ASCOM DRIVER

FOR CELESTRON SMART DEWHEATER CONTROLLER

Instruction Manual

INTRODUCTION

This driver allows you to manage your Celestron Smart DewHeater Controller using ASCOM. Before we begin, it's important to know which version of the controller you have:

- The Smart DewHeater Controller 2X (#94035) has two dew heater ports with variable auto or manual modes and one 12V power supply that you can turn on or off.
- The Smart DewHeater and Power Controller 4x (#94036) has four dew heater ports with variable auto or manual modes, four 12V power supplies (one variable voltage), and three 5V USB ports.

Both monitor the ambient temperature and humidity, allowing precise calculation of the dew point.

This ASCOM driver provides two interfaces:

- The Switch Driver lets you control the dew heaters, power supplies, and USB power.
- The Observing Conditions Driver allows you to monitor the temperature, humidity, and dew point.

SETUP

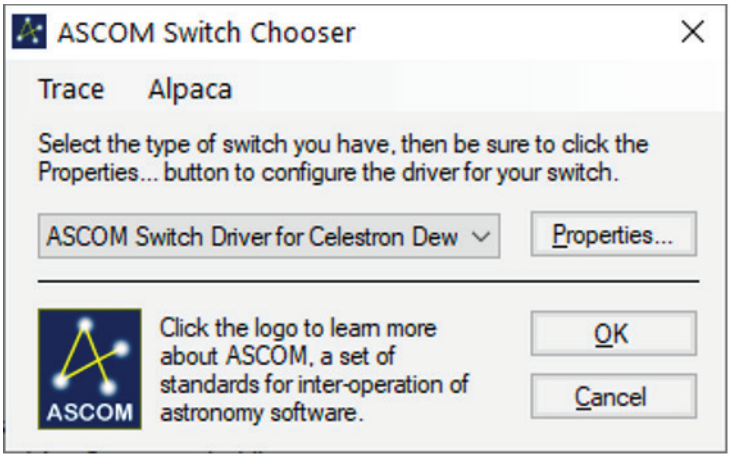
Driver Installation
Before you begin, you must install the ASCOM platform, version 6.2 or better. Next, download the Celestron Smart DewHeater Setup.zip file, extract the Celestron Dew Heater Controller Setup.exe file, and run it.

Install the file the same way you'd install other ASCOM drivers. You may need to circumvent Windows security.

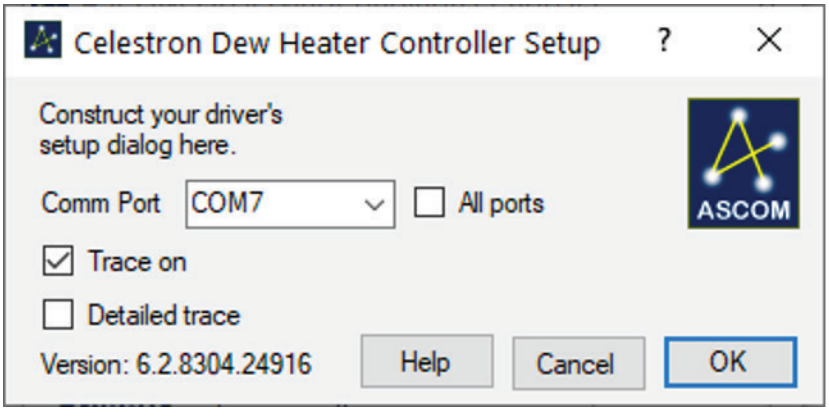
Connections
Connect your controller to the PC running the ASCOM driver via the controller's PC Port (USB Type-B). Alternatively, you may connect the controller to the telescope mount using the AUX-1 or AUX-2 ports, as described in the controller's instruction manual. Do NOT use the hand control connection.

You can connect Celestron CPWI telescope control software in two ways: either directly to the mount via USB or through the hand control. Whichever method you choose, CPWI and this driver MUST have separate connections. They cannot share one USB port.

Driver Selection and Configuration
1. To proceed, turn on and connect the Celestron Smart DewHeater Controller.
2. Choose the Celestron Dew Heater Controller in the Switch or Observing Conditions Chooser.



3. Select Properties to bring up the Setup dialog.



4. Set the Comm Port number. Only ports with a Smart DewHeater Controller will be visible unless you have checked "All ports."
5. If desired, check "Trace on," and the drive will generate a trace file showing the driver operation. Check "Detailed trace" for a more comprehensive trace file.
6. Click OK.
7. Select and configure the Observing Conditions Driver using the same procedure outlined in steps 1-6. ASCOM uses the same port for both interfaces, and you only need to set it once.

SWITCH DRIVER

The Switch Driver controls the dew heaters and power supplies (including USB power). This instruction sheet describes all the Switch Driver's features and functionality. Depending on which application you use to interface with the driver, you will have different features available to you. Your exact implementation depends on the application you use.

SMART DEWHEATER CONTROLLER

Each dew heater can operate in Auto or Manual mode. You cannot change modes within the ASCOM interface. Instead, you must change modes in the hand control or CPWI software. However, you can adjust the level of each heater within ASCOM.

Auto Mode
In Auto mode, the controller automatically adjusts the dew heaters' power depending on the dew point and the heaters' temperature using an aggression control that ranges from 0 (off) to 10 (highest).

[1] If you do not have a thermistor installed for the dew heater, the power level depends on the dew point alone.

You can use the ASCOM driver to set the aggression level or turn the heater on or off. When you turn the heater off and back on, it will remain at the last aggression level you used.

Manual Mode
Manual mode works more like a traditional dew heater controller. You can turn the heater on or off and set the power level between 0% and 100%. The power level will not change as the observing conditions change.

The ASCOM SwitchName Property
You can give each heater port a more memorable and helpful name by editing the ASCOM SwitchName property.

The Smart DewHeater Controller 2X (#94035) has two dew heater ports, named DEW Heater-1 and DEW Heater-2 by default. They are numbered 0 and 1 in the ASCOM driver. The Smart DewHeater and Power Controller 4X (#94036) has four dew heaters, DEW Heater-1 to DEW Heater-4, numbered 0 to 3 in the ASCOM driver.

POWER SWITCHES

The Smart DewHeater Controller 2X (#94035) has one 12V power supply (labeled 12V-Output) that you can turn on or off. This is ASCOM switch number 3.

The Smart DewHeater and Power Controller 4X (#94036) has one variable power supply, three 12V power supplies, and three 5V USB ports. The variable power supply is labeled Variable-1, ASCOM switch #4. You can set the voltage at any level between 0V and 12V. However, due to a hardware restriction, if you choose a value less than 3V, the actual power level will be set to 0V. If you choose 12V, the power supply will provide full voltage.

The 12V power supplies are labeled 12V-2 to 12V-4, ASCOM switches #5 to #7. The 5V USB ports are labeled USB-1 to USB-3, ASCOM switches #8 to #10. You can only turn these switches on or off.

As with the dew heaters, you can edit the ASCOM SwitchName property for each power supply to something more helpful and easier to remember.

ADDITIONAL FEATURES

Beyond auto/manual switching, the controllers have additional features specific to the Celestron hardware that you cannot control via the ASCOM driver. They are:

- Each dew heater or power switch can detect if it has been shorted. There is a reset fuse command.
- You can view the overall power consumption and input voltage.
- You can set a maximum current limit for the controller.

The Switch Driver DriverInfo command will provide some of this information. For example: "ASCOM Switch Driver for Celestron DewHeaters Version: 6.6, hardware model: 1, version: 1.1.1270, Num Switches 3, input 11.65 V, 1.111 A, enabled, status voltageOK, limit 4 A, max10 A, OK"

You'll need to use the ASCOM SupportedActions interface to control these features. To learn more, see the Implementation Details section below.

OBSERVING CONDITIONS DRIVER

This driver provides access to the temperature and humidity sensors, as well as the calculated dew point, in the Celestron Smart DewHeater Controller. Typically, you would connect this through the Observing Conditions hub as part of an observatory monitoring system.

IMPLEMENTATION DETAILS FOR APPLICATION DEVELOPERS

This is a normal .NET server-based ASCOM driver with two interfaces, Switch and Observing Conditions. It allows multiple connections to both interfaces. We've described the basic functionality above, but there are additional features that will help those designing applications.

MinValue, MaxValue, and Step
These values are set differently for each switch type. Use the table below to identify the type of switch and implement the appropriate control.

Switch Type	MinValue	Max Value	Step	Notes
Auto Dew Heater	0	10	1	This is the maximum aggression level.
Manual Dew Heater	0	100	1	This is the maximum power level.
Variable Power	0	12.0	.01	
12V and USB Power	0	1	1	These are binary switches.

Supported Actions
Below is a comprehensive list of actions that allow full control through the ASCOM interface.

- The actions follow the ASCOM driver documentation.
- ActionName is a single word. It is not case-sensitive.
- A parameter refers to a string of comma-separated variables. Each variable is parsed using TryParse for the type required. Integers and Doubles use TryParse(parameter, NumberStyle.Any,CultureInfo.InvariantCulture). This means that the decimal point in the string must be a full stop (.) regardless of what the local culture requires.
- The Reply is, "OK, {action}, {reply string}", or "ERR, {action}, {Error message}."
- Unrecognized actions throw the ASCOM ActionNotImplementedException.
- Invalid values (such as an action that expects a particular data type not being able to parse it) will throw an ASCOM. InvalidValueException.

ActionName	Parameter	Reply String	Notes
GetModel		int	Gets the hardware model number (1 or 2)
GetVersion		string	Returns the hardware version string
FactoryReset		boolean	Throws an exception because the factory reset will close the port on the hardware
InputPowerGetEnabled		boolean	Gets the input power state
InputPowerSetEnabled	boolean		Turns the input power on or off
GetInputPower		double, double, string, boolean	inputVoltageV, inputCurrentA, voltageStatus, isOverCurrent
GetExternalCurrentLimit		double, double	currentLimitA, maxCurrentLimitA
SetExternalCurrentLimit	double		Sets the limit in A
GetLedBrightness		int	0-10
SetLedBrightness	int		0-10
SetPortEnabled	int, boolean		PortNum, boolean
SetPortVolts	int, double		PortNum, voltageV
(Variable voltage port only)			
SetDewHeaterAuto	int, int		PortNum, 0-10
Switches the dew heater to auto and sets the aggression level			
SetDewHeaterManual	int, int		PortNum, 0-100
Switches the dew heater to manual and sets the aggression level			
GetPortInfo	int	string	PortNum, returns a string describing the port
ResetFuse	int		PortNum, resets the internal dew heater or power fuse
GetPortVolts	int	double	PortNum, returns the voltage in V
GetPortPower	int	double	PortNum, returns the power in W
EnableSelfHeater	boolean		True to enable the dew point sensor
GetEnvironmentData		double, double, int	Returns temperatureC, dewPointC, Humidity%

The Switch Driver implements the complete set of commands described above. The Observing Conditions Driver only executes the EnableSelfHeater and GetEnvironmentData commands.

Test/Demo Software
The Install Sources option on the installer loads two C# source file projects. You can build these using the ASCOM developer components and Visual Studio (e.g., VS2019 Community Edition).

Dew Heater Test Form
This ASCOM driver test project builds a test application that can open the driver as an Observing Conditions Driver or a Switch Driver.

- The Observing Conditions tester connects to the Observing Conditions Driver and allows the conditions implemented to be read.
- The Switch Driver connects to and loads SwitchController objects (3 or 11 objects, depending on your controller model). This allows you to handle the different switch devices, either as a dew heater, a variable voltage switch, or a fixed voltage binary switch. It demonstrates how the properties read from each switch can be used to change the user interface.

ActionsTest
This is a tester of the complete Switch Driver, including the Supported Actions. It is slightly aware of the Celestron driver commands.

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