CHAPTER 6

VISIBILITY AND DAY/NIGHT SENSOR

SECTION I. DESCRIPTION AND LEADING PARTICULARS

6.1.1 INTRODUCTION

The ASOS visibility and day/night sensor, hereinafter referred to as the visibility sensor, provides the means to automatically calculate the current visibility level and indicate current day/night conditions. The visibility sensor measures ambient meteorological optical range (visibility) using the forward scatter technique. This technique involves transmitting a flash of xenon light through a section of the atmosphere (which scatters the light) and measuring the scattered light level to determine the loss. An extinction coefficient is calculated from the amount of light received from the scattered xenon flash lamp light source. This coefficient is then translated into a value of visibility. The visibility sensor also computes and outputs a day or night indication as derived from an ambient light sensor. Both extinction coefficient and day/night data are output for use by the ASOS in response to request signals from the data collection package (DCP). Each response message also includes sensor operating status signals generated by the visibility sensor through a continuously running self-test.

6.1.2 PHYSICAL DESCRIPTION

The visibility sensor (Figure 6.1.1) is mounted on a single support. All of the processing and sensing electronics are mounted to the support, thereby eliminating the need for careful alignment between separate stations. The components of the visibility sensor are divided into two separate sections: an upper section and a lower section. The upper section contains all of the sensing elements. The lower section contains all of the processing, communications, and diagnostic electronics as well as the power supplies and electromagnetic interference (EMI) protection. The following paragraphs provide detailed descriptions of the two sections and the cabling of the entire unit.

6.1.2.1 **Upper Section**. The upper section is mounted above the electronics enclosure and contains all of the sensing elements of the visibility sensor: crossarm/support, transmitter hood assembly, receiver hood assembly, and day/night assembly.

6.1.2.1.1 **Crossarm/Support**. The crossarm and support hold the sensing elements at the appropriate height and relative orientation. The support is a pole mounted to the top of the enclosure mounting support with four bolts. The crossarm is mounted to the top of the support with four bolts. Two mounts provided on the support allow for the attachment of a scatter plate. The scatter plate is a calibration tool that, when mounted to the support (thereby extended into the scatter volume), creates an artificially high amount of scattered light for the receiver to detect. The location of the scatter plate mounts is such that the scatter plate is firmly held in the scatter volume. The crossarm is a welded assembly that consists of the hoods, arms, and plenum. The arms connect all of the other crossarm components. The hoods contain the transmitter and receiver units. They also contain heaters to prevent snow and ice buildup as well as fogging and icing of the lenses. The plenum is a small enclosed cavity where the support is attached and through which the sensor cables are passed to the electronics enclosure.

6.1.2.1.2 **Transmitter Assembly**. The transmitter assembly flashes a xenon bulb to produce visible light for scattering. Light is focused into the scatter volume by a fixed lens included with the transmitter assembly. The transmitter assembly consists of two basic parts: the canister and the cap. The canister is a field replaceable unit (FRU) that can be quickly and easily replaced for maintenance. The canister is an aluminum

cylinder that contains all of the transmitter electronics and interface wiring in a single package. The canister slides into the transmitter hood and is keyed for correct insertion. Once the canister is fully inserted into the hood, the transmitter is aligned and ready to be connected to the system. The cap protects the canister by covering the end of the hood.

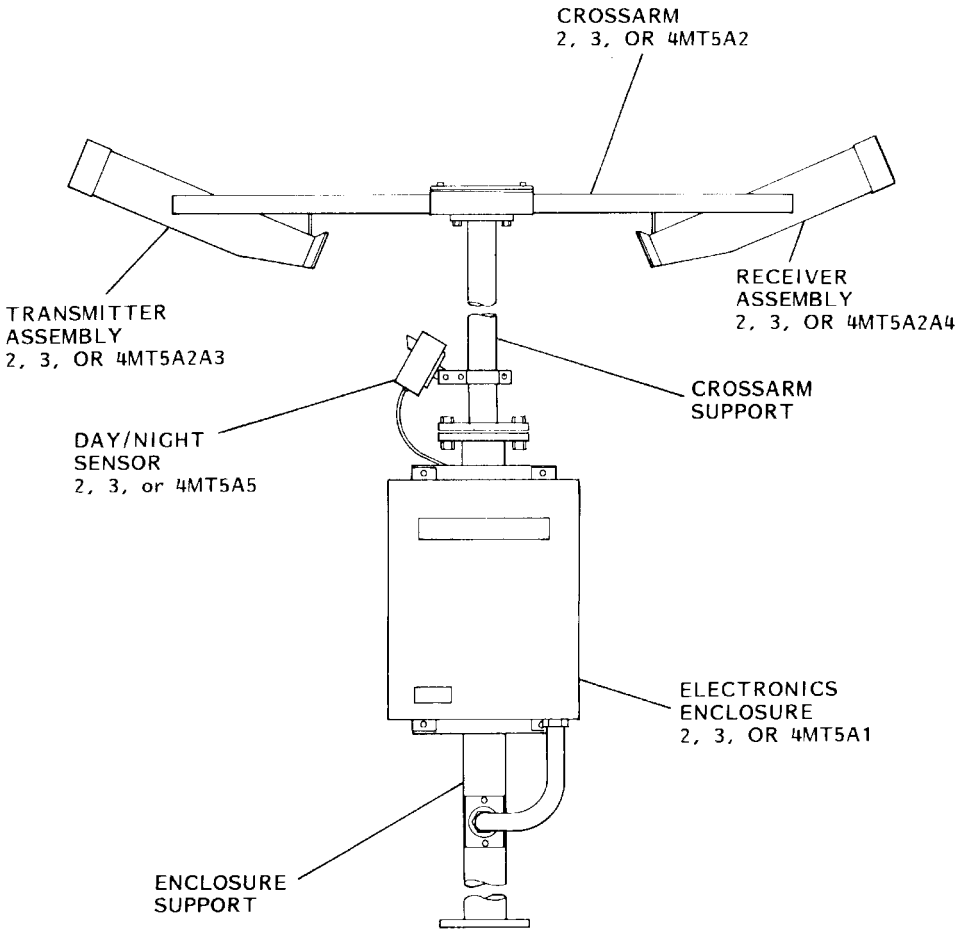

Figure 6.1.1. Visibility Sensor

6.1.2.1.3 **Receiver Assembly**. The receiver assembly is the unit that detects the transmitted xenon light after it is scattered by the atmosphere. The light is detected by a positive-intrinsic-negative (PIN) photodiode mounted in the receiver canister. Light is focused onto the photodiode by a fixed lens included with the receiver assembly. The photodiode converts the light energy into an electrical current signal for processing. The receiver assembly consists of two basic parts: the canister and the cap. The canister is an FRU that can be quickly and easily replaced for maintenance. The canister is an aluminum cylinder that contains all of the receiver electronics and interface wiring in a single package. The canister slides into the receiver assembly and is keyed for correct insertion. After the canister is fully inserted into the assembly, the receiver is aligned and ready to be connected to the system (presupposing previous factory alignment and calibration). The cap protects the canister by covering the end of the assembly.

6.1.2.1.4 **Day/Night Assembly**. The day/night assembly is a photometer designed to indicate daytime or nighttime conditions. The sensor mounts to the support pole just above the flange. Signal and power cables are contained within the hollow support. The connection for the signal cable is made inside the electronics enclosure. The connection for the power cable is made inside the plenum with free-hang connectors. The

day/night assembly detects light via a photodiode mounted behind a clear window. The photodiode is positioned such that its field of view is 6 degrees above the horizon. A heater located on the inside of the small day/night assembly prevents the accumulation of snow or ice. The day/night assembly (an FRU) can be easily removed from the day/night mount for repair. The assembly is connected to the electronics enclosure by a cable. Removal is accomplished by unscrewing the assembly mounting screws, unplugging one connector, and removing the signal cable out through the support pole.

6.1.2.2 **Lower Section**. The lower section, which mates directly with the standard flange, consists of the electronics enclosure and the enclosure support. A flange at the top of the enclosure support mates with the bottom part of the upper section support.

6.1.2.2.1 **Electronics Enclosure**. The electronics enclosure (Figure 6.1.2) houses all of the processing and diagnostic electronics. The enclosure also houses all of the EMI filtering and power supplies. All of the internal components are accessed through a hinged front door. All external cables are connected to the enclosure at the bottom. The enclosure is mounted to the support with four bolts. Four mounting flanges are welded to the enclosure for this purpose. The power input box within the electronics enclosure contains either one filter and surge suppressor or two filters and surge suppressors. The two-filter configuration is illustrated in the figure. To determine the configuration, one or two filters are observed protruding from the top of the power input box. Visibility sensors with serial numbers A0358 and above have one filter; those numbered A0357 and below have two filters. The power input box wiring for the one- and two-filter configurations is illustrated in Section IV.

6.1.2.2.2 **Enclosure Support**. The enclosure support is a pipe with flanges at each end and mounting brackets for the enclosure box. The electronics enclosure attaches to the enclosure mounting brackets with four bolts. The visibility sensor is aligned relative to north by properly positioning the support on the mounting flange. The bottom flange is provided with holes at 30-degree intervals to allow for this alignment. The top flange mates with the bottom flange of the upper section support.

6.1.2.3 **Cabling**. Signal cables run between the electronics enclosure and the transmitter and receiver sections. These cables carry all of the data signals and DC power for the sensing sections and are physically located internal to the support. The heater power is included with these cables. Day/night sensor cables run internal to the support through an opening in the enclosure support. The sample trigger cable is the coax cable that runs between the transmitter and receiver sections. This cable runs internally through the crossarm.

6.1.3 SPECIFICATIONS

The visibility sensor meets the full range of ASOS outdoor environmental requirements during continuous operation. The visibility sensor is capable of providing an extinction coefficient equivalent to visibilities up to and including 10 miles, with sufficient accuracy and resolution to allow the acquisition control unit (ACU) to report the standard reporTable increments. The visibility sensor agrees with the 1,500-foot baseline National Weather Service (NWS) transmissometer according to table 6.1.1. The day/night assembly provided with the visibility sensor indicates day or night condition according to the ambient light level and operates for ambient light levels up to 50 foot candles (fc). The day/night sensor always indicates day for illumination greater than 3 fc and always indicates night for illumination less than 0.5 fc. The transition from indicating day to indicating night occurs once in the region from 3 to 0.5 fc (as illumination decreases). The transition from indicating night to indicating day occurs once in the region from 0.5 to 3 fc (as illumination increases). The day/night assembly is mounted such that it points in the same direction as the receiver. The design is such that snow and ice buildup is prevented from affecting operation.

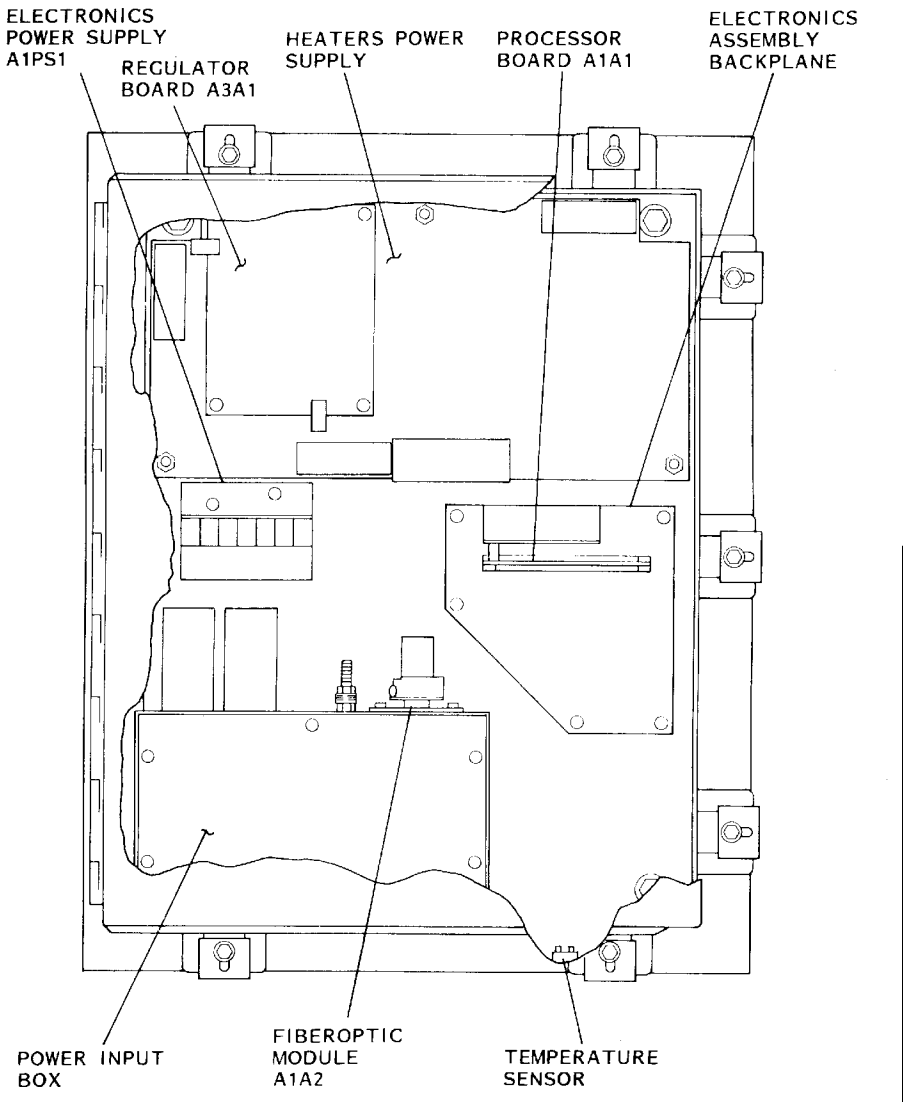

Figure 6.1.2. Visibility Sensor Electronics Enclosure

6.1.3.1 **Configurations**. There is only one configuration of the visibility sensor. This configuration is described in Section II.

Table 6.1.1. Visibility Sensor Accuracy*

Visibility of NWS Standard Transmissometer	Sensor Accuracy (Percent of All Data)		
	At Least 80%	No More than 18%	No More than 2%
0 to 1-¼	±¼	±½	±1
1-½ to 1-¾	+¼, -½	+½, -¾	±1
2 to 2-½	±½	±1	±1
3 to 3-½	+½, -1	+2 RI**/-1	+2 RI**/-1
4 to 10+	±1 RI**	±2 RI**	±2 RI**

*All units in miles except where noted with double asterisk.

**ReporTable increments (RI's) are used as units instead of miles.