

Airport Manager/Operator's Guide to AWOS Operations

The Iowa DOT maintains a network of widely dispersed Automated Weather Observation Systems (AWOS.) This system requires coordinated efforts between the airports and the Iowa DOT to ensure that accurate data is collected and available to pilots. While the actual AWOS equipment was purchased with federal, state, and/or local funding, the Iowa DOT provides the majority of the ongoing maintenance, operation and data transmittal costs. Airports have a role to help the Iowa DOT maintain the accuracy of the system in the most efficient way possible. Section 1 of the AWOS Guide provides an overview of the functions of the AWOS system. Section 2 includes simple troubleshooting that airport operators may be asked to perform to help provide efficient operations.



Section 1: AWOS Functions

Wind – The first observation reported by the AWOS is the wind speed and direction. The wind speed sensors are located on the top of the thirty-foot tower. If there are trees, hangars or other obstructions near the site, the sensor may pick up readings that are slightly different than what the pilot encounters. In gusty winds, a pilot on approach five miles away may see things differently. Wind data is calculated (as are all AWOS readings) according to government furnished algorithms. Wind speed-readings are taken every second and a running 2-minute average is computed and updated every 5 seconds. If the wind speed average is less than 3 knots, the wind will be reported as calm. If the 2-minute average wind speed equals or exceeds 9 knots and the difference between the highest 5-second average and the 2-minute average equals or exceeds 5 knots, gusts are reported. Wind direction readings are taken every second and a 2-minute average is again computed every 5 seconds and reported to the nearest ten degrees magnetic.



Visibility - Along with cloud height, visibility can be the most misinterpreted information provided by the AWOS system. The visibility sensor is mounted on a pole approximately 10 feet high. The sensor transmits pulses of infrared light and detects the light scattered by airborne particles. Intensity of the received pulses is measured and used to determine visibility. This visibility reading is taken between the visibility transmitter and receiver placed less than 3 feet apart. It can only determine the visibility between these 2 points on the ground. It is unable to determine the visibility along the plane's route of flight. Conditions on the ground can differ dramatically from conditions on an IFR approach. The visibility readings are taken every 15 seconds and averaged over a 10-minute period. Rapidly changing conditions may make the reported condition slightly different than what the pilot sees. As with all of the AWOS sensors, what is reported is an average of what has already happened. If a fog bank suddenly rolls in, reduced visibility will be averaged into the calculation and it will take several minutes for the output to stabilize.



Ceiling – Cloud height is determined by a ceilometer utilizing a laser transmitter to bounce signals off of the clouds. A returned signal's time of travel is measured to determine distance to the clouds. The ceilometer measures the cloud height directly above the AWOS sensor site. Readings are taken every 30 seconds and averaged over a 30-minute period. A weighting scheme is employed for data collected during the most recent 10 minutes to make the output more responsive to



rapid changes in sky conditions. If the bottoms of the clouds are ragged, the average reported might be different from what a pilot may see at his or her position on approach. The longer averaging time is necessary for the determination of scattered, broken or overcast layers. A rapidly approaching (or departing) cloudbank will be averaged into the calculation but again will take some time for the output to stabilize. Cloud heights are reported to the nearest 100 feet up to 5000 feet; to the nearest 500 feet from 5000 to 10,000 feet and to the nearest 1000 feet above 10,000.

Temperature and dew point - Temperature readings are taken every second and a one-minute average is calculated. Four one-minute averages are used to determine the temperature. Dew points are determined likewise. If the temperature is missing, the dew point is also reported as missing. To prevent radiant heating of the sensors by the sun, the sensors are mounted in a MARS (motor aspirated radiation shield). This unit uses a fan to continually pull fresh air over the sensors. The airflow is monitored and if the air movement ceases, the temperature and dew point are reported as missing.



Altimeter - Barometric pressure may be the most important observation output by the AWOS system. Every system has a minimum of 2 sensors. The pressure sensors are sampled every 10 seconds and a 1-minute average is calculated. The two pressures are compared and the lower of the two is used in calculating the altimeter setting. If the pressures differ by more than 0.04 inHg the altimeter will be reported as missing. Density altitude is computed from field pressure and the current 5-minute average temperature. It is rounded to the nearest 100 feet and updated each minute. Density altitude will not be reported unless it is greater than 1000 feet above the field elevation.



Present weather - The visibility sensor incorporates a rain detector to determine present weather. This detector outputs a signal proportional to the amount of water on two sensing elements. Temperature near the rain detector along with reported visibility is used to determine the type of precipitation. The detector is sampled every 15 seconds and the precipitation type is determined. These readings are integrated into a 10-minute formula to determine present weather.



Section 2: AWOS Troubleshooting

The ultimate goal of the AWOS system is to provide pilots with accurate and timely data. The system is checked daily by the Iowa DOT and/or its contractor to determine any sites that may be experiencing difficulty, but the airport operator should monitor the accuracy of the AWOS readings. Any discrepancies that the airport manager encounters should be reported to the DOT for further investigation. When discrepancies are discovered, the DOT or its contractor may ask the airport manager to reset the system or to conduct minor troubleshooting at the site.

This section explains several common problems and solutions. These simple actions may rectify the problems quickly and restore the system to accurately reporting weather information. If not, a visit from the maintenance technician may be necessary.

Please contact the DOT before proceeding with any of the following actions!

Symptom: Site appears dead

Action: First, look for the red lights on the top of the AWOS tower. If they are lit, the site has power. If the red lights are not lit, check the breakers in your terminal building or hangar to see if they are tripped. If all the breakers seem okay, drive out to the site and listen for fans. Several fans should be heard if there is power to the site. If it still appears that there is no power, you may need to contact a local electrician to troubleshoot further.

Action: **Upon direction from the DOT**, or its contractor, reset the main breakers at the AWOS site. This can be accomplished by cycling the breakers in a breaker box at the site. Usually the box is located between two wooden four by fours on the plot.



Symptom: Wind speed or direction inaccurate

Action: Look at the top of the tower to see if there is any apparent damage to the sensors. The wind speed sensor has three cups and should be spinning with the wind. The wind direction sensor should be pointed into the wind. **Notify the DOT with your conclusions.**

Symptom: Visibility not consistent with current conditions

Action: A very common problem with the visibility sensor is vulnerability to spider webs. It only takes one strand of a spider's web to make the visibility read drastically lower than it should or be reported as missing. At the tower site, check carefully for a spider web on the visibility sensor and sweep it off with a broom. You may also need to clean the lenses with a soft cloth. Remember, it will take up to 10 minutes for the sensor to start reporting correctly.

Symptom: Cloud height not consistent with current conditions

Action: First remember that the cloud height is averaged over a 30-minute period and it can only see directly above the sensor site. If it is still inaccurate, check for obstructions in and around the window-conditioning unit. Bird dropping or

nests may interfere with the operation of the sensor and may need to be removed.

Symptom: VHF transmitter not functioning

Action: Thunderstorms routinely knock out the VHF transmitters and many times simply resetting it will return it to operation. Upon direction from the DOT, or its contractor, cycle power to the AWOS site and after several minutes listen for the transmitter on the assigned frequency.

Symptom: Computer terminal not displaying data

Action: First determine which screen is not displaying data. The AWOS maintenance screen is a Wyse 55 terminal that is a cream color. If the data is not displayed or is corrupted simply cycle the power with the on/off slide button on the front of the screen. If there is still no response, make sure all of the AC power cables to the screen and its modem (small black box, usually on the floor) are plugged into live outlets.



Action: If the DOT screen (system that can view other airports) is saying "Waiting for local weather," make sure that all of the power cables to the terminal and modems are plugged into live outlets. If there is still no response, reboot the state computer.

Symptom: Dial-in voice line problems (always busy or no answer)

Action: You will need a common, everyday single line telephone for this check. Locate the telephone jack, typically on the wall near the entrance of the field cable. The AWOS voice line number should be written on it. Unplug the cable from the jack and plug your telephone into the jack. You should be able to make and receive calls just like any other phone. If the line is dead, or there are other problems with it, you will need to contact your local telephone company and have them complete the required repairs. If the phone line works correctly, plug the AWOS line back into the jack and await further instructions.

With your help, the AWOS network can remain an important and valuable part of the National Airspace System. Airports' assistance in these minor troubleshooting procedures will help to keep costs down and ensure accurate data is collected as soon as possible.

Important Phone Numbers:

Iowa DOT: Airport Inspector – 515-239-1468 (during business hours)
515-290-5743 (after hours)
Computer support – 515-239-1119

AWOS Contractor: Carpenter Technology