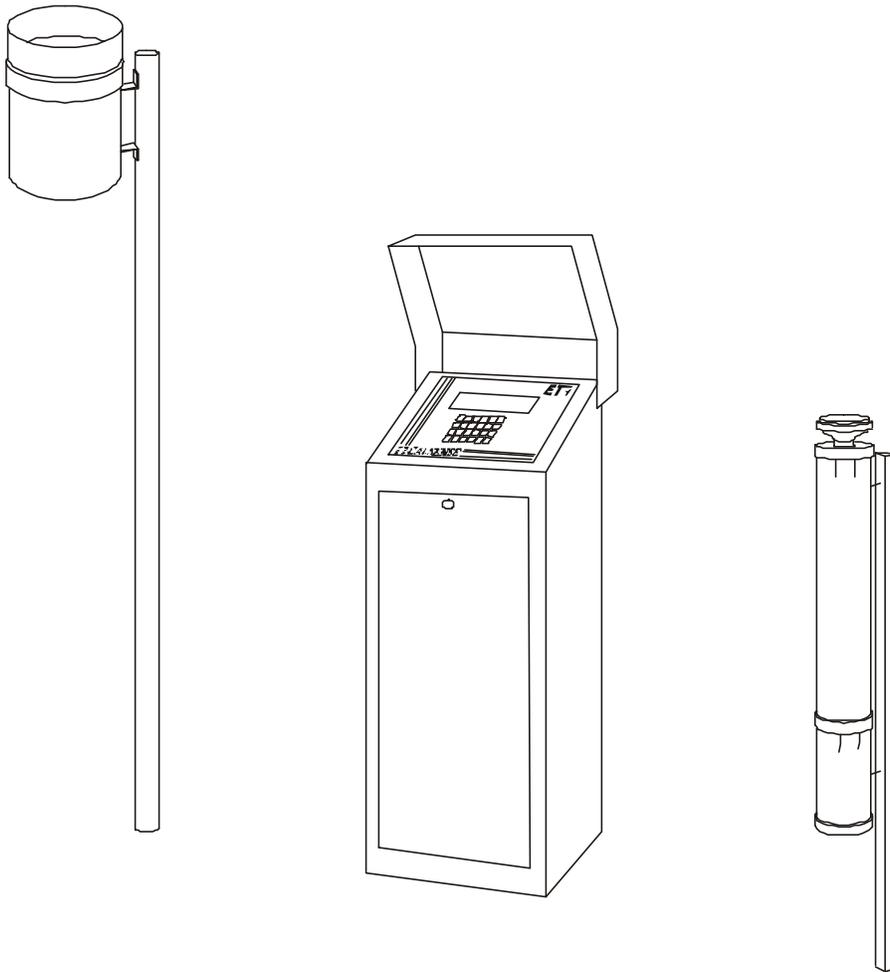




Real Time ET Based Water Management

A Guide to Programming the ET1 Irrigation Controller for use in Daily-ET Mode



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1. System Evaluation

One of the most important factors in water conservation is an efficient irrigation system. To maximize water savings, evaluate and upgrade the irrigation system to increase uniformity. This may be costly, but the payback is relatively short where water costs are high. If you do not have the expertise to perform a water audit, contact an irrigation consultant. Many irrigation consultants either do water audits or work closely with a water auditor.

2. Getting Essential Information

When using daily ET, the controller must know the precipitation rate (or application rate) for each station. This is the amount of water applied during irrigation and is measured in inches per hour. You can get this information in one of the following ways:

1. Perform an irrigation audit to measure the effective precipitation rates for each station. This method will give you the most accurate information.
2. Measure or calculate the flow rate for each station. Then measure the area covered for each station (in square feet). Enter this information into the controller and it will automatically calculate a precipitation rate for each station.
3. Use precipitation rates published by the equipment manufacturer for the type of irrigation heads being used.

If you are using the second method of determining precipitation rates, you must measure the area in square feet for each station. This can be done with a planimeter on an as-built drawing or with a measuring wheel in the field. Then you must determine the flow rate for each station. If a Calsense flow meter is installed this process is very simple, the controller will measure flow rates automatically for each station, and keep a record of this information for you to access when setting up daily-ET (*See Section 11 for other methods you can use to calculate flow rates if a Calsense flow meter is not installed*).

If you are using the third method you can obtain literature from the equipment manufacturer which contains precipitation rates for various heads. Most equipment manufacturers list precipitation rates for their irrigation heads in their product catalog. You will also need to determine the flow rates for each station.

3. Calsense ET-Gage

The Calsense ET Gage is a device which measures real-time Evapotranspiration (ET) in .01 inch increments. When an ET Gage is connected to a Calsense ET1 Irrigation Controller (or shared using the Calsense Command Center program), the controller(s) will use the information to automatically calculate station run-times whenever scheduled irrigation is set to occur. Since ET is determined by weather conditions, irrigation run-times change daily based on current weather conditions. This helps conserve water and creates healthier plant material.

Before enabling daily-ET be sure the ET Gage is properly installed and is functioning (for assistance call Calsense at 800-572-8608). If you do not have an ET Gage installed you can still enable daily-ET in the controller and run the program on historical ET. Historical ET is the 50 year average of monthly ET for a given area. The Calsense ET1 program stores this information for most areas throughout California. You also have the ability to create your own ET numbers. Historical ET is also used automatically as a backup for actual real-time ET in case a problem should ever occur with the ET Gage (*See Section 5 for more information about daily-ET*).

4. Calsense Tipping Rain Bucket

The Calsense Tipping Rain Bucket is a device which measures the amount and rate of rainfall in .01 inch increments. When a Rain Bucket is connected to a Calsense ET1 Irrigation Controller (or shared using the Calsense Command Center program), the controller(s) will use the information to offset daily-ET. Depending on the amount of rain, and the rate of rainfall, the controller will either have station run-times reduced or not irrigate at all.

Using rain to offset irrigation is an integral part of daily-ET, it can only be used when a controller is setup in the daily-ET mode. It is automatically enabled when daily-ET is enabled. If the daily-ET is enabled, and the controller does not have a rain bucket installed, then rain will have no effect on scheduled irrigation (*See Section 6 for more information about how rain effects daily-ET*).

5. ET Table

The ET table is where the controller stores daily ET values (measured in inches). The values in this table are what determine the amount of irrigation to be applied by each station. The values in the ET table can be generated from the following sources:

1. Automatically generated from an ET Gage wired to the controller.
2. Automatically shared from a another controller connected to an ET Gage using the Calsense Command Center program (controllers must have communication capabilities to share ET).
3. Historical ET which is automatically entered into the ET table when daily ET is enabled, and remains in the table until it is replaced by real-time ET from an ET Gage or manually edited by the user.
4. Manually edit the ET table.

ET Amounts from 10/29/01 Back						
Mon	Sun	Sat	Fri	Thu	Wed	Tue
h .16	g .18	g .20	g .19	g .19	g .18	g .17
g .18	g .17	g .20	g .19	g .17	g .17	g .16
g .14	g .13	g .11	g .15	g .17	e .21	e .21
e .23	h .16					

(push <review> to see RAIN table)

The ET table stores the last 28 days of ET values. In the example shown on the previous page, the ET table has a combination of historical ET, actual real-time ET and user edited ET. The letter next to each value indicates how it got into the ET table, h=historical, g=ET Gage and e=edited.

The upper left hand value is today's ET, it will remain a historical number until 8:00 PM each night, at which time the controller will place the total real-time ET from the ET Gage into that position (if an ET Gage is not attached and you are not sharing ET, the value will remain historical). The total real-time ET value is the amount of ET that has occurred since 8:00 PM the previous night. Scheduled irrigation occurring after 8:00 PM will use that value to calculate station run-times. At midnight all numbers will shift one place to the right, a historical number will be placed in today's position (upper left) and the number from 28 days ago (lower right) will be deleted.

If at the time scheduled irrigation is set to occur, there was no scheduled irrigation the previous night, the controller will combine the ET values for the last 2 days and calculate station run-times using the total of the two values (if it had been 3 days since the last scheduled irrigation it would combine the last 3 days of ET values and so on, for up to 28 days of total ET).

6. Rain Table

The rain table is where the controller stores rainfall values (measured in inches). The values in this table can only be generated from a rain bucket wired to the controller, or shared using the Calsense Command Center program from a rain bucket wired to a controller. In the example below the rain table has a combination of values. The letter next to the value indicates what the value represents:

o=original, this value is zero which means it has not been altered, it has no effect on daily-ET

m=below minimum, the below minimum value is measured rain but it is not used to offset daily-ET.

r=usable rain, this value is rain that is used to offset daily-ET.

0.00 Rain Amounts From 10/29/2001 Back						
Mon	Sun	Sat	Fri	Thu	Wed	Tue
o .00	o .00	m .06	o .00	r .23	r .18	o .00
o .00	o .00	o .00	o .00	o .00	o .00	o .00
o .00	o .00	o .00	o .00	o .00	o .00	o .00
o .00	o .00	o .00	o .00	o .00	o .00	o .00

(push <review> to see ET table)

The usable rain in the rain table can be thought of as negative ET, (or negative hold-over). When scheduled irrigation is set to occur, the controller will subtract the negative hold-over in the rain table from the ET in the ET table, and calculate a run-time with the reduced ET value. If the negative hold-over is greater than ET, no irrigation will occur, this will continue until all of the negative hold-over is subtracted from ET, then irrigation will begin again. The amount of time that irrigation is reduced or halted is determined by the rate and amount of rainfall. Usable rain is determined by the settings programmed at the Rain Bucket Setup screen (See Section 7 for more information about Rain Bucket settings).

To view the ET table and the rain table (this can only be done if the ET1 controller is in daily-ET mode), press the **STATUS** key, the ET table will appear. Press the **REVIEW** key to toggle between each table (See Section 10 for more information about the Status screen).

7. Setting Up The ET1 Controller For Use In Daily-ET Mode

When programming the ET1 Controller, there are four keys which are used repeatedly, the **CHANGE** key, **UP ARROW** key, **DOWN ARROW** key and the **ENTER** key. They are used in the following manner:

Press the **CHANGE** key to highlight an item to be changed. It is also used to move the highlighted cursor around the display to other items (if necessary). Press the **UP ARROW** or **DOWN ARROW** Keys to make a change to the highlighted item. Press **ENTER** after making changes to proceed to the next screen.

Start by accessing the ET1 Set-Up Program. To access Set-Up, a four key code must be entered as follows. Press the **IRRIGATE ON/OFF** key (this will not be necessary if the controller is already off). Press **STATION UP**, Press **STATION DOWN** then Press the **UP ARROW** key. The following pages describe each screen, and the settings necessary to set-up the ET1 controller in daily-ET mode.

Daily ET Section :
USE DAILY ET TO CALCULATE RUN-TIMES ? NO

After Entering Set-Up, Press the **ENTER** key repeatedly to proceed through each screen until the first DAILY ET screen appears (shown above). To enable daily-ET, Press the **UP ARROW** key to change the highlighted selection from NO to YES.

```

Daily ET Section :

USE DAILY ET TO CALCULATE RUN-TIMES ? YES

CONTROLLER WIRED TO AN ET-GAGE ? YES

```

If the controller has the -G option installed (an ET gage interface), you will be asked if an ET gage is wired to the controller, if this is the case, Press the **CHANGE** key to move the highlight, then Press the **UP ARROW** key to select YES. If you are going to share daily-ET information through a central computer (you must have the Calsense Command Center program to do this) or use the Historical ET data built into the controller, leave the selection at NO. If the controller does not have the -G option installed you will not be asked about the ET gage.

```

Daily ET cont'd

LOG EACH ET PULSE NO

```

Press **ENTER** to proceed to the next screen. Press the **UP ARROW** to change the selection. Here you have the option of keeping a record of each ET gage pulse sent to the controller. This information is located in the diagnostic log. This is helpful when first setting up the ET gage to make sure it is working properly, but can be set to NO after you are sure the ET gage is working properly. NOTE : You will only see the screen above if the controller has an ET gage interface installed, which would be designated as a -G controller, and you selected YES when asked if an ET gage is wired to the controller.

```

Daily ET cont'd : ET AVERAGING

PROG A : ON DRIP 1 : ON
PROG B : ON DRIP 2 : ON
PROG C : ON
PROG D : ON
PROG E : ON

(to smooth effects of skip days turn ON)

```

Press **ENTER** to proceed to the ET AVERAGING screen. Press the **UP ARROW** to select to use, or not to use, ET averaging on each program in the controller. With ET averaging ON the controller will not use each individual ET value in the ET table, instead it will use the average of the last 7 days of ET, in this way it will smooth out the long station run-times caused by turning water days off. As an example, many sites such as public parks do not irrigate on weekends, so the schedule is set with Saturday and Sunday water days off. If ET averaging is turned OFF, and scheduled irrigation is set to occur on Monday, the controller would combine the ET for Saturday, Sunday and Monday, then calculate station run-times using the total of 3 days of ET. In this situation, each Monday would have station run-times much longer than any other day of the week, which could cause over watering problems. With ET averaging ON, the extended run-times on Monday would be spread throughout the week, eliminating possible problems caused by over watering.

```

Daily ET cont'd : WATER WINDOW CONTROL

Set a limit on how much daily ET can be
used. This determines the length of
irrigation. The limit is relative to
historical ET.

MAX. ET-GAGE VALUE is 150% of HISTORICAL

```

Press **ENTER** to proceed to the WATER WINDOW CONTROL screen. Press the **UP ARROW** to increase or **DOWN ARROW** to decrease the setting. This setting controls the maximum allowable amount of ET that can be used to calculate station run-times. The default value is 150%, which means that if actual real-time ET, measured by the ET gage, exceeds 150% of historical ET, the controller will place an ET value in the ET table equal to 150% of historical ET instead of the actual real-time ET. This setting allows the user to control the maximum amount of total irrigation time for sites that have a limited water window. The water window is the time from when you can start irrigating to when you have to end irrigating.

```

DAILY ET cont'd : Plant water needs vary
monthly with growth activity.

DO YOU WANT TO USE
MONTHLY CROP COEFFICIENTS ?

NO

```

Press **ENTER** to proceed to the CROP COEFFICIENTS screen. Press the **UP ARROW** to change the selection. Crop coefficients are used to adjust ET for a specific type of crop at different periods throughout the year. If you do not want ET to be modified, leave the selection at NO. If you select YES, you will then be asked to enter crop coefficient values for each month of the year, on each program in the controller. If you are not familiar with crop coefficients, we suggest you leave the selection at NO.

```

Daily ET cont'd : RAIN BUCKET
Stop Irrigation after 0.10 inches
Maximum Hourly Rain is 0.20 inches
Maximum 24 Hour Total is 0.60 inches
Let Rain Only Build Up to 1.50 inches

```

Press **ENTER** to proceed to the RAIN BUCKET screen. Press the **UP ARROW** or **DOWN ARROW** to increase or decrease the setting. Press the **CHANGE** key to move the highlight to another setting. The 4 settings on this screen determine how much actual rainfall will be placed into the rain table, which is used to offset daily-ET in the ET table. The “Stop Irrigation after” setting determines how much rain must fall before the controller will start accumulating rainfall values in the rain table, and halt any ongoing irrigation. The “Maximum Hourly Rain” setting determines the maximum amount of rain that will be put into the rain table in a 1 hour period of rain. The amount of rain from this setting, that is put into the rain table, will increase only until it reaches the next setting, the “Maximum 24 Hour Total”. The “Maximum 24 Hour Total” setting determines the maximum amount of rain that will be put into the rain table in a 24 hour period of rain. The final setting, “Let Rain Only Build Up to” is the total maximum amount of rain that can ever be stored in the rain table.

The reason for these settings are to limit the values stored in the rain table. If limits were not put on rainfall, the values in the rain table could easily increase during an extended period of rain, or a short period of heavy rain, to cause irrigation to possibly be halted for many weeks. In most situations this would not be desirable. NOTE : The 4 settings on the RAIN BUCKET screen will be available only if the controller has a rain bucket interface installed, which would be designated as a -RB controller. If there is no rain bucket installed the only setting will be the “Let Rain Only Build Up to”.

```

Daily ET cont'd : RAIN CAUSES NEGATIVE
HOLD-OVER which subtracts from upcoming
irrigations. With a 'YES' enable this
feature for each program.
A YES      D YES      D1YES
B YES      E YES      D2YES
C YES

```

Press **ENTER** to proceed to the next screen. Press the **UP ARROW** to change the selection. Press the **CHANGE** key to move the highlight to another setting. Here you have the option of enabling or disabling the use of negative hold-over (rain) for each of the individual programs in the controller. If you select YES, negative hold-over will be used for that program to offset daily-ET, if you select NO, rain will have no effect on daily-ET for that program. If there is no rain bucket installed and you are not sharing rain data using the Calsense Command Center program, these settings will have no effect on daily-ET.

```

Daily ET cont'd :
ADVANCED PROGRAMMING !
Use the 12-month schedule to change the
water days and start times ? NO
Only answer YES if fully understood.

```

Press **ENTER** to proceed to the 12 MONTH SCHEDULE screen. Press the **UP ARROW** key to change the selection. Here you have the option of enabling or disabling the use of a 12-month schedule. If you select YES, it will be necessary to create the 12-month schedule after leaving the ET1 Set-Up mode. In 12-month schedule mode, program start times and water days, station minutes per cycle and soak-in times are pre-programmed for each month throughout the year (See Section 9 for instructions to program the 12-month schedule).

```

STATION 1                               Last GPM 0.0
Station Flow Rate : 1 GPM
Area Covered : 100 square feet
(calculated)
PRECIPITATION RATE : 0.96 inches / hour

```

Press **ENTER** to proceed to the STATION PRECIPITATION RATE screen. Press the **UP ARROW** or **DOWN ARROW** to increase or decrease the setting. Press the **CHANGE** key to move the highlight to another setting. This is where you enter each station’s flow rate (gpm) and area covered (square feet). As you enter this information, the precipitation rate for the station will be automatically calculated (shown at the bottom of the display). Start by entering the flow rate for the station, then enter the area covered. When entering the area covered, Pressing the **UP ARROW** will increase the setting in 100 foot increments, Pressing the **DOWN ARROW** will decrease the setting in 10 foot increments. After completing the setup of the first station, Press **ENTER** to proceed to the next station. Repeat the process described above until all stations have been set.

NOTE: If a Calsense flow meter is installed, the last measured flow rate for the station will be shown in the upper right corner of the display. The flow rate shown is for your information only, it is not a setting.

As explained in the beginning of this guide, historical ET is used as a back-up to daily-ET, or it can be used as the source data to drive the program. In either case, you would want to use the historical ET for the area you are located in. The ET1 controller stores historical ET information for 21 counties in California, and numerous cities within each of those counties. After setting the precipitation rate for all stations, the following screens will appear. Select the area that you are located in, or the area that most represents your location. You can also choose to enter your own ET numbers.

```

CIMIS ETo County Choice

Choose your County :  KERN
    
```

Press **ENTER**, the screen above will appear. Press the **UP ARROW** or **DOWN ARROW** key to select the desired county.

```

CIMIS ETo City Choice

Choose the CITY which BEST REPRESENTS
your area :  CHINA LAKE
    
```

Press **ENTER**, the screen above will appear. Press the **UP ARROW** or **DOWN ARROW** key to select the desired city.

```

ETo (inches/month) for your location :

  JAN   FEB   MAR   APR   MAY   JUN
  2.1   3.2   5.3   7.7   9.1  10.0

  JUL   AUG   SEP   OCT   NOV   DEC
  11.0  9.8   7.3   4.9   2.7   1.7
    
```

Press **ENTER**, the screen above will appear. This screen displays the monthly historical ET for the area you chose in the previous screens. It is only for your information.

```

IRRIGATION NEVER CONTINUES past  OFF .

      At this time any paused or on-going
      irrigation will be terminated and
      carried over to the next irrigation.
    
```

Press **ENTER** repeatedly until the screen above appears. Press the **UP ARROW** or **DOWN ARROW** key to set the desired time (setting a time here is optional).

This setting is the end of the water window (the beginning of the water window is the program's scheduled start time). Irrigation will never continue past the time set at this screen. If irrigation is in progress when this time is hit, it will halt, and all unfinished irrigation will be saved as "hold-over time" and will be used on the next scheduled irrigation cycle. If the setting is OFF, irrigation will continue until the program is finished. If the controller has hold-over time, you can view it or delete it (See Section 10 for information about viewing and deleting hold-over time). Press **ENTER** repeatedly until you exit the Set-Up mode.

8. Main Display in Daily-ET Mode

```

STN 01          Gage=.00   Left= 0%       PROG A

Estimated Mins : 10.0           Last Min :    0.0
Mins Per Cycle : 4              % of ET  : 100%
Soak-in Time  : 5
    
```

After you exit the Set-Up program the main display will appear as shown above (if you do not have an ET gage attached to the controller the "Gage=" and "Left=" at the top of the display will not appear). The following describes each part of the main display.

STN : Indicates the current station number. Press the **STATION UP** or **STATION DOWN** key to change to another station.

Gage=.00 : The amount of ET measured by the ET gage since 8:00 PM the previous night. This is for your information only, it lets the user know that the gage is working properly.

- Left= 0% :** This is the amount of water in the ET gage (measured as a percentage). Whenever the gage is refilled, this should be reset. Press the **%** key, then the **UP ARROW** key to reset the value (the maximum setting is 99%). Press the **ENTER** key after the value has been reset.
- PROG :** Indicates the program that the current station is assigned to. A station can be assigned to only one program. Press the **CHANGE** key until the program is highlighted. Press the **UP ARROW** key to select the desired program.
- Estimated Mins :** The Estimated Minutes is the amount of irrigation time calculated by the controller, it is the maximum amount of irrigation that will be applied in the current 24 hour period. This setting cannot be changed directly by the user. The time is calculated by the program based on the precipitation rate for the current station, the amount of ET in the ET table, crop coefficients (if used), and the % of ET (described below). If any of these values are changed the Estimated Minutes will change.
- Mins Per Cycle :** The Minutes Per Cycle is the maximum amount of irrigation time applied in a cycle. This setting should be the most water you would want the current station to apply at any one time, that is before water starts to “run-off”. If the setting is less than the Estimated Minutes (described above) there will be multiple cycle starts, until the total time applied equals the Estimated Minutes. If the setting is more than the Estimated Minutes the run-time will be equal to the Estimated Minutes (total run-time will never exceed the Estimated Minutes). Press the **CHANGE** key until the setting is highlighted, Press the **UP ARROW** or **DOWN ARROW** key to adjust the setting.
- Soak-in Time :** The Soak-in Time is the amount of time between multiple cycle starts (if there are multiple cycle starts). If there are no multiple cycle starts, this setting will be ignored by the program. Press the **CHANGE** key until the setting is highlighted, Press the **UP ARROW** or **DOWN ARROW** key to adjust the setting.
- Last Min :** This is the average applied time for the last five irrigation cycles. It is for your information only.
- % of ET :** This is the individual station adjustment to daily-ET. This adjustment is used to fine-tune each stations run-time. It is one of the factors used in calculating the Estimated Minutes (described above). Press the **CHANGE** key to highlight the % of ET, Press the **UP ARROW** or **DOWN ARROW** key to adjust the setting. As you make adjustments to this setting, you will see the Estimated Minutes change. Try to make small adjustments, 5% to 10% at a time, and allow a few days to pass before re-adjusting if necessary. Daily-ET only replaces the moisture that has evaporated since the last irrigation cycle, if for example you have a problem with a valve, and an area becomes stressed from lack of water, use the manual water feature to add water until the area is back to normal conditions.
- The % of ET setting is used to adjust for factors such as different types of plant material (e.g. turf would generally have a higher adjustment factor than shrubs), soil conditions (e.g. sandy soils might have a higher adjustment factor than clay type soils because they don’t hold moisture as long), terrain (e.g. the system at the top of a slope might have a higher adjustment factor than the system at the toe of a slope). If this adjustment ends up a large number from 100% (in either direction), you should re-evaluate your precipitation rate numbers for that station, which were entered in the Set-Up program (described earlier in this guide).

9. 12-Month Schedule

If 12-Month Schedule was enabled (while in the Set-Up program described earlier in this guide), it must be programmed after leaving set-up. When using the 12-Month Schedule, you will be able to pre-program for each month of the year, every stations Minutes Per Cycle and Soak-in Time settings, and each programs Start Time and Water Days. To program 12-Month Schedule starting from the main display, Press the **REVIEW** key, the display will appear as shown below.

STN 01	(January)	PROG A
Mins Per Cycle :	4	
Soak-in Time :	5	

The month being programmed is shown at the top of the display. Press the **CHANGE** key (a message will appear saying you are about to make changes to the Master Schedule (12-month schedule). Press the **CHANGE** key once more to highlight the “Mins Per Cycle”. Press the **UP ARROW** or **DOWN ARROW** key to change the setting. Press the **CHANGE** key to move the highlight to “Soak-in Time”, Press the **UP ARROW** or **DOWN ARROW** key to change the setting. Press the **STATION UP** or **STATION DOWN** key to change to another station, make desired changes as described above. After all station settings have been programmed, Press the **ENTER** key to save changes. Then press the **SCHEDULE** key, the Schedule screen will appear as shown below.

PROG A				START TIME is	OFF
week 1	SU	MO	TU	WE	TH FR SA
	--	--	--	--	-- --

The current program will be shown in the upper left corner, the lines beneath each day represent an off water day. Press the **CHANGE** key, the current day will be highlighted. Press the **UP ARROW** key to turn the day on, Press the **DOWN ARROW** key to

turn it off. Press the **CHANGE** key to move the highlight. After all water days and the start time has been set, Press the **ENTER** key to save the changes. If you have stations assigned other programs, Press the **SCHEDULE** key until the desired program is displayed in the upper left corner of the display, make desired changes as described previously. When all changes have been made and saved, Press the **ENTER** key again to return to the main display. Press the **REVIEW** key to go to the next month, make all changes to that month's program(s) as described previously, continue until each month of the year has been programmed. Press the **REVIEW** key to return to the currently running program.

Whenever you need to make changes to your 12-Month Schedule, Press the **REVIEW** key repeatedly until the desired month appears, make changes as described previously, then Press the **REVIEW** key repeatedly until the you return to the currently running program.

With the 12-Month Schedule running, on the 1st of every month your Minutes Per Cycle, Soak-in Times, Water Days and Start Times will change based upon the settings you programmed into the 12-Month Schedule. The 12-Month Schedule will continue to run until it is disabled in the Set-Up program described earlier in this guide.

10. Status Screen

From the Status screen in the ET1 controller you can:

1. View or edit the ET table (See Section 5 for more information).
2. View the rain table (See Section 6 for more information).
3. View the status of each station during an irrigation cycle or stop any station while in an irrigation cycle. The irrigation can be a normally scheduled cycle, a manual irrigation cycle, or a test cycle.
4. View the amount of each station's hold-over time, with the option of clearing a station's hold-over time. Negative hold-over time (hold-over time generated by a rain bucket) will be shown as a negative number.

Press the **STATUS** key, if there is any hold-over time or if an irrigation cycle is currently in progress, the display will appear as shown below. Select which screen you want to view by Pressing the **CHANGE** key to move the highlight, then Press the **ENTER** key (if there is no hold-over time, and/or no current irrigation is running, you will go directly to the ET/rain tables after Pressing the **STATUS** key).



If you select LOOK AT IRRIGATION/HOLD-OVER STATUS, the Status screen will appear (shown below).

STN	HOLD-OVER	IRRIG LEFT	STATUS
1	0.0	10.0	Waiting
2	0.0	3.5	Irrigating
3	8.2	0.0	
4	-15.3	0.0	
5	0.0	0.0	
6	0.0	0.0	
7	0.0	0.0	

In the example above all the types of information that can be viewed from the Status screen are shown. An explanation of each follows:

Station 1 has no hold-over time and and is waiting to irrigate, it's irrigation time will be 10.0 minutes.

Station 2 has no hold-over time and is currently irrigating, it has 3.5 minutes left on it's irrigation cycle.

Station 3 has 8.2 minutes of hold-over time, which will be added to the next scheduled irrigation cycle.

Station 4 has -15.3 minutes of negative hold-over time, which will be subtracted from the next scheduled irrigation cycle.

Stations 5, 6 and 7 have no hold-over time and are finished irrigating.

To clear a station's hold-over time or to stop a station's irrigation cycle, Press the **UP ARROW** or **DOWN ARROW** key repeatedly until the station is highlighted, then Press the **CLEAR** key. When you are finished viewing and/or clearing hold-over time and irrigation time Press the **ENTER** key to return to the main display.

11. How to Calculate Station Flow Rates

There are two methods to determine station flow rates if a Calsense flow meter is not installed on the system. The following describes each method.

Using Manufacturers Published Data:

With this method you use a manufacturers catalog which has the flow rates listed for the type heads, and nozzle sizes on the system you are calculating. Simply total the flow rates for all the nozzles on the station.

Example:

A station has 8 half-circle pop-ups with a flow rate of 2 gpm each, 3 full-circle pop-ups at 4 gpm each and 4 quarter-circle pop-ups at 1 gpm each. The station's flow rate would be calculated as follows.

$$\begin{aligned} 8 \text{ heads} \times 2 \text{ gpm} &= 16 \text{ gpm} \\ 3 \text{ heads} \times 4 \text{ gpm} &= 12 \text{ gpm} \\ 2 \text{ heads} \times 1 \text{ gpm} &= \underline{2 \text{ gpm}} \\ \text{Total flow} &= 30 \text{ gpm} \end{aligned}$$

Measuring Station Flow Rates:

The second method is a little more complicated, but the results are more accurate. You will use the irrigation system's water meter to calculate flow rates. Use the following procedure :

1. Determine the units used by the water meter (gallons, cubic feet, etc.). Make sure no other water will be flowing while you are measuring flow rates. Also, if there is more than one water meter connected to the mainline, all of them must be turned-off except the one you are using to measure flow with.
2. Before beginning, turn on each station to make sure there are no broken heads or pipe and no plugged heads. Breaks or plugged heads will cause incorrect flow readings.
3. Begin by turning on a station, let it run long enough to purge all the air out of the system. Then simultaneously, make note of the meter reading and start timing using a stopwatch. After 3 minutes has elapsed make note of the meter reading again. Subtract the starting meter reading from the ending meter reading, this will give you the amount of water used by the station in 3 minutes. Continue this procedure until all stations have been measured.
4. To calculate the flow rate, divide the amount of water the station used (measured in gallons) by 3 minutes, this will give you the station's flow rate measured in GPM's (gallons per minute).

Example #1 (if water meter units are in gallons) :

The starting meter reading is 312,121. After 3 minutes the ending meter reading is 312,378 gallons, the flow rate would be calculated as follows:

$$\begin{aligned} 312,378 \text{ gallons} - 312,121 \text{ gallons} &= 257 \text{ gallons} \\ 257 \text{ gallons} \div 3 \text{ minutes} &= 85.6 \text{ gpm} \\ \text{station flow rate} &= 85.6 \text{ gpm} \end{aligned}$$

Example #2 (if water meter units are in cubic feet or CF) :

The starting meter reading is 9,975 CF After 3 minutes the ending meter reading is 10,003 CF, the flow rate would be calculated as follows:

$$\begin{aligned} 10,003 \text{ CF} - 9,975 \text{ CF} &= 28 \text{ CF} \\ 28 \text{ CF} \times 7.48 \text{ gallons} &= 209.4 \text{ gallons} \quad (1 \text{ CF} = 7.48 \text{ gallons}) \\ 209.4 \text{ gallons} \div 3 \text{ minutes} &= 69.8 \text{ gpm} \\ \text{station flow rate} &= 69.8 \text{ gpm} \end{aligned}$$

Example #3 (if water meter units are in hundreds of cubic feet or CCF) :

The starting meter reading is 12,321 CCF After 3 minutes the ending meter reading is 12,321.25 CCF, the flow rate would be calculated as follows:

$$\begin{aligned} 12,321.25 \text{ CCF} - 12,321 \text{ CCF} &= .25 \text{ CCF} \\ .25 \text{ CCF} \times 748 \text{ gallons} &= 187 \text{ gallons} \quad (1 \text{ CCF} = 748 \text{ gallons}) \\ 187 \text{ gallons} \div 3 \text{ minutes} &= 62.3 \text{ gpm} \\ \text{station flow rate} &= 62.3 \text{ gpm} \end{aligned}$$

NOTE : In examples #2 and #3 above, there is one extra step in the calculation, this is to convert the cubic feet into gallons before dividing by 3 minutes.