group, there will only be one Main Line Flow Limit. Remember that the Main Line Flow Limit must be higher than an expected flow under normal operation yet low enough to react when a main break occurs.

Main Flow Procedure

Step 1 Advance to the Station Number/Master Valve Entry screen through the following sequence:



F1=Main Menu
F5=Setup
F3=Stations
F2=Limits/Type

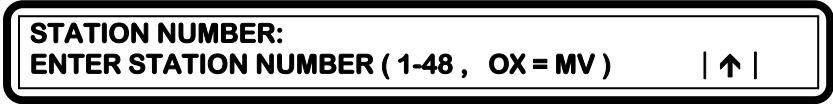


Figure 218: Main Flow Limit Entry

Step 2 Enter 01 (zero 1) then press ENTER. The following screen options are displayed:



| F1 | =CURRENT LIMIT | F2 | =FLOW LIMIT | ↑ |

Figure 219: Main Limit Options

- Step 3** Select F2=FLOW LIMIT. The maximum main flow limit is displayed (the default value is 2000 GPM).



MAIN FLOW MAX FLOW LIMIT: 2000
ENTER MAX LIMIT (0-2000) | ↑ |

Figure 220: Main Flow Maximum Limit

- Step 4** Enter the determined value for your system and press ENTER. Press QUIT to return to the base screen.

This completes the Main Flow Limit procedure.

Press the QUIT key to return to the base menu.

- Step 5** **Unscheduled Flow Limit**
From the base menu, advance to the UNSCHED FLOW LIMIT display through the following sequence:



F1=Main Menu
F5=Setup
F4=Controller
F1=Flow Options
F4= Unshed Limit



Figure 221: Unshed Flow Limit

Enter the appropriate value then press ENTER.
This value sets the maximum allowable flow when
NO stations are on (units in GPM).

This completes the Flow Max setup procedure at the
submaster.

Press the QUIT key to return to the base menu.

Satellite Controllers

Procedure

The remaining two Satellite Controllers may be configured to
either of the two following options:

- Non-participant Satellite - Satellite IS NOT part of the
Flow Max system.
- Participant Satellite - Satellite IS part of the FlowMax
system utilizing one or more shared devices.

Step 1 Non-participant Satellite

Note: This step does not apply to our sample procedure.

Advance through the following displays to clear all
Flow Max connections:



F1=Main Menu
F5=Setup
F4=Controller
F4=Configuration
F3=Flow Max



Figure 222: Normal Mode

Select F3=NORMAL MODE.

The controller returns to the base menu.

**Step 2 Participant Satellite
(No Physical Device Connection)**

Establish the Flow Max mode at the satellite by advancing to the configuration display as follows:



F1=Main Menu
F5=Setup
F4=Controller
F4=Configuration
F3=Flow Max



Figure 223: Controller Options

Select F1=SHARE FLOW, PUMP & MV and verify that the Main Menu returns.

Note: This mode selection must coincide with what was programmed at the submaster.

Press the QUIT key to return to the base menu.

Step 3 Set up device parameters by advancing to the Flow Max display through the following sequence:



F1=Main Menu
 F5=Setup
 F4=Controller
 F4=Configuration
 F3=Flow Max
 F1=Share Flow, Pump & MV

IS FLOW METER 1 CONNECTED TO THIS CLOCK?
 | F1 | =YES | F2 | =NO | NOW=NO | ↑ |

Figure 224: Flow Meter Connection

Step 4 Enter F2=NO and press the Down Arrow. Repeat for the five remaining displays and respond to each of the following displays with F2=NO:

- Is Flow Meter 2 Connected To This Clock?
Then press the Down Arrow key.
- Is The Pump Connected To This Clock?
Then press the Down Arrow key.
- Is Shared MV1 Connected To This Clock?
Then press the Down Arrow key.
- Is Shared MV2 Connected To This Clock?
Then press the Down Arrow key.
- Is Shared N.O. Connected To This Clock?

Then press the Down Arrow key.

In larger installations, repeat step on all remaining controllers with no physical device connected.

Press the QUIT key to return to the base menu.

Step 5 Participant Satellite (Physical Device Connected)

This procedure assumes our example configuration with devices MV1 and FM1 physically connected to Satellite address 1-1.

Advance to the Flow Meter display through the following sequence:



F1=Main Menu
 F5=Setup
 F4=Controller
 F4=Configuration
 F3=Flow Max
 F1=Share Flow, Pump & MV



Figure 225: Flow Meter Connection

Step 6 Using the Down Arrow key, respond to the six sub-menus of the SHARE FLOW, PUMP & MV Menu accordingly, per the system configuration.

Select F1=YES, then press Down Arrow key.

This selection must be identical to the submaster setup. Select F1=YES for Flow Meter 1.

The K and Offset Values will require configuration using the exact same values as entered for the submaster. Refer to the Flow Meter K and Offset Values section of the Submaster procedure.

Step 7 Press the Down Arrow key.
Is Flow Meter 2 connected to the clock?

Step 8 Press F1=NO, then press the Down Arrow key.
Is the Pump connected to this clock?

Step 9 Press F1=NO, then press the Down Arrow key.



Figure 226: Master Valve Connection

Step 10 Select F1=YES for MV1 to complete the configuration for this sample procedure. Once all the participants have been programmed with the Flow Max configuration data:

- Program each satellite with the desired irrigation program(s).

Note: *Insure the program(s) have been set up properly for usage of a Master Valve and/or Pump.*

- Flow limits must be established for all stations in the system. Flow limits can be established using the Auto Limits feature.

This completes the Setup procedure for the satellite controllers.

Press the QUIT key to return to the base menu.



F1=Main Menu
F5=Setup
F3=Stations
F3=Auto Limits



Figure 227: Auto Limits

Selecting F2=SET LIMIT (%) allows a global % to be used for upper limit calculations. Be sure to set the % before selecting the F3 or F1 option.

Selecting F3=AUTO LIMITS FOR ALL SATELLITES will start the Auto Limits function. All Flow Max participants will be tested. Each station is turned on one at a time and the flow limits will be automatically learned.

Note: This selection applies to the submaster only.

Flow Max Worksheet

The Flow Max Worksheet lists all parameters for the example Flow Max configuration. This table may serve as a guide to setting up a future Flow Max system.

Table 6: Flow Max Sample Worksheet

| Menu Function | Submaster | Controller 1 | Controller 2 |
|----------------------|-----------|---------------|---------------|
| Address | 1-0 | 1-1 | 1-2 |
| Share Flow Pump & MV | yes | yes | yes |
| Flow Meter 1 | No | yes | no |
| Flow Meter 2 | n/a | n/a | n/a |
| Pump | yes | no | no |
| Shared MV 1 | No | yes | yes |
| Shared MV2 | n/a | n/a | n/a |
| Shared N.O. | n/a | n/a | n/a |
| Last Address | 2 | (auto config) | (auto config) |
| K/Offset Value | yes | yes | no |
| Flow Limits | yes | yes | yes |
| Main Limits | yes | no | no |
| Unsched Limit | yes | no | no |
| Non-participant | No | no | no |

Device Connection

Flow Max Worksheet

| Menu Function | Submaster | Controller 1 | Controller 2 | Controller 3 |
|----------------------|-----------|---------------|---------------|---------------|
| Address | | | | |
| Share Flow Pump & MV | | | | |
| Flow Meter 1 | | | | |
| Flow Meter 2 | | | | |
| Pump | | | | |
| Shared MV 1 | | | | |
| Shared MV2 | | | | |
| Shared N.O. | | | | |
| Last Address | | (auto config) | (auto config) | (auto config) |
| K/Offset Value | | | | |
| Flow Limits | | | | |
| Main Limits | | | | |
| Unsched Limit | | | | |
| Non-participant | | | | |

Device Connection

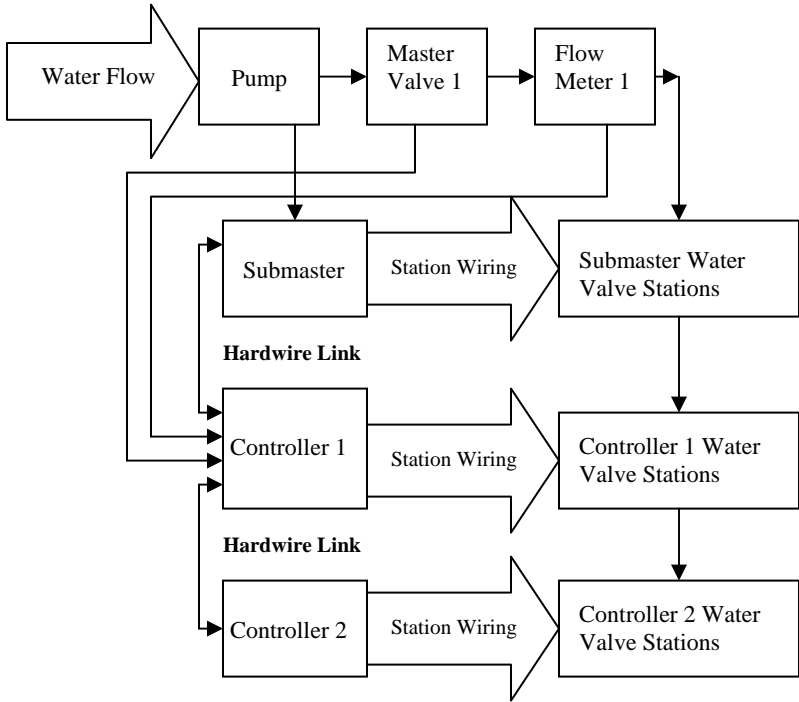


Figure 228: Configuration Block Diagram

Flow Max Diagnostic Tools

Real Time Flow Monitor

A Real Time Flow Monitor is available at the submaster controller of a Flow Max system. This tool provides a wealth of information about the operational status of the system. The real time monitor can be started and run in the back ground as the system is running.

Procedure

Step 1 Advance to the real time flow screen display as follows:



F1=Main Menu
 F3=Status
 F2=Measurements
 F1=Flow

F1 = 126 UL = 150 MV1 = ON MV2 = OFF P = ON
F2 = 0 L = 75 TF = 126 FD NO = OFF | ↑ |

Figure 229: Submaster Real Time Review

The Real Time Flow Monitor updates continuously and displays:

- Flow from Flow Sensors one and two (F1, F2)
- The sum to Flow Sensor a and Flow Sensor 2 (TF)
- The dynamic flow upper limit (UL), changes whenever stations at any controller transition On or Off
- The dynamic flow lower limit (L), changes whenever stations at any controller transition On or Off

- The status of Master Valves and Pump (On or Off)

MV1 = master valve 1

MV2 = master valve 2

NO = Normally open master valve

P = PUMP

- The status of whether the submaster is in Flow Delay (FD) mode. If "FD" appears on the second line of the display this indicates that flow delay is in effect, hence limits are not being checked. The absence of "FD" from the display means that the measured flow is being checked against the displayed limits.

The Real Time Flow Monitor is a useful tool for verifying that the proper flow delay has been programmed for the system. Flow readings should stabilize a minimum of 20 to 30 seconds prior to the "FD" removal from the display. This should provide adequate margin when programming this parameter.

Step 2

In addition to the submaster capabilities, each participant controller of the Flow Max system can display the measured flow. Flow is monitored at the Flow Max participant using the same key sequence as at the submaster.

Press the QUIT key to return to the base menu.

From the Flow Max participant controller, advance to the satellite measured flow screen as follows:



F1=Main Menu
F3=Status
F2=Measurements
F1=Flow



Figure 230: Satellite Real Time Review

Press the QUIT key to return to the base menu.

Review Flow Max Physical Configuration

The Flow Max physical configuration can be reviewed after it has been entered into all Flow Max participants. The review capability is available at the submaster only.

Review All Procedure

Step 1 Advance to the program display screen as follows:



F1=Main Menu
F3=Status
F4=Review All

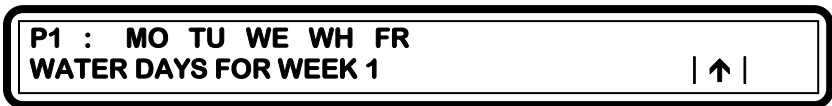


Figure 231: Program Parameters

The first display indicates the program number and the watering days as programmed.

Step 2 Press the Down Arrow key repeatedly to step through all parameters of the program.

Step 5 Continue pressing the Down Arrow key to review all remaining satellite units.

Note: *A device can only be physically connected to one controller. Duplicate device assignments must be checked, verified and eliminated.*

This completes the Flow Max REVIEW ALL procedure.

Press the QUIT key to return to the base menu.

Flow Max Warnings and Exception Conditions

All warnings referenced in this section are described fully in Chapter 10, Flow Max warnings. Please refer to that section for details. Most exception conditions result in warnings being generated at the submaster as well as each Flow Max participant. Different information however will appear at different controller locations depending upon the circumstances.

Flow Max Lower Limit Violation

The submaster has determined that the measured flow from the flow meters(s) is less than the expected flow. Irrigation is terminated for all stations which were on at the time of the violation. Programs automatically advance to their next scheduled station.

| SUBMASTER WARNING | SATELLITE WARNING |
|--|--|
| <i>FM FLOW LO LIM</i> | <i>FM STATION ADVANCE</i> |
| This warning includes a list of satellites which had stations on at the time of the alarm. | Lists the station(s) which were on Note: FM STATION ADVANCE only appears at the satellite if at least one station was turned on. |

Flow Max Upper Limit Violation

The submaster has determined that the measured flow from the flow meters(s) is greater than the expected flow. Irrigation is terminated for all stations which were on at the time of the violation. Programs automatically advance to their next scheduled station.

| SUBMASTER WARNING | SATELLITE WARNING |
|--|---|
| <i>FM FLOW UP LIM</i> | <i>FM STATION ADVANCE</i> |
| This warning includes a list of satellites which had stations on at the time of the alarm. | Lists the station(s) which were on. Note: FM STATION ADVANCE only appears at the satellite if at least one station was turned on. |

Flow Max Communications Failure

The hardwire data communications between the submaster and one or more satellites has been lost or interrupted. This may be indicative of a failure of the communications cable which runs to/from each satellite in a Flow Max configuration. All irrigation is terminated.

| SUBMASTER WARNING | SATELLITE WARNING |
|---------------------|---|
| <i>HW COMM FAIL</i> | <i>OFFLINE</i> |
| | <i>FM STOP WATER</i> |
| | Lists the station(s) which were on. |
| | Note: The "OFFLINE" warning only appears at the satellite (s) which lost hard wire communications. |

Flow Max Main Flow

The main line limit for the Flow Max system has been exceeded. All irrigation is terminated and all future scheduled irrigation will be inhibited.

| SUBMASTER WARNING | SATELLITE WARNING |
|--|-------------------------------------|
| <i>FM MAIN FLOW</i> | <i>FM STOP WATER</i> |
| This warning includes a list of satellites which had stations on at the time of the alarm. | Lists the station(s) which were on. |

Flow Max Unscheduled Flow

Flow was detected but no controllers within the system had any stations which were turned on.

The normally open master valve will be energized and all future scheduled irrigation will be inhibited.

| SUBMASTER WARNING | SATELLITE WARNING |
|--|-------------------------------------|
| <i>UNSCHED LIMIT</i> | <i>FM STOP WATER</i> |
| This warning includes a list of satellites which had stations on at the time of the alarm. | Lists the station(s) which were on. |

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Appendix F

Troubleshooting Basics

When troubleshooting a field wiring problem, it will become necessary to verify that the wires and connections are reliable and secure.

Wires must be checked for continuity using an appropriate tester or instrument. The continuity of a wire refers to its ability to conduct electrical current throughout the entire length of the wire. When a wire successfully delivers current flow from a source to a destination, it is referred to as a complete or closed circuit. If a wire becomes broken somewhere along the line, the continuity is destroyed, therefore the wire is said to be open. This condition is defined as an open circuit.

The instrument most commonly used to check continuity is the ohmmeter. In addition to continuity, this meter also measures resistance of wires or electronic components. The ohmmeter is available in either analog or digital design. The analog version uses a basic meter needle movement whereas the digital version provides a digital readout display. The meter may also feature a buzzer or beeper used for easily checking continuity by listening for an audible sound to verify a complete circuit. A more simplified device is the continuity checker, which only provides an audible tone and does not measure resistance.

The ohmmeter is generally part of a three-in-one type of instrument called a multimeter. The multimeter measures voltage, current or resistance. The multimeter is also referred to as a Voltage Ohm Meter (VOM). Each function has its own set of measurement scales and ranges, which are used independently from each other.

The type of instrument you choose depends on your application and requirements, however, the multimeter is recommended for its overall versatility. The multimeter can be a useful tool in diagnosing approximately 90% of all electrical problems.

Analog Multimeters

The following pictorial diagram illustrates a typical analog multimeter. The face of the meter displays a resistance scale on the top and a DC voltage scale below (the AC voltage scales are not shown for simplification). The resistance is measured in units called Ohms. The full scale ranges from 0 Ohms to 5 thousand Ohms (5K=5 thousand) (K=Kilo). The ohmmeter scale usually reads from right to left.

The symbol for Ohm is the Omega Greek letter Ω .

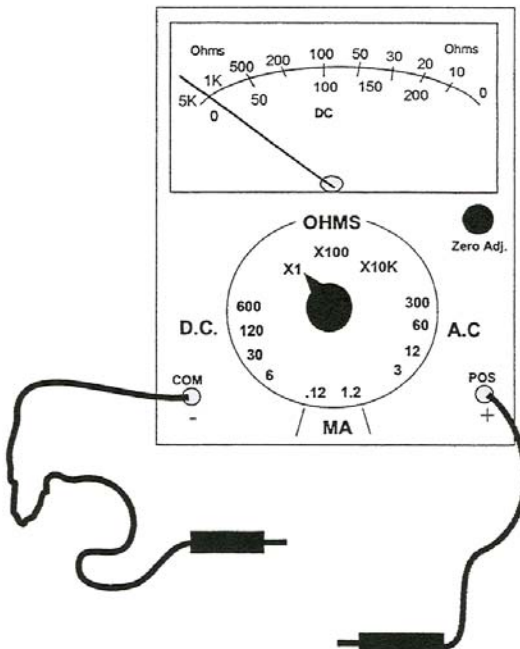


Figure 235: Analog Multimeter

Resistance Scale

The actual resistance reading is determined by the Range Selector Knob, which is illustrated in the X1 (times 1) position. The X1 means that any registered reading on the Ohms scale should be multiplied by 1. The X100 range means that any reading on the Ohms scale should be multiplied by 100. The x10K means that any reading on the Ohms scales should be multiplied by 10,000.

The illustration is reading approximately 3K (3,000) Ohms, because the selector knob is set to the X1 scale. This reading, however, for all practical purposes, is erroneous because the meter leads are not connected to anything (open circuit).

The two meter leads are generally black for common (negative or ground) and red for positive. If you touch the two leads together, the needle should go to the 0 (zero) reading, which indicates continuity (zero resistance) between the positive and negative terminals.

If the needle does not completely go to zero, adjust the Zero Adj. knob to set the needle to 0. Due to the internal meter battery, this is often necessary to maintain reasonable calibration of the meter resistance readings. As a general rule, you should always zero the meter prior to making resistance measurements or when checking continuity.

Voltage Scale

The voltage measurements operate in a similar manner as the resistance measurements. The scales, however read left to right with 0 volts at the extreme left. The Selector knob is set to the appropriate DC or AC scale and the measurement is read out directly. A prime consideration when making DC voltage measurements is the polarity of the leads. You should be aware that a positive (+) voltage must be measured with the positive lead on the voltage point and the negative (-) lead connected to ground.

Digital Multimeters

The digital multimeter is the meter of choice in today's technical world. These instruments are easy to use, highly accurate and offer features, such as automatic ranging, built-in continuity beeper, diode test and automatic polarity sensing.

Resistance measurements are easily made by merely switching to the Ohm position and measuring. The measurement is displayed directly or may be accompanied by a K or an M, indicating Kiloohms (thousand) or Megohms (million).

Voltage measurements are displayed regardless of polarity. If the voltage is negative, the display will be indicated with a - (minus) sign.

Switching to the continuity position provides a continuous tone in continuity checks. This allows for quick continuity checks without looking at the digital display.

Troubleshooting

This discussion will consider the most commonly used wiring configuration, which is the two conductor cable. The two conductor cable contains two individual insulated wires enclosed inside a shielded common outside insulation covering. This type of cable is used in the installation of field valve solenoids, flow sensors, moisture sensors; hardwire communications, wind anemometers, rain gauges, ET Weather Computers and many others.

Cable Checkout Procedure

The following procedure is a recommended method in troubleshooting a wiring continuity problem using an ohmmeter or a continuity checker.

- Step 1** Disconnect both wires of the cable from the controller Station Output Board, Master/Valve Power Board or Sensor Terminal Board.

- Step 2** Separate the wires making sure that they do not touch each other.

- Step 3** Locate the other end of the cable and disconnect the two wires from either the valve solenoid, sensor or any other device. Separate the wires making sure that they do not touch each other.
The cable should now be isolated from the system and the wires isolated from each other.

- Step 4** Locate the two wires at one end of the cable. Using an ohmmeter or a continuity checker, connect one meter lead to one wire and the other meter lead to the other wire.

Step 5 Verify that there is no reading or audible tone. A reading at this point indicates that a short exists between the two wires.

If this is the case, examine the wires carefully at both ends to determine where they may be touching (shorted). If the cable also connects to a terminal block, check for shorts in the terminal block. If the short cannot be located, replace the cable.

Step 6 If no short exists; connect the two wires at one end by twisting the wires together. At the other end of the cable, connect one meter lead to one wire and the other meter lead to the other wire, as depicted in Figure F-1.

The meter should indicate a reading, which verifies continuity. The reading will most likely not be zero, since there is an expected amount of resistance in the wire. A reading of 20 ohms or less would be acceptable.

Step 7 If no reading is displayed, the cable is open and should be checked or replaced. Further checkout of a cable depends on the cable location and installation conditions. If the cable is not buried and only a short distance from one end to the other, the two ends of a single wire may be brought together for a continuity check.

If this is possible, disconnect the two wires that were twisted together earlier. Connect one meter lead to one end of a single wire and the other lead to the other end of the same wire. Check the remaining wire in the same manner. Verify the continuity of each wire.

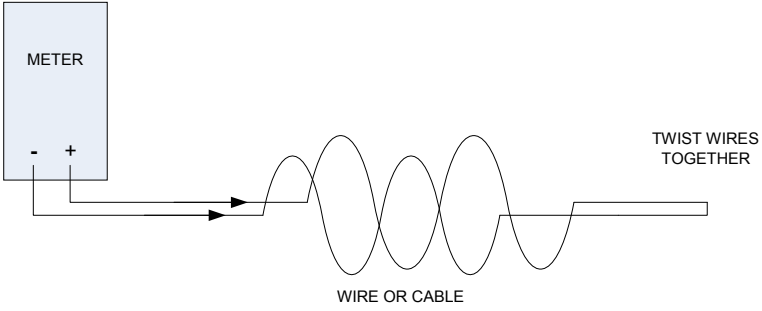


Figure 236: Cable Continuity Check

Polarity Checkout Procedure

In some cases, it will become necessary to identify the polarity of two wires in an installation to prevent possible damage to your equipment. This is when a positive wire must be connected to the positive terminal and the negative wire must be connected to the negative terminal. If the wires are colored or easily identified, polarity is no problem. The standard Rain Master cables are easy to identify because one wire is copper and the other is tinned (silver).

However, there may be custom installations where the wire colors may be the same, which will make identification very difficult. The following procedures offer two methods of checking polarity.

This procedure assumes two wires of the same color are twisted together into one installation cable extending from a controller to an on-site location of a sensor (flow, rain, or anemometer).

Required Equipment

- 1 Volt Meter (VOM)
- 1 Flashlight Battery (1.5 Volts)

Procedure

- Step 1** Verify that the cable is not connected at either end.

- Step 2** At one end of the cable, connect the flashlight battery between the two wires. At the other end, connect one meter lead to one wire and the other lead to the other wire, as depicted in Figure F-2.

- Step 3** Set the meter to DC volts. If the meter has a DC scale selection, set it to the lowest scale.

- Step 4** Observe the meter for a reading of approximately 1.5 volts. If the voltage reads negative; a digital meter will display a minus (-) sign, an analog meter needle will travel in the opposite direction going off the scale. If your meter indicates a negative reading, reverse the meter leads on the wires.
- Step 5** With the meter leads properly polarized, the reading should now be positive 1.5 volts. The wire connected to the positive (red) meter lead may now be identified as positive. The wire connected to the negative (black) meter lead may now be identified as negative.
Identify each wire using a colored pen, tape, or label.
- Step 6** Identify, label, or mark the two wires at the other end of the cable. The battery end with the extended tip is the positive side (+).
- Step 7** The cable may now be connected to the appropriate terminals and device. Be sure to observe polarity when making connections.
- Step 8** This completes the polarity checkout procedure.

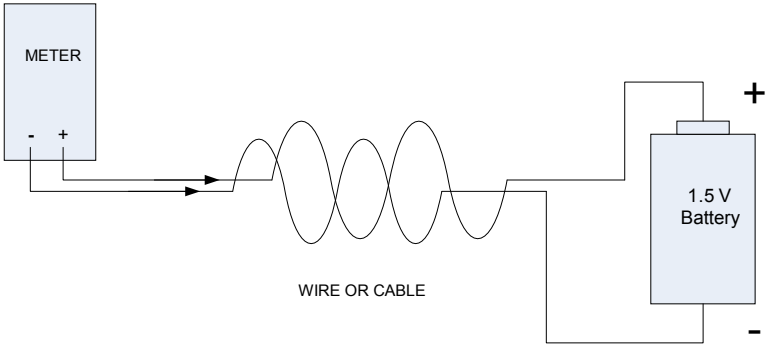


Figure 237: Polarity Check

Alternate Polarity Checkout Procedure

This procedure assumes that an Evolution DX2 Controller, equipped with a Sensor Terminal Board is available and may be used for testing. The four sensor inputs on the Sensor Terminal Board (labeled as Input 1 through Input 4) may be used as a source voltage to test the polarity of a cable. This procedure applies +8 volts to the cable under test, allowing the voltage to be read at the other end.

Required Equipment

1 Volt Meter (VOM)

Procedure

- Step 1** Connect one wire of the cable to the negative (-) terminal of Input 1 on the Sensor Terminal Board. Connect the remaining wire to the positive (+) terminal of Input 1.
- Step 2** Turn on the controller, if not already on.
- Step 3** Set the volt meter to the DC scale and select a voltage range, if necessary, to read approximately +8 volts.
- Step 4** Connect the volt meter to the Input 1 terminals with the negative (black) lead to the negative side and the positive (red) lead to the positive side. Verify a meter reading of approximately +8 volts.
- Step 5** Disconnect the meter and connect the meter leads to the other end of the cable. Read the voltage on the meter, as depicted in Figure F-3.

If the voltage reads negative; a digital meter will display a minus (-) sign, an analog meter needle will travel in the opposite direction going off the scale. If your meter indicates a negative reading, reverse the meter leads on the wires.

- Step 6** With the meter leads properly polarized, the reading should now be positive +8 volts. The wire connected to the positive (red) meter lead may now be identified as positive. The wire connected to the negative (black) meter lead may now be identified as negative.
- Step 7** Identify each wire using a colored pen, tape, or label. To avoid any future confusion, identify and label or mark the two wires at the sensor board end of the cable.
- Step 8** With the wires properly identified, the cable may now be connected to the appropriate sensor terminals and to the sensor device. Be sure to observe polarity when making final connections.
- Step 9** This completes the Alternate Polarity Checkout procedure.

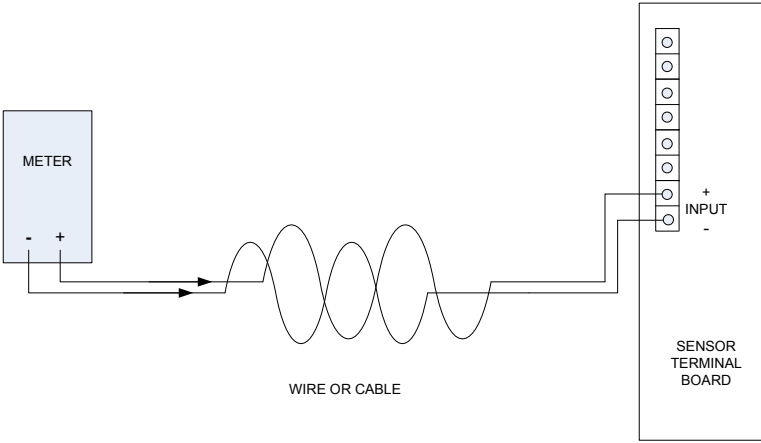


Figure 238: +8 Volt Polarity Check

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RAIN MASTER LIMITED WARRANTY

Rain Master Irrigation Systems Inc. warrants to the first customer purchaser that this Rain Master brand product (the "product"), when shipped in its original container, will be free from defective workmanship, and materials and agrees that it will, at its option, either repair the defect or replace the defective product or part thereof at no charge to the purchaser for parts or labor for the time period set forth below.

This warrant does not apply to any appearance items of the product nor to any product the exterior of which has been damaged, or defaced, which has been subjected to misuse, abnormal service or handling, or which has been altered or modified in design or construction. (See additional exclusion below).

In order to enforce the rights under this limited warranty, the purchaser should ship or carry the product to a Rain Master authorized service depot, or send product prepaid to Rain Master at the address below (ensuring product is packaged correctly for shipment).

For nearest location, call Rain Master Service Center 1-805-527-4498.

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In no event shall Rain Master be liable or in any way responsible, for any damages or defects in the product which were caused by repairs or attempted repairs performed by anyone other than a Rain Master Service dealer or center. Nor shall Rain Master be liable or in any way responsible for an incidental or consequential economic or property damage. Some states do not allow the exclusion of incidental or consequential damages, so the above exclusion may not apply to you.

This limited warranty does not apply to improper installation or grounding, acts of God, such as lightning and/or power surges, floods, earthquakes, hurricane, tornados, vandalism etc.

The RME EAGLE Controller has a 5 year limited warrant from date of purchase.

All other Rain Master Brand products carry a 2 year limited warranty unless otherwise specified.

SERVICE

Should it be necessary to require servicing of your controller, contact your local Rain Master distributor or contact Rain Master at 1-805-527-4498 for a listing of distributors in your area.

When sending a controller or a component of the controller back to be serviced, ensure it is properly protected with a soft packaging material, and that the box will withstand normal shipping abuses. Enclose a complete description of the type of problem that is occurring, and be sure to put your name, address and phone number where you can be reached.

WARNING: This equipment has been tested and found to comply with the limits for Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions manual, may cause interference to radio communications. Operation of this equipment in a residential area is likely to cause interference in which case the user will be required to correct the interference at his own expense.

The user is cautioned that changes and modifications made to the equipment without approval of the manufacturer could void the user's authority to operate this equipment.

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RMIS Part No. 500052 Revision D

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Glossary

Access Code

A user assigned 3 digit code used to restrict unauthorized usage (reprogramming/control) of the controller.

Alarm

An irrigation related "event" reported by the controller which requires operator notification and/or action.

Anemometer

Wind speed measuring device (Measuring units in MPH). at water limit The specified monthly water total limit based on a given irrigation program. When the limit is exceeded, the watering program will either stop watering or display a warning.

Auto Limits

Feature that automatically establishes upper and lower limits for flow and current.

Base Screen

Base screen is the starting point or reference screen/position from which all user interaction occurs. Additionally, when the controller displays the base screen information, the controller functions in the "automatic mode" meaning that any valid program(s) will automatically start at its programmed start time(s).

(The manual functions [see chapter 8] disable the automatic mode.) The controller has a built in time-out function (2 hour time-out) which returns the controller to the base screen (automatic mode) if the user inadvertently leaves the controller in some other screen.

Central Control Mode

Central Control Mode indicates that two way communications have been established between the evolution controller and the Central Control PC. This means that programming data can be downloaded and uploaded, and that the Central Control PC can control all functions remotely. Central Control Mode can be entered in two ways:

1. If a controller has been setup as a submaster and a valid address has been entered.
2. If the controller is physically connected as a satellite and has established two-way communications with its submaster.

Central User

One who operates a controller irrigation system using a Central Control computer.

Condemned Station

A station that shut down due to operational defects or exceeded limits. The condemned station will not operate again until the defects are corrected and warnings are cleared.

Continuous Cycle

A watering program that will run continuously within a user defined water window. After the first cycle, a specified soak time is initiated and the program starts again.

Controller

A microprocessor based solid state programmable apparatus that automatically controls and manages irrigation valves, pumps, flow sensors and other peripheral devices.

Controller Address

Identifies each controller/satellite within a multiple controller system. The address number is alternately displayed on the base screen with the program number.

Controller Initialization

A one time initialization process that sets up the controller to operate under global default settings.

Controller Keys

The controller panel touch keys used to move through all menus for programming and data entry.

Current Limits

The maximum amount of current that a station is allowed to draw. If the specified maximum current is exceeded, the station will shut down and the program advances to the next station. Also refers to the minimum amount of current that a station should be drawing. If a station output does not draw any current, it is likely that the circuit is open.

Cycle Mode

Option that selects either start times or continuous cycle.

Day Keypad

Front panel keys representing days of the week used to enter water day programming information.

Default Values

The parameter values established prior to any programming.

Delay Time

The specified time period prior to taking flow measurements (range from 1 to 6 minutes) to allow for water line stabilization.

Device

Defined in an irrigation system configuration as a Master Valve, Pump or Flow Sensor.

Download

When operating a controller in Central Control Mode, the term download indicates when one or more programs are sent from the Central Control Computer to the controller (satellite). The controller program is overwritten.

Downloading

The process of transferring files or programs from a Central Control Computer to a satellite controller or a group of controllers.

Down Arrow

A menu positioning key used to move to the next screen/function.

Enter Key

Front panel key used to indicate that previously entered numeric keypad data is complete /correct. When ENTER is hit, the controller accepts and processes the numeric data.

EvapoTranspiration (ET)

The name reflects two ways water moves from an irrigated field to the atmosphere: Evaporation, which is the movement of water from the wet soil to the air, and Transpiration which is the movement of water from the plant to the air.

EV-CAB-COM

A particular type of communication cable used in controller hardwire configurations.

Field Wiring

The wiring setup among controllers, Master Valves, Pumps, sensors, and valve solenoids.

FlowMax

Multiple controller system configuration comprised of one submaster and one or more satellites. This unique feature allows controllers to utilize a single point of connection to share devices (i.e. Flow Sensors, Master Valves, Pumps, etc.) and intelligently manage system operation.

Flow Rate Delay

Refers to a delay time between 1 and 6 minutes to allow water line pressures to stabilize prior to performing a flow limit check.

Flow Sensor

A rotating paddle device placed in a main water line used to measure water flow. The device must be calibrated using K and Offset values to compensate for pipe size.

Function (F1-F6) keys

Front panel keys F1-F6 are used for transition through different controller functions. Their function is context sensitive which means that their definition changes depending on the current menu level.

Global Settings

Settings which are programmed into all controllers of an irrigation system.

Host Computer

The Central Control Computer that controls the irrigation system.

Icon

A graphic symbol or representation of a function, such as the pointing finger icon indicating the flow of menu display screens.

Initialization

Upon the very first time controller power-up, various data must be initialized (e.g. date/time, usage of master valve, etc.) before the user can enter the base screen. Once this data has been correctly entered, subsequent power-ups will bypass the initialization prompts and start with the base screen display. (In the event that the user wishes to change the initialization data, the user can do so from the setup screens.)

Injector Station

A dedicated station output most commonly used for applying fertilizer.

Irrigation Program

See Program.

ISC

Individual Station Control (ISC) is an alternative programming mode that treats an individual station like a program. The user enters water days, start times, and runtimes for each station programmed as an ISC.

K Value

A numeric value required for the proper setup/ calibration of flow sensors.

Limit Checking

The controller validates user defined upper and lower limits for flow, and current readings. Violations are reported in the warning/report buffer.

Main Flow

The maximum flow limit for a complete irrigation system.

Main Menu

The starting menu that provides the major options for all subsequent programming and setups.

Manual Control

Manual control provides maintenance personnel the ability to turn on/off individual stations and programs. The controller can also be placed in rain shutdown for either a programmable or indefinite amount of time.

Manual Station

Feature allowing any one station to be turned on manually.

Manual Test Mode

Test feature that turns on all stations one at a time for a specified time period for purposes of testing and analysis.

Master Valve Output

A dedicated controller output which is activated by the controller each time a program start time occurs (typical operation). The evolution controller however, allows a number of different setup options associated with master valve operations. This output is typically connected to a Pump or another valve which acts as the master enable for all irrigation.

Master Valve Delay Turn On

The amount of delay time in seconds from the time a Program starts until the master valve turns on.

Menu

Any LCD display which has F1-F6 menu select option keys to move to other LCD displays.

Moisture Sensor

A water sensing device placed in the root zone of a watering area which monitors the amount of water application. If watering exceeds specified limits, the station will turn off.

Moisture Sensor Trip Point

The specified watering level that determines watering activity.

When the sensor detects moisture above the trip point, watering will stop.

Non-volatile Memory

Refers to computer memory that will not be erased regardless of power failures or related problems.

Normally Closed Valve

Master Valves are normally closed and must be energized to deliver water flow.

Normally Open Valve

Master valve that is normally open and must be energized to turn off.

No Water Window

A user specified period of time (stop water flow) where irrigation is not allowed. The watering window is specified on a daily basis by establishing a daily start and end time. The controller automatically disregards any program start times which occur in the watering window.

Numeric Keypad

Front panel keys used to enter all numeric data.

Off-line

Relates to any controller that loses hardwire communication within a system.

Offset Value

A numeric value required for the proper setup/calibration of flow sensors.

Omit By Date

An Evolution DX2 feature which allows the user to specify dates which irrigation will be disallowed (any programmed start times which occur on these dates will be skipped).

On-line

Relates to any controller that is properly communicating within the irrigation system.

Over Current

Condition at any station that detects an excessive amount of electrical current.

Overlap Protection

Feature which insures that no two programs will run during the same time. (Each program must be set up to have its overlap protection on.)

Percent Run Time

Provides the ability to modify the run times of all stations in a given program. A station run time programmed at 10 minutes would run for 5 minutes if the percentage run time is set to 50%.

Power Glitch

A disturbance in the AC power line.

Program

A program provides a way of grouping stations with similar irrigation characteristics so that the start/stop of water can be controlled automatically. In order to establish a valid program the user must specify:

1. The station numbers associated with the program (stations).
2. The time(s) during the day when the program is executed (start times).
3. The days of the week when the program is to be executed (water days).
4. The amount of time each station operates (station run time).

Program On/Off Key

A dedicated front panel key which allows the user to immediately turn a program either on or off.

Quit Key

A front panel key which brings the user back to the base screen display.

Rain Gauge

Device used to measure rainfall. Units are measured in pulses with each pulse representing 1/100 inch.

Rain Shutdown

A feature which stops all irrigation in the event of rain. Several options are associated with rain shutdown including:

1. Rain shutdown on/off (indefinite period)
2. Programmable rain shutdown (user specifies the amount of time which the controller is in rain shutdown)
3. Rain shutdown enable/disable on a per program basis

RAM

Random Access Memory

Run Time

The amount of "on" time either in minutes/ seconds or hours/ minutes (setup option) for a station.

Satellite

A term used for any controller which is connected to a Central Control System or a submaster.

Satellite Address

Identifies each satellite within a multiple controller system. The address number is alternately displayed on the base screen with the program number.

Screen Display

The information which appears in the LCD display of the front panel.

Sensor

A device used to detect and measure flow, moisture, wind or ET (evapotranspiration).

Setup

The setup function provides the mechanism for tailoring the evolution controller operation to a specific irrigation application. Numerous setup options allow flexibility for master valve usage, program execution, station limit checking, controller operations and programming.

Short Circuit

Electrical term indicating an excessive amount of current being drawn on a given station or Master Valve/Pump output.

Skip By Day

A water day cycle option which allows the user to program water days by defining the number of days which should be skipped before the next watering occurs.

Solenoid

An electrical coil used to turn valves on or off which is energized by the station or Master Valve/Pump outputs.

Start Time

The time of day which a program (or ISC) starts its execution.

Station Delay Time

The inter station delay time (in seconds) which the controller waits before starting the next successive station of a program.

Station and Station Number

The LCD displayed station number has a one for one correspondence with the evolution output board station number at the terminal block (field wire connection). Each station may actually connect to one or more valve solenoids depending on the installation as long as the maximum current for a station and is not exceeded. Stations can be assigned to programs, or can be programmed individually as ISCs.

Submaster

A submaster is a term used for an Evolution DX2 controller

which is being operated in conjunction with an RMIS Central Control System. A submaster is a controller which has specialized communications capability. It can be set up for direct two-way communications with the Central Control PC either via radio, telephone, or wire. Additionally, the submaster has additional responsibility for communications to any satellites which may be physically connected to it.

Time Format

Option that allows time to be indicated in hours and minutes or minutes and seconds. An additional option selects 24 hour or 12 hour AM/PM format.

Touch Key

The keys on the DX2 front panel producing the distinctive beep which verifies key press.

Transient Protection

Built-in feature to prevent damage to electronic components against AC power disturbances and lightning.

Trip Point

Moisture sensors must have a definition of "wet" versus "dry" soil. This transition point is known as the moisture sensor trip point. Each moisture sensor must have its trip point setup on an individual basis. The trip point is established using a relative number between 0 and 200. Higher numbers indicate more moisture.

Up Arrow

A menu positioning key used to move to the previous screen/function.

Unscheduled Flow

Defined as any water flow that is not programmed or under the control of the controller.

User Interface

Refers to the inter-action that takes place between the user and the controller. The menu option selection features provide an easy-to-use method of programming thereby making the system "user friendly".

Upload

When operating a controller in Central Control Mode, the term upload indicates when one or more programs are sent from the controller (satellite) to the Central Control PC.

Valve Solenoid

See solenoid.

Warning/report

A controller detected warning or report condition. The user is notified of these conditions by the appearance of [F2]=WARNING while in the base screen. Depressing [F2] will then allow the user to view a list of warning/report conditions.

Water Days

User defined (programmed) days which irrigation shall occur on.

Water Window

A user specified period of time where irrigation is allowed. The watering window is specified on a daily basis by establishing a daily start and end time.



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