

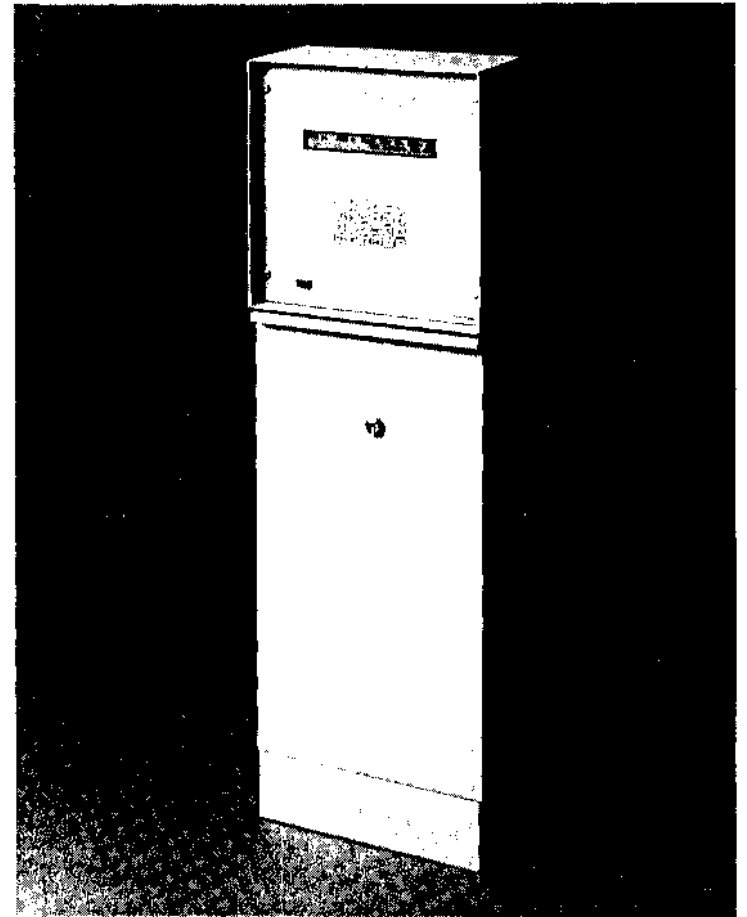
PROGRAM CHART

STATION	PROGRAM	SENSOR	MAX. TIME	SET POINT
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
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CALSENSE 2000

Moisture Control Computer

PROGRAMMING AND OPERATING INSTRUCTIONS



Models 2000-12 2000-24
 2000-16 2000-32

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SPECIAL FEATURES

Moisture Sensing
The CALSENSE 2000 uses a number of moisture sensors to monitor and control irrigation. The computer uses the recent irrigation history, current moisture level and user-specified set point to calculate the irrigation need.

No Extra Wiring
Sensors send messages over the same wires that operate the valves.

Battery Backup
The included lithium battery used for memory backup is designed to last ten years.

Water Off/Water On
Any station can be singled out for operation without sensor control or turned off completely for one to nine days. After that time, the station automatically will return to normal operation.

Automatic Skip to Next Station
The moisture sensors are used to calculate the actual irrigation need, allowing the computer to irrigate continuously. This reduces total irrigation time and provides smooth pump operation.

WARRANTY

The California Sensor Corporation warrants to the purchaser of its products against defects in material and workmanship for a period of one year from the date of original purchase by the owner. In addition, it warrants the sensors which it sells for a period of five years in accordance with the following prorated table:

First year	No charge
Second year	20% of purchase price
Third year	40% of purchase price
Fourth year	60% of purchase price
Fifth year	80% of purchase price

Please send products which appear defective directly to the factory. When sending sensors in for warranty replacement, include a check for the prorated charge with the product.

California Sensor Corporation's liability is limited solely to the replacement or repair of defective parts. There are no other express warranties.

This warranty does not apply where equipment is used, or installation performed, in any manner contrary to California Sensor Corporation's specifications and instructions, nor where equipment is altered, modified, misused or neglected.

California Sensor Corporation is not liable for indirect, incidental or consequential damages in connection with the use of equipment, including but not limited to, vegetation loss, property damage or personal injury from installer's negligence.

For service or repair, please call (619) 438-0525 Monday through Friday, between 8:00 and 5:00 P.M. Pacific Standard Time.



California Sensor Corporation
2075 Corte Del Nogal
Carlsbad, CA 92009
(619) 438-0525

Transferring History Log to Computer

The information stored in the history log of the CALSENSE 2000 can be transferred to an IBM-compatible computer. Use the cable provided with the optional CALCOMM program to connect the RS232 serial port of the computer to the nine-pin connector on the front of the CALSENSE 2000. Boot up the computer and load the CALCOMM program included with your system. When the menu appears, select the desired download feature and press ENTER. The CALCOMM program will download the data onto a file on the CALCOMM disk in the computer, titled "CALCOMM". PRN. Consult the CALCOMM instructions enclosed with the CALCOMM software for further information on the file format and methods of printing.

Program Overlap Protection

The computer will automatically delay start times to prevent overlapping irrigation.

Automatic Seasonal Adjustment

The computer can be programmed to change the maximum irrigation time for each station at the beginning of each month to compensate for seasonal changes in the evapotranspiration rate.

Automatic Power Short Protection

If the computer detects that a solenoid is drawing too much power, it will automatically skip that station and place a warning on the display.

Two Minute Walk-Through Test

In the test mode, the computer will operate each station for two minutes, taking a measurement of the moisture level in the soil and (optionally) the flow rate for each station.

Irrigation History Summary

The computer stores information on the 30 most recent irrigation days, displaying any one day at a time.

Finish Times Display

The computer will calculate and display the latest possible time of day that the irrigation will be completed. It also will estimate when the irrigation actually will be completed, when using the moisture sensing feature.

OPTIONAL FEATURES

Flow Rate Monitoring

The CALSENSE Flow Meter enables the computer to monitor the flow rate for each station. When the meter indicates that broken heads or irrigation lines at a station have caused the flow rate to exceed a user-set tolerance, the computer will bypass that station. When the meter indicates that a condition such as a stuck valve has caused the flow rate to drop to zero, the computer will skip immediately to the next station.

Memory Printout

The CALSENSE Data Retrieval Package enables the user to print a full history of the computer's operation over the last 30 irrigation events.

Remote Control Interface Cable
A radio remote cable permits manual operation via most standard radio remotes.

Pedestal Mount
An attractive, weather-resistant pedestal provides easy installation.

DESCRIPTION

The CALSENSE 2000 Moisture Control Computer is a complete irrigation control system. It combines a computerized controller, moisture sensors, and flow monitor in one easy-to-use system. Sensors supervising one or more stations measure the moisture level just before each irrigation sequence to determine the percentage of programmed time necessary to maintain the moisture level set by the user. The monitor measures the flow at the start of each sequence to protect against mainline or riser breaks. The computer records and displays the irrigation activities of the preceding 30 watering days.

SAFEGUARDS

If a sensor is damaged or the connecting wire is cut, the computer will water for the maximum time programmed and display two asterisks — “**”—in place of the sensor reading. Until the problem is corrected, the computer will water the master and slave stations associated with the sensor for the maximum time.

To avoid drops in water pressure leading to incomplete coverage, a second irrigation program cannot begin until the first has finished.

A preset program causes each station to water five minutes twice a day until the system is programmed.

If the computer tries to turn on a shorted solenoid valve, a flashing “SHORTED” will be displayed on the screen and the computer will move on to the next station. The display will remain until the computer makes another attempt after the short is removed, or until **CLEAR** is pressed while the station with the shorted valve is displayed.



Step 3 Press **NO** and **OFF** to view data from any or all of



Step 4 Press **CLEAR** to end the display of historical information.

the days.

History Log Display:

```

STN DATE TIME REFD SET CYC MAX RFP DUR
01 01/02 12:20PM ** 99 01 005 005
  
```

STATION NUMBER IRRIGATION DATE OF MOISTURE READING AT START TIMES FOR THE ACTUAL NUMBER OF MINUTES THE MOISTURE SENSING ALLOWED WATERING TO OCCUR

DATE OF IRRIGATION MOISTURE READING AT START TIMES FOR THE ACTUAL NUMBER OF MINUTES THE MOISTURE SENSING ALLOWED WATERING TO OCCUR

STATION NUMBER IRRIGATION DATE OF MOISTURE READING AT START TIMES FOR THE ACTUAL NUMBER OF MINUTES THE MOISTURE SENSING ALLOWED WATERING TO OCCUR

TIME IRRIGATION STARTED AT THE TIME MOISTURE SET POINT

STARTED IRRIGATION AT THE TIME MOISTURE SET POINT

MAXIMUM NUMBER OF WATERING MINUTES PER START TIME

STATION WAS PROGRAMMED TO WATER THE MAX TIME ON THIS DAY

M INDICATES THAT THE STATION WAS PROGRAMMED NOT TO WATER ON THIS DAY

N INDICATES THE STATION WAS PROGRAMMED NOT TO WATER ON THIS DAY

History Log for Station Zero

The history log reached by pushing **STATION DOWN** when in Station One History

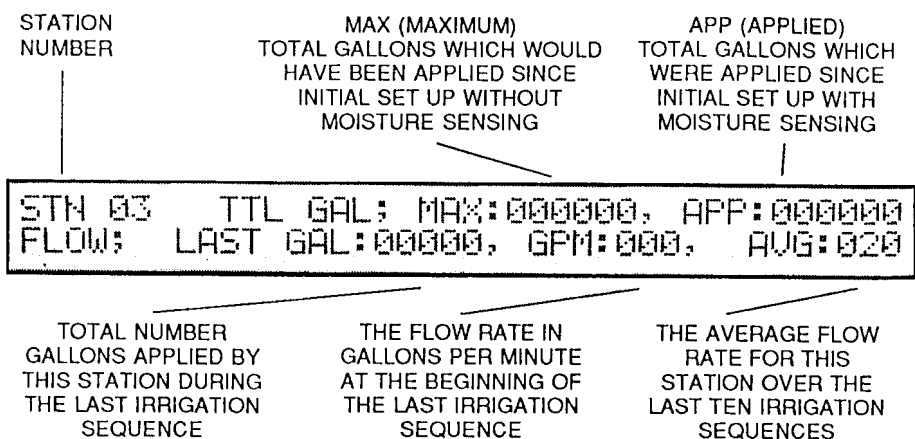
Log is called “Station Zero.” This file contains the information listed below, starting with the most recent event. Each of the following is preceded by the date. Press **OFF** to reach the other events.



POWER FAIL
POWER FAIL RECOVERY
COMPUTER OFF
COMPUTER ON

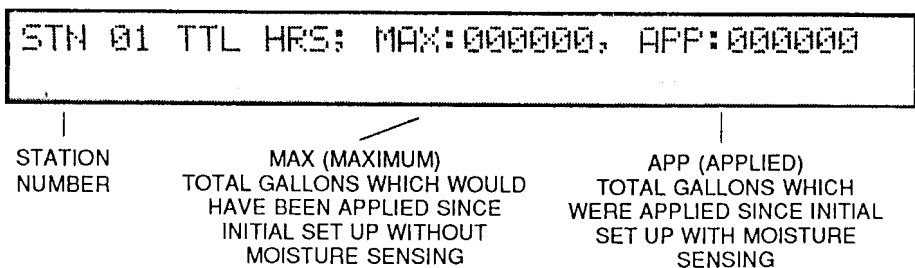
OVERFLOW ON STATION NUMBER
UNDERFLOW ON STATION NUMBER
SHORTED ON STATION NUMBER

History Summary Display With Flow Sensor:






If you do not have a flow sensor, the summary will provide a running total of the amount of time the station has operated and how much time it would have operated without the moisture sensing.

History Summary Display Without Flow Sensor:



History Log

The CALSENSE 2000 retains and displays the operating information for the preceding 30 irrigation events. Follow these four steps to view the data.

- Step 1 Press  or  to reach the desired station.
- Step 2 Press .

GLOSSARY

Irrigation Sequence

Typically, a series of evening irrigations, the term refers to the total irrigation activity within a 24-hour period. First start time refers to the first time a station begins irrigation and is in the upper left position on the start time display.

Master Stations

Master stations, which are representative of stations within an area, are given sensors.

Slave Stations

Slave stations are stations without sensors that are assigned to a master station in an area that shares a similar water requirement. The watering time of the slave station will be the same percentage of its maximum time as the master to which it is assigned. A slave's maximum time can be greater than, less than or equal to its master's, thereby allowing the slave's watering time to be more, less or the same as the master.

Maximum Time

The maximum amount of time the operator wants the station to water, in accordance with the environment, vegetation and season. Each day, when the irrigation cycle begins, the computer determines what percentage (from 0 to 100%) of the maximum time is necessary to maintain the moisture level the user desires.

Program

Each master station is assigned to program A or B. The program determines the water days, beginning time, and number of start times for each station. A program will finish its sequence of start times, even if the time runs over to a no-water day. However, one program will not begin until the other is finished. In a typical installation, turf might be assigned to Program A, and shrubs to Program B.

Set Point

The user establishes the moisture level set point for each master station in accordance with the moisture level desired at that location. At the start of each irrigation sequence, the CALSENSE 2000 will adjust the watering time upward or downward, based on the comparison between the individual set point, existing moisture level and the recent irrigation history.

FRONT PANEL

STN 14 PROG A MOIST SET: 99, REED: **
 MAX 2x05min, AVG 99%

STATION NUMBER
 PROGRAM (A OR B) WHICH CONTROLS THIS STATION'S START TIMES AND WATER DAYS
 MOISTURE LEVEL SET POINT
 MOISTURE READING AT THE BEGINNING OF THE LAST IRRIGATION SEQUENCE

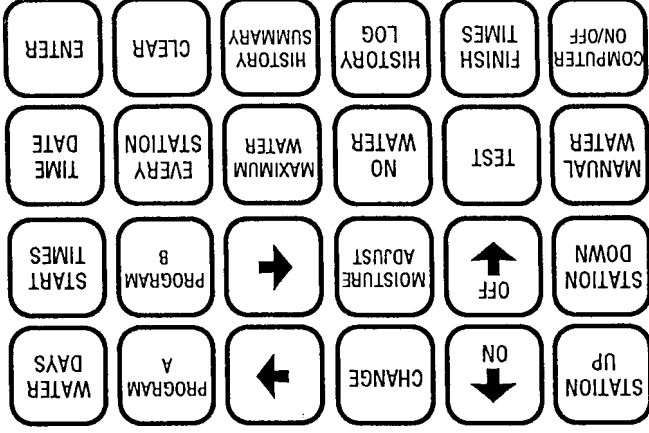
NUMBER OF START TIMES PER IRRIGATION SEQUENCE
 AVERAGE PERCENTAGE OF MAXIMUM NUMBER OF WATERING MINUTES PER START TIME
 MOISTURE SENSORS HAVE ALLOWED WATERING FOR THE LAST TEN TIMES

Master Display:

STN 02 PROG A SLEWED TO STATION NO 01
 MAX 2x05min, AVG 99%

Slave Display:

PROGRAM (A OR B) WHICH CONTROLS THIS STATION'S START TIMES AND WATER DAYS (CHANGING THIS ON THE MASTER AUTOMATICALLY CHANGES ITS SLAVES)

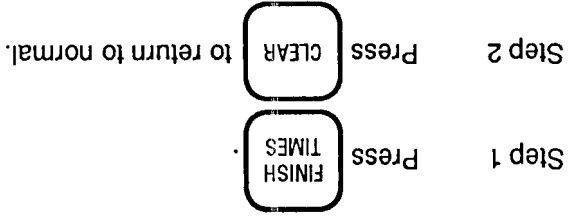


Key Pad:

The following error messages may appear:

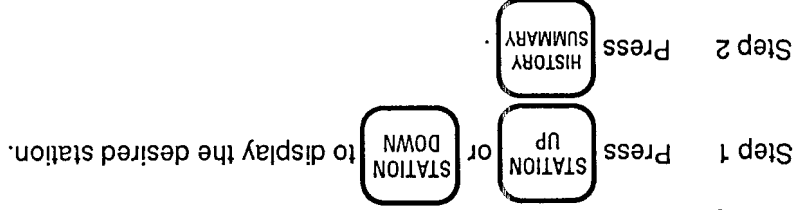
- "NO END" - The second program does not end within 24 hours of the beginning of the first.
- "NO RUN" - No stations are assigned to the program; no days are on; no start times have been set.

To retrieve Finish Times:




History Summary

The CALSENSE 2000 provides valuable historical information. To retrieve a summary, follow these steps.



If you have a flow sensor, the summary will provide a running total of the gallons of water the station has used as well as the gallons it would have used without the moisture sensing. The display also will show the most recent flow rate and the gallons of water used during the last irrigation.

automatically to the next station. The station will not water during an overflow sequence. At the beginning of the next sequence, the flow will be measured again. If the problem has been corrected, "OVERFLOW" will be removed

from the display and normal irrigation will resume. Pressing  also

will remove the flashing "OVERFLOW" and return the system to normal operation.

If the flow is more than twice the selected percentage above the average flow of the highest flow station: The system will assume the main line has been

broken and will turn off all irrigation until  is pushed.

If the flow is zero: The computer will display a flashing "UNDERFLOW" and advance to the next station.

When the flow meter option is selected, the "HISTORY SUMMARY" display will show totals in gallons instead of hours. It also shows the flow rate and average flow rate, as indicated in the illustration on page 20, labeled "HISTORY SUMMARY DISPLAY WITH FLOW SENSOR."

Finish Times

The Finish Times display shows the ending irrigation times using the present program. The column labeled "LATEST" shows when programs A and B will complete the last watering, if every station waters for the maximum time. "EST" gives an estimation of when the last watering will be completed, based on recent history and moisture levels.

Finish Times Display:





PROG A:	LATEST 02:10PM,	EST 02:09PM
PROG B:	LATEST 03:05AM,	EST 03:04AM

THE LATEST FINISH TIME FOR THIS PROGRAM WITH THE PRESENT SETTINGS FOR BOTH PROGRAMS



THE ESTIMATED FINISH TIME FOR THIS PROGRAM BASED ON THE PRESENT SETTINGS AND RECENT MOISTURE CONTROL HISTORY OF BOTH PROGRAMS

INITIAL SETUP

CALSENSE 2000 is designed to be easy to operate, with a self-prompting format for initial setup. Referring to the keypad and display on page 6, follow these simple steps to begin operation.

1. Press . The first line of the display, which reads, "The computer has been turned off," will flash.
2. Press . The display will not change.
3. Press . Again, the display will not change.
4. Press .

You have now entered the setup mode. The computer will guide you through setup, directing your selection of flashing choices and instructing you to push enter after each selection.






Note: The  key signifies UP; the  key signifies DOWN.

If you make a mistake in your selection(s), simply finish the sequence and begin again with Step 1.


PROGRAMMING

Setting Maximum Times

Follow these five steps to set or adjust the maximum amount of time each station will water.



- Step 1 Press  or  to reach the desired station.
- Step 2 Press 
- Step 3 Adjust the time upward or downward by pressing  or 

Step 4 Repeat steps 1 & 3 for each station you wish to set or adjust.


- Step 5 After you have completed all settings, press 



Setting Start Times

The CALSENSE 2000 can be programmed for up to six start times per irrigation program. The computer will initiate a cycle start for each start time that does not say "OFF." It will automatically prevent simultaneous watering operations within and between irrigation programs. Follow these seven steps to set or change start times. Keep in mind that you may set all start times to the identical time; if you do, the computer will automatically cause the repeats to follow in a continuous cycle.

- Step 1 Press  or 

- Step 2 Press 




- Step 3 Press 

- Step 4 If necessary, use  or  to move the flashing 8




Deleting Maximum Water or No Water Instructions

You may remove the maximum water or no water override before it automatically ends by performing the following steps.

Deleting Instructions For Individual Stations

- Step 1 Press  or  to display the desired station.
- Step 2 Press  Irrigation at that station will now return to programmed operation.
- Step 3 Repeat steps 1 and 2 for each station programmed to receive maximum water or no water.

Deleting Instructions For All Stations








- Step 1 Press 
- Step 2 Press 
- Step 3 Press  Irrigation will now return to programmed operation.

ADDITIONAL FEATURES







Optional Flow Meter Operation

If a flow meter has been connected and the flow meter option selected in initial setup, the CALSENSE 2000 will record the flow the first time a station turns on in each sequence. The flow will be compared with the average of the last ten measurements for that station.





If the number exceeds the average by more than the selected percentage: The computer will flash "OVERFLOW" on the display and advance

- Step 2 Press .
- Step 3 If more than one day will be overridden:
- A. Press .
- B. Use  or  to move the flashing cursor to the "MAX WATER" days number.
- C. Press  or  to desired number of days.
- Step 4 Press .

Programming No Water for All Stations








- Step 1 Press .
- Step 2 Press .
- Step 3 If more than one day will be overridden:
- A. Press .
- B. Press  or  to desired number of days.
- Step 4 Press .

cursor to the number to be changed.

- Step 5 Adjust the start time upward or downward by pressing  or . Remember that "OFF" signifies 12:00 A.M. midnight; 12:00 P.M. is noon.
- Step 6 Press .
- Step 7 Press .
- Repeat steps 1-7 for the other program (A or B).


Setting Watering Days

The CALSENSE 2000 uses a two-week watering cycle. Non-watering days are indicated by a dash on the "Water Days" display. At first, a flashing day indicates the current day in the cycle. An irrigation cycle that begins on a water day may continue into and conclude on a non-water day. For example, if a first start is scheduled to occur at 8:00 P.M. on the evening of Tuesday, a watering day, a second start may be programmed to begin at 2:00 A.M. on the following non-watering Wednesday. Setting and/or adjusting water days is easily accomplished with the following six steps.

- Step 1 Press  or .
- Step 2 Press .
- Step 3 Use  or  to move the flashing cursor to the appropriate day.
- Step 4 Press  or  to program the day as watering (abbreviation displayed) or non-watering (two dashes displayed).

Step 5 Repeat steps 3 and 4 for each day you wish to change.

If the stations on this program use rotating heads which take several minutes to complete a rotation, adjust SS (STEP SIZE) to the number of minutes per rotation.



Step 6 After completing all settings, press .


SETTING MOISTURE LEVELS



Normal moisture levels for the areas being controlled are determined during the first few weeks after irrigation begins. Set all moisture levels to 99 for the first two to four weeks. Use MAXIMUM TIME to maintain the soil at the appropriate moisture level and to generate a history log for each area. Calculate individual set points by taking an average of the most recent readings from normal weather conditions. The figure below shows master operation over four watering days.


MEASURED MOISTURE PERCENT	MAX. APPLIED PERCENT	SET TIME	TIME OF MAX. APPLIED	LEVEL POINT	MINUTES APPLIED
FIRST DAY	77	77	30	0%	0
SECOND DAY	74	77	30	60%	18
THIRD DAY	76	77	30	80%	24
FOURTH DAY	80	77	30	20%	6

Adjusting Set Points of Master Stations


Step 1 Press  or  to reach the desired station.



Step 2 Press .



Step 3 Press  or  to reach number corresponding to desired set point.

Step 4 Press .

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A. Press .

B. Use  or  to move the flashing cursor to the "MAX WATER" days number.

C. Press  or  to desired number of days.


Step 4 Press .



Applying Maximum Water to All Stations

Step 1 Press .

Step 2 Press .

Step 3 If more than one day will be overridden:

A. Press .

B. Press  or  to desired number of days.

Step 4 Press .


Programming No Water for Individual Stations

Step 1 Press  or  to display the desired station.

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displaying the station's measured moisture level and flow data.


Step 3 Repeat steps 1 and 2 to test other stations.


Step 4 Press  to end the testing cycle.

Testing All Stations

Step 1 Press .

Step 2 Press .

Step 3 Press . The computer will operate each station in numerical order, displaying the measured moisture level and flow data for each station in the sequence.


Step 4 Press  to end the testing cycle.

OVERRIDES

The CALSENSE 2000 can automatically bypass the moisture sensors of stations individually or as a whole, for one to nine days. The computer will display the number of days remaining in override. Stations can be set to receive maximum water or no water during this period. After the time has elapsed, the system will automatically return to the programmed operation.

Applying Maximum Water to Individual Stations

Step 1 Press  or  to display the desired station.

Step 2 Press .

Step 3 If more than one day will be overridden:

Adjusting Set Points of Slave Stations

Since slave stations irrigate the same percentage of their maximum time as the masters that control them, their adjustment is made by adjusting the maximum time. If the heads on the slaves have the same precipitation rate as their master, it usually is best to start with the same maximum time. The figure below shows slave operation.

		MAX. TIME MINUTES	APPLIED TIME MINUTES	PERCENT OF MAX. APPLIED
STATION 1	(MASTER)	30	18	60%
STATION 2	(SLAVED TO 1)	30	18	60%
STATION 3	(SLAVED TO 1)	20	12	60%
STATION 4	(SLAVED TO 1)	40	24	60%


After a few weeks, the slave areas should be checked and readjusted if necessary. If the slave area is too dry, adjust its maximum time to 25% more. If the area is too wet, decrease it by the same percentage. In both cases, the area should be rechecked after another few weeks, with readjustments made until the proper irrigation level is achieved.


Subsequent Moisture Level Adjustments

Moisture levels must be changed occasionally, in accordance with changes in compaction, sprinkler head coverage and plant needs. CALSENSE recommends at least four reviews of the set point adjustments each year.

If an area appears too dry:

1. Make sure the area has good coverage and the sprinkler heads are operating properly.
2. Master station - Read the AVG (average percentage of the maximum time of the last 10 irrigations) number on the normal display for that station.
 - If AVG is:
 - A. More than 95% - Increase MAX TIME 25%.
 - B. Between 80% and 95% - Increase MAX TIME 25% and raise moisture level 2 points.
 - C. Less than 80% - Increase moisture level 2 points.
3. Slave station - Compare the slave station with its master. If the master also is too dry, following the above procedure will handle both master and slave. If the master is not dry, increase the slave MAX TIME 25%.




4. Program these dry stations for  override for five days.






1. Make sure there are no broken sprinkler heads causing the area to flood.
2. Master station - Adjust the set point down 2 points.
3. Slave station - Compare the slave station with its master. If the master also is too wet, following the above procedure will handle both master and slave. If the master is not wet, decrease the slave MAX TIME 25%.
4. Program these wet stations for  override for five days.

MANUAL OPERATION


The CALSENSE 2000 permits you to manually water each station individually or all stations as a whole.

Manually Watering Individual Stations






- Step 1 Press  or  to display the desired station.
- Step 2 Press .
- Step 3 To water for a period greater or less than the programmed time:

- A. Press .
- B. Press  or  until the "WATERING" FOR" display begins to flash.
- C. Use  or  to set the desired watering time.

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- Step 4 Repeat steps 1-3 for each station you wish to water.
- Step 5 Press  to end watering and return to the programmed schedule.




Manually Watering All Stations

- Step 1 Press .
- Step 2 Press .
- Step 3 Press  to begin watering.
- Step 4 Press , then  to end watering and return to the programmed schedule.

TESTING THE SYSTEM

You can test the operation of your system, either by individual station or as a whole. The test feature will operate any or all stations for two minutes each. During the test phase, the computer will read and display the moisture sensor (and optional flow meter) information for each station.

Testing Individual Stations:

- Step 1 Press  or  to reach the desired station.
- Step 2 Press . The system will perform a two-minute test.

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