IMMS ET Software Operations Manual

IMMS ET is an optional upgrade to the Hunter IMMS 2 central control system.

Contents

Introduction

ET, or "evapo-transpiration", describes how plants and soil lose moisture to environmental factors. IMMS-ET bases automatic irrigation on sensors that measure the climatic conditions that cause moisture loss. The result should be healthier plants and minimized water waste and run off.

IMMS-ET adjusts individual station run times to "match" the climate conditions. It does not change Day schedules or Start Times. All settings in the controllers work exactly the way they are set up, except that station run times will vary in length, depending on how much watering they require.

The goal of ET-based irrigation is to create enough information for the irrigation zones to water only as much as is required to keep the plants healthy, based on local climate conditions. During start up of an ET system, many adjustments may be required, but ultimately the system will "follow the weather" and keep plants healthy with maximum water savings.

IMMS-ET requires a complete database for each station (or "zone") in the irrigation system that it will control. The setup of this database is easy, but the operator is completely responsible for the accuracy of the information, and the results of using it. Every system must be carefully observed after initial installation. Most systems require adjustment, at station level, for some time after installation to provide ideal results. Inattention can result in plant damage, loss, and water waste.

## IMMS-ET System Considerations

IMMS-ET is primarily designed for Hunter Model ACC controllers, and the Hunter ET Sensor. It can also be used in a more limited manner with other Hunter IMMS-compatible controllers (ICC, Pro-C, and SRC), provided that there is at least 1 ACC controller and ET Sensor in the system. Each controller will need a communications link to the central computer.

Only ACC controllers may be used to report ET data to the central. ACC controllers also provide the most flexibility and feedback for dealing with real-world environmental and plant conditions. However, the data they gather can be used to adjust other Hunter controllers.

IMMS-ET relies on frequent communications (at least once per day) with all controllers in the system. Ensure that communications are the top priority of the installation of this system. If it communicates reliably, ET implementation is relatively easy. However, no amount of data or software features will compensate for a system which does not communicate reliably.

ACC controllers with facepack firmware versions 4.00 and higher are ET-compatible. Earlier versions can be flash updated in the field, with firmware available for download from the Hunter website.

ACC controllers that will be connected to an ET Sensor also require an "ET Ready" Master Module (part 572000). Versions of the Master Module are marked with an "ET Ready" sticker. This module cannot be updated in the field, and an older module must be replaced if the controller will be used with an ET sensor. The version number can be checked from the Advanced Features dial position, Utility Functions, Check Firmware Versions. "Master Mod" version must be 4.0 or greater.
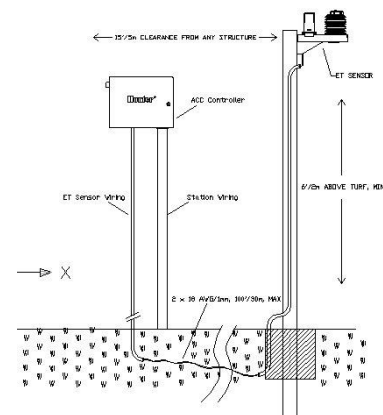
IMMS-ET relies on a minimum of 1 ET Sensor, installed to a communicating ACC controller, as its ET source. It is possible to have more than one ET Sensor in a system, but there is a maximum of one per controller.

The best practice is to have at least 1 ET Sensor per microclimate. The data from this sensor can be shared with other controllers (via the central) that are installed in similar climate conditions. There is no limit on the number of ET Sensor-equipped ACC controllers that can exist in a single system, and it is possible to have an ET Sensor on each ACC controller.

ET Overview

Evapo-transpiration is the result of atmospheric conditions that cause the amount of water available to the plants to be lost. This water is generally only replaced one of two ways: a) natural rainfall, and b) irrigation.

IMMS-ET works by using sensors to gauge the relevant atmospheric conditions (using the modified Penman-Montieth equation). The amount of ET, or moisture loss, from each zone of irrigation is then calculated, based on the characteristics of each zone.

IMMS-ET actually creates, and tracks, a "model" of the moisture available in each zone's soil reservoir. The station database contains the root depth, which defines the size of the zone's soil reservoir, and information about the plants in the zone, including their water needs.

As water is lost, the soil reservoir is depleted. Every zone in the system has its own reservoir, which deplete at different rates. You can see the moisture depletion in the Deficit column of the database.

The first factor in the Deficit column is the percentage of depletion, which is the easiest to understand. The second is the actual amount of depletion in inches or millimeters, which is used to calculate the run times to replenish the moisture.

Natural rainfall is measured by the ET Sensor, and automatically applied to the soil reservoir. If there is enough rain to replenish the moisture, the irrigation will not need to run. If rain has replenished a portion of the moisture, IMMS-ET will schedule only enough irrigation to make up the difference.

How to Adjust Irrigation Results in IMMS-ET
The factors and settings in the station database are critical, because they determine the rate at which moisture is lost in each zone, as well as the depth (size) of the zones through the root depth setting.

The station database settings should be seen as a STARTING POINT. Every zone in the real world is different, and not all of them have uniform characteristics within a zone.

The purpose of the Type and other settings is to start the zone with a realistic starting point. However, when a system is new, <u>close observation is required</u> to adjust the zones to the desired performance.

It can take several weeks or months to adjust a large system, so that each zone follows the weather changes at the correct levels.

If all plants of a certain Type (including the other related settings) are over- or under-watering, the Type characteristics may need adjustment.

If individual zones need adjustment, within one of the plant types, the other site factors may need individual adjustment (Sun, Soil, and Precip rates).

Any zone may be adjusted with the ET Percentage adjustment. If you are not certain which factor is causing the condition, but you can determine that it is over- or under-watering by a given percentage, just change the percentage factor.

Controller Depletion level determines how dry the landscape is allowed to become before scheduling irrigation. This does not directly affect the total amount of water in the long run, but affects the frequency with which plants will water.

Remember the goal is to create factors that will finally follow climate changes without continuous adjustment. Slower, smaller changes are best, and close observation will show the results of the changes before plant damage occurs.

Setup Steps

Install ET Sensor(s) in the field at ACC controller(s) and enable ET.

Install and Unlock IMMS-ET Software

Set Up Communications and Sync Options

Configure ET Sources and Source assignments

Assign sources to other controllers

Assign individual Programs to ET Control

Assign individual Stations to ET Programs and assign Station Attributes

Proceed to Operations.

Installation (IMMS-ET Software)

Create back up of main database (File, Database, Create Backup) if upgrading an existing IMMS 2 installation.

Insert CD in controller drive. If installation does not begin automatically after a few seconds, locate the file on the CD called Setup.exe and double-click it.

The installation will replace the non-ET version of IMMS 2, but should open with the existing data.

If this is a new installation, a blank database will be created. You will need to set up communications, Sites and Controllers before proceeding with ET setup (see IMMS 2 Help).

Copy the Installation ID, and call or email Hunter Technical Support to obtain an Unlocking Code. The IMMS-ET unlock codes are unique to each computer installation, and will be required even if you already have an unlocked version of IMMS 2 only. This code will only be required once for IMMS-ET, but the ET portion of the software cannot be used until this is obtained.

Requirements for Unlock Code:

- Installation ID

- Exact Model of IMMS you are unlocking.

- User name and contact information.

It is not possible to provide an Unlock Code without all of this information!

Contacts:

Email: www.asktheexpert@hunterindustries.com

North America: 1 (800) 733-2823

International or local: +1 (760) 591-7383

Telephone support is available (with possible delays, depending on activity) from 6:00AM - 5:00PM Pacific Standard Time, Monday through Friday.

Set Up Communications

IMMS-ET is completely dependent on communications between the field (the controllers and their sensors) and the central computer. Without communications, there is absolutely no ET adjustment of anything in the controllers.

Best practice is to get the basic IMMS 2 central communications fully operational, before starting the setup of IMMS-ET. Become familiar with the main functions of the central control system before entering all the ET data.

The controllers will always water, without a Sync from the central, if they have programs to run.

However, IMMS-ET is designed to send daily adjustments based on ET.

If the daily ET-based programs are not sent out, or not sent before the earliest start time, the controllers will water using the last information they were sent.

Sync (download) once per day, to keep current with climate conditions.

Make sure the Sync will have enough time to complete before the earliest start time.

Com Ports

At the System-level Configure Hardware option, verify correct Com Port settings for all communications types (SI/CI Hardwire, Modem, and ACC Hardwire) by performing a test with the Test button.
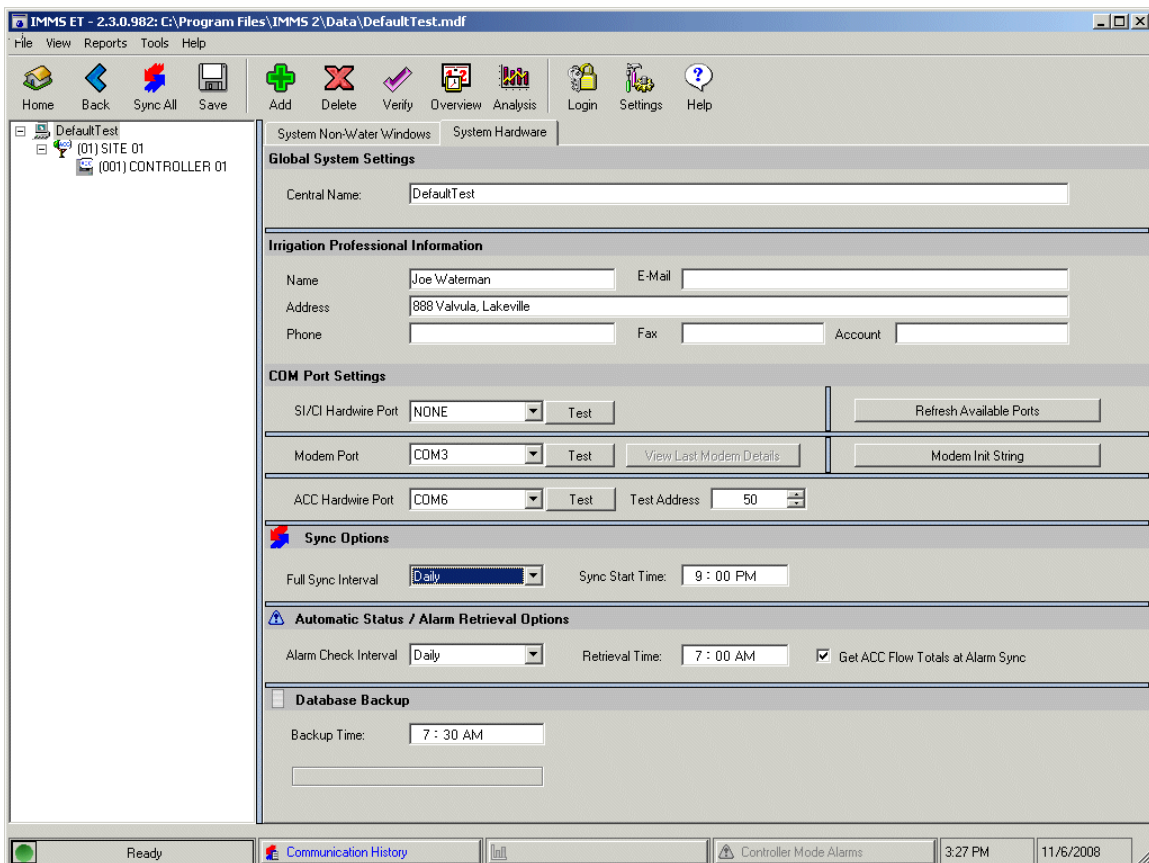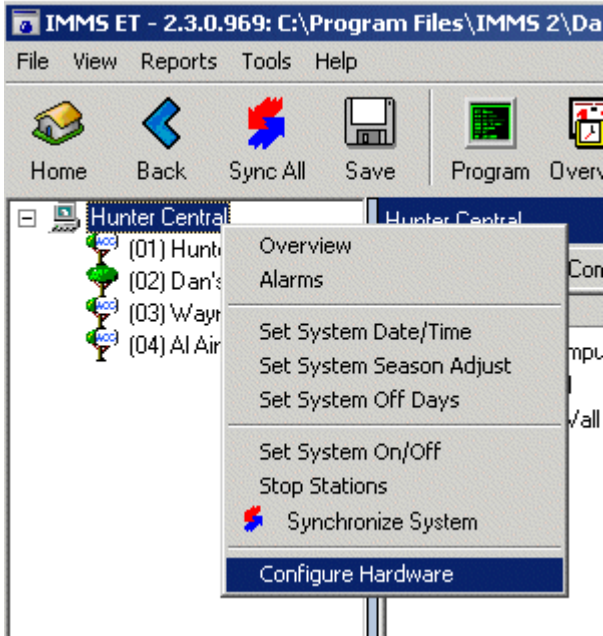
Sync Options

The Full Sync Interval option must be set to at least once per Day for automatic adjustment. It is possible to perform this manually each day, but the recommended setting is Daily.

Sync Start Time

The Sync Start Time will designate the time of day at which the Sync occurs. This is an important setting that may take some trial and error, if it is a new system. You need to know how long it takes to perform an entire Sync, and then set this time early enough to complete the whole process before the irrigation window begins.

Automatic Status/Alarm Retrieval Options

The Automatic Status setting is not required, but it is highly recommended. A minimum setting of Daily is a good idea. Set the Automatic Status check to run at a time of day after irrigation is complete.
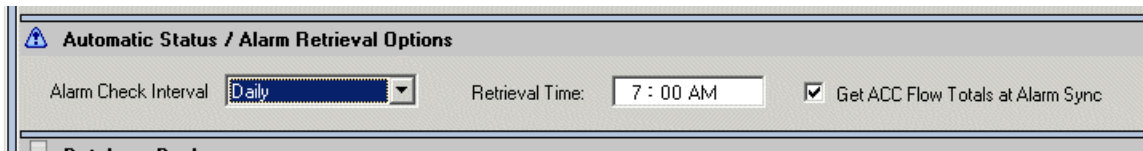
The purpose of the Automatic Status setting is to check for alarms and other conditions which may have occurred during the last watering window, or time of day during which most irrigation occurs.

Units of Measure Settings

The Settings button at the top of the IMMS Home screen includes units of measurement selections for the entire software program.
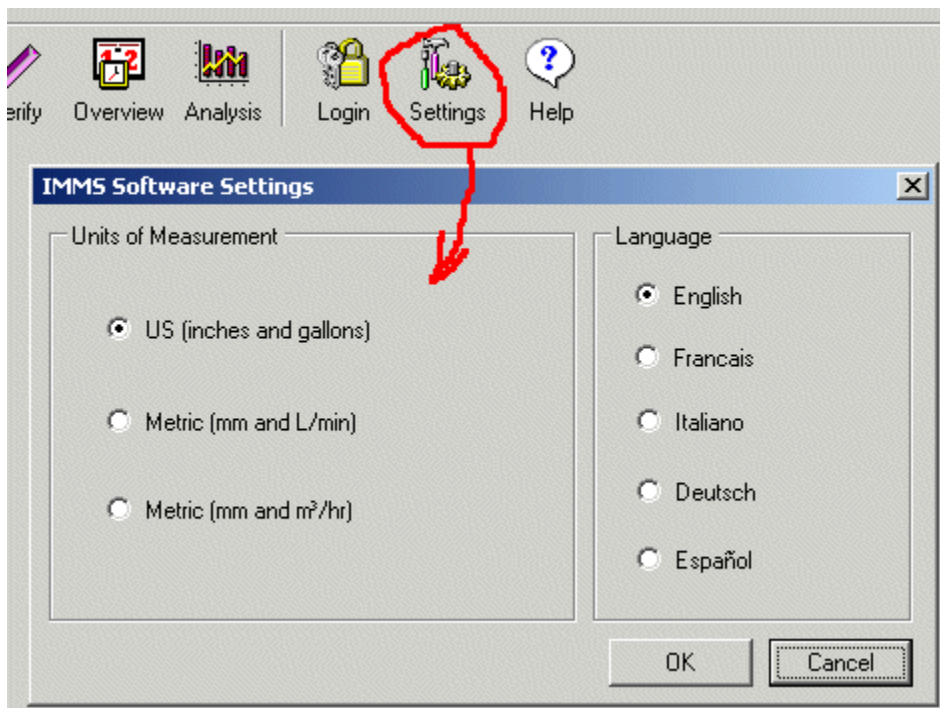

The default setting is US (inches and gallons).

If either Metric selection (Lpm or m^3/hr) is chosen, all units in the software including ET and rainfall will be displayed in international metric or SI units.

Date/Time formatting in IMMS are derived the computer's operating system, and will be the same as the host computer's settings. IMMS does not reformat date/time and does not track time separately from the computer (including Daylight Saving Time changes). It will change when the computer does.

Site Hardware
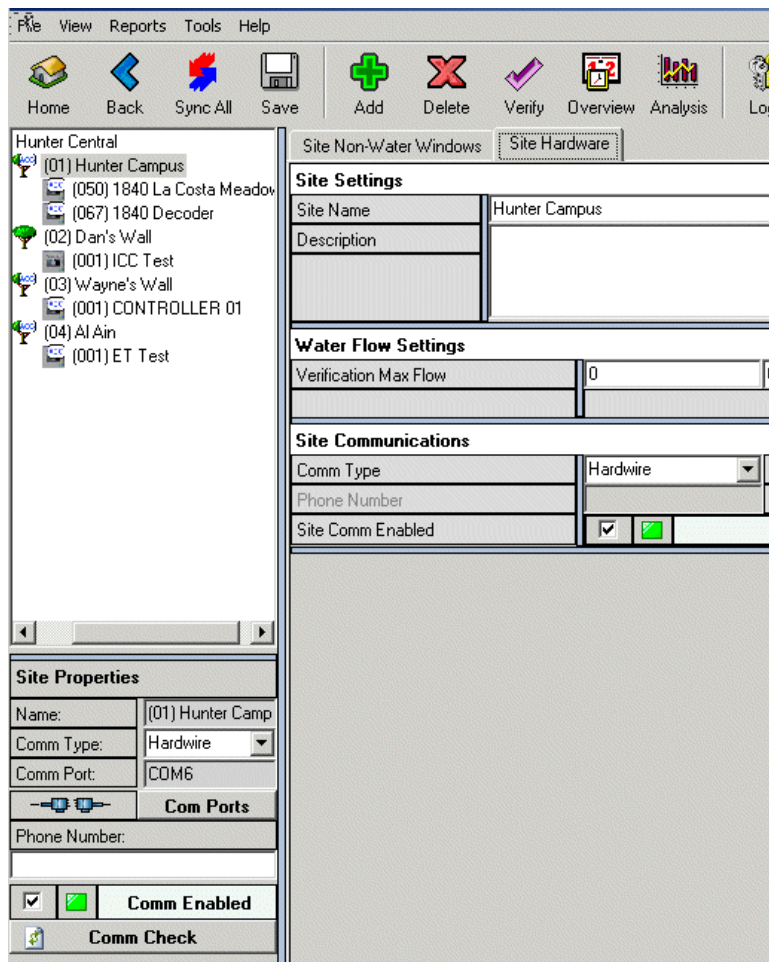
Each Site has a Hardware tab, which contains its communications settings. There is nothing specific to ET here, but verify that each Site's information is correct, and that the Site Comm Enabled box is checked.

Configuring ET Sources

Once the software is installed, it must be taught how to communicate with the ET Sensors, and which controllers will respond to each ET sensor.

When an ACC controller has an ET Sensor connected, it becomes a Source. Any other controller (ACC, ICC, Pro-C, or SRC) can use any designated Source for its own adjustment. These controllers, who use the sensors attached to other controllers, are ET "dependents".

If a controller does not have a designated source, it cannot be ET controlled (although it can still run normally). If necessary, each ACC controller can have its own sensor, and could be its own source.

A controller on a Site can use a Source on another Site as its source. The connection between a controller and its source is made through the central software, so it does not matter where it is physically connected to the system.

Caution: If a controller's ET Source designation is cleared, all the ET program assignments and runtimes will be cleared. All other ET data will be preserved but the controller will no longer be ET adjusted until a new Source is selected. The station/ET program assignments will also need to be made again.

Controller Hardware tab (ACC Source controllers)
Each ACC controller has a Hardware tab, and near the bottom is an ET section. If the controller will be a Source, check (click in) the ET Sensor Installed check box. Do not check this for any controller that does not have an ET Sensor physically wired to the controller.

Non-ACC controllers do not have the ET Installed option. They cannot report ET.

Next to the check box, there is a pull down menu which allows you to designate a Source for the controller. If the controller has an ET Installed check, it will appear as one of the choices for Source. It is logical to select it as its own Source (although it is possible to select another Source, possibly if its sensor was damaged).

Check the box for each ACC controller that will have an ET Sensor, and will serve as a Source, for the rest of the system. This will allow a complete selection of Sources for the other controllers.

ET Sensor values (Rain Max, Temp, Wind)

- These settings only affect the controller to which the ET Sensor is connected!

These settings allow the local ET Sensor to shut down irrigation programs at the Source controller, only, based on local sensor input. The shutdowns occur off-line from the central.
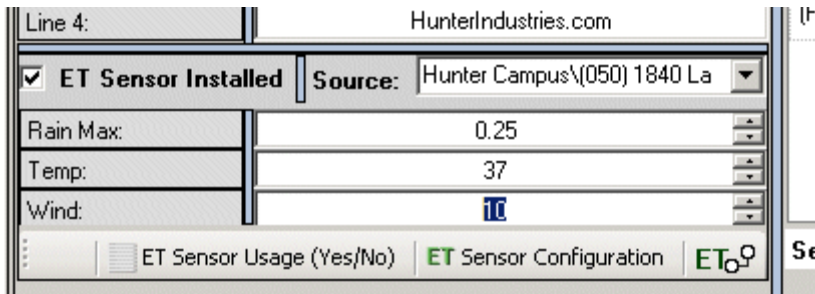
These settings only apply if the controller's ET Sensor inputs have been set to act as "Clik" sensors at the controller. The controller can be set to shut down certain programs on individual sensors.

- Rain Max is the total amount that is allowed at the controller, before it will cease trying to water for the day until the next sync from the computer.

- Temp sets a low temperature at which irrigation in designated programs will be stopped.

- Wind only applies if the optional ET Wind sensor is connected to the ET Sensor. This sets a wind speed, at which all watering in designated programs will be stopped.

These settings happen independently of the central computer, and only apply to the controller that has the ET Sensor attached.

Each controller in an IMMS-ET system should have its own separate rain shut off device.

Controller Hardware tab (Dependent controllers)

Each controller that is to be ET adjusted must have a designated Source, even if it does not have a sensor.
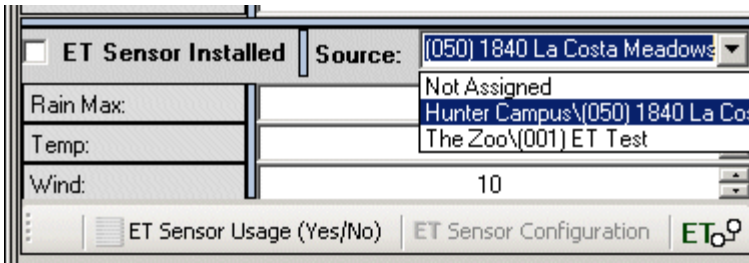
At every controller in the system, go to the Hardware tab, and use the pull down menu to select the Source for that controller. The Source can be any designated ACC controller with an ET Sensor in the system. The best practice is to use the Source whose climatic conditions most closely match the controller's.

For example, coastal areas may share characteristics within an area, and might generally be expected to see the same climatic conditions. Inland controllers may see slightly drier conditions, with different sun and wind exposure. The coastal controllers might respond to the coastal source, and the inland controllers might respond to an inland source.

Controller Setup (Programs and Stations)

After communications and Source designations are made, set up the ET programs and station database for each controller.

This is done in three steps:

1. **Assign Programs to ET.** (Scheduling tab)

2. **Create Plant Types.** (ET Settings tab)

3. **Assign Stations to ET Programs, and complete their information.** (ET Settings tab)

1. Assign Programs to ET

IMMS-ET can use ET to control any program or programs within an IMMS controller, regardless of model.

Designate the programs which will be controlled by ET on the Scheduling tab for each controller.

The ET Mode row on the Controller Scheduling tab determines which Programs will have run times determined by ET. To change the setting, click in the cell for the program, and change between Yes and No.

Controller Scheduling	Controller Non-Water Windows		Controller Hardware	Station Settings	Custom Manual	ET Settings
Program	**A**	**B**	**C**	**D**	**E**	**F**
Program Name	Front Lawn	Other Turf	Shrubs	Flowers	Drip	Lights
Days To Water	s M T W T F S	s M T W T F S	INT 3	s M T W T F S	s M T W T F S	s M T W T F S
Next Water Date	10/16/2008	10/17/2008	10/16/2008	10/16/2008	10/20/2008	10/16/2008
Start Times						
Start Time 1	4:00 AM	4:00 AM	3:00 AM	6:00 AM	2:00 AM	3:00 PM
Actual Start	4:00 AM	----	3:00 AM	6:00 AM	----	3:00 PM
End Time	5:20 AM	----	3:30 AM	6:54 AM	----	9:00 PM
ET Mode	No	No	No	No	No	No
Season Adjust	100　G	100　G	100　G	100　G	100　G	100　G
Start Mode	Overlap	Overlap	Overlap	Overlap	Overlap	Overlap

ET Mode set to No means the program will run any stations for the exact run times as they appear on the tab. These will not be adjusted.

ET Mode set to Yes means the run times will be filled in automatically based on the ET. If you change the mode of an existing program, a warning will appear that all run times will be set to 0 minutes, and only one start time will be allowed.

ET Mode	No	No	No	No	No

ET stations to Non-ET stations ✕

❓ All runtimes and starttimes but one start time in this program will be set to zero. Do you want to continue?

Yes　　No

(02) STATION 02	0:12:00	0:00:00	0:00:00	0:00:00	0:00:00
(03) STATION 03	0:12:00	0:00:00	0:00:00	0:00:00	0:00:00
(04) STATION 04	0:12:00	0:00:00	0:00:00	0:00:00	0:00:00
(05) STATION 05	0:12:00	0:00:00	0:00:00	0:00:00	0:00:00
(06) STATION 06	0:12:00	0:00:00	0:00:00	0:00:00	0:00:00

This is normal, because IMMS-ET will calculate the run times after the ET data has been retrieved from the field, and only one start time per Program will be allowed in this mode.

If no ET Source has been designated for the controller, the IMMS will not allow you to set the Program to ET Yes. You must go the controller's hardware tab, and designate an ET Source for the controller.

An ET Program may only have one Start Time. All other start time indicators will be dimmed, to reflect this.

A Station may only be in one ET Program.

A Station that is assigned to an ET Program can also be in a non-ET program, but the run time in the non-ET program will not be adjusted by ET. This is not recommended.

ET Mode	Yes	Yes	Yes	No	
Season Adjust	N/A	N/A	N/A	Global	
Start Mode	*Smartstack*	*Smartstack*	*Smartstack*	*Smartstack*	
	▬▬ ▬▬	▬▬ ▬▬	▬▬ ▬▬	▬▬ ▬▬	
Station Delay	00:00:04	00:00:00	00:00:00	00:00:00	
Station Name	Program A	Program B	Program C	Program D	
(01) lawn	0:00:00	0:00:00	0:00:00	0:00:00	
(02) Main Lawn 1	**0:16:00**	0:00:00	0:00:00	**0:02:00**	
(03) Main Lawn 2	**0:13:00**	0:00:00	0:00:00	**0:02:00**	
(04) Side Lawn	0:00:00	0:00:00	0:00:00	0:02:00	

IMMS-ET only adjusts run times. All other features of the program, including watering days, Overlap and Stack settings, cycle and soak, and actual start times, will be left the way they were set, until you change them.

Days to Water are not necessarily watering days, however. IMMS ET may choose not to irrigate on days that are set to Yes, if it determines that the plants do not need watering. This is based on the Deficit, and the Depletion settings.

Controller Scheduling	Controller Non-Water Windows	Controller Hardware	Station Settings	Custom Manual	ET Settings
Program	**A**	**B**	**C**	**D**	**E**	**F**
Program Name	Front Lawn	Other Turf	Shrubs	Flowers	Drip	Lights
Days To Water	s M T W T F S	s M T W T F S	INT 3	s M T W T F S	s M T W T F S	s M T W T F S
Next Water Date	10/16/2008	10/17/2008	10/16/2008	10/16/2008	10/20/2008	10/16/2008
Start Times	▭	▭	▭	▭	▭	▭▭

Watering Days are *permission to water* in ET controlled systems. If they plants don't need water, the stations will not run, even on a Watering Day when the rest of the stations in the program do run. You will be able to see the stations likely to run, on the ET Settings tab.

You may set any program or combination of programs to ET control, and you may use any other programs without ET, even within the same controller.

Only programs that have been assigned to ET control will be available as choices on the ET Settings tab, for the individual stations. You can add or remove ET control from a program at any time (but you will be warned that all run times will change back to 0).

2. Create Plant Types

Plant Types may be created, added, or edited at any time, but it is most convenient to create them before moving on to the individual station settings. They will then appear in the list of choices you have at individual station settings.

The attributes of the Plant Types are extremely important to proper irrigation. The amount of watering for each station or zone depends on these settings.

The principle is to create a list of plant types, and then assign them to individual stations in controller setup. The plant types are created at the system level. After they are created, they are available to assign to stations at each individual controller.

For each plant type, you will need to enter or edit:

- o Name

- o A Type

- o Variety/Water Use requirements

- o Crop Coefficient (Kc) if necessary

- o Root Depth if necessary.

Quick Shortcut Setup
The correct approach to ET setup is to have an irrigation professional enter complete information for all plants and other data on the ET Settings tab, station by station, for a starting point. This is outline in detail in this section.

However, a quick approach is to set all zones to the Full ET setting, and use the ET % factor only, to adjust their applications.

Controller Scheduling	Controller Non-Water Windows		Controller Hardware	Station Settings	Custom Manual	ET Settings
Name	Program	Dep %	ET Pct %	Plant Type		Sprinkler
(01) NW Lawn	(A) Lawns Main	1.1	100	FULL_ET		MP Rotator
(02) SW Lawn	(A) Lawns Main	1.1	100	FULL_ET		MP Rotator
(03) NE Lawn	(A) Lawns Main	1.1	100	FULL_ET		MP Rotator
(04) SE Lawn	(A) Lawns Main	37.6	100	FULL_ET		MP Rotator
(05) W Walks 1	(B) Lawns Walks	1	90	FULL_ET		MP Rotator
(06) W Walks 2	(B) Lawns Walks	4.2	100	FULL_ET		Spray
(07) N Walks	(B) Lawns Walks	15.6	120	FULL_ET		Spray
(08) S Walks	(B) Lawns Walks	3.1	85	FULL_ET		Spray

This method is likely to waste water until all adjustments have been made. However, all the settings in IMMS-ET require careful observation of real world results over a period of time, before satisfactory automatic operation is achieved.

Sprinkler Precipitation rates must be entered accurately by zone, or no approach will work correctly and plant loss can occur!

Hide/Show Columns

The Hide/Show Columns button lets you choose the columns that appear in the Settings window. Because of the large amount of data, the columns will extend off the screen to the right (a horizontal scroll bar will appear under the window to allow you to move back and forth).
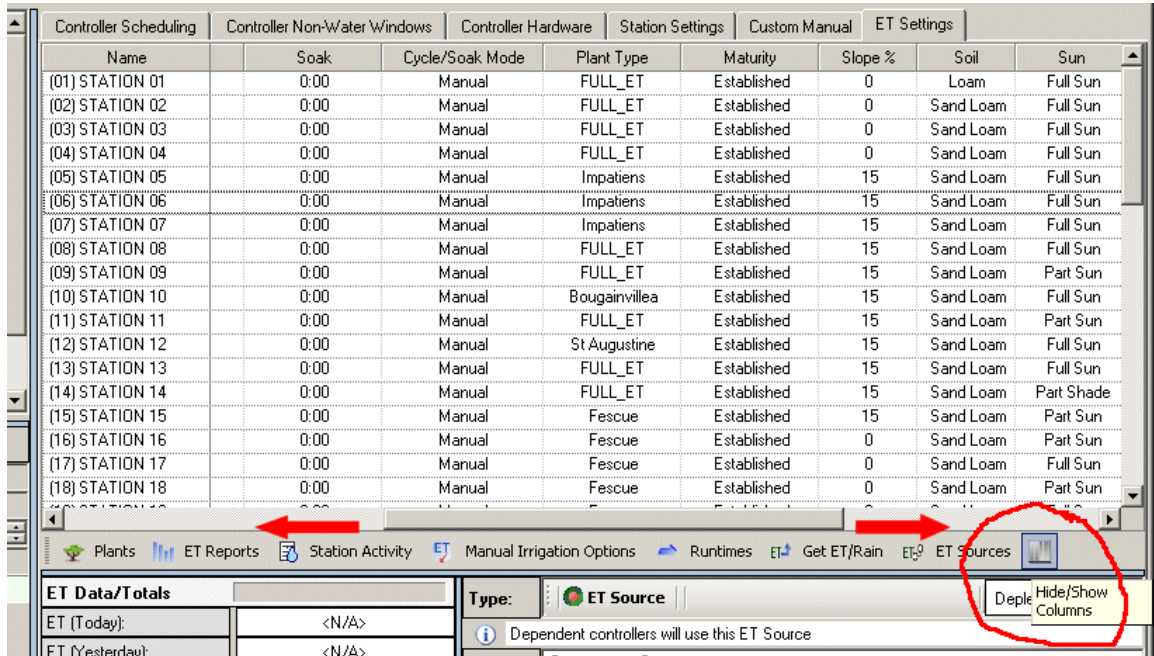
The column visibility tool lets you check or uncheck the columns you are not using, to clean up the screen. You can click it again to change the visible columns at any time.

Tip: During set up, you could uncheck the ET%, Cycle, Soak, and Cycle/Soak Mode columns, to get better access to the Plant settings on the right. During normal operations, you could change the display to show the Deficit and other columns of interest. You may change the column view at any time.

FULL_ET
The default "Full ET" Plant Type means that run times will be calculated to completely replace all water lost to evapo-transpiration, with no modification for plant characteristics.

This setting is likely to over-water plants. It is a very conservative setting which makes no allowance for the type of plant or its water use. It tries to replace every drop of water that the soil has lost to ET.

The Full ET characteristics cannot be edited (all other plant types can be customized). It has a modifier of "1", meaning irrigation will try to replenish the soil reservoir exactly. Only use this plant type when you are uncertain what settings to use. Most zones set to Full ET will run very "wet" and you can edit them later.

Adding New Plants

Double-click any controller in the system to open its settings, and click the ET Settings tab. Plant types created at any controller are available to all controllers in the system.

Click the Plants button, near the center-left of the ET Settings tab. The Edit Plant Types window will appear.

The plant type "Full ET" is set for all stations in a new database. A sample type, "Fescue", may also have been included in the database. You will create the additional plant types that appear in your landscape, before assigning them to stations.

To create a new Plant, click the Add New Plant button. This will be assigned an automatic name, such as New Plant 2.
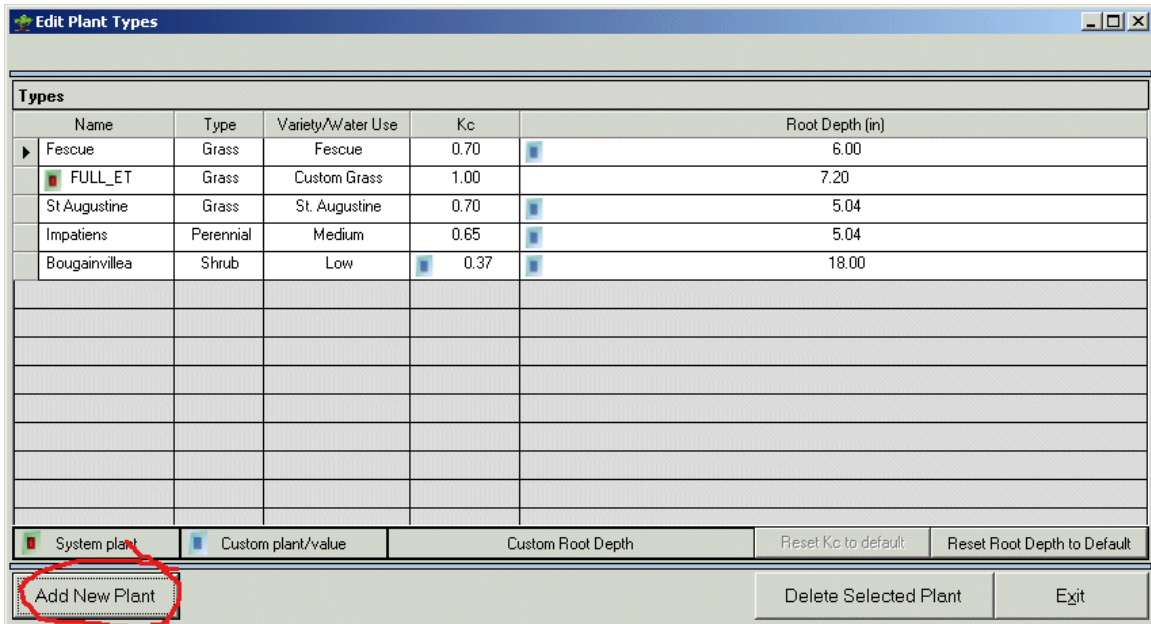
Click in the Name field, and type a new name for the plant type.
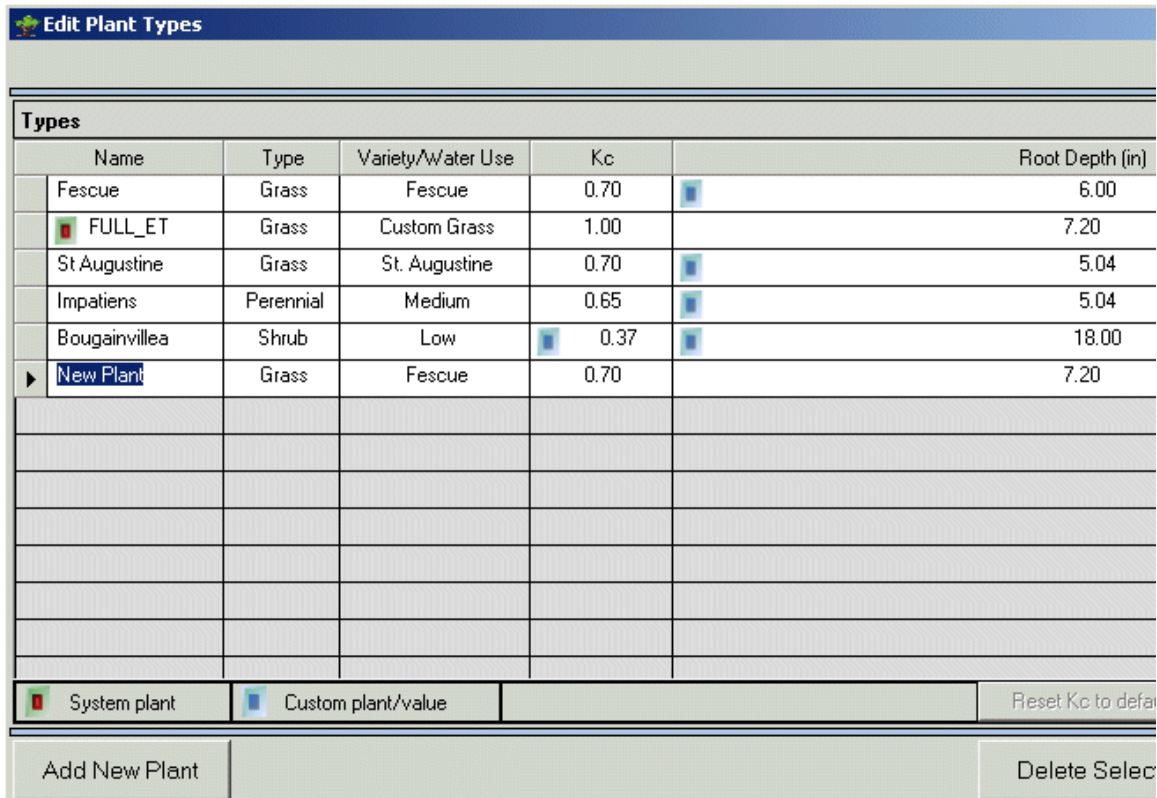
When the Plant is named, choose the Type. To understand the Type and Variety/Water Use settings, please read the section on "Plant Characteristics" and "WUCOLS".

Plant Characteristics

Each plant type has important characteristics (Type, Variety/Water Use, Crop Coefficient, Root Depth) that affect the amount of water which will be calculated for each station or zone.

The characteristics are set for each new plant type in the Add New Plant function. Then, whenever the Type is selected for a certain station, those characteristics are assigned to the zone automatically.

IMMS-ET creates the Crop Coefficient (Kc) and the Root Depth automatically, based on WUCOLS standards, when Type and Variety are selected. You can then customize them further, if you wish.

WUCOLS
The Types and Varieties are from categories defined by a study called the Water Use Classification of Landscape Species, or WUCOLS. This was sponsored by the State of California and is a free public resource.

The document is available in PDF format online from the University of California (most internet search engines will find "WUCOLS" easily), and is highly recommended to those seeking a deeper understanding of the principles underlying this control software. The document was also available from:

Department of Water Resources

Bulletins and Reports

P. O. Box 942836

Sacramento, California 94236-0001

WUCOLS identified numerous landscape species, and organized them by their water use requirements. These general categories are designed to be reasonable estimates of a plant's needs for health, appearance, and reasonable growth.

You are not required to use any of the factors supplied by this University of California project, and there may be species of interest not covered in this study, or local conditions which require different settings.

The Plant Type values can be customized for virtually any plant in any landscape, and the WUCOLS categories merely provide a convenient starting point.

The software user is completely responsible for the final decisions regarding plant type characteristics and settings. IMMS-ET was not designed for agricultural applications, and is specifically designed for landscape plantings.

Observe the results of ET based irrigation in the real world, and adjusting selections accordingly. Software cannot replace human observation and judgement.

Type

Click in the Type cell of the Edit Plants screen, and a pull-down arrow will appear. This contains several choices of groups of plants, based on WUCOLS.

Edit Plant Types

ypes

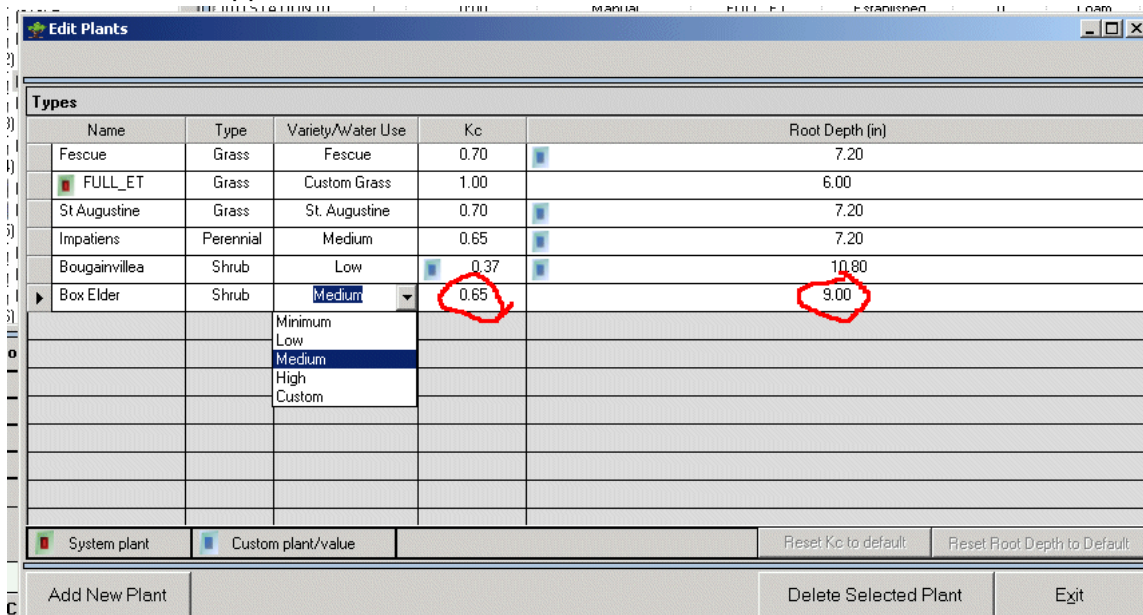| Name	Type	Variety/Water Use
Fescue	Grass	Fescue
▪ FULL_ET	Grass	Custom Grass
St Augustine	Grass	St. Augustine
Impatiens	Perennial	Medium
Bougainvillea	Shrub	Low
Box Elder	Grass ▼	Fescue
	Grass	
	Shrub	
	GroundCover	
	Vine	
	Tree	
	Perennial	
	Desert	

Choose the Type which most closely represents the New Plant you are creating. It may not be an exact match (see Kc and Root Depth) but you will be able to edit the characteristics if necessary.

When you choose a Type, the Root Depth cell will automatically be filled in. This can be changed later.

Variety/Water Use

The variety (or species, if the type was Grass) indicates the relative water use characteristics of the plant, within the Type category. Selecting the Variety/Water Use group actually pre-sets a Crop Coefficient (Kc) for general use.

Click in the Variety/Water Use cell for the New Plant, and right-click to select. The pull-down menu will appear.

If the Type was Grass, the Variety menu will show various species.

If the Type was any other selection, the Variety menu will show the water use group according to WUCOLS, usually High, Medium, Low, and Minimal.

Choose the species or group that most closely matches your new plant.
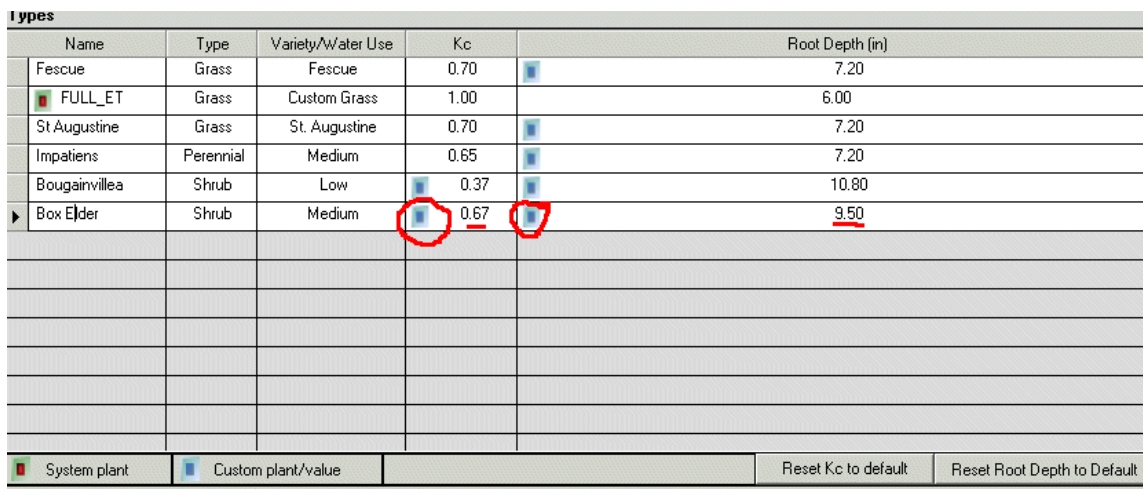
When you have made this selection, the Kc field will be filled in automatically. You can change this later, if desired.

If the Kc cell has a blue icon in it, it means that the Crop Coefficient has been changed by a person. If you want to change the Kc back to the default value (based on the Variety/Water Use selection), select the plant and click the Reset Kc button.

If the Kc is already at the default setting for the Variety/Water Use selection, the Reset button will be gray, because the value is already based on the selections.

Box Elder	Shrub	Medium	0.65	9.00		
▮ System plant	▮ Custom plant/value				Reset Kc to default	Reset Root Depth to Default

It would be impractical to list every landscape species known, and display them all as menu options, so the Variety selection allows you to select the category that most closely matches your New Plant. You can edit the Kc value separately, if necessary.

When you add a plant type for this controller, it will be available as a selection for all controllers in your system. You do not need to create new plant types for each controller unless there are additional species and varieties in other locations. All types created are available for all controllers.

Find the water use group of a specific plant from WUCOLS, or research the exact crop coefficient from local sources. Otherwise, an educated guess will work to begin irrigation… you can observe the results and edit later.

Tip: If you edit the characteristics of a Plant Type, every station in the system that has this type will be changed to the new characteristics.

Kc (Crop Coefficient)

The Kc column is standard notation for "crop coefficient" in agronomy and irrigation, and is a general factor representing a plant type's needs in relation to total ET. It is actually a multiplier which is applied to the raw ET data from the sensor, for each zone of irrigation.

Example: Total measured ET is .2"/5.08mm. A station or zone of irrigation has a landscape planting with a crop coefficient (Kc) of .75. The crop will see an estimated water loss of .15" or 3.81mm. Other factors, such as soil type and sun exposure, will be factored in before the final watering decision is made.

This factor may be edited. Click in the cell, and either type the new value or click the up and down arrows to change the number. If you change the value from the default, the Custom symbol will appear.

The "Reset Kc to default" button will change the custom value back to the original WUCOLS-based crop coefficient for the Type and Variety selected.

Crop coefficient information may be available online, in libraries, and from county cooperative extension services.

Root Depth

This is another very important setting for a plant type, because the root depth of a plant type determines how much of the soil reservoir is available to the plant.

The Root Depth cells will be filled in for the Plant Type, automatically. The default values are as shown in this table:

Type	Root Depth in./mm
Grass	7.2/15cm
Shrub	9"/23cm
Tree	14"/36cm
Vine	6"/15cm
Perennial (also Annual, Biennial)	6"/15cm
Groundcover	5.5"/14cm
Desert	6"/15cm

The root depth can easily be changed for actual plant conditions.

Click in the cell and type the desired root depth, or select a new value with the arrow buttons. If you change the value from the default, the Custom symbol will appear.

If the Root Depth cell has a blue icon in it, it means that the Root Depth has been changed by a person. If you want to change the Root Depth back to the default value (based on the Type selection), select the plant and click the Reset Root Depth to Default button.

If the Root Depth is already at the default setting for the Type selection, the Reset button will be gray, because the depth is already based on the Type settings.

ater Use	Kc	Root Depth (in)
cue	0.70	■ 6.00
Grass	1.00	7.20
justine	0.70	■ 5.04
lium	0.65	■ 5.04
w	■ 0.37	■ 18.00

	Custom Root Depth	Reset Kc to default	Reset Root Depth to Default
		Delete Selected Plant	Exit

Delete Selected Plant will completely remove a plant type from the database. However, you cannot delete a plant type that has already been assigned to one or more stations, because this would accidentally prevent them from watering at all. Only a Plant Type that is not assigned to any stations in the system can be deleted from the list.

Assumptions (default values)

The following assumptions are made with regards to the plant conditions, for the WUCOLS standard settings.

Normal root depth and health based on the plant type: assumptions based on average root depth in non-restrictive soils:

Non-stressed plant health, no environmental stress

No excessive soil salinity

Plants are actively growing, not in dormancy

New maturity = initial growth stage (past germination)

Established maturity = mid growth stage, before seed harvest or late stage decline

No large areas of exposed soil or contiguous vegetation

Crop coefficients are considered to be relatively uniform over station area, ie native plants are not grouped together with water intensive plants.

Crop coefficients are based on the WUCOLS ratings.

3. Assign Stations (and SSGs)

IMMS-ET requires complete information for each zone of irrigation under ET control. This allows it to determine how much moisture has been lost, and how much needs to be replaced with irrigation. It will also include naturally occurring rainfall in its calculations.

Overview
Each controller has an ET tab.

Each ET tab has a row for each station (including SSGs, if in use) with all the characteristics for the zone(s), including Plant, Site, and Sprinkler characteristics.

The Precip column is most important! These settings will be used directly to calculate run times.

Each row must be filled in correctly for the proper run times to be calculated.

There are tips and shortcuts for filling in large systems with similar zones. Some information is more important than others, but all will have an effect on run times and the total use of water, as well as plant health.

Read and understand the effects of each column's settings.

Station Setup
Double-click a controller to open its settings, and click the ET Settings tab.

Each station will be shown in the left column under Name. The row across from the name will contain all the information for that zone of irrigation.

Name	Program	Dep %	ET Pct %	Plant Type	Maturity	Slope %	Soil	Sun
(01) lawn	(A) Lawns	23.7	80	Fescue	Established	0	Clay	Full Sun
(02) Main Lawn 1	(A) Lawns	28.7	80	Fescue	Established	0	Loam	Part Sun
(03) Main Lawn 2	(A) Lawns	32.1	90	FULL_ET	Established	10	Sand Loam	Full Sun

If an ACC controller is in SSG/Smartstack mode, the SSGs will be visible below the individual stations. The stations that belong to the SSGs will not be shown individually, and instead will respond to the settings for the group.

Tip: You can multi-select within each column, and change a large number of station values at once. You can click and drag down a range of cells, or hold down the Control key and click multiple cells, or hold down the Shift key to select a range of cells. Then right-click in one of the highlighted cells, change the value, and press Enter to change them all.

Setup Tip: For initial setup, it is easiest to set the Station/Program assignments, then go to Plant Type. Fill in the Type, Maturity, Slope%, Soil, Sun, and Sprinkler information, first.

This will create data automatically in ET%, and Cycle and Soak information. You can edit these later, if necessary.

Program
Click in the Program cell, then right-click to set, and a pull-down arrow appears. Click the arrow and a list of all ET assigned programs will appear.

Each station must be assigned to an ET program if ET control is desired. The programs that appear are all the programs in the controller that have been set to ET Mode: Yes on the Scheduling tab.

If you change a program to ET Mode No, and stations were previously assigned to that program, the stations will become "Not Assigned" in this table. They will not water at all, unless they are placed in a non-ET program.

Tip: Similar plant types should be grouped into programs for plants with similar watering needs. The main purpose of the program organization is to determine the watering days, so plants with similar needs should be assigned to the same program.

Deficit

This shows the current state of soil moisture for the zone, according to IMMS-ET calculations, as both a percentage and a depth. The percentage value indicates the percent of Field Capacity of the soil. The depth is the shortage, in inches or millimeters, of water.

The bigger the Deficit, the more water will be applied, after the Allowable Depletion has been reached. Small deficits will not water as much (if they are not pink or red shaded, past the Allowable Depletion, they will not receive a run time at all).

Name	Program	Dep %	Deficit (in)	ET Pct %
(03) NE Lawn	(A) Lawns Main	1.4	0.016	100
(04) SE Lawn	(A) Lawns Main	34.1	0.38	100
(05) W Walks 1	(B) Lawns Walks	36.5	0.42	100
(06) W Walks 2	(B) Lawns Walks	1.7	0.016	100
(07) N Walks	(B) Lawns Walks	10.9	0.126	100
(08) S Walks	(B) Lawns Walks	1.4	0.016	100
(09) Box Elder	(C) Shrubs	14.2	0.246	100
(10) Begonia 1	(C) Shrubs	34.5	0.67	100
(11) Begonia 2	(C) Shrubs	52.8	1.026	100
(12) Oleander	(C) Shrubs	34.5	0.67	100
(13) Impatiens	(C) Shrubs	51.7	0.67	100
(14) Pelargonium	(C) Shrubs	33.2	0.43	100
(15) Verbena	(C) Shrubs	33.2	0.43	100
(16) Nemesia	(C) Shrubs	33.2	0.43	100
(17) Ice Plant 1	(C) Shrubs	45.5	0.39	100
(18) Ice Plant 2	(C) Shrubs	50.1	0.43	100
(19) Heather 1	(C) Shrubs	38.5	0.43	100
(20) Heather 2	(C) Shrubs	54.7	0.61	100

The Deficit field is updated automatically every time IMMS-ET retrieves ET data from the controller(s). Deficit is filled in and changed by the software, and indicates the approximate state of the moisture in each zone of irrigation.

Generally, Deficit is for your information, not for direct adjustment in the software (except under special circumstances).

At initial setup, the deficit should be 0.10"/2.54mm. This means the soil is well watered, with only a slight deficit. If this is not accurate, you can either water the soil manually or with a traditional program to get to .10"/2.54mm, or you can edit the deficit fields to a more realistic number.

Program	Dep %	Deficit (in)	E
Lawns Main	1.4	0.016	
Lawns Main	34.1	0.38	
.awns Walks	36.5	0.42	
.awns Walks	1.7	0.016	
.awns Walks	10.9	0.126	
.awns Walks	1.4	0.016	
C) Shrubs	14.2	0.246	
C) Shrubs	34.5	0.67	
C) Shrubs	52.8	1.026	
C) Shrubs	34.5	0.67	
C) Shrubs	51.7	0.660	
C) Shrubs	33.2	0.43	
C) Shrubs	33.2	0.43	
C) Shrubs	33.2	0.43	
C) Shrubs	45.5	0.39	

When a station or zone has lost enough moisture to consider watering, it begins to shade red in the Deficit cell. The drier it becomes, the more red the cell. Very red cells are in serious need of watering, and the software will run them at the next legal opportunity.

If you edit the Deficit manually and exit the cell, you will see the results in terms of the percentage. If the deficit becomes pink or red shaded, the deficit amount will cause watering at the next watering day for the program.

Allowable Depletion

IMMS-ET uses Management Allowable Depletion for its watering philosophy. It attempts to water each station, or zone, to 100% of field capacity of the soil.

The default Depletion % for a new controller is 35%. Each controller's allowable depletion can be adjusted, from 15% to 70%. This setting determines how dry it will allow the zones to become, before scheduling irrigation.

DepletionAdj.gif

When each station's deficit reaches the Depletion %, a runtime will be generated.   No runtimes will be generated until its deficit reaches, or exceeds, the Depletion %.

When ET/Rain values are retrieved daily, the Depletion % is calculated for each zone, and runtimes are calculated for the zones that have reached or exceeded the Depletion %.

IMMS-ET seeks not only to save water, but to discourage shallow watering caused by short run times. Management Allowable Depletion encourages waiting to water until this set point, so that roots are encouraged to develop, and soil does not stay wet on the surface for extended periods.

IMMS-ET will wait until the soil has reached the Depletion %, and then replenish the zone. However, if the station reaches the Depletion %, and it is not yet a selected watering day for that ET Program, the program will have to wait to run, and the deficit may fall below the percentage. IMMS-ET continues to track the deficit until it is permitted to water the Program.

The Deficit field for each zone is recalculated after irrigation, or natural rainfall, or both. Water that goes into the soil causes the percentage and depth to reduce. Water that evapo-transpirates out of the soil causes the numbers to increase.

The Deficit field can be edited manually, but this should be done with care. The amount of the deficit determines how much automatic irrigation will be applied to the zone. Only edit the Deficit field when you know that moisture conditions in the field are different than what the software is showing. This may be caused by manual irrigation (which the software could not know about) or inactive valves which were turned off manually, for example.

You can click in a cell (or range of cells) then right-click to adjust the amount of the deficit as a depth. You cannot edit the percentage directly, but changing the amount of the deficit automatically changes the percentage.

Tip: If the ET function has not been in regular use, and/or the area has been thoroughly watered by traditional or manual means, you can reset the deficit to a modest amount (.1"/2.54mm) so the system does not start with a large deficit.

ET %
This is the amount of the measured ET that will be used to calculate moisture loss for the zone. It can be used to adjust how much water will be automatically applied. A setting of 100% will use 100% of daily ET to deplete the zone. If the ET % is changed to

80%, only 80% of ET will be applied, with the result that the system will water approximately 20% less.

The bigger the percentage, the more water (and longer run times). Lower percentages will get less water, and shorter run times.

Example: ET is .2"/.51mm. Station is set to 80%. Station will accrue an actual deficit of .16 (.2 x .8) or 4.06mm (.51 x .8), and will therefore water less than if it had been set to 100%.

Controller Hardware	Station Set
Deficit (in)	ET Pct %
0.016	100
0.38	100
0.42	90
0.016	100
0.126	120
0.016	85
0.246	100

Use the ET percentage to adjust a station's irrigation after all other factors have been set properly. There are factors in a landscape that may affect moisture evaporation, which cannot be entered into a table. The ET % adjustment is the "final adjustment" for a station's performance.

Cycle and Soak
(ACC and ICC)

These factors, along with Cycle/Soak Mode, are used to divide the total watering for each station into "bite sized" amounts that the soil can absorb, to prevent wasted water and puddles.

Cycle is the maximum time that a station is allowed to run continuously.

Soak is a minimum time that it must wait, before applying another Cycle.

Name	Cycle	Soak	Cycle/Soak Mode
(03) NE Lawn	1:39	2:07	Auto
(04) SE Lawn	1:39	2:07	Auto
(05) W Walks 1	0:42	2:06	Manual
(06) W Walks 2	0:06	1:04	Manual
(07) N Walks	0:06	1:04	Manual
(08) S Walks	0:09	1:36	Auto
(09) Box Elder	0:09	1:36	Auto

Cycle/Soak Mode

If Cycle/Soak Mode is set to Auto, the Cycle and Soak cells will be filled in automatically based on Slope, Soil, and Precip rate. Changing any of these factors will automatically change the Cycle and Soak settings.

If Cycle/Soak Mode is set to Manual, you can directly enter the Cycle and Soak values.

Controller Scheduling	Controller Non-Water Windows	Controller Hardware	
Name	Cycle	Soak	Cycle/Soak Mo
(03) NE Lawn	1:39	2:07	Auto
(04) SE Lawn	1:39	2:07	Auto
(05) W Walks 1	0:20	1:30	Manual
(06) W Walks 2	0:06	1:04	Manual

Click in a cell to set the Cycle, which is the maximum run time allowed at once, and right-click to change the maximum.

Click in a Soak cell and right-click to change the Soak minimum.

Tip: Start with Cycle/Soak Mode is set to Auto, then change to Manual to adjust for desired performance.

Example: If a station must apply 30 minutes worth of water for the plants, but run-off or puddling begins to occur after 10 minutes, a Cycle of 10 minutes and a Soak of 30 minutes may allow the water to be applied without waste. The first 10 minutes will have a chance to soak into the soil, during the 30 minute Soak period.

Cycle and Soak does not affect how much water is applied to the plants. It determines how much water is applied per cycle. The Soak period requires the station to stop watering for at least the Soak time amount, and allow the first cycle to soak into the ground, before applying the next. The total watering amount remains the same.

When a station is in Soak mode, the controller is allowed to water other stations in the program, and will not remain idle.

Example: Stations 1, 2, 3, and 4 are in a Program and have Cycle and Soak times of 10 min. for Cycle, and 30 min. for Soak. Each station has a total of 40 minutes run time.

Station 1 will run for a 10 minute cycle, and then begin to Soak. It must Soak for at least 30 minutes.

Station 2 will then run immediately, for a 10 minute cycle, and then Soak.

Station 3 will run immediately, for a 10 minute cycle, and then Soak.

Station 4 will run immediately, for a 10 minute cycle, and then Soak.

After Station 4, the controller will check to see whether Station 1 has met its minimum Soak time requirement. While stations 2, 3, and 4 were watering, 30 minutes has elapsed, meeting the Soak minimum for station 1, so it may now apply another 10 minute cycle to Station 1.

This process is repeated until all stations have received their full watering amount. It is possible that all stations are in Soak mode, and until the Soak minimum is met for a station, nothing will water.

Some controllers do not have the Cycle and Soak feature, and these settings will not be shown for them.

Plant Type
Choose a plant type for each station from the list you have created (Create Plant Types section).

Click in the Plant Type cell for the zone, and right-click to view the selections. A down arrow will appear showing all currently created Plant Types. This will list all the Plant Types you have created with the Add New Plants function.

Click the Plant Type that is the predominant plant for the station.

You can multi-select multiple cells (with Ctrl, Shift, or click and drag) to set many zones at once to the same Type.

Tip: There can only be one plant Type per station. If a zone of irrigation covers multiple plant types, select the Type which is most sensitive to watering. The station is the minimum level of adjustment possible. If a zone includes a plant which is more sensitive to over- or underwatering, select that type (with the assumption that the other plants will be more tolerant of variations).

Maturity

The Maturity setting can be used for New plantings, which do not have fully developed root zones. This will automatically increase the watering factor for a zone, for a preset period of time, until the root zone develops. Then the station will automatically change to Established.

Most plants are set to Established, but in a new landscape, you may have many which are New.

Click in the cell to change. Right-click in the cell, and select either Established or New from the pull-down menu.

A plant set to New will receive twice as much water as an Established plant, at the beginning of the schedule. This is then backed off in a linear fashion over the grow-in time, until the Plant automatically becomes Established.

The New-to-Established time is determined by the Type selection, according to the following schedule:

Grass	42 days
Shrub	90 days (3 months)

Tree	210 days (7 months)
Vine	42 days
Perennial (also Annual, Biennial)	30 days
Groundcover	30 days
Desert	42 days

The Maturity factors are not programmable, and if longer or shorter grow-in periods are required, use the ET % factor to adjust for the new plant requirements.

Tip: Never use ET to germinate seed. Seeds do not have roots and ET is not relevant. Traditional programming, especially with Cycle and Soak, is the recommended way to germinate seed. Once the plants have sprouted, the converting to ET and using the Maturity New setting will help the seedlings until they are Established.

Slope %

The Slope factor is mainly used to auto calculate Cycle and Soak times. Enter the slope factor as a percentage. Steeper slopes will cause shorter cycles, and longer soak times. The net results will be more cycles (for a given run time) and less run off and wasted water.

The use of Slope as a percentage factor is common in surveying and civil engineering, and is often described as a "grade". It is calculated as Rise (elevation) / Run (distance) x 100.

Percentage example: If a sloped area rises (or drops) 1 foot in elevation (30cm), over 5 feet of horizontal run (150cm), the slope is 20%.

1 / 5 = .2 x 100 = 20% (30cm / 150cm = .2 x 100 = 20%).

Steeper slopes may also cause longer overall program watering times, due to the soak requirements and increased number of cycles.

Controller Hardware	Station Settings	
Maturity	Slope %	Soil
Established	0	Clay
Established	0	Loam
Established	10	Sand Lc
New	10	Sand Lc
New	0	Sand Lc
Established	0	Sand Lc
Established	50	Sand Lc
Established	12	Sand Lc
Established	0	Sand Lc

Tip: If you want to spread some watering around all stations during severe water restrictions with short watering windows, set a very steep slope percentage (even for relatively level areas). This will cause the software to increase the numbers of cycles, and lengthen the soaks, giving more stations a chance to get at least some watering in the legal time available.

Soil

The soil setting brings two important factors: the infiltration rate for the soil type (which affects the cycle and soak calculation) and the water holding capacity of the soil type (which affects the Deficit, and indirectly the total amount of watering).

The soil types in IMMS-ET are:

Sand	Clay Loam
Loam Sand	Silt
Sand Loam	Silt Loam
Loam	Clay

Select the soil that most closely matches that of each station or zone.

Slope %	Soil	Sun
0	Clay	Full Sun
0	Loam	Part Sun
10	Sand Loa ▼	Full Sun
10	Sand	Full Sun
0	Loam Sand	Full Sun
0	Sand Loam	Full Sun
50	Loam / Clay Loam	Part Shad
12	Silt	Full Sun
0	Silt Clay	Full Sun
0	Clay	Full Sun

Click in the cell to highlight, and right-click to select the soil type from the pull-down menu. You can multi-select many stations with the Shift or Control keys, and change them all at once.

Sand absorbs water very quickly, and therefore has a very high infiltration rate. However, it has low water holding capacity, and water will disappear quickly from the large particles that make up sand.

Clay has a very poor infiltration rate, often requiring many cycle/soaks to water thoroughly. However, it also has a very high water holding capacity.

Each choice creates infiltration and water-holding capacity factors for the general type of soil.

Because the soil is important in modeling the deficit, we do not recommend "fooling" the software by substituting another type. If more cycles are desired, it is better to change the Slope factor, or edit Cycle and Soak directly, with the Manual setting.

Sun

Sun exposure of each zone is a very important setting in the calculations. There are 4 choices for each station.

Full Sun: Exposure to direct sunlight of 6 hours per day or more.

Part Sun: 75% exposure, 4.5 hours or more.

Part Shade: 50% exposure, 3 hours or more.

Full Shade: 25% or less exposure, 1.5 hours or less.

Click in the cell to highlight the setting, then right-click to select from the pull-down menu. Multi-select to change several stations at once.

Increasing the sun exposure setting for a station will tend to increase the amount of watering, and run times, for that station. Decreasing the sun will reduce the watering.

Sprinkler

The sprinkler setting determines how long a station must run to replace the water lost to ET, indirectly. This pre-selects a precipitation rate for the station, which tells the system how much water in inches or millimeters is being applied for each minute of run time.

Choices are Rotor, MP Rotator, Spray, Drip, and Bubbler.

There is also a Custom setting.

Click in the cell to highlight, then right-click to select from the pull-down menu. Multi-select to change several stations at once. If you are using a non-standard sprinkler or other watering device, you can choose Custom and give it unique characteristics.

Sprinkler	Precip (in/hr)	Efficienc
Spray	1.6	0.4
MP Rotator	0.45	0.8
Spray	1.8	0.8
MP Rotator	0.42	0.75
Rotor	0.5	0.9
Spray	1.6	0.8
MP Rotator	0.45	0.8
Custom	0.00	0.9
Bubbler	1.16	0.98
Spray	1.6	0.8
Spray	1.6	0.8

Custom will have a Precipitation rate of 0, until you enter a value. The station cannot water with a precipitation rate of 0, so if you set Custom, you must set a precip rate.

When you make a selection, it will automatically fill in the cells in the next two columns, Precip [precipitation rate] and Efficiency.

IMMS-ET uses the following default factors for Sprinkler selection.

Sprinkler	Precip in./mm per hour	Efficiency
Rotor	.5/12.7	.9
MP Rotator	.45/11.4	.8
Spray	1.6/40.6	.8
Drip	.33/8.38	.65
Bubbler	1.16/29.4	.98
Custom	0	.9

You can edit the precipitation rate and efficiency, if necessary.

Precip

The precipitation rate is the amount of water, in inches or millimeters, that the zone applies for every hour of run time. This allows the software, and the controller, to control the amount of water application, by adjusting run times. Each minute of irrigation becomes an amount, in inches or millimeters, of watering depth.

Precip is one of the most critical settings on the ET tab.

Sprinkler	Precip (in/hr)	Efficiency
Spray	1.6	0.4
MP Rotator	0.45	0.8
Spray	1.8	0.8
MP Rotator	0.42	0.75
Rotor	0.56	0.9
Spray	1.6	0.8
MP Rotator	0.45	0.8
Custom	0	0.9
Bubbler	1.16	0.98
Spray	1.6	0.8

Higher Precip rates tend to cause shorter run times (for a given deficit). Lower Precip settings tend to cause longer run times. Many high-efficiency sprinkler types actually have low precipitation rates. These apply water more evenly over the coverage area. High efficiency sprinklers can run longer, while using less water to achieve the same coverage (see Efficiency section).

The precipitation rate will be filled in automatically based on the Sprinkler selection (except in Custom) but it can also be edited directly in the cell.

To edit, click in the cell to highlight it, then right-click to change the value. You can multi-select cells, to change several Precips at once.

The Precip is filled in with a reasonable number for the sprinkler type, but variables such as flow, pressure, nozzle, etc. can affect the actual precipitation rate of any station of irrigation.

You can perform your own tests with catchments, or use manufacturer's specifications for known performance factors, to set the precip rate more exactly for any station.

The controllers can only directly control run times. Therefore, the precipitation rate determines how long the station must run, to make up the soil moisture deficit.

Do not leave any ET-controlled station with a precipitation rate of 0 or it will not be able to run, at all.

Edits to the "Precip" column only affect the station to which they are applied.

Efficiency

The Efficiency column is an advanced setting, which modifies the effects of the precipitation rate on the final run time. Efficiency is a "run time factor" which can be used to reflect the characteristics of the zone of irrigation. This setting reflects characteristics that are sometimes called Scheduling Coefficient (SC), Irrigation Efficiency (IE), or Distribution Uniformity (DU) in various formulas.

Efficiency will be set automatically by the Sprinkler selection, at first. It can then be edited directly.

Sprinkler	Precip (in/hr)	Efficiency
Spray	1.6	0.4
MP Rotator	0.45	0.8
Spray	1.8	0.8
MP Rotator	0.42	0.75
Rotor	0.56	0.88
Spray	1.6	0.8
MP Rotator	0.45	0.8
Custom	0.38	0.9
Bubbler	1.16	0.98

Editing the Efficiency factor will not visibly change the Precipitation rate, but it will have an effect on calculated run times. Efficiency can be based on the performance of the sprinklers themselves over their coverage radius, and/or the total efficiency of a zone with multiple overlapping sprinklers. This is affected by factors like nozzle selection and spacing of the sprinkler heads. These factors vary from system to system.

Efficiency is inversely proportional to run time.   As the efficiency value decreases, the generated ET run time will increase (to make up for the inefficiency).

Efficiencies are usually a decimal lower than 1, and have the net effect of creating a lower effective Precipitation Rate, and therefore a longer run time. This will compensate for non-uniform coverage of multiple sprinklers in a given area.

High efficiency sprinklers (.8 and above) may run longer, if their precipitation rates are lower, but can still use less water to cover a given area than lower efficiency sprinklers. This is because low efficiency sprinklers must spread more water to "fill in" the weak spots in their coverage.

SSGs in ET Mode

An SSG is a group of up to 4 stations which turn on at the same time, and run together as a single unit. SSGs (Simultaneous Station Groups) behave exactly like individual stations, if they are used in ET irrigation.

Each SSG has its own deficit, plant types, and other settings. They are not based on the settings for the individual stations included.

Controller Scheduling	Controller Non-Water Windows		Controller Hardware	Station Settings	Custom Manual	ET Settings	
Name	e	Maturity	Slope %	Soil	Sun	Sprinkler	Precip (in/hr)	Efficiency
(08) Azaleas		Established	12	Sand Loam	Full Sun	Custom	0.38	0.9
(09) BoxElder1	urs	Established	0	Sand Loam	Full Sun	Bubbler	1.16	0.98
(10) BoxElder2		Established	0	Sand Loam	Full Sun	Spray	1.6	0.8
(11) Hedges A		Established	0	Sand Loam	Full Sun	Spray	1.6	0.8
(12) Hedges B	yrtle	Established	0	Sand Loam	Full Sun	MP Rotator	0.45	0.8
(01) LawnGroup1		Established	0	Loam	Full Sun	Rotor	0.5	0.9
(02) LawnGroup2		Established	0	Loam	Full Sun	Spray	1.6	0.8
(03) LawnGroup3		Established	0	Loam	Full Sun	Spray	1.6	0.8

All stations included in an SSG must have <u>identical </u>characteristics if the SSG is assigned to an ET program! The soil reservoir and deficit will be calculated for the whole SSG as a single unit. SSG run times are calculated equally for all member stations. IMMS-ET treats an SSG as a single large zone.

Even if the member stations already have individual characteristics, the SSG must be set up with completely new Plant, Site, and Sprinkler settings. It does not attempt to combine or average the settings of the individual station members.

If the controller is taken out of SSG mode, the individual stations will reappear with their own individual settings. It is possible for these to be very different from the settings of their SSG, because the data is not linked.

If an SSG has an accrued soil deficit, and then the controller is changed out of SSG mode, the member stations will not retain the deficit. They may not water immediately, because the deficit calculation will begin at 0 for them. The same is true when stations accrue a deficit, and are then switched to SSG mode.

Tip: Before switching the controller between SSG/Smartstack and one of the other Stack Modes (Stack/Overlap or Smartstack), carefully note the current deficits, and edit the deficits of the individual stations to match after the switch.

Operations

When all Stations have ET Settings configured, and the Source and Program assignments have all been completed, the system should be ready to irrigate with ET.

If the Full Sync has been set to run automatically, IMMS-ET will automatically retrieve ET from the Sources, recalculate run times for all designated stations, and download the new run times as part of the full Sync.

IMMS-ET will not change the Day Schedules or Start Times, or any other controller features, at all. It will only calculate run times and place them into the existing programs.

Not every station will run on every watering day, even if the program is set to run on those days. IMMS-ET will prevent shallow watering, and only runs a station when it is required. IMMS-ET will use Management Allowable Depletion to let the soil reservoir moisture fall to a certain point, then water back up to 100% Field Capacity.

If a station does not need water, it remains assigned to the program, but receives a run time of 0 minutes. If other stations in the program do require water, they receive their run times as calculated, and the stations which do not require water are skipped. They will reappear in the program when they need to water. This can cause the total length of the program to vary from day to day.

Most of the major controller settings are viewed or edited on the Scheduling tab for a selected controller. The controllers will still have the same features and capabilities they would have as standalone controllers. Only the run times are automatically changed, based on the climatic conditions.

Program level Season Adjust in the ACC controller is not available when a program is assigned to ET Mode, but will be set automatically to 100%. Program level Season Adjust is still available for non-ET programs, and behaves normally in those programs.

Program	A	B	C	D	E	F
Program Name	Lawns	Shrubs	Flowers&Such	Groundcover	Ice Plants	Lights
Days To Water	S M T W T F S	S M T W T F S	INT 1	S M T W T F S	S M T W T F S	S M T W T F S
Next Water Date	11/6/2008	11/6/2008	11/6/2008	11/7/2008	11/6/2008	11/6/2008
Start Times						
Start Time 1	11:00 PM	7:00 PM	3:03 AM	2:02 AM	3:00 AM	8:00 AM
Actual Start	----	7:00 PM	----	----	----	----
End Time	----	7:44 PM	----	----	----	----
ET Mode	Yes	Yes	Yes	Yes	No	No
Season Adjust	N/A	N/A	N/A	N/A	70 G	90 G
Start Mode	Overlap	Overlap	Overlap	Stack	Overlap	Stack

Note: if Program level Season Adjust is modified at the Controller's dial and button controls in the field, the ET calculated run times will no longer be correct for ET Programs (until the next download). There is no reason to modify the ET Programs at the controller, since they are controlled by the software.

Global Season Adjust should be left at 100% when a controller has any programs set to ET Mode: Yes. If the controller Seasonal Adjust is set to anything else, the ET-based run times will be incorrect, with unpredictable results.

IMMS-ET does not use or affect Season Adjust settings. All run times are calculated with the expectation that the controller will be in 100% adjust mode.

Controller Properties

Name:	1840 La Costa Meado
Type:	ACC
Season Adjust:	100
Station Size:	12
Actual Size:	12

☑ 🟩 **Comm Enabled**

🔄 **Comm Check**

Change Site

Mode:
- ● Stack/Overlap
- ○ Smartstack — 5
- ○ SSG/Smartstack — 0

ACC controllers have selectable Stack or Overlap modes, as well as SmartStack settings. These features remain in effect even if they are under ET control. All 6 programs in the ACC may run at once, even with ET adjusted run times, if the controller has been set up to Overlap all programs. If controllers are set to Stack, the changing run times may have a side-effect on actual start times.

ICC controllers may run any program and program D at the same time. This feature remains in effect with IMMS-ET.

Pro-C and SRC controllers always Stack, and run one program at a time. All 3 programs (or any smaller number) may be used with IMMS-ET, but they will always Stack as the controller does in standalone mode.

Program	A	B	C
Days To Water	s M T W T F S	s M T W T F S	s M T W T F S
Next Water Date	11/6/2008	11/6/2008	11/6/2008
Start Times	▮▮▯▯▯▯	▮▯▯▯▯	▯▯▯▯▯
Start Time 1	10:00 PM	3:00 AM	OFF
Actual Start	----	----	OFF
End Time	----	----	OFF
ET Mode	Yes	Yes	No
Station Name	Program A	Program B	Program C
(01) STATION 01	0:00	0:00	0:00
(02) STATION 02	0:00	0:00	0:00
(03) STATION 03	0:00	0:00	0:00

Set Controller Schedules and Start Times, including Stack or Overlap options, as you wish. Only run times will be changed, and the other controller settings will be observed when watering.

Non Water Windows (ACC only)

ACC Programs may have Non Water Windows set, by Program. This feature prevents any automatic irrigation between specified hours of a day.

Non Water Windows may interact with IMMS-ET in unexpected ways!

If a program conflicts with a Non Water Window setting, it is Suspended. This means the program events continue to run in memory, even though watering is suspended. The reason for this is that the maximum number of stations will be allowed to water without moving the Start or End times of the total water window. Programs take exactly as long as they always would, and are not extended into the day because of Non Water Window conflicts.
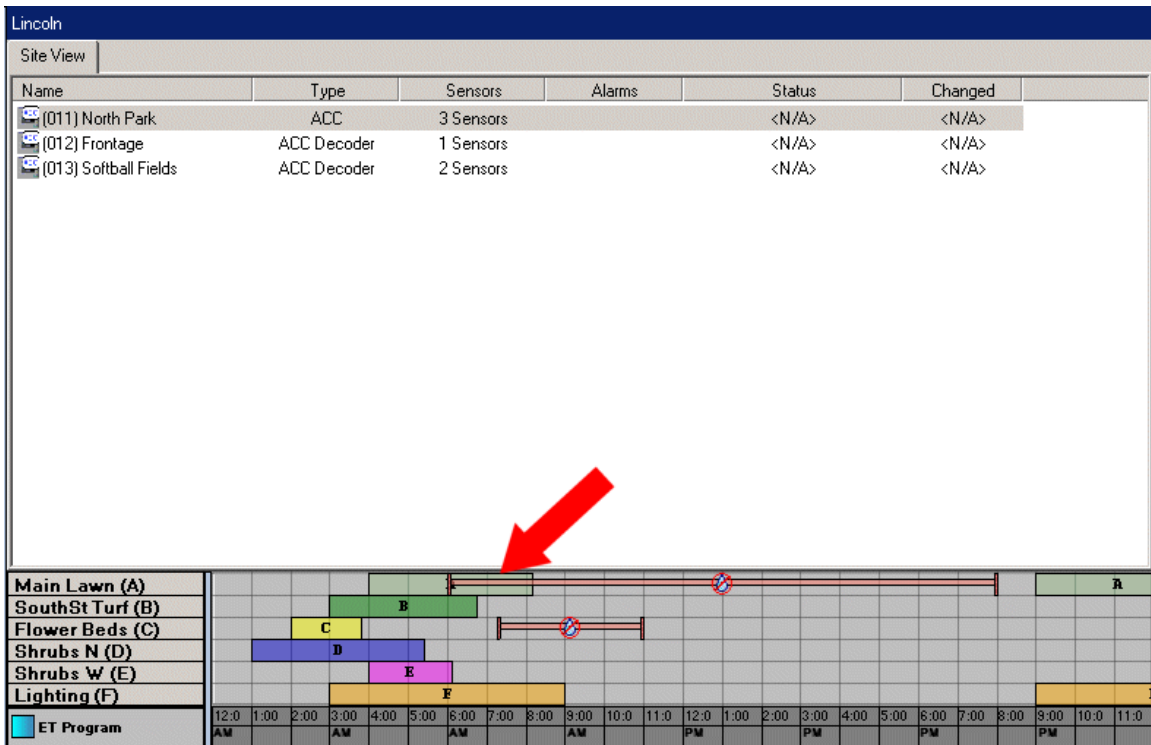
With IMMS-ET, the program length will vary with the adjusted run times, and Non Water Window violations may occur. When they do, the watering will stop during the Non Water Window, but the station run times will elapse, anyway. This means that the stations which expire ("run" without watering) in prohibited times of day, will not water.

Fortunately, the controller knows this and reports it to the central software as an alarm, on the next Sync. IMMS-ET will see that the conflicting stations did not water, and adjust the soil reservoirs accordingly. However, it will not be able to water them at illegal times.

The conflict will be reported in the Alarm log for any possible corrective action.

The Missed Stations will also be reported in the Station Activity Log automatically, and the station deficits will be adjusted reflect any shortages in the run times.

Program	Start Time	Duration	Mode	Station	Description
(B) Shrubs	11/6/2008 7:00:00 PM	00:15:00	Auto Program M...	(010) BoxElder2	Irrigation Completed
(B) Shrubs	11/6/2008 7:15:00 PM	00:47:00	Auto Program M...	(012) Hedges B	Irrigation Completed
(B) Shrubs	11/6/2008 7:15:00 PM	01:00:00	Auto Program M...	(010) BoxElder2	Irrigation Delayed Soaking
(B) Shrubs	11/6/2008 8:15:00 PM	00:15:00	Auto Program M...	(010) BoxElder2	Irrigation Completed
(B) Shrubs	11/6/2008 8:30:00 PM	01:00:00	Auto Program M...	(010) BoxElder2	Irrigation Delayed Soaking
(B) Shrubs	11/6/2008 9:30:00 PM	00:14:00	Auto Program M...	(010) BoxElder2	Irrigation Completed
(A) Lawns	11/6/2008 11:00:00 PM	01:37:00	Auto Program M...	(002) Main Lawn...	Irrigation Completed
(A) Lawns	11/7/2008 7:48:42 AM	00:30:10	Manual Program...	(002) Main Lawn...	Irrigation Stopped
(A) Lawns	11/7/2008 8:18:00 AM	00:00:00	Auto Program M...	(002) Main Lawn...	Irrigation Interrupted
(A) Lawns	11/7/2008 8:20:41 AM	00:18:09	Auto Program M...	(002) Main Lawn...	Missed Irrigation No Water Windo...

Human intervention will be required to make some adjustment to prevent the shortage from continuing, however.

ET Programs with Non-Water Windows need to be closely watched on a regular basis. The deficits for missed stations will continue to grow.

Possible solutions:

If possible, shorten or delete the Non Water Windows.

If the piping and water source permit, disperse stations over more programs (or SSGs), allowing more stations to run at once. This will help reduce overall watering times.

Tip: Cycle and Soak are very helpful, when faced with short watering windows and large systems. A Non Water Window conflict can be worked around by setting shorter Cycle times, so that all stations get some water, even if there is a Non Water Window conflict later in the program.

ET Settings Tab, Other Features

The lower portion of the ET Settings tab provides data for ET and individual sensors. You can check the ET and sensor data in the field directly from this screen.

Get ET/Rain button

You can receive updated ET data any time by going to a Source controller's ET Settings tab, and clicking the ET button (Get ET/Rain).

This will immediately call that controller and retrieve current ET and Rain data, which can be viewed in the Communication Status Window.

This retrieves the newest ET information from the controller, and adds it to the totals. The total ET is tracked by the software. If you retrieve once, and then try again in an hour or two, the controller may only have a small additional amount of ET to report.

These totals are visible on the ET Settings tab.

ET Today, Yesterday, 2 Day, and 7 Day show running total accumulations of ET for the controller's ET source sensor.

Rain Today, Yesterday, and 7 day show recent rain totals, which will be added to each zone's moisture level.

Last ET Accumulation shows only the amount of additional ET on the last communications with the controller. This will have been added to the other totals, and just shows the new amount on the last communication.

Note: The ACC controller display (on the controller in the field) will always show the daily total ET since midnight. This is only for casual information, and not the running ET balance that is kept in detail in the software. The controller's visible ET display resets to 0 every midnight.

Manual Irrigation Options button
The Manual Irrigation Options button allows you to specify whether manually applied irrigation will be counted toward replenishment of the plant's moisture, or whether it should be ignored.
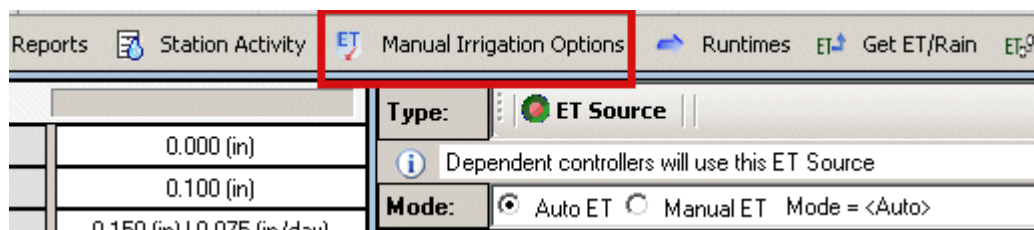
This button will open the Manual Irrigation options window. The options list all forms of electronically-started manual irrigation. If a box is checked, any station that starts for the checked reasons (Manual start from controller dial, ICR remote control, etc.) will have the soil reservoir replenished in the software, and automatic irrigation will be adjusted accordingly.

This is useful for sports fields and other turf applications where a significant percentage of irrigation is performed with remote control, or manual starts of programmed irrigation.

Manual Irrigation Options for ET

Check listed modes that you want counted toward the station's water deficit. Note, only stations managed by ET programs are affected.

Mode	
Manual One Station Mode	☑
Manual Program Mode	☑
Maintenance Radio Manual Single Station Mode	☑
Maintenance Radio Manual SSG Mode	☑
ICR Manual Single Station Mode	☑
ICR Manual Program Mode	☑
Custom Manual Program Mode	☑

OK   Cancel

If the box is not checked, stations run for that reason will not be counted for soil replenishment. If you normally use a wireless remote just to cool down hot spots in turf during the day, you can uncheck the box for ICR and that watering will not count toward the automatic irrigation.

The controller cannot track manual irrigation in the field from hoses or manually actuated valves, even though it will see the flow. Even with flow monitoring, the controller cannot know which zones to which the water was applied, unless it was started electronically. This watering is not applied to the soil reservoir. You can manually edit the Deficit fields to compensate for manual watering, however.

ET Modes (Auto and Manual)

A controller assigned to an ET Source can operate in one of two modes, "Auto" or "Manual".

Auto ET

"Auto ET" mode retrieves the ET and Rain accumulations from the assigned ET Source for the controller. This is the normal operating mode for IMMS-ET.

If the controller is unable to retrieve the ET accumulations for any reason, or the returned ET value has missing or garbled data, then the controller will use its ET Coast rate to calculate the ET accumulation.

ET Coast
ET Coast is the "emergency" or contingency ET total, if communications with the ET Sensor are lost. It is the most reliable means of continuing ET-based irrigation until a problem with the sensor is fixed. The ET Coast value is a *rate* and uses the average of the last 3 days of known good ET for run time calculations, if the ET Sensor is unavailable for fresh updates.

ET Sensor failures are announced in the Alarm logs, and should be fixed in the field as soon as possible to return to real ET operation.

Manual ET

"Manual ET Rate" uses a customized ET rate, instead of ET Sensor input, to set the daily ET. This amount will be applied to the total ET every day, when run times are calculated.

The Manual ET is a rate, not a total. It means that the value you enter will be applied to the soil every day (until you change back to Auto ET).

Manual ET can be used when a sensor is unavailable, to simulate local conditions.

Additional ET to Apply Now is an amount of ET you can add to the existing deficit, immediately. This adjusts the moisture depletion based on the amount you specify. This has the effect of increasing watering for the next irrigation only, because the number is not added every day.

Additional Rain to Apply Now is an amount of rainfall you can specify. This will reduce the moisture deficit, and have the effect of reducing the next irrigation. This is the opposite of applying Additional ET. It is also a one-time adjustment to the existing soil moisture conditions.

Click Apply to adjust the deficits immediately. The Additional ET or Rain number will return to 0, but the individual zone deficits will be adjusted immediately.

ET Min/Max
The ET Minimum and Maximum specify the minimum and maximum amounts of ET that are allowed to accumulate in any given day.

This can be used to prevent accidental under- or over-watering for any reason.

A minimum ET will always add the minimum amount to the total, every day, regardless of the sensor reading.

A maximum ET will not permit the daily ET to exceed the specified number. It can be used, with caution, to limit the amount of irrigation stations receive in hot weather when watering restrictions are in place.

Maximum ET does not limit run times (and program durations) directly. It limits the total amount of ET that can be applied, which will generally have the effect of limiting run times and program durations.

The Min/Max settings are not enforced unless the Enforcement check box is checked.

Runtimes button

The Runtimes button will apply the total accrued ET to all ET-assigned stations, immediately.
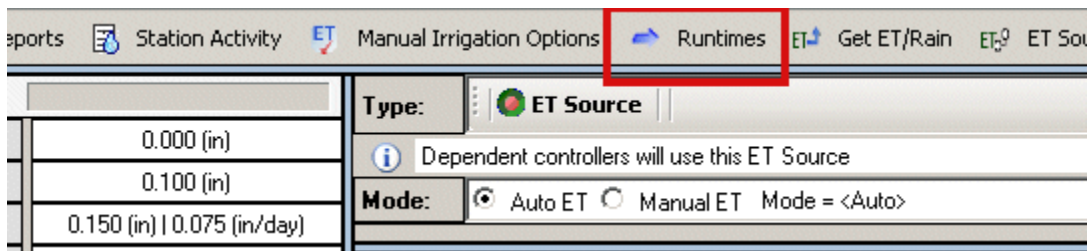
You will not see a visible change, until you go to the Scheduling tab. There, the new ET based run times will be visible immediately. If no run times appear, there was not enough soil moisture deficit to cause a run time (see Depletion % and Deficit).

The new Runtimes are not sent to the field until the Sync time.

Runtimes calculated in this way are generally for information, only. If it is still daylight, ET will continue to accrue through the remainder of the day, and the final calculation at the Sync time will be more up to date (it will include all ET since the last Sync).

If you calculate Runtimes from the button, they will be updated automatically at the next Sync.

You could also choose to send the new Runtimes immediately, by sending an immediate Sync to the controller.

Not all stations in a program will necessarily get run times. If their deficits do not require watering, IMMS-ET will not schedule irrigation for them. Each station must reach the Allowable Depletion limit, before run times will be scheduled.

Station Activity

The Station Activity button will report all station activity at the selected controller reported at the last Sync.
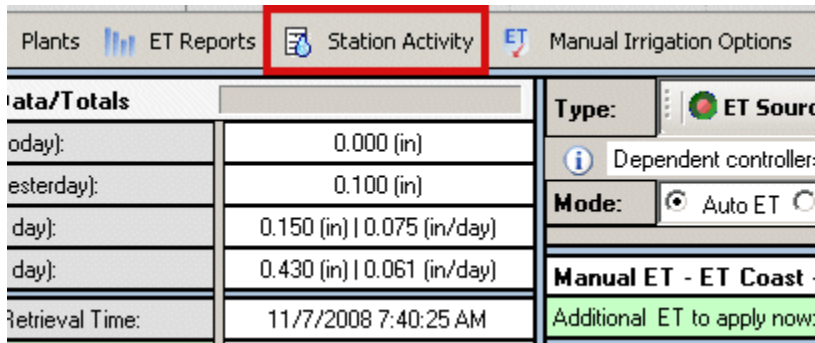
This displays the Station Activity Report.
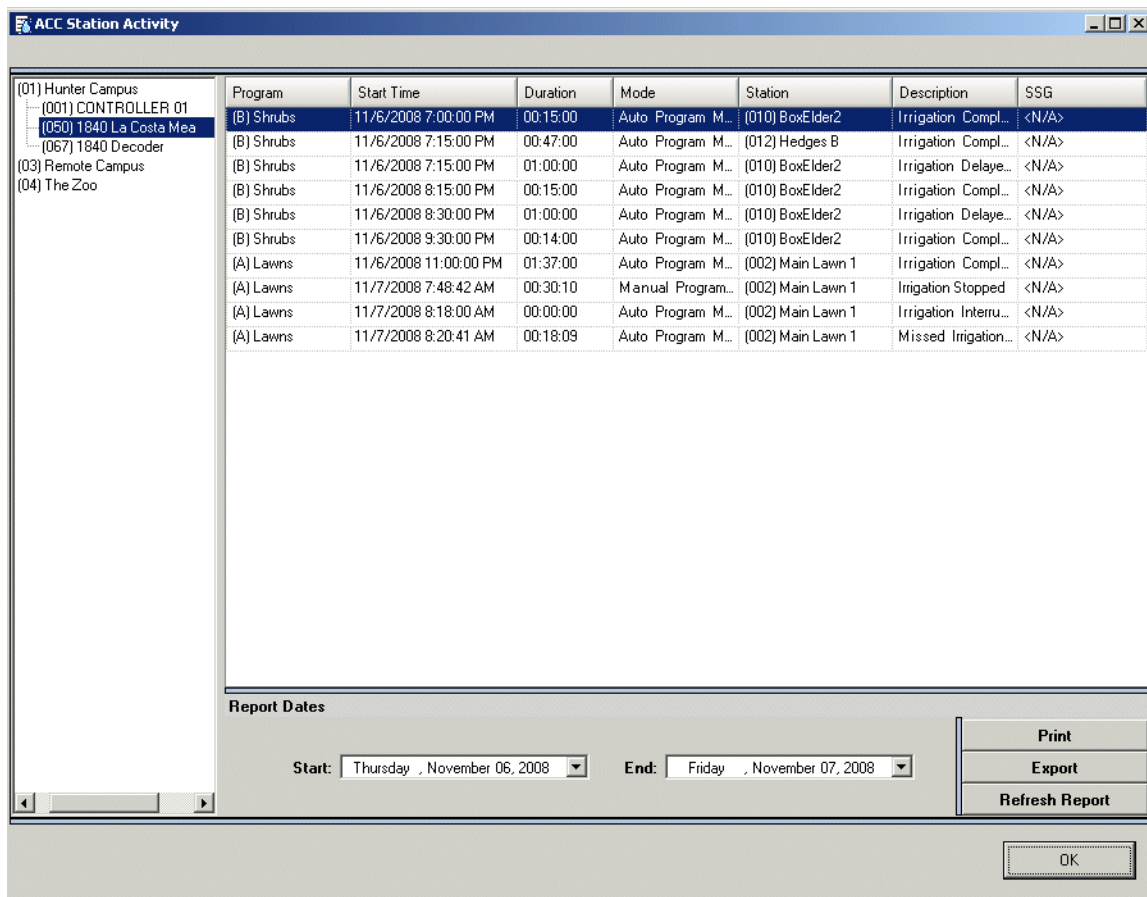
Each ACC controller logs all activity, normal and interrupted, internally, in the Station Log. When IMMS-ET performs an automatic Sync, it retrieves the log information, and uses it to verify that scheduled irrigation has actually taken place.

If a scheduled station did not run for any reason, the soil reservoir was not replenished. IMMS-ET will correct all station moisture level calculations for station interruptions, and the station deficits will be shown with the updated information, after a Sync.

You can view a greater range of activity by selecting a date range at the bottom of the report. Choose a Start date and an End date, and then click Refresh Report. This will show all station activity for the selected range.
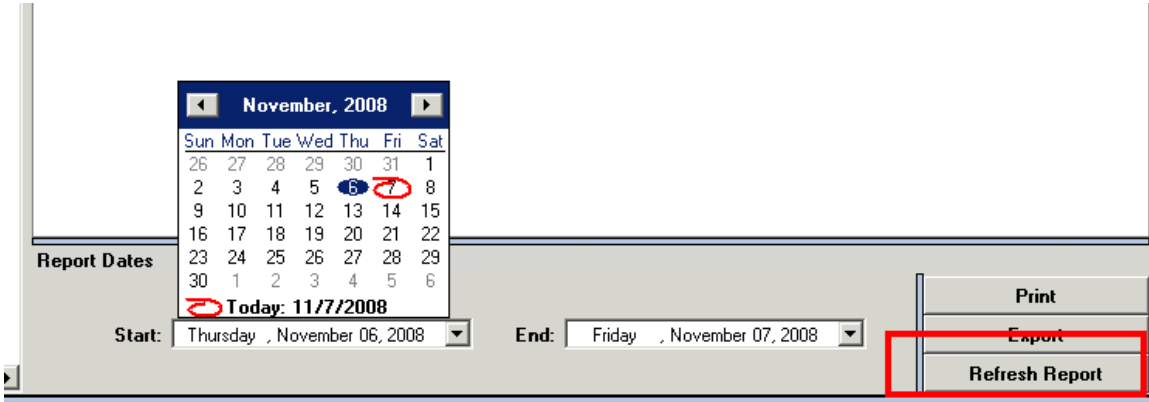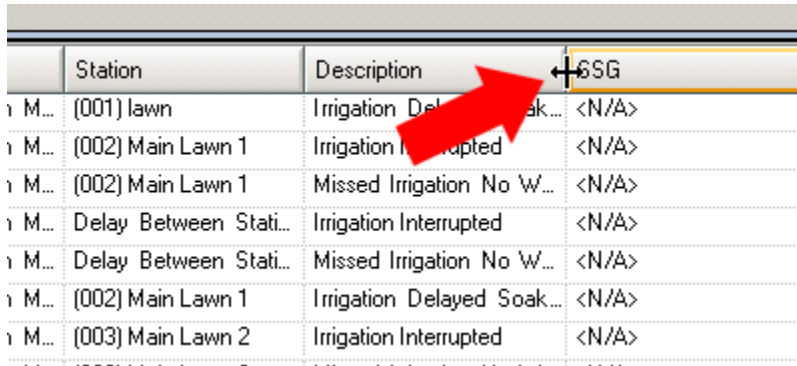
The report can be Printed, or Exported to Microsoft Excel, with the Print and Export buttons. If you have reporting or charting requirements that exceed the ability of IMMS-ET software, export the data into Excel and use the advanced spreadsheet functions available there.
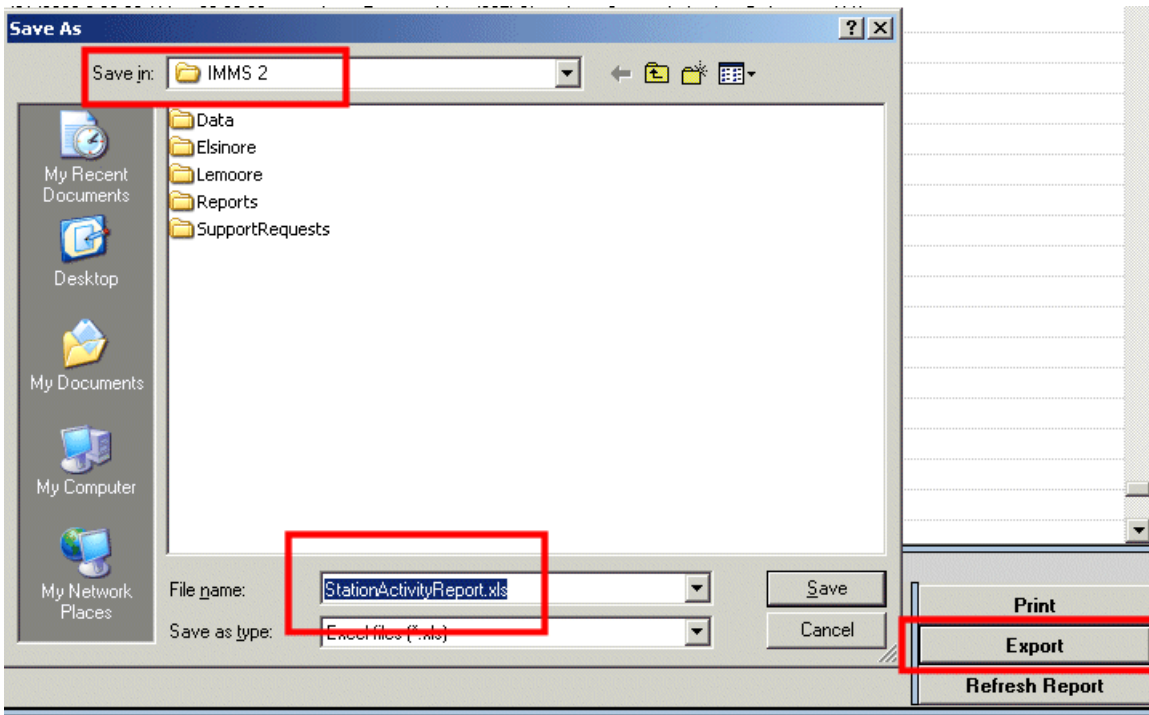
Not all delays reported in the Station Activity report are problems. If a station has Cycle and Soak settings, or Delay between Stations set for the program, the delays will be reported along with the run times. The Station Log in the controller records all activity, good or bad. Be sure to read the complete description of any reported event to fully understand it, before assuming that there is a problem.

You can expand any column to read the full description by clicking on the divider between the column headers, and pulling to one side.

The Station Activity report can be used for diagnostic purposes, or just to verify whether stations have run.

Example: A program is interrupted by a Clik sensor.

The stations that did not water because of the sensor shutdown are reported in the Activity Log.

After the next Sync, IMMS-ET puts the deficit for each missed station back to the level before irrigation was scheduled. At the next Sync, longer run times will be calculated to make up the difference for the missed irrigation.

ET Reports

Click the ET Reports button to track ET, or individual sensor readings (Rain, Solar, Air Temperature, Humidity, or Wind) for periods of time.
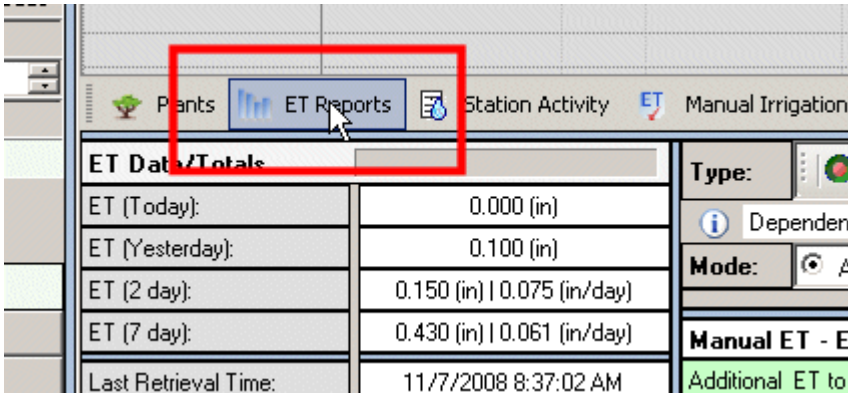
The ET Report will display data as both a graph, and a table. ET Report will show current day by default, but you can select a date range to view sensor history for a longer period of time.
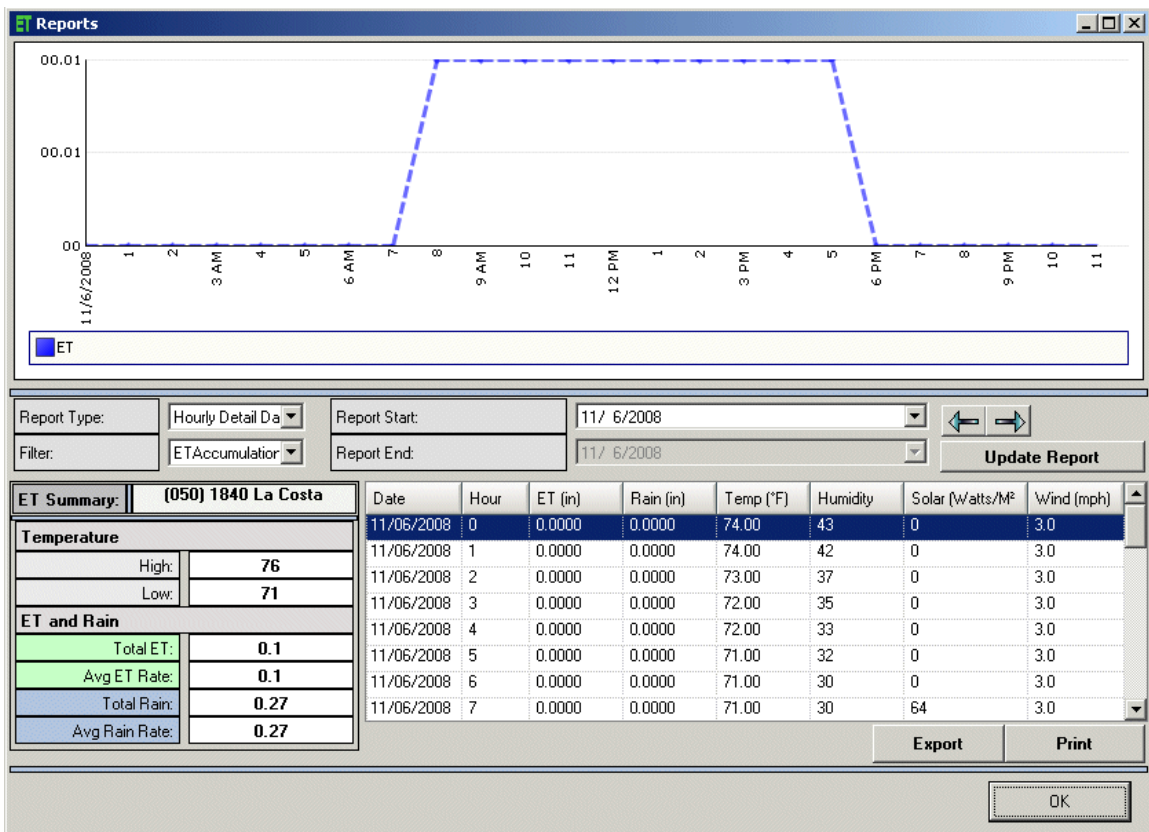
The Report Type and Filter fields determine which sensor will be reported. The report window will open with Hourly Detail Data within a specified day, or you can choose Daily Summary Data for an extended period.

Report Type allows 3 time period types.

Hourly Summaries, for hourly readings within any given day. This report allows ET and individual sensor histories to be viewed at different points within the 24 hour day selected.

The Filter field specifies which sensor is reported in the Hourly Summary mode. The report will automatically display ET Accumulation, but the Filter can be used to select any individual sensor. The filter selection is not active in the Daily Summary mode.
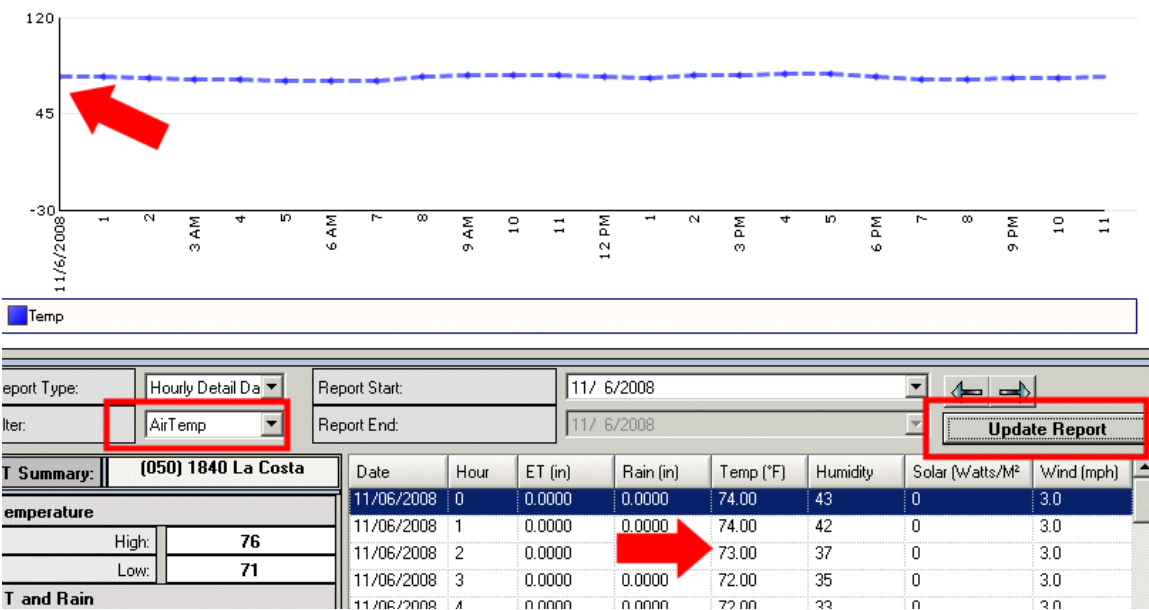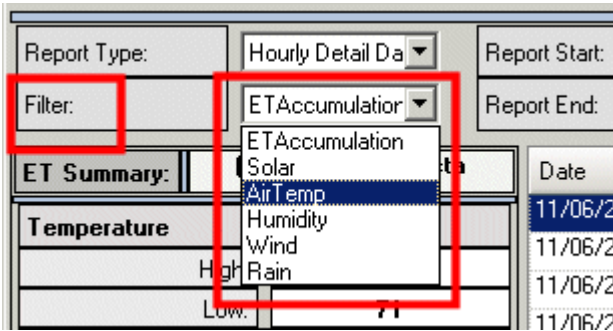
Daily Summaries, which show total ET and Rain for a range of days. Click the down arrows next to the report Start and End dates to select the range from a calendar, and then click Update Report to see the graph for the period selected.
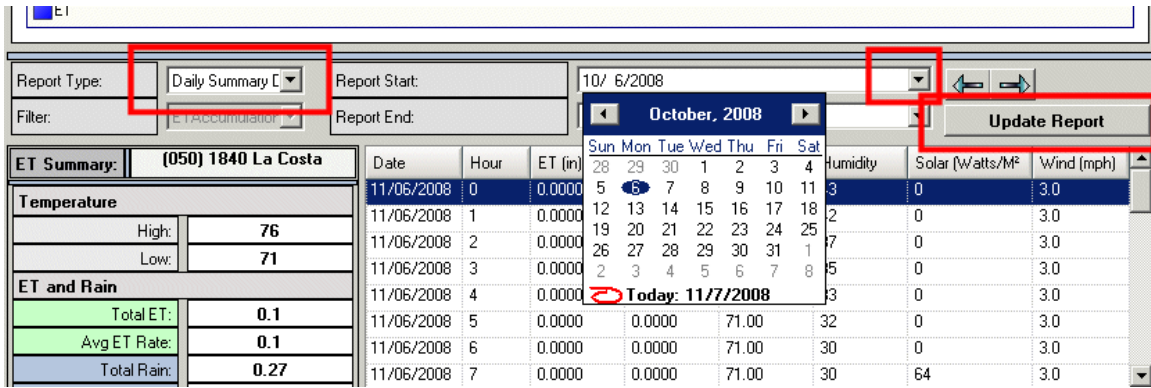
Retrieval Times, which shows the totals which were retrieved during individual communications. The Retrieval Times report shows the total amounts at the time of retrieval, and is mostly for diagnostic purposes.

The left and right arrow buttons can be used to change the dates for the reports.
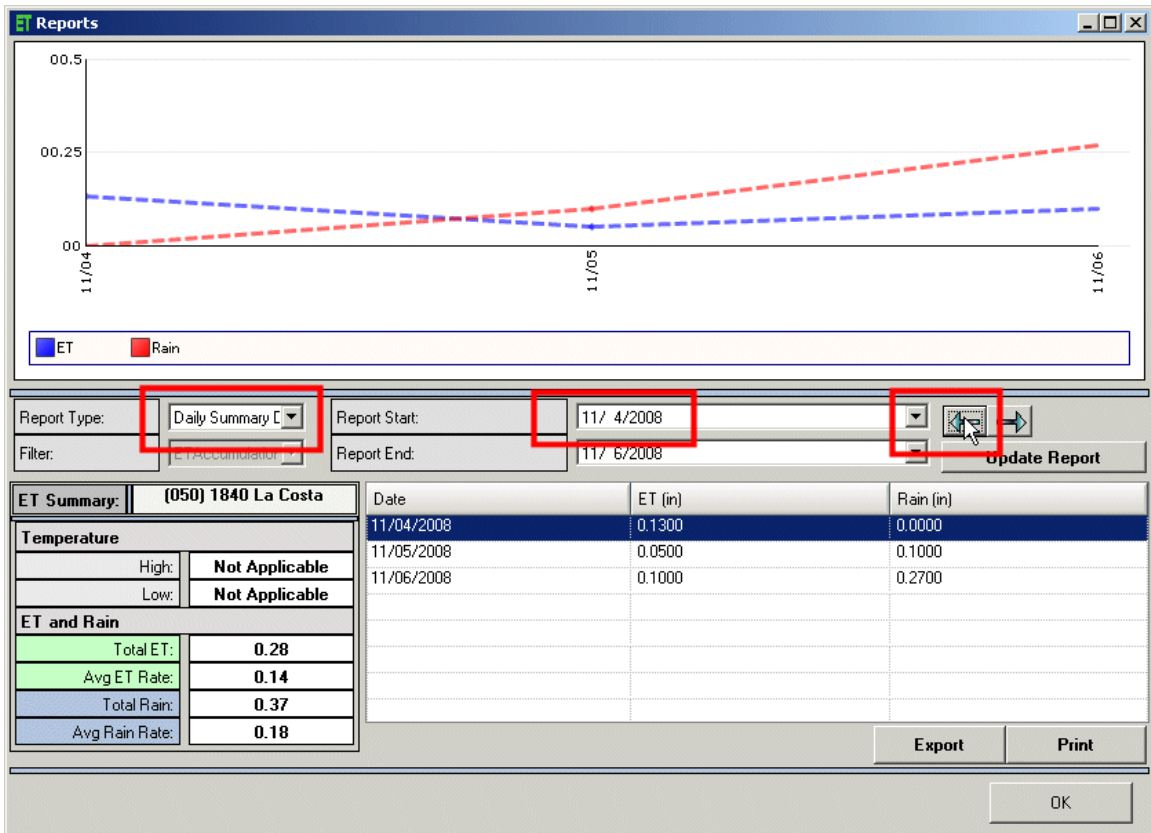
Export: Most reports in IMMS can be exported to Microsoft Excel, and some to other formats. The data shown in the ET Reports graphs and tables can be exported to Excel by clicking the Export button. Choose a location and a file name for the report, and click Save.
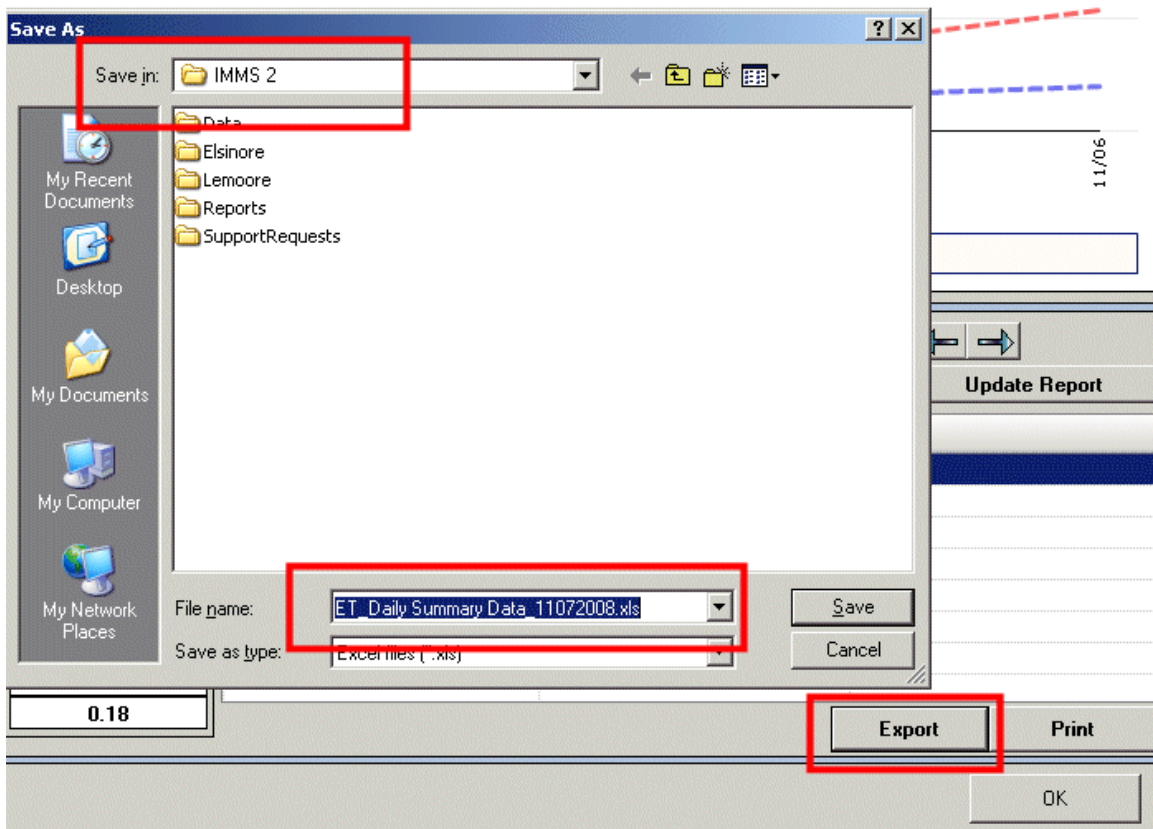
Depletion %

The Depletion % field specifies the Allowable Depletion level for the controller. Normally this is set to 30-35%.

This means that watering will not be scheduled for a station until the soil moisture level has dropped to 35% below the water holding capacity of the soil.

This percentage can be changed, if you want to water more or less frequently, for the entire controller and all its stations. This does not affect the amount of water. It affects how frequently watering is scheduled.

If you increase the percentage of allowable depletion, the controller will water less frequently. For example, 50% would allow the stations to lose 50% of their water holding capacity before watering would be scheduled. They would then be watered back up to 0% depletion (no missing water).

If you decrease the percentage of allowable depletion, the controller will water more frequently.

In effect, the Depletion % determines how much "dryness" the system will tolerate, before scheduling irrigation. Generally, 35% is the best overall setting for most landscapes.

ET Source

The ET Sources button on the ET Settings tab opens the ET Source view window, which contains an interactive view of the ET Sources and Dependencies that affect where, and how, ET is obtained for each controller.
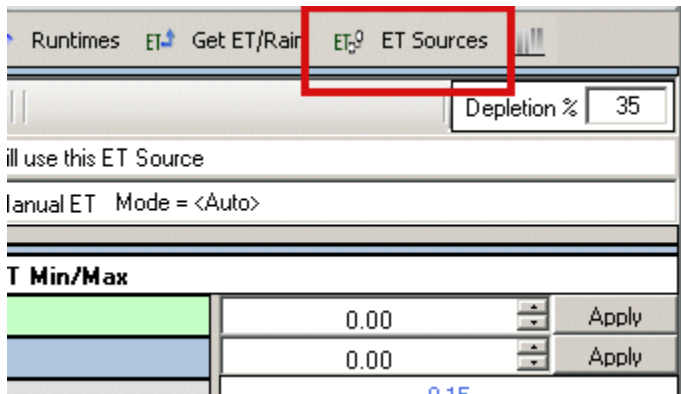
A controller that has an ET Sensor connected is an ET Source. Click the + symbol next to Sources to view their dependents.
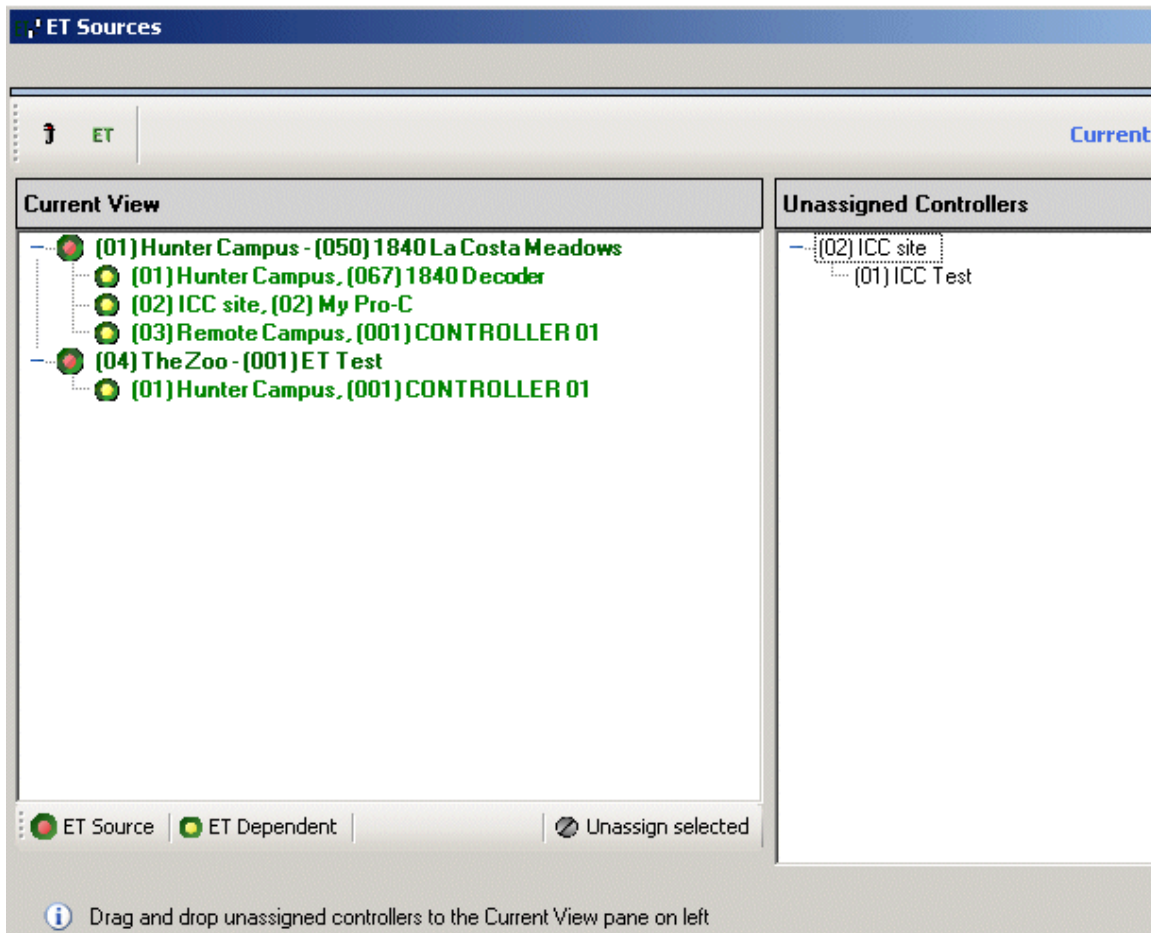
A controller that has been assigned to use an ET Sensor on another controller is an ET Dependent.

IMMS-ET allows any controller to use the ET Sensor from any other controller in the system (regardless of Site). In this way, it is possible for a large number of controllers to share information from a much smaller number of ET Sensors.

An entire system can theoretically be dependent on a single Source. In larger systems, it is more common to have several sources, representing different geographical areas, or micro-climates.

Controllers should be assigned to the Source that most closely represents their climatological conditions.

The ET Sources button will show the relationships of all controllers in the system with all ET Sources in the system. These tools can also be used to change ET relationships (between controllers and sources) at any time.

If you change the Source to Unassigned, a dialog will warn that all ET program assignments and run times will be cleared.
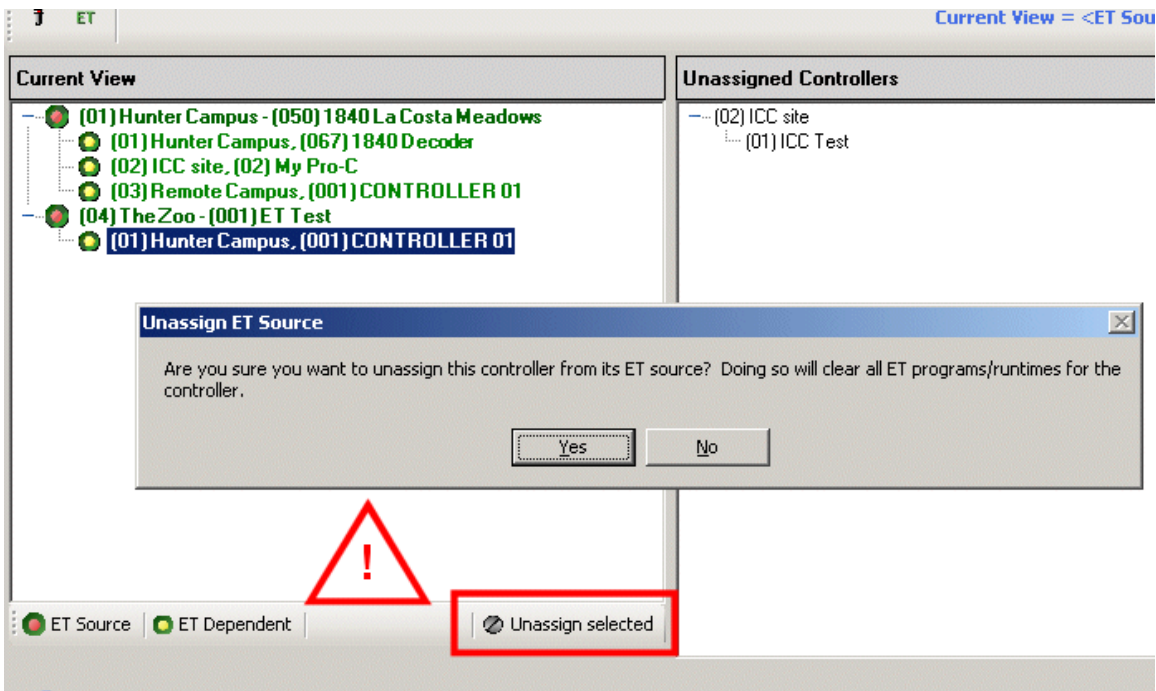
Do not "Unassign" a controller from its Source, unless you are prepared to lose all ET-based data for that controller.

If you wish to change the source for a dependent controller, to another ET Source, this can be done more easily on the controller hardware tab for the dependent controller.
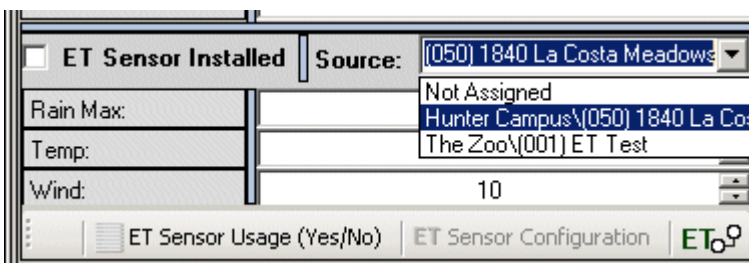
Controller Report (Print Scheduling Screen)

It is not practical to print the Scheduling tab for each controller directly. Instead, use the Controller Report for a much better option. This will format the same information for archiving or immediate printing.

This will create one file per controller, with the name of the controller in the file name. It will be formatted correctly regardless of station size, and will also include the Station/SSG settings and the ET database if those boxes are checked.

Right-click on any controller name in the tree-view, and the drop down menu will appear. The Controller Report function is at the bottom of this menu.
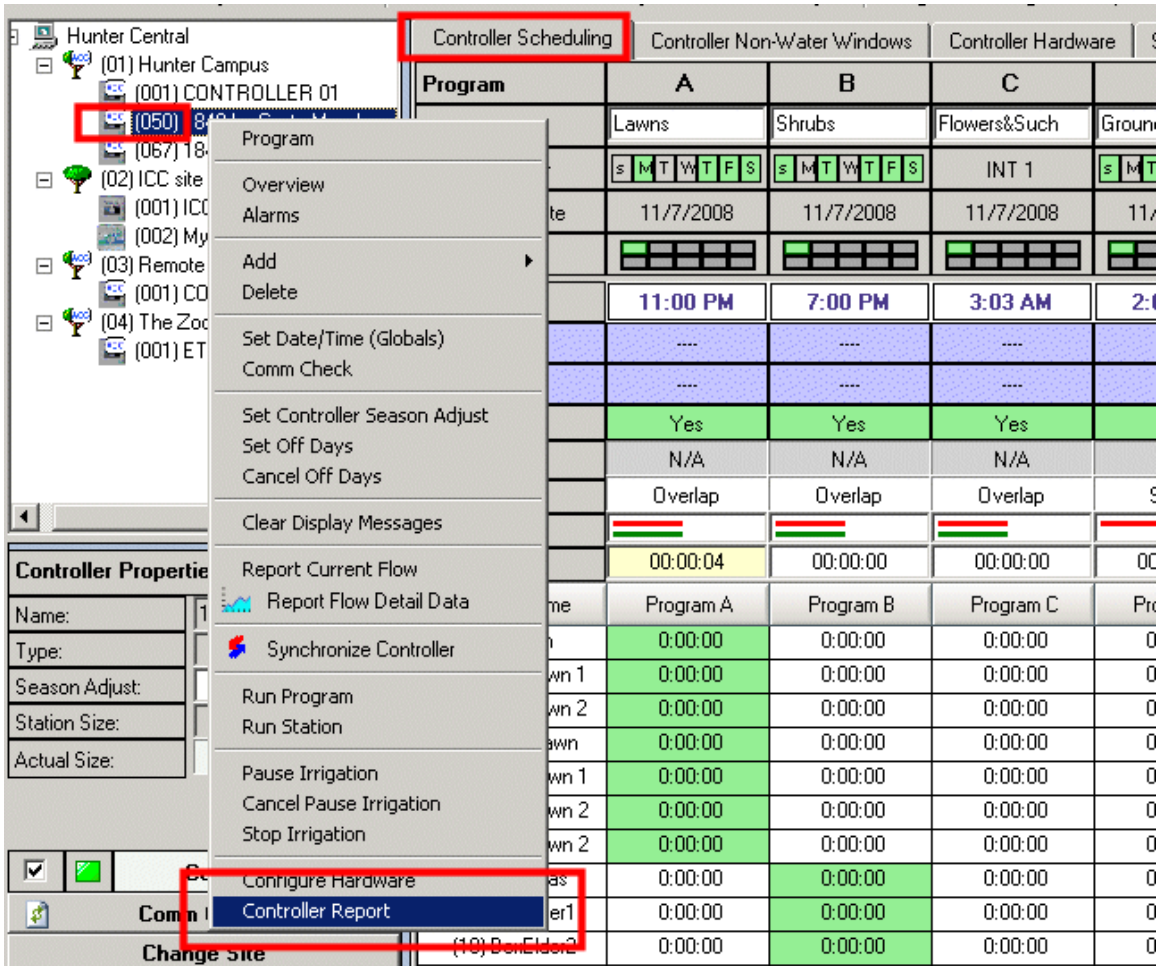
This will open the Report Wizard to customize the Controller Report.
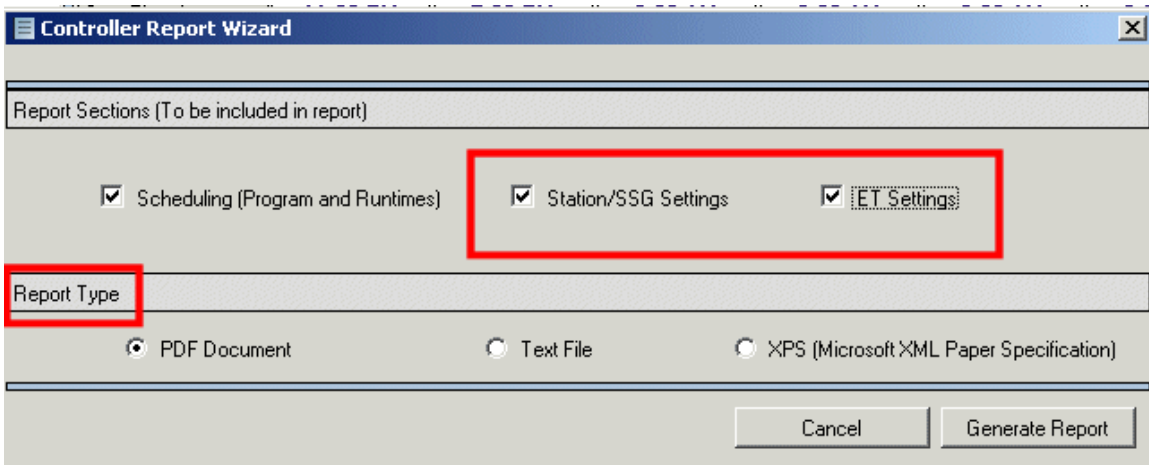
Check any optional features you wish to include, such as the SSG or ET settings. The Adobe Acrobat PDF option makes a convenient, printable organization of all the controller setup information, regardless of station size.

The report will be generated as a file, which you can save in a convenient location. The controller's address and date will be included in a default file name, and you can rename the file or save to another location.
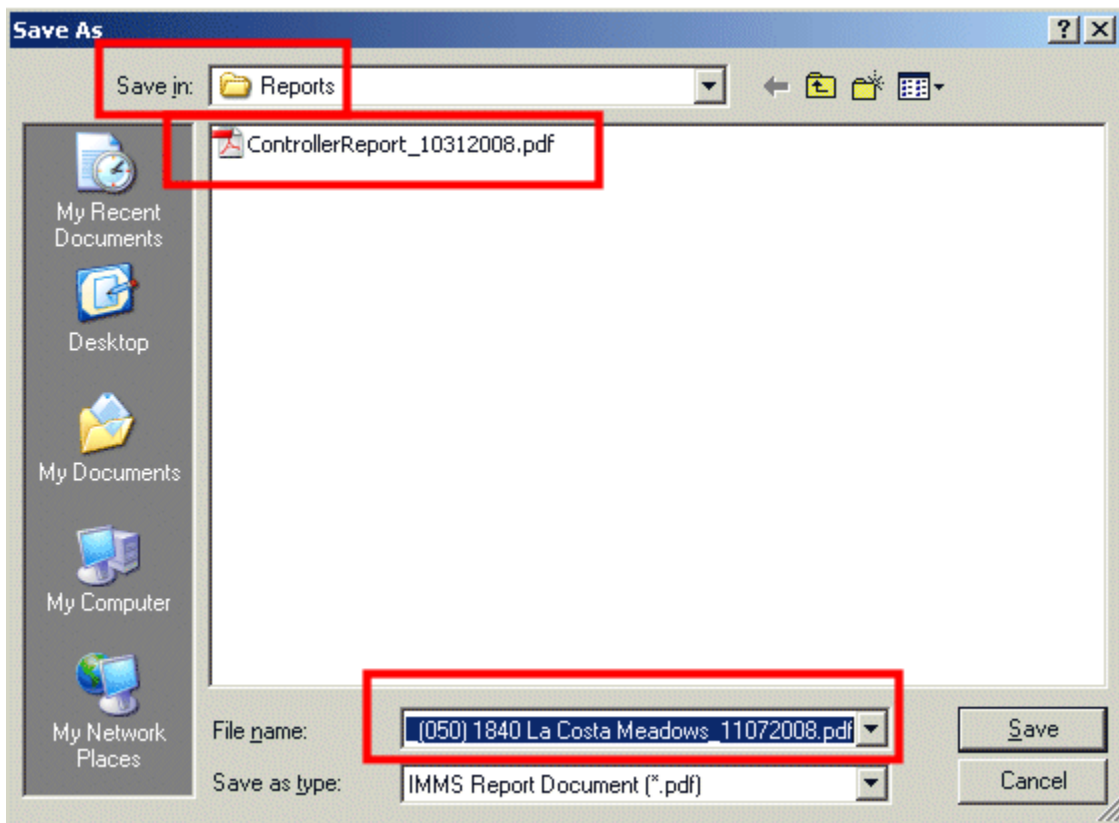
The PDF format is opened with the Adobe Acrobat reader and can be printed directly. Larger station count controllers, with SSGs and ET options, may require several pages.

This method allows controllers with too much information to fit a single screen or page to be organized for a full report.

Hunter Support Request

An option has been added to the Help selection on the IMMS menu bar to automatically create a Hunter Support Request.
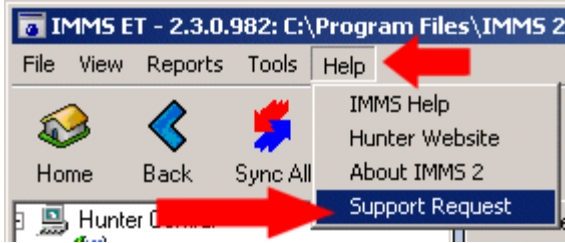
This will open the Support Request utility. This will gather and compress all files needed for advanced technical support, and compress them into a standard zip file.

Fill out the contact information to assist Hunter in responding.

Leave the check box checked for Automatically include Database Backup.

Click the Create Support Zip file button. This process may take a minute or two, depending on the size of the database. The progress bar will show status of the backup and then the

compression.

A zip file named for the current day will be placed in the Support Requests folder, in the IMMS2 directory.
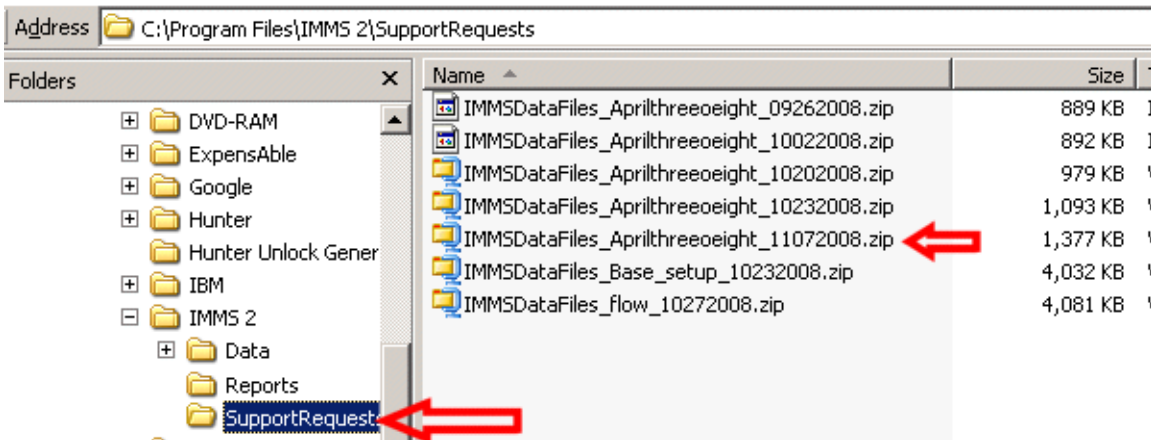
The zip file may then be sent to Hunter Tech Support directly as an attachment to an email, or can be copied to a flash drive if email is not available.

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