



VAC[®] Controller

User's Guide

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TRADEMARKS

Weathermatic, Wetware, VAC, Watermiser, Soak-Cycles

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Introduction

The VAC Irrigation Controller is a programmable microprocessor-based controller capable of managing up to 48 stations. The design includes a 24 button keypad with audio feedback, real-time clock, sensor inputs and can be operated as a stand-alone controller and as a satellite in a centrally controlled computer system via radio, telephone or twisted pair signal wires. Programs and real time are stored in battery-backed memory, and the real-time clock can automatically adjust to Daylight Savings Time.

The 48 outputs are switched by normally open relays and are protected by metal oxide varistors and TVS-diodes, providing superior surge isolation. Dual isolation transformers also protect the VAC from power surges.

Outputs can control irrigation valves, lighting or other devices, and can be grouped to run simultaneously or sequentially. Additional output modules (VOPM) may also be added to the controller to provide a maximum of 48 outputs. Up to five valves and a master valve may be operated simultaneously.

All VAC controllers are ready for communication and require only the addition of modems or appropriate wiring. Units may be field upgraded to a central control system by adding the communication device to the control. RS-232 and RS-485 serial communications are both supported, allowing radio modem (trunking or simplex), telephone modem, hard-wired, and fiber-optic systems.

A pump start/master valve relay module (PSMV or PSMV-F) is available as an option. The -F module also contains the flow meter interface option, which provides input for flow monitoring and an output for an external fault alarm.

The VSIM option has inputs for a wind sensor, rain sensor, flow meter, and 10 moisture sensors. Some sensors may require signal-conditioning interfaces based upon lengths of wire runs and the application.

Feature Overview

Groups

Group scheduling is accomplished by assigning a start time to one or more of the 10 Groups. This will tell the controller what time of day the Group is to be run. A list of Stations is also entered in the desired run order. Up to 10 groups may be programmed. A group may be either a Valve or Non-valve Group (fountains, lighting, etc.) and each group operates independently. Stations may be assigned to a group in any order, and to more than one group of the same type. A station may not be assigned to the same group more than once. Each group may be set to operate sequentially or simultaneously. Valve groups may operate up to five stations simultaneously. Non-valve groups may operate up to ten stations simultaneously. The VAC monitors simultaneous operations with consideration for start times, station run times and Water Miser settings. If a group exceeds the limits it will not operate and a fault is displayed.

Pause Time

Station #99 is inserted to a Groups Station list to create a fixed pause time either between stations or between multiple cycles of the same group (Soak Cycles). Station #99 must be entered within the station list of a group in order to properly operate. A run time for station #99 may be assigned to any valve group to create a pause in the irrigation sequence. The Water Miser and Soak Cycles functions do not affect the duration of the Pause Time.

Run Times

Stations may be individually set to operate up to 18 hours each, adjustable in one-minute increments. Stations not assigned to a group or having no run time set will not operate. When using the Soak Cycle function to repeat a valve group, use the total station duration for all cycles as the station run time.

Schedule

Each group may be set to operate either every day, every odd day, every even day, on selected days, or on a skip day schedule. The skip day schedule allows operation for a set number of days then skips a set number of days. The skip day schedule on and off days may be adjusted from 1 to 30 days each.

Soak cycles

Up to 10 soak cycles may be set for each valve group operating sequentially. Each station run time, after being adjusted by the Water Miser, is divided by the number of soak cycles. Each station is then operated for the calculated time in sequence and the sequence repeated for the number of soak cycles. For example: If Group #1 has a Soak Cycle setting of 2, and the station run times are 30 minutes, the Group will operate each station in the list 2 complete group cycles of 15 minutes per station.

Water Miser

Water budgeting for adjusting station run time may be individually made for each valve group. The adjustment range is from 1% to 300% of programmed run-time in 1% increments. Station run times are calculated to one-second accuracy. For example: If a group has a Watermiser setting of 50%, the stations in that Group will be operated for half of their programmed run time.

Syringe

Syringe immediately operates stations for brief periods, adjustable from 1 to 30 minutes in 1-minute increments. You may syringe all stations, stations within a group, or a mixed list of stations. The stations are individually operated in sequence for the specified time. Non-valve stations may not be syringed. When a Syringe is started, all normally scheduled operation is overridden.

Rain Days

Rain Days stops valve group operation for up to 90 days and may be set up to begin seven days in advance. After the rain days have all counted down, the VAC resumes the programmed irrigation schedule. Syringe, Semi-auto, and Manual functions are still available when the controller is in Rain Day override. Rain Days does not affect non-valve stations. Rain Days activate and expire at midnight. For example: If one Rain Day is set to begin in 1 day, normal irrigation will occur until midnight tonight. All normally scheduled irrigation will be inhibited until the following midnight.

Manual

Manual operates any station immediately. The station runs for the time you set (120 minutes maximum). No other stations will operate while in manual mode. The VAC returns to the original mode when Manual operation terminates.

Standby

Standby discontinues automatic valve operation until the VAC is placed back in Run mode. Non-valves will continue to operate in the Standby mode. Syringe, Semi-Auto and Manual mode are still available while in Standby.

Semi-auto

Immediately operate a group, all stations, or a list of stations for the programmed run time. If using Semi-Auto mode on a Group, the Group's Watermiser and Soak Cycle settings are active. Following a Semi-Auto run, the controller reverts back to the previous mode.

Instant Program

Sets the VAC to operate Group #1 at 9:00 PM every day. All Stations are automatically assigned to Group #1. Any settings for Group #1 will be lost if the Instant Program is used.

Flow Meter

VAC's equipped with a VPSM-F and flow meter can record and display accumulated flow and monitor for excess and low flow conditions. Flow faults prevent the stations(s) affected from operating, and in the case of mainline break, shut down automatic operation using an available master valve. Adjustable pulse factors allow the use of any industry standard pulse-type sensors. Be sure to install the recommended flow cable between the sensor and controller.

Wind Sensor

A VSIM option and a wind-sensing device attached to the VAC will terminate automatic operation while high wind is detected. You may assign wind sensor control to one or more Valve groups. A fault is recorded for the affected groups. If a fault is recorded, the groups will not run again until one hour after high wind is detected. The wind sensor can be enabled and/or disabled by individual group.

Rain Sensor

When an optional Rain Sensor detects rain, the VSIM module prevents all valve stations from operating and a fault is displayed. When the sensor no longer detects rain the VAC returns to automatic operation. Non-valve groups are not affected by Rain Faults.

Moisture Sensors

Up to ten moisture sensors may be installed and each sensor can be assigned to a Valve group. When excess moisture is detected, the associated group of valves is not allowed to operate until dry conditions are sensed. A fault is displayed for the group. Each time excess moisture is sensed during a group run, the Water Miser for the group is adjusted down by 5%. When the group sensor records drier conditions, and no excess moisture fault occurs before the group completes operations, the Water Miser is adjusted by up to 5% until the user's maximum set value is reached. The automatic Water Miser adjustment feature may be disabled at the keypad.

Alarm Output

If the optional Flow module is connected, the VAC activates an alarm output on the module whenever a Master Valve fault (2 consecutive flow faults) is recorded. This output can be used to shut off a Normally Open Master Valve, activate a warning beacon or audible alarm. The alarm is shut off when the fault condition is corrected and cleared. The output can operate a 24 volt relay, allowing the connection of a warning light, audio alarm or other device.

Secret Code

You may enter a pass code of up to 6 digits for access protection of:

- Programming
- Water miser
- Rain days
- Standby
- Instant programming
- Flow meter
- Code number
- Communications

The code number does not display as it is being entered. Any attempt to change the above settings will require the Secret Code prior to making the change

Communications

All information, features, functions and programming capabilities available at the VAC keypad are also available through commands received through a serial interface standard to all VAC controls. A communications device to each satellite, or to each group of hardwired satellites, and an IBM-compatible personal computer with communications hardware and Valcon's water management software (Wetware), are required. After connecting the VAC to the Central System, ALL stand-alone functions are still available, and changed made are automatically reported to the central.

Basic Operations

VAC Keypad Description:



- sets real time clock, date and time.



- sets start time and stations to group.



- sets days to operate.



- sets station run times.



- sets Water Miser per group.



- sets rain days off.



- sets soak cycle per group.



- provides access to special features.



- manual operation of stations.

**RUN
AUTO**

- automatic operation.

**SUN
1**

- enter numbers and days of week.

ENTER

- keys to enter information set with other keys and to complete steps in programming.

ESCAPE

- cancels the current keypad entry or programming step.

**YES
INSERT**

- used to respond to displays asking for a yes or no response, and to insert stations.

**NO
DELETE**

- used to respond to displays asking for a yes or no response and to delete stations.

On Power Up

On power-up, the VAC will briefly display VALCON MODEL VAC VERSION 2.0. If the VAC memory has been damaged the display will remain blank for a few seconds while the VAC resets all memory to default values.

After power-up initialization, the VAC will display status information. Four screens of information will be displayed in rotation. You may lock and unlock whatever is on display at any time by pressing the Enter key. The four screens are:

Date and time:

**TUE 01/01/95
03:15:35 PM**

Operational status: The number of active events and the number of faults. Possible states are Standby, Run-Auto, Syringe, Semi-Auto, Rain, Manual and Default.

**STANDBY OPERATION
00 EVENTS 00 FAULTS**

Current station operating and associated group number in Run-Auto or Semi-Auto, remaining run time, flow rate and total system flow rate.

**NO STATIONS ON
FLOW 0000 GPM**

Fault identification and a fault description as shown below. These screens are followed by subsequent screens identifying the date and time of the fault and the group and station numbers (if any) that were operating when the fault occurred. If a flow fault is displayed, the flow rate at the time the fault occurred will be shown.

**FAULT #01
CIRCUIT BREAKER**

Possible faults are:

- A) Power Went Off - power was lost or the controller has been reset
- B) Power Back On - power was returned to the controller
- C) Too Many Stations On - irrigation schedule turns on too many stations at the same time
- D) Group Overlap - A single group has two or more overlapping start times.
- E) Station Overlap - a single station has two or more overlapping run times.
- F) Master High Flow - excess flow while two or more valves are running simultaneously, or two valves running sequentially record excess flow.
- G) Master Low Flow - low flow while two or more valves are running simultaneously, or two valves running sequentially record low flow.
- H) Station High Flow - excess flow for valve.
- I) Station Low Flow - low flow for valve.
- J) High Wind Detected - wind sensor tripped.
- K) Rain Detected - rain sensor tripped.
- L) Excess Moisture - moisture sensor tripped.
- M) Circuit Breaker - circuit breaker tripped.
- N) Program Integrity - the controller's internal diagnostics found that the irrigation program data had been damaged and the controller has been reset.

See Advanced Programming Section and troubleshooting section for more detailed information regarding faults.

General Programming Information

Use the ESCAPE key to quit any keypad entry sequence. In most cases ESCAPE aborts any changes you have made. If no keys are pressed for 60 seconds, the VAC returns to station control just as if you had pressed the ESCAPE key.

The VAC will not allow you to enter a value that is out of range. Invalid entries will sound the beeper and return the original value. Invalid key press operations will beep and briefly display an error message.

The fastest way to program a simple schedule is to use the Instant Program feature in the Special Menu. See the Instant Program description in the Advanced Programming section - Special Menus. **DO NOT USE INSTANT PROGRAMMING IF YOU HAVE NON-VALVE STATIONS OR SIMULTANEOUS GROUPS SET.**

When the VAC is shipped from the factory, real time is set to current Central Standard Time, Maximum Stations is set to correspond with the model ordered, and all other programming data is set to default values.

If you are going to operate Non-valve stations, multiple valve groups, use sensors, run a special schedule, or communicate with a central computer you must first set up the VAC by entering appropriate information through the Menu key. See the Advanced Programming section, Special Menus.

If the VAC memory is ever scrambled because of power line noise or a dead battery, it will be necessary to reset the Start Up Menu values, especially Maximum Stations, before reentering programming information. See the Advanced Programming section - Start Up Menu.

Programming a Simple Irrigation Schedule

STEP 1: Set Time and Date

Press the AM/PM key to display the current date and time. If the time and date are correct, press the ESCAPE key.

To set a new time and date, enter the appropriate values at the cursor position with the number keys. Press the ENTER key to enter the new value or to move the cursor to the next position. When the cursor is on the AM or PM, press the AM/PM key to change the value. Press ENTER to set the clock and return to status screens. The clock is set only if ENTER is pressed while cursor is under AM or PM.

STEP 2: Set Groups, Start Time and Station List

Press the GROUP key; GROUP #01 should be displayed with a start time of 12:00 AM. The group type VALVES, SEQUENTIAL is also displayed. You may enter a different group number if desired - 10 groups are available. Press the ENTER key to move the cursor position to the start time. Enter the start hour, press ENTER. Enter minutes if desired, press ENTER. Press the AM/PM key to change AM to PM if desired, press ENTER.

The screen now displays GROUP #01 with the start time you entered and an "empty" list of stations - 00, 00, 00, 00, 00, - with the cursor positioned on the first 00. Enter a station number and press ENTER. The cursor will move to the next station to be set. Continue entering station numbers for all valves connected or until the end of the list is reached. When done press ENTER. NOTE: if the VAC will not allow you to enter stations in the list. You may need to reset the Maximum Stations for the VAC. See the Advanced Programming section, MENU - Start Up Menu, Maximum Stations.

The end of the list is shown as 00, but you will be unable to enter a station number. Each group can contain no more than the maximum stations the VAC is set for (see the Advanced Programming Section for setting Maximum Stations) and this number is preset at the factory. If you have a 12 station VAC then you cannot enter more than 12 stations in each group.

Stations may be entered in any order, but a station cannot be entered twice in the same group. You can change a station number before pressing ENTER. Caution! Pressing ENTER on 00 will end the list. Use YES/INSERT to add a station in an existing list, use NO/DELETE to remove a station. Enter station 99 anywhere in the list you wish to have a pause time between valves.

You may repeat a list of valves (some or all) by setting a start time for GROUP #02 or any other group and entering a list as above. When all groups are set, press ESCAPE.

STEP 3: Set Schedule:

Press the SCHEDULE key. GROUP #01 SCHEDULE/NOT SCHEDULED TO RUN is displayed. Press the ENTER key. CHANGE SCHEDULE Y/N? is displayed. Press YES/INSERT. GROUP #01 SCHEDULE/ DON'T RUN GROUP Y/N? is displayed. Press the NO/DELETE key. GROUP #01/RUN SELECT DAYS? is displayed. Press the YE/INSERT key. GROUP #01 SCHEDULE/su mo tu we th fr sa is displayed. Press the DAY keys to turn on the days you wish to run. A day that is set to run will be in upper case - su MO tu WE th FR sa. Press ENTER. Repeat as required for GROUP #02 and any other groups that you have set. Press ESCAPE when done.

See the Advanced Programming Section for other scheduling options.

STEP 4: Set Valve Run Times

Press RUN TIMES key. STATION #01 RUN TIMES/HRS:MNS = 00:00 is displayed. The cursor is positioned on the station number. You may change the number or press ENTER to accept the current number. Pressing ENTER will position the cursor on HRS 00. Enter hours of run time if required, or press ENTER to accept 00. Pressing ENTER positions the cursor on MINS:00. Enter run time minutes and press ENTER. A maximum of 18:00 hours of run can be entered for each station. Enter stations run times for other groups if you wish. Press ESCAPE when done.

To enter a Pause time for a group, enter 99 for the station number. Press ENTER. Enter the group number you wish to have the Pause in. Press ENTER. Set the Pause time as you would for any other station. Press ENTER. Add a Pause time for other groups as desired. Press ESCAPE when done.

See the Advanced Programming section for more information on Pause times.

STEP 5: Run Auto

Press RUN AUTO key to set the clock for automatic operation of the schedule you have entered. The VAC will prompt you to confirm the Run-Auto command by pressing the YES key.

Advanced Programming

The VAC has many features that can help you manage difficult irrigation situations and conserve water. Using the Water Miser, Soak Cycles, and Rain Days features allows for quick scheduling adjustments for weather and seasonal changes without reprogramming the entire schedule. Scheduling options allow a wide range of choices for operation.

If the VAC is connected to wind, rain, moisture, or other sensors, many irrigation adjustments are made automatically. Flow meters can help you keep track of water use and prevent costly leaks and damage due to line breaks and missing heads.

If you are communicating to VAC's from a personal computer with Valcon's Wetware, you have all the programming capabilities for all your controllers at your fingertips in one location.

Water Miser

Press the 1% 300% key. Enter the desired group number (valve type groups only) and press ENTER. The cursor will move to the MAX 000% position. Enter the value you desire and press ENTER. Repeat for all groups you need to set. Press ESCAPE when done.

The MAX value is the highest Water Miser value the VAC will use. The ACTUAL value is the current value the VAC calculates and uses if moisture sensors are connected and Auto-Miser adjustment is enabled. If Auto-Miser adjustment is disabled the MAX value and ACTUAL values will always be the same.

Rain Days

Press the RAIN DAYS key. At the RAIN DAYS OFF enter the number of rain days (0 to 90) and press ENTER. At the BEGINS IN: 0 DAYS prompt you may then enter 0 to 7 days to delay the rain function. Enter 0 if you wish to start Rain Days off on the current day, and press ENTER. Non-valve groups and stations continue to operate when Rain Days off are set. Set Rain Days to 0 to cancel the function. When Rain Days are allowed to count down to 0, the VAC will resume automatic operation. Each "day" begins and ends at 12:00 a.m.

Soak Cycle

Press the SOAK CYCLE key. Enter the group number (valve-sequential groups only) and press ENTER. Enter the number of soak cycles (1 to 10) and press ENTER.

The run time of all the stations in the affected group will be divided by the number of cycles after adjusting for the group's Water Miser value. When the group runs, each station operates for its divided time, and then runs through another cycle (as many cycles as are set). A Pause Station (99) at the end of such a station list will create a pause between cycles. Pause Station run times are not divided by Soak Cycles.

Manual

Press the Manual key. Enter the number of the station you wish to operate and press ENTER. Enter the run time in minutes (up to 120 minutes) and press ENTER. Only one station will operate while in manual and when it finishes running the VAC resumes automatic operation. Press MANUAL again to run another station.

You may cancel a manual operation by pressing the RUN AUTO key at any time. This key is also used to cancel Syringe, Semi-auto, Standby and Default modes.

Reviewing and Editing your Schedule

To review your schedule, simply choose the STEP that you wish to look at, press the key and ENTER through the data that is displayed. You may make changes at any point and ENTER them, or ESCAPE back to automatic operation. The VAC will remember where you left the operation and return to that point when you press the function key again.

To get back to the beginning of most functions just keep pressing ENTER until the data you require is displayed.

Special Features:



Press the MENU key. The last menu item you accessed will be displayed. To step through the list of Menu selections, press NO/DELETE at each Y/N? prompt until the menu item you want is on display and then press YES/INSERT. The selections and their uses are described in detail below.

Special Menu	- the main menu
Clear Program	- clears all schedules that have been programmed
Standby Mode	- suspends valve groups until Run Auto command is set
Syringe	- runs test operations for a valve, a group or all stations
Semi-Auto	- starts a scheduled group immediately
Clear Faults	- clears the existing faults which may be in memory
Special Events	- suspend operation for an station or group in the future
Instant Program	- sets Group 1, all stations, 10 min. per station, 9:00 p.m.
System Menu	- system sub-menu
Flow Meter Menu	- flow meter sub-menu
Total Gallons	- sets accumulated total gallons

Flow Meter Mode	- sets flow meter mode to standby, detect, or report
Flow Tolerance	- error tolerance for a range of 5% to 50% of expected
Line Fill Time	- inhibits flow faults during charging of irrigation main lines
Pulse Factor	- calibrates controller to a flow sensors output
Wind Sensor	- enables wind sensor
Rain Sensor	- enables rain sensor
Moisture Sensor	- enables moisture sensor
Secret Code	- sets secret access code
Miser Auto Adjust	- enables miser auto adjust
Serial Menu	- communications sub-menu
Baud Rate	- sets baud rate
Serial Addresses	- sets VAC, host address, and company addresses
Serial Medium	- sets type of communications device used
Enable/Disable	- enables communication
Start Up Menu	- start up sub-menu
Daylight Savings	- enables automatic Daylight Savings Time
Maximum Stations	- sets maximum stations controlled
Station Types	- sets station types as either valve or non-valve
Special Groups	- sets group types and modes
Clear Memory	- clears memory including communications and flow

Special Menus

Press the MENU key to view the SPECIAL MENU. Press the NO/DELETE key to skip over menu items until you see the one you want to use. Press the YES/INSERT key to use the feature displayed.

Standby Mode

Press YES/INSERT to put VAC in Standby mode. Standby mode prevents operation of valve groups only until you return the VAC to RUN. To cancel Standby, press the RUN AUTO key.

Syringe

To syringe a group (Valve groups only) press YES/INSERT when RUN A GROUP? is displayed. Enter the group number, press ENTER and then enter a syringe time and press ENTER. To syringe one or more (or all) valves press YES/INSERT when RUN STATIONS? is displayed and then press ENTER.

To syringe all stations, press YES/INSERT when SYRINGE ALL? is displayed. To pick and choose valves press NO/DELETE. Enter the station numbers you wish to syringe and then press ENTER. Enter the syringe time (up to 30 minutes) and press ENTER. Stations always syringe one at a time in the sequence they are found in the syringe list regardless of how they may have been entered in a group. Press RUN AUTO to cancel an on-going Syringe operation.

Hint: Choosing SYRINGE ALL fills Syringe station list with all the valve station numbers. You can then go back and edit the list by deleting the numbers of valves you don't wish to run.

Semi-Auto

SEMI-AUTO is similar to Syringe, except that the stations will run for their programmed run times and are corrected for the Water Miser adjustments and Soak Cycles. Stations run in the SEMI-AUTO list will not be corrected.

To operate a group (Valve groups only) press YES/INSERT when RUN A GROUP? is displayed. Enter the group number and press ENTER. To operate one or more (or all) valves press YES/INSERT when RUN STATIONS? is displayed and then press ENTER.

To run all stations, press YES/INSERT when RUN ALL? is displayed. To pick and choose valves press NO/DELETE. Enter the station numbers you wish to run and then press ENTER. Stations will run as they are entered in a group, or as they are entered in the SEMI-AUTO list.

Press RUN AUTO to cancel an on-going SEMI-AUTO operation

Hint: choosing RUN ALL fills SEMI-AUTO station list with all the valve station numbers. You can then go back and edit the list by deleting the numbers of valves you don't wish to run.

Clear Faults

Press YES/INSERT to clear all fault data from memory.

Special Events

This feature allows you to schedule a shut down of one or more stations or groups in advance of the event. This is useful if a zone or controller needs to be turned off for maintenance or other reasons, and irrigation personnel won't be around to operate the VAC (on a weekend, for instance).

Enter the event number you wish to enter or edit. Enter the time and date to start the event. Then enter the number of run hours and minutes (up to 24 hours). If the event affects a group, enter the group number. If you wish to pick and choose stations you may enter a list of stations. Station types may be mixed in the list. If an event is active (it will be or is currently in progress) the VAC will prompt you to clear it after you enter the event number. Answer YES to clear the event or NO if you just want to review the event.

Only one Special Event may be active at any given time. If an additional Event is scheduled to start before a current event has expired, the new event will supersede it.

Instant Program

Caution! If you use Instant program all irrigation schedules you have entered will be erased and the Instant Program will remain in memory. Instant program sets all station run times to 10 minutes and fills GROUP #01 with a list of all valves to operate sequentially at 9:00 PM every day. DO NOT USE Instant Program if you have Non-valve stations or Simultaneous groups set.

If you use Instant Program, you can go back to edit GROUP #01 start time, and then edit the days to by pressing the SCHEDULE key. Station and run times may also be edited. See the Programming a Simple Irrigation Schedule section, and Reviewing and Editing your Program section.

When SPECIAL MENU/INSTANT PROGRAM Y/N? is displayed press the YES/INSERT key. WARNING PROGRAM WILL BE REPLACED! is displayed for about 3 seconds, and then PROCEED WITH INSTANT PROGRAM Y/N? is displayed. Press YES/INSERT to run the Instant Program.

System Menu

This sub-menu contains all the VAC's advanced features and the menus below. These are less frequently used, or are usually used only once to set up the controller.

Flow Meter Menu

All features related to the flow meter system are available under this menu. Flow monitoring requires VAC option PSMV-F and either a two or three wire flow sensing detector with pulsed output. Flow sensors may be wired directly to the PSMV-F circuit board.

Total Gallons

Answer YES to set or review the current accumulated flow meter reading. You may adjust the number shown (maximum 999999).

Flow Meter Mode

Answer YES to the Y/N? prompt of the flow meter operating mode you wish to set. The three modes are Standby, Detect and Report. Answering NO skips to the next choice.

Standby mode allows only accumulated total flow to be recorded in the VAC.

Detect mode allows the VAC to calculate and record the flow rate for each valve as it operates under Syringe. The Syringe time must be set to accommodate Line Fill Time (see below) plus two minutes of measurement time. If Line Fill Time is set to 1 minute, syringe time must be 3 minutes, minimum. The longer the measurement time, the more accurate the flow rate recorded.

For best results, set Line Fill Time and Detect mode before starting syringe operation. Flow rate calculation and recording only works while Syringing.

Report mode monitors the flow rate while any valve is operating, compares the rate with the Detected rate for the valve, and issues a fault report if the valve exceeds the expected flow by the positive or negative Flow Tolerance.

When valves are operating sequentially (one at a time), a high or low fault is reported for any valve that exceeds the tolerance, and the valve is shut down. If two valves in sequence fault, a master valve fault is recorded and the entire controller is shut down. Faulted valves will not run again until the problem is corrected and the faults are cleared.

If multiple valves are running (Simultaneous operation) and the flow rate exceeds the tolerance, a fault is reported for all the valves that were running. The VAC will not run again until all faulted valves have been corrected and cleared.

Faulted valves will operate under Manual mode only. Faults are not recorded unless the VAC Flow Meter Mode is set to Report mode. Flow rates are calculated once per minute after line fill time.

Flow Tolerance

Enter the tolerance percent you require. The default value is 20%. Flow Tolerance is used in determining high and low flow faults. For instance, a flow that is 20% or more over the Detected flow is a high fault, and a flow that is 20% or more under the Detected flow is a low fault.

Line Fill Time

Enter the line fill time (1 to 300 seconds). This is required to allow the lines time to fill and stabilize operating pressure. Field experience is required to accurately set this value. Note that every time a valve is turned on, the line fill time is started over. If valve durations are short and line fill time relatively long it is possible that flow rate detection will never occur. Set the minimum workable time for line-fill.

Pulse Factor

Answer YES to either gallons/pulse or pulse/gallon. Then enter the number of pulses or gallons rounded to the nearest whole number (1 minimum to 99 maximum). The manufacturer of the flow valve will usually provide this number or a way to calculate it.

Wind Sensor

Wind sensor operation requires the VSIM option to detect and record wind faults. You may select which Valve groups, if any, are affected by the wind sensor. The GLOBAL ENABLE Y/N? prompt

must be answered YES for the sensor to work with the VAC. Then, the sensor must be enabled for each group individually.

If enabled, the wind sensor always works in RUN AUTO. In Semi-Auto or Syringe it works only if groups are chosen. A fault will be reported for any station that is operating at the time it is tripped. Once tripped, automatic operation will not resume for one hour past the time high wind is detected. If the sensor is disabled (group disable) the group will operate again immediately. This might be helpful when doing maintenance in windy conditions.

Rain Sensor

Rain sensor operation requires the VSIM option to detect and record rain faults. If the rain sensor is connected to the VAC through the sensor interface, it must be enabled before it can record faults. A rain sensor which is not connected to the VSIM interface will not record faults and may generate low flow faults if it breaks the irrigation common. In this case the rain sensor option should not be enabled.

When rain is detected all valve stations will be canceled and a fault for each recorded. When the sensor no longer detects rain, the VAC is allowed to resume automatic irrigation. The rain sensor prevents operation of group runs in Syringe or Semi-Auto. Valves may always be run in Manual.

Moisture Sensor

Moisture sensor operation requires the VSIM option. When one or more moisture sensors are connected to the VAC via the sensor interface, the VAC must be globally enabled for moisture sensing. Each moisture sensor must be assigned to a group (enabled for the group). Up to ten sensors may be connected and enabled - one for each group.

Valves are allowed to run when the sensor detects dry conditions. If the sensor detects excess moisture and if the Auto Water Miser adjustment is enabled, the group Water Miser value will be adjusted down 5% each time the sensor detects excess moisture. The group Water Miser value is automatically adjusted up 5% (up to the set maximum), only when there is a normal automatically scheduled run of the group.

A normally scheduled run must have no other faults including power failures. The VAC must remain in Run Auto, and program changes must not be made before the group is scheduled to run again.

Secret Code

The code you enter will deny access to certain programming features of the VAC, unless the code is entered first. A user who does not know the code will only be able to operate the VAC in Manual, Syringe, or Semi-Auto but will not be able to make any programming changes. When entered, the code does not display on the screen.

Once a code has been set, and you try to change a protected item and press ENTER, you will be prompted for the code. You have three tries to enter it correctly. Once entered, the code is good for 15 minutes. If time runs out, you will be prompted to enter the code again.

To change or disable the secret code you must know the old one. Setting the code to zero disables the feature. There are two different prompts - SECRET CODE: _____ to enter the current code, and NEW CODE: _____ to enter a new code. Enter up to 6 digits.

Miser Auto Adjust

Answer YES to enable automatic Water Miser adjustment when a moisture sensor trips. Moisture sensors must be enabled as well. See Moisture Sensor and Water Miser sections above.

Serial Menu

This sub-menu provides menus and features related to the serial communications port.

Baud Rate

Answer YES to the prompt that displays the desired baud rate. All radio communications currently supported must operate at 1200 baud or less.

Serial Address

Each VAC must have a unique address (ID number), and each host (central system computer) must also have a unique address. This allows for multiple hosts (a second computer at a different location for a weekend duty person for example) and also prevents two nearby systems on the same trunking radio system from accessing the wrong VACs.

Serial Medium

Answer YES to the prompt that displays the type of communications equipment you are using.

Radio Modem

Radio modem is used for Simplex Radio, Fiber-optic, and local RS-232 systems.

Trunked Radio

Trunked Radio is used for Trunking Radio systems.

Phone Modem

Phone modem is used for Telephone Modem and local RS-232 systems.

RS-485

RS-485 is used for RS-485 systems using twisted pair communications.

Enable/Disable Comm.

This will enable or disable communications. The default is enabled.

Start Up Menu

This sub-menu provides access to menus and features usually only needed when the VAC is initially installed.

Daylight Savings

Enable or disable automatic Daylight Savings Time adjustment. The default is enabled. Adjustments are made on the first Sunday of April and last Sunday of October.

Maximum Stations

Maximum Stations is set at the factory, but if memory is lost because of a power line surge or failed battery it must be reset. No other programming should be done until this value is set first. Maximum stations may be changed if more stations are added to the VAC with option VOPM expansion boards.

Station Types

You may choose which stations are Valves and which are Non-valve. The default is all stations are set to Valve. Non-valve stations are used for operating lights, fountains, chemical feed pumps, filter backwash equipment, etc. Non-valve stations should be set up before any other programming is done. **DO NOT USE Instant Program** if you have Non-valve stations set.

Special Groups

If you wish to run Simultaneous (multiple) valves or Non-valve groups you must set them up here. Set Non-valve groups after setting Station Types. **DO NOT USE Instant Program** if you have set Special Groups.

Clear Memory

CAUTION! This will erase all programming including Real Time, Maximum Stations and the Access Code. The VAC will be left in Standby mode with Start Up defaults. If you clear memory, you will have to reprogram everything.

If you only wish to clear the Irrigation Schedule, use the "Clear Program" feature. Most program changes can be made easily by editing the existing program.

Programming Suggestions

- Chart the irrigation schedule on paper
- Avoid programming overlapping group start times and station run times. Be cautious when using the WATER MISER. Overlapping run times and operation outside the watering "window" can result if increases which are too large. Use an irrigation chart to calculate run times and schedules.
- Use the WATER MISER when possible to make seasonal adjustments to run times. Reprogramming individual stations may not be necessary.
- Use RAIN DAYS OFF to shut down the controller in wet weather. The VAC will automatically resume scheduled irrigation after the shut down.
- Remember that the day change is at 12:00 a.m. Programming a night schedule with multiple group start times may require programming on two successive days.
- Use groups to repeat stations, and Soak Cycles and Pause times to allow sufficient soak time without run-off on slopes and compacted soils.
- Use INSERT an DELETE to add or remove stations. Start times and run times may be altered without reprogramming the entire controller. Be cautious when adding stations, increasing run times, or altering start times. Such changes can create overlaps.
- See the Advanced Programming section for scheduling options and more information. VALCON Customer Service and Sales representatives are available to assist with your special programming requirements.

Troubleshooting the VAC

1.00 Controller Problems

1.01 If there is no display at all, AND the 120 VAC indicator lamp is not lit, check line supply voltage. Make certain that power is on. Check 120 VAC supply fuse on power supply cover. If VAC is connected to GFI outlet, check that GFI is not tripped.

1.02 If microprocessor has display and 120 VAC lamp is lit then low voltage breaker may be tripped. Push to reset. If you still have no output, check controller low voltage circuit, including field wire and valve solenoids.

1.03 If display shows Default Mode, memory has been lost or corrupted. VAC may also show Power Back on fault or Program Integrity fault. If Default Mode is running, VAC must be reprogrammed. If unit will not reprogram call Customer Service.

1.04 Output modules can be checked for 28 VAC output in SYRINGE or MANUAL mode.

1.05 If the above is OK but no valves operate, check that unit is in run mode and no are faults being displayed.

1.06 If unit is equipped with a Master Valve/Pump Start Module, make certain that the module is operating correctly and that the master valve or pump is also operating.

1.07 If all electronic and electrical checks are good but valves still won't operate, double check programming. Check displays and make sure that the real time and day of week are correctly set. Review the schedule and make certain that the days to operate, start times, and valve run times are entered correctly.

2.00 Valve Problems

2.01 If NO valves operate in RUN AUTO try operating them in MANUAL. If the valves operate manually, the transformer, circuit breaker, field wiring, and solenoids are OK. Review the schedule. If the VAC is equipped with a flow meter, check for Flow Faults. Check for other faults.

2.02 If NO valves operate manually, check valve common connection, field wiring, circuit breaker and 120 VAC supply.

2.03 If a particular valve is not working in RUN AUTO mode, perform a check in MANUAL. Do the other checks as in 2.01 and 2.02.

3.00 Flow Faults

3.01 There are two types of fault - High and Low. A High fault results from excessive flow conditions usually caused by a line break, broken or missing heads, or other leaks in the system. A Low fault results from low flow conditions usually caused by an obstruction, a failed valve, or non-operational pump.

3.02 When a fault is recorded for a station, that station cannot be operated automatically until the fault is cleared from the VAC. If two adjacent stations are faulted (two stations running one after the other) the system assumes a major problem has occurred and will not operate ANY valves until the faults are cleared. If faults are cleared without correcting the cause of the fault(s) the next irrigation cycle will again record faults.

3.03 If the system continually faults and no field problems are discovered, check the Flow Rates recorded in DETECT mode. Re-run DETECT if necessary. If changes have been made in the field (different or additional heads) then flow rates will be affected. Check the Flow Tolerance Factor. The factor may need to be increased. Extreme fluctuations in the delivery system can cause faults.

3.04 The cause of high flow faults will usually be easily spotted. Look for missing heads or evidence of leaks. Adding heads or replacements with higher flow will change the flow characteristics of the affected valve. Re-run DETECT if necessary.

3.05 Low faults can be caused by system problems such as a non-operating pump, a failed master valve, a failed remote control valve, or a line obstruction. Other causes may not be easily detected. A valve that is temporarily disconnected from the controller or mechanically throttled down or shut

off will produce a 0 flow reading and record a low fault. Temporarily capping sprinkler risers instead of replacing heads, or replacement heads with lower flow rates will alter the flow characteristics of the affected station. Re-run DETECT if necessary.

3.06 Read the section on Flow Meter Menu for more information on flow faults and how to set up the VAC to monitor flow.

4.00 Communication Problems

4.01 If the VAC is part of a central system using Valcon's Wetware, communication problems that are reported at the base station may be caused by problems at the field satellite. Read the troubleshooting section of the Wetware manual for a description of communication errors and probable causes.

4.02 If the VAC is suspected, run the checks under the Controller Problems Section 1.00 above. A VAC that is part of a central system will have a communications board installed, and must be enabled for the device.

4.03 Check that the communications device has power and that it is properly connected to the communications board. Check wires and cables for good connections and continuity. Use contact cleaner on connectors, make certain that wires are securely fastened in terminal blocks.

4.04 If the communications device is a phone modem, make certain that it is properly connected to the phone line and that the phone line is active. RF modems should be connected to an antenna - make sure connections are clean, tight and dry.

4.05 No field service should be performed on the VAC and communication devices without supervision or consultation with Valcon technical service.. If service is required, call 1-800-420-5466.

5.00 Other Faults

See description of faults and how to identify them on the status displays of the VAC. The fault identification number (FAULT #01, FAULT #02, etc.) refers to the order in which the faults were recorded - FAULT #01 is the first recorded, FAULT #02 is the second recorded and so on. It is possible to have multiple instances of the same fault - as when the power goes off several times before anyone checks the controller.

5.01 Power Back On - every time the power is turned off or lost, and then is turned back on, this fault will appear. It has no effect on operations and is displayed to alert the user that power was off. Clear the fault and review your schedule. If the VAC is running in DEFAULT mode, the program was lost when the power was off. This could be the result of a bad battery.

5.02 Rain Detected, High Wind Detected, and Excess Moisture Detected all report sensors that have tripped. The VAC resumes automatic operation after conditions detected return to normal, and you may clear these faults with out taking further action. If excess moisture occurs frequently, adjust the station run times or Water Miser.

5.03 Group Overlap and Station Overlap report situations where a group of valves is attempting to run at the same time as another group containing the same valves, or a valve is scheduled to run twice during the same time. Review your schedule, make corrections and Clear the fault. Note that adjusting the Water Miser upwards may create a Group Overlap.

5.04 Too Many Stations reports that you have more than 5 Valve stations and/or more than 10 Non-valve stations attempting to run at the same time. Correct your groups and Clear the fault.

5.05 Circuit Breaker reports that the circuit breaker has been tripped. This usually means a field wire or solenoid problem. See section 2.00 above. Correct the problem and Clear the fault.

5.06 Program Integrity reports that memory and program data have been corrupted. This can be the result of power line noise from lightning and other sources, or from losing power with a bad battery. Clear the fault and reprogram the controller. See the Start Up Menu on page 18.

5.07 Fault reports are always meaningful even if they have no immediate effect on automatic operation. Fault reports indicate three types of problems - valve, water line and field wiring problems, scheduling and programming problems and electrical problems. Faults DO NOT mean there is something wrong with the VAC. Faults do mean there are problems with electrical power, scheduling, and equipment being operated by the VAC. Check your system thoroughly, make corrections or repairs. Clear the faults and run the VAC again. Call VALCON Customer Service if problems persist.

CHECKING CONTINUITY

- 1) Put VAC in STANDBY. Do not check continuity while operating valves.
- 2) Set meter to R X 1 or low ohms scale.
- 3) Disconnect splices at waterproofed connection and put probes on wires of solenoid. Probe tips may be forced through wire insulation on solenoid side of splice. See Test Point A above.
- 4) A reading of 10 ohms indicates a good solenoid coil.
- 5) An extremely high reading indicates an open circuit. Replace the coil.
- 6) A reading of 5 ohms or less indicates a short circuit. If you have not disconnected the coil from the field wiring, do so and take another reading directly on the coil. If the reading indicates a good coil, then the problem is in the splice or field wiring.

CHECKING VOLTAGE

- 1) Use VAC MANUAL key to operate station to be checked.
- 2) Set meter to 200 AC volts scale.
- 3) Disconnect splice and put probe tips on wires at Test Point B. Probe tips may be forced through wire insulation
- 4) If the reading is 20 volts or less, then one or more of the following problems is indicated.
 - A) A severe voltage drop caused by too long a wire run with wire of insufficient size.
 - B) A voltage drop caused by degraded wire insulation, bad field splice, or corroded connection.
 - C) A reading of 0 volts indicates a broken or disconnected wire.

APPENDIX

Installation and Grounding

1) To mount cabinet see attached diagram. When possible mount the VAC at eye level in a protected area away from weather.

2) AC line is 120 VAC 60Hz. Supply should be fused or on a circuit breaker.

Black = Hot
White = Neutral
Green = Grounded to cabinet

This unit must be adequately grounded. Use an 5/8" o.d. 8' copper-clad ground rod.

3) Installing conduit fittings:

- A. Open cabinet, remove access plate (two captive thumbscrews).
- B. Carefully remove the screws attaching Power Cover Plate.
- C. Remove the Power Supply Cover plate.
- D. Install fittings; replace plate.
- E. CAUTION! Do not pinch any wires when reinstalling power cover plate.
- F. In case of difficulty, check the Troubleshooting section of this manual.

Electrical Specifications

Line Voltage - 120 VAC 60 Hz standard
240 VAC 50 Hz optional

High Voltage Circuit Protection

1.0 Amperes Slow Blow fuse, panel mounted, spare fuse included.

Primary surge protection - 3 MOV (5 MOV on 240 VAC).

Secondary surge arrestor (external mount) optional.

Low Voltage Circuit Protection

Push-to-reset breaker rated at 1.65-Ampere hold.

Primary surge protection - Relay switched output, MOV on each output, opto-isolation where required. All inputs DC isolated from AC.

Secondary surge arrestor module available for 24/28 VAC valve outputs. One module = 12 stations.

Output Transformer

Primary 120 / 240 VAC 50 / 60 Hz

Secondary 24 / 28 VAC 50 / 60 Hz

90 VA (3.3 A)

Power Supply Transformer

Primary 120 / 240 VAC 50 / 60 Hz

Secondary 16 VAC 50 / 60 Hz

48 VA (3 A)

DC Supply

+ 12 VDC @ 1.5 A

+ 5 VDC @ 1.5 A

Maximum ripple 100 mV peak to peak

Both transformers have isolation windings.

Wire Sizing Chart

	Length in feet	Station Wire	Common
One valve			
	to 1500	#14	#14
	1500 to 2000	#14	#12
	2000 to 3000	#12	#10
	3000 to 4000	#10	#10
	4000 to 5000	#10	# 8
Two valves			
	to 700	#14	#14
	700 to 1000	#14	#12
	1000 to 1500	#12	#10
	1500 to 2000	#10	#10
	2000 to 2500	#10	# 8
	2500 to 3000	# 8	# 8
Three valves			
	to 500	#14	#14
	500 to 1000	#12	#10
	1000 to 1500	#10	# 8
	1500 to 2000	# 8	# 8

Valve Output Color Code

WIRE COLOR	STATION	STATION	STATION	STATION
Black	1	13	25	37
Brown	2	14	26	38
Red	3	15	27	39
Orange	4	16	28	40
Yellow	5	17	29	41
Green	6	18	30	42
Blue	7	19	31	43
Violet	8	20	32	44
Gray	9	21	33	45
Blue/Black	10	22	34	46
White/Red	11	23	35	47
Orange/Black	12	24	36	48
White	Common			

Pump Start/Master Valve and Sensor Input Diagram



