INTRODUCTION

Evapotranspiration (ET) is the measure of the quantity of moisture transpiring from the leaves of a crop and evaporating from the ground. It might be thought of as "negative rain." It is measured in inches or millimeters of water, the same measurements as rainfall. Knowing ET gives the grower an estimate of the need to replace by irrigation the water lost by the crop to the atmosphere.

For drip irrigation of a crop, frequent irrigation is beneficial; daily irrigation is preferred (Ref. 1). The Daily ET value determined by the GroWeather station may be used to control daily (or as frequently as hourly) drip irrigation. Because it is based on the amount of moisture lost – and, therefore, the need for moisture replacement -- this method is more efficient in its use of water than is a method based on fixed time intervals.

ETo, Reference ET, is the water loss from cropped grass. The loss expected from another crop is determined by multiplying the value of ETo by a K-factor which has been determined for that crop. K-factors are often provided by agricultural colleges or advisory services.

If an Alarm Output Module (AOM) is connected to the GroWeather station, the alarm is made available as a floating solid state relay "contact" closure (Ref .1). The Daily ET Alarm is output 15 on the AOM.

Two alternative ET output Modes are available from the GroWeather AOM: ALARM and PULSE. In the ALARM mode a contact closure is provided whenever the value of ET exceeds a user-selected threshold value. In the PULSE mode the output is one contact closure per 0.01 inch of ETo, an output similar to that of an atmometer. Each mode is discussed below.

THE ETo CALCULATION

A GroWeather station calculates ETo values from its measured data on Wind Run, Air Temperature, Relative Humidity, and Solar Radiation. The ETo value is calculated once each hour, on the hour, using data averaged over the prior hour.

If the ET value is greater than the threshold value, the excess is saved for use in accumulating the next ET value. No ET amount is lost. (A possible exception may occur if the ET amount in one hour is more than twice the threshold value. See discussion below.)

ALARM MODE

When the calculated value of ET reaches or exceeds the value set as the Daily ET Threshold the ET Alarm is activated. It remains active for a minimum of one minute and a maximum of three minutes. The output of the AOM is a floating relay "contact," either normally-open or normally-closed (see the AOM manual). As specified in the manual, the voltage and current ratings of the relay are moderate. The relay will be suitable in many cases for direct connection to an irrigation controller, but this should be checked by an electrician before connection is made.

It may be necessary to connect a time-delay relay to the AOM and use the time-delayed output to drive the irrigation pump or flow valve (Ref. 2). The GroWeather's ET value will then start the pump, and the setting of the time-delay relay will determine the flow time.

To use the ET output via the AOM:

1. Set a jumper wire in the AOM to select Alarm 15 as an output. (See the AOM manual for details).

2. Connect the AOM contact closure output to the irrigation controller, using intermediate circuitry if necessary.

3. Set the ET Alarm threshold to the amount of ET water loss at which you want irrigation to begin.

The Alarm threshold must be greater than 0.01 inch and greater than the largest value of ET expected over any one-hour period.

At the end of each hour ET is calculated, and the result is added to the total since the previous alarm. If that total reaches or exceeds the Alarm Threshold value, the alarm output is activated for a period of one to three minutes.

If the calculated ET value is larger than the threshold, the difference is saved and used to begin the accumulation of the next ET subtotal.

If the calculated ET value is more than two times the Daily Alarm Threshold value only **one** alarm will be generated. It will be longer by two minutes than a normal alarm.

PULSE MODE

When in PULSE mode, the GroWeather system with AOM provides a separate countable contact closure for each 0.01" of calculated ETo. To set the system to PULSE mode set the ET Threshold to 0.01 inch (do not use a millimeter value). This may be done at the Console or, if WeatherLink software is used, at the PC.

At the end of each hour, the station calculates the ET loss over that hour. When the calculation is complete, the station issues a string of pulses: three seconds ON, three seconds OFF. The AOM output may be normally-closed or normally-open; as selected by the jumper on the AOM and discussed in the manual.

This mode works correctly only if a working AOM is connected to the system; after issuing a pulse the console will not continue until the pulse is received and acknowledged by the AOM. If the AOM is not connected or not working correctly the alarm will remain on continuously.

REFERENCES

1. Leaflet 21259: Drip Irrigation Management, University of California Extension
2. Applications Note 3: Using the Alarm Output Module, Davis Instruments.