ASOS MAINTENANCE NOTE 55 (for Electronics Technicians)
Maintenance, Logistics, and Acquisition Division
W/OPS12: JD

All Weather Precipitation Accumulation Gauge

GENERAL

Update to the Automated Surface Observing System (ASOS) Site Technical Manual (STM) (S100) to include Chapter 10A, All Weather Precipitation Accumulation Gauge (AWPAG).

PROCEDURE

Insert and maintain Chapter 10A, All Weather Precipitation Accumulation Gauge (AWPAG), in the ASOS STM (S100), Revision A, Change 2. (Insert behind the current Chapter 10, Liquid Precipitation Accumulation Sensor [Rain Gauge].) All subsequent versions of the STM shall include this chapter.

EFFECT ON OTHER INSTRUCTIONS

This maintenance note affects ASOS STM, Revison A, Change 2, August 2000. The AWPAG chapter number will be reassigned in future revisions to the STM.

REPORT MAINTENANCE ACTION

None.

Signature Not Verified

Mark S. Paese

Digitally signed by Mark S. Paese
DN: cn=Mark S. Paese, o=DOC/NOAA/NWS, c=US
Date: 2004.07.28 12:33:49 -04'00'

Mark S. Paese
Director, Maintenance, Logistics, and Acquisition Division

(This page intentionally left blank.)

CHAPTER 10A

ALL WEATHER PRECIPITATION ACCUMULATION GAUGE

SECTION I. DESCRIPTION

10A.1.1 INTRODUCTION

This chapter provides information about the All Weather Precipitation Accumulation Gauge (AWPAG) sensor (see Figure 10A.1.1-1). It includes a physical description and details on the operation, theory of operation, and preventive and corrective maintenance.

Figure 10A.1.1-1. AWPAG

10A.1.1.1 AWPAG Sensor Overview

In contrast to the conventional type of rain gauge that uses a primitive tipping methodology, the AWPAG uses a sophisticated weighing methodology. The AWPAG is commonly referred to as a weighing type rain

gauge. Each instance of precipitation, whether liquid or solid, ends up directly in the bucket and is calculated by determining the weight increase of the bucket.

A stainless-steel windscreen surrounds the AWPAG. The windscreen is height adjustable and should be set 1 inch higher than the collection orifice. The windscreen is delivered unassembled and must be assembled before the AWPAG is installed. The lower frame can be separated at one point to allow installation around the sensor array raceway.

The pipehouse (see Figure 10A.1.1.1-1) provides protection from the elements for the analysis electronics and balance system. The pipehouse is built of stainless steel and has a collection surface of 31 square inches. The ring heater element at the top of the pipehouse forms the collection orifice. This ring heating element prevents snow buildup in a temperature range of 18 to 41 °F. Electronic monitoring and power to the ring heater are supplied by the bayonet connector. The bayonet connector is permanently attached to the pipehouse and connects to the bottom of the measurement system.

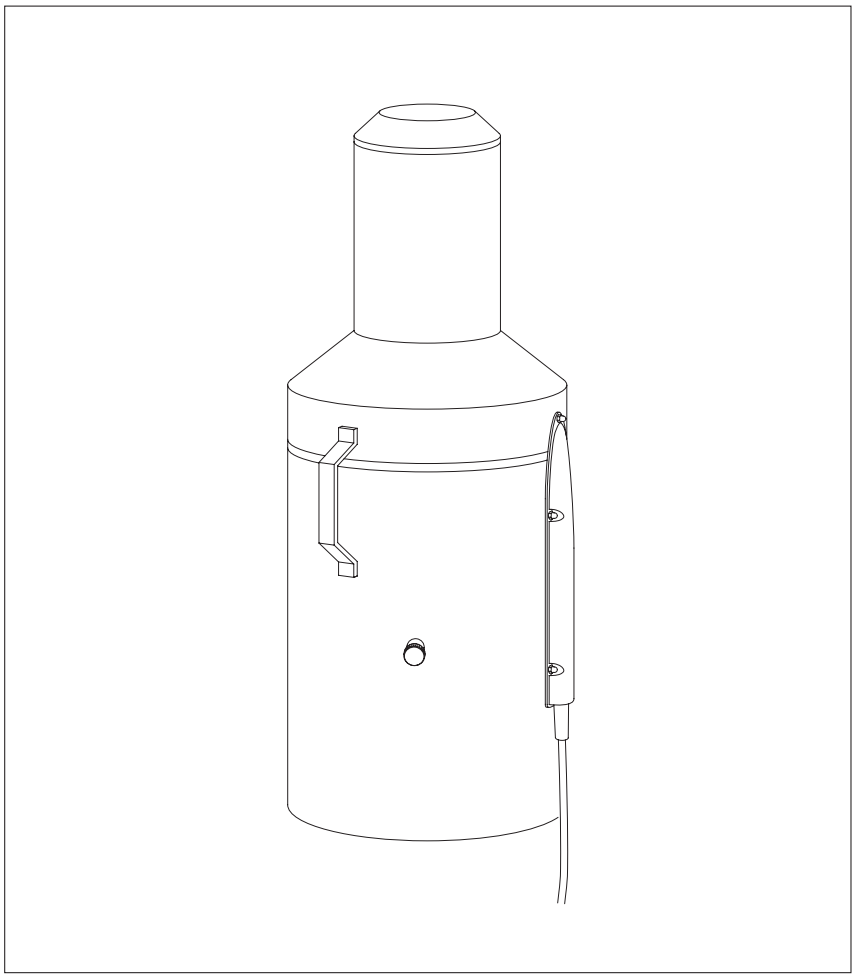


Figure 10A.1.1.1-1. Pipehouse

The collection bucket (see Figure 10A.1.1.1-2) is constructed of cold- and ultraviolet (UV)-resistant plastic and can hold 53 inches of precipitation. Unlike the small pivoting buckets in tipping-bucket precipitation gauges, this bucket does not have a funnel.

A precision load cell serves as the sensor element for weight determination. It is hermetically sealed against the elements. A specially designed transverse bar construction provides stress-free force to the load cell. The mechanical overload safety design prevents the load cell from being damaged due to overload.

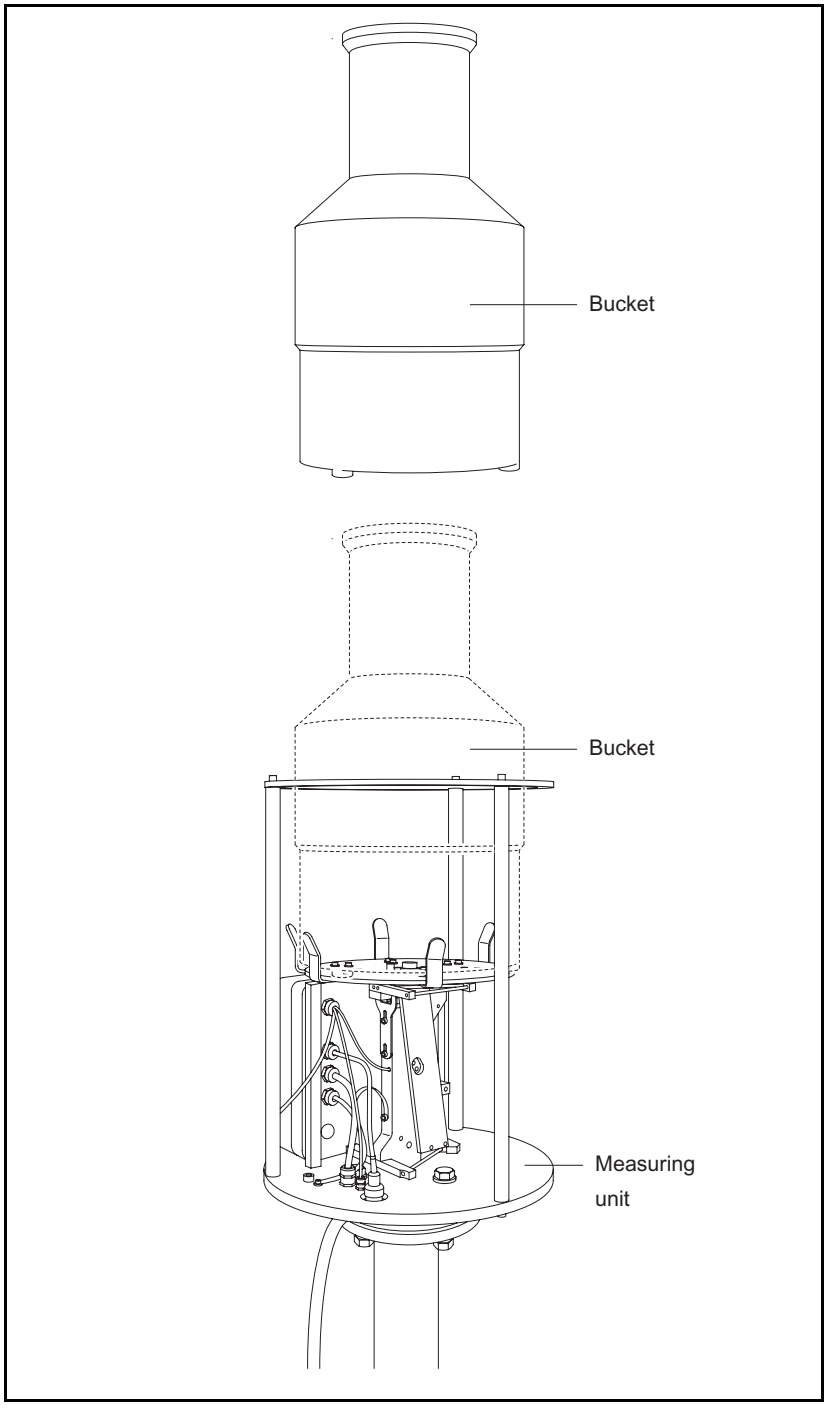


Figure 10A.1.1.1-2. Measuring Unit With Bucket

The AWPAG's analysis electronics (see Figure 10A.1.1.1-3) include a LOGOSense circuit board, a ring heater controller board, an internal heater, and an internal temperature sensor.

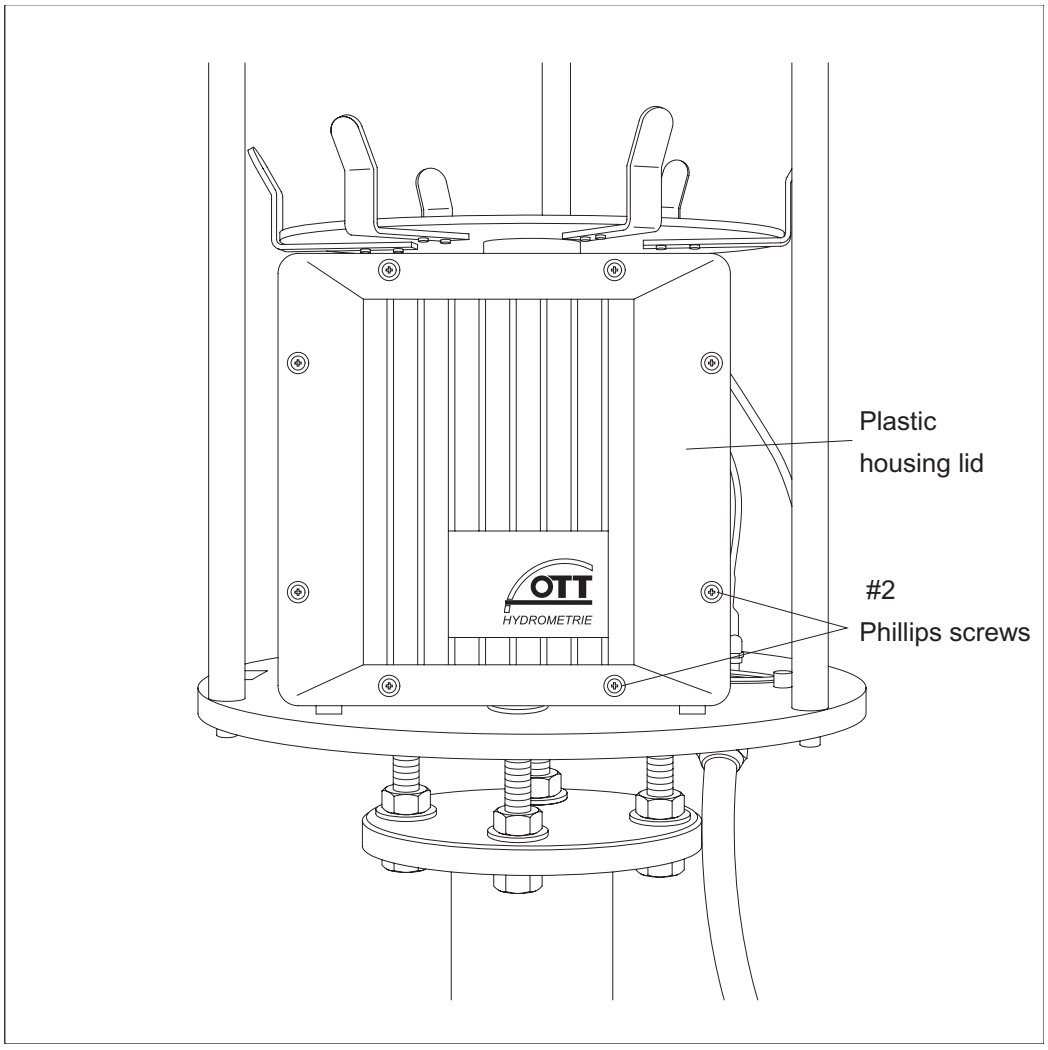


Figure 10A.1.1.1-3. Analysis Electronics

10A.1.2 PHYSICAL DESCRIPTION

The following paragraphs provide physical descriptions of each field replaceable unit (FRU).

10A.1.2.1 AWPAG System (S100-2MT6-3)

The AWPAG system (see Figure 10A.1.2.1-1) consists of the AWPAG sensor assembly, electronics enclosure assembly, and windscreen assembly. This FRU package contains all the necessary components for a complete site installation.

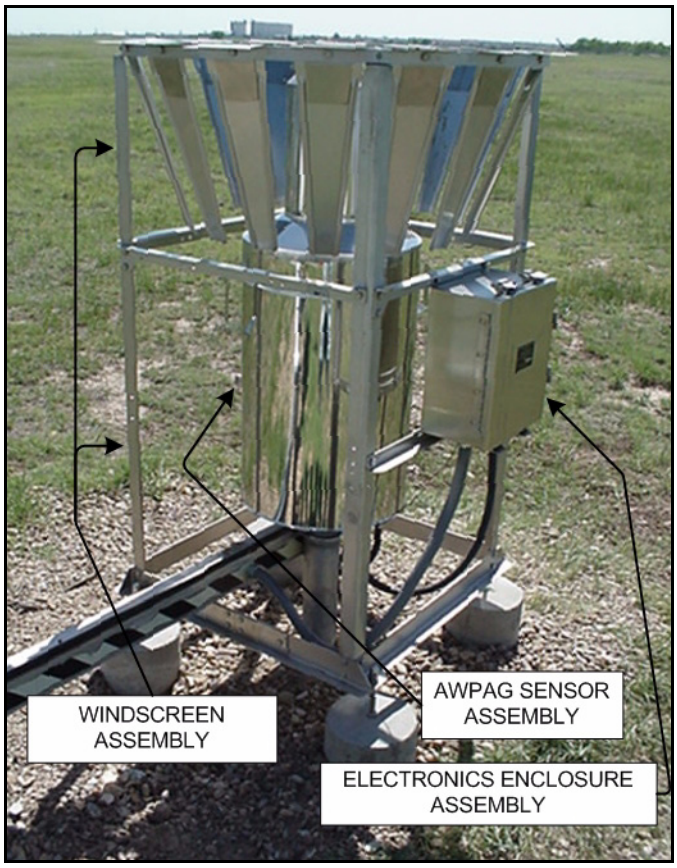


Figure 10A.1.2.1-1. AWPAG System

10A.1.2.2 Windscreen Assembly (S100-2MT6-3A3)

The windscreen assembly is designed to prevent wind-blown precipitation from blowing around the collection orifice and then collecting inside the measuring system assembly.

The windscreen assembly consists of the frame, lamella ring, and lamellas. The lamella ring is attached to the frame by four knurled screws.

10A.1.2.3 Lamella (S100-2MT6-3A3MP1)

As shown in Figure 10A.1.2.1-1, lamellas are part of the windscreen assembly. The lamellas are bolted to the ring. Each lamella is an FRU and can be ordered separately if damaged.

10A.1.2.4 AWPAG Sensor Assembly (S100-2MT6-3A1)

The AWPAG sensor assembly (Figure 10A.1.2.4-1) consists of a pipehouse, sensor bucket, and measurement system. This FRU package has all the necessary components for a complete replacement. The windscreen assembly and electronics enclosure are packaged separately.

Figure 10A.1.2.4-1. AWPAG Sensor Assembly

10A.1.2.5 Sensor Bucket (S100-2MT6-3A1A1)

Each instance of precipitation is collected directly into the sensor bucket (see Figure 10A.1.2.5-1). It is made of plastic and rests on top of the measurement system assembly. The amount of precipitation is calculated by determining the change in weight of the bucket due to a precipitation event.

Figure 10A.1.2.5-1. Sensor Bucket and Pipehouse

10A.1.2.6 Sensor Pipehouse (S100-2MT6-3A1A2)

The pipehouse, shown in Figure 10A.1.2.5-1, is constructed of stainless steel and has a 31-square-inch collection orifice. It provides protection for the analysis electronics and the measurement system assembly. It contains a ring heating element that prevents frozen precipitation buildup in a temperature range from 18 to 41 °F.

A cable provides power and communications to the pipehouse ring heater. The cable is permanently attached to the pipehouse and plugs into the a socket located on the underside of the measurement system assembly.

10A.1.2.7 Measurement System Assembly (S100-2MT6-3A1A3)

The primary function of the measurement system assembly (see Figure 10A.1.2.7-1) is to measure the weight of any given amount of precipitation and thereby determine how many inches fell. The FRU breakdown of the measurement system assembly consists of the weighing mechanism, LOGOSense board, ring heater controller board, LOGOSense internal heater, ambient temperature sensor, analysis electronics ambient temperature sensor, and sensor pipehouse switch.

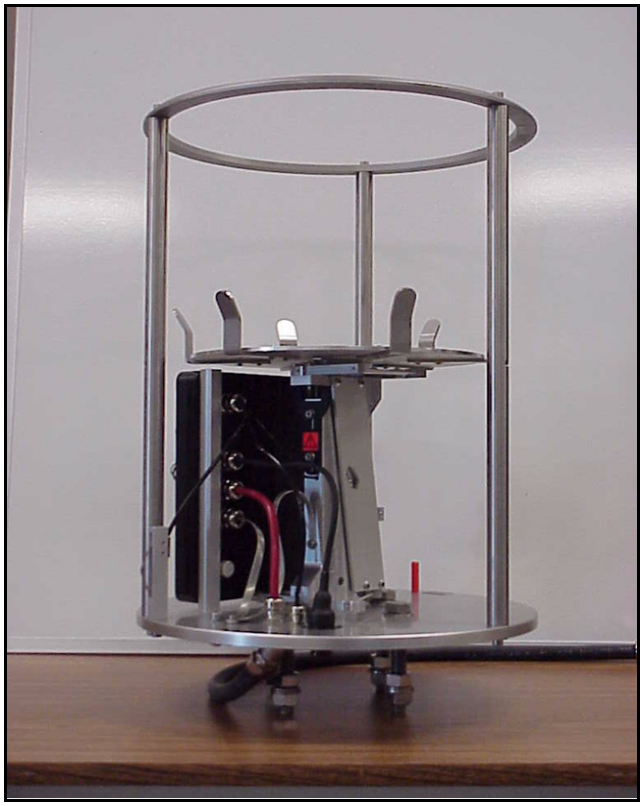


Figure 10A.1.2.7-1. Measurement System Assembly

10A.1.2.8 LOGOSense Board (S100-2MT6-3A1A3A1)

The LOGOSense board inside the analysis electronics enclosure (see Figure 10A.1.2.8-1) monitors status information.

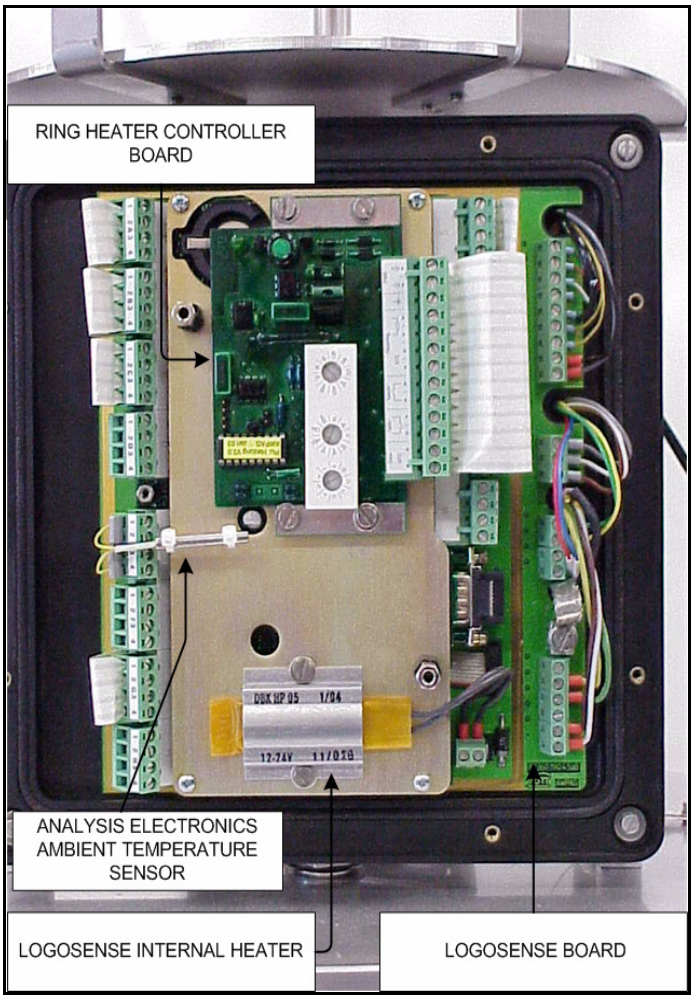


Figure 10A.1.2.8-1. Analysis Electronics Enclosure

10A.1.2.9 Ring Heater Controller Board (S100-2MT6-3A1A3A2)

The ring heater controller board monitors ambient temperature. In the temperature range of 18 to 41 °F, the AWPAG heats the collection orifice to avoid the buildup of frozen precipitation. A wired connection to the LOGOSense board allows the heater to be turned off at temperatures below 17.6 °F.

10A.1.2.10 LOGOSense Internal Heater (S100-2MT6-3A1A3HR1)

The AWPAG analysis electronics are housed in a thermally insulated plastic enclosure. Below an ambient temperature of 14 °F, a heating element heats the interior of the housing. This ensures correct operation even at very low outside temperatures.

10A.1.2.11 Ambient Temperature Sensor (S100-2MT6-3A1A3RT1)

The ambient air temperature sensor monitors the outside air temperature. The analysis electronics uses the data produced by this sensor to activate and deactivate the pipehouse ring heater.

10A.1.2.12 Analysis Electronics Ambient Temperature Sensor (S100-2MT6-3A1A3RT2)

This ambient temperature sensor monitors the internal temperature of the analysis electronics enclosure. The LOGOSense internal heater is turned on when the temperature drops below 14 °F. This allows the analysis electronics to operate properly during extremely cold temperatures (see Figure 10A.1.2.8-1).

10A.1.2.13 Sensor Pipehouse Switch (S100-2MT6-3A1A3S1)

The sensor pipehouse switch (see Figure 10A.1.2.13-1) provides data to the LOGOSense board to determine if the pipehouse is attached.

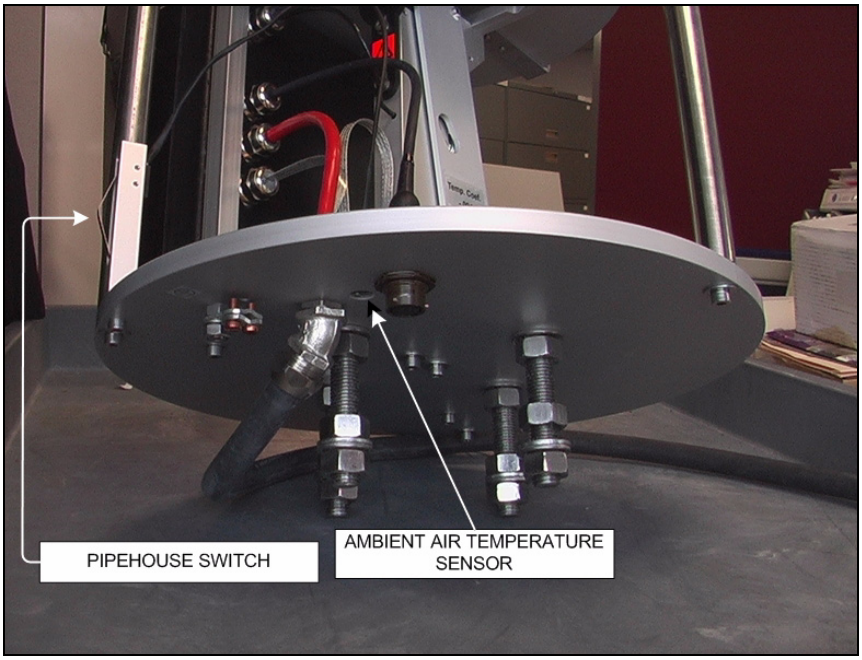


Figure 10A.1.2.13-1. Ambient Temperature Sensor and Pipehouse Switch

10A.1.2.14 Electronics Enclosure Assembly (S100-2MT6-3A2)

The electronics enclosure assembly (see Figure 10A.1.2.14-1) provides distribution of AC power, including over-current protection, communications for the AWPAG, and UPS backup power to operate the AWPAG without heaters. The fiber-optic module and DC power supply are both contained within the enclosure, which is attached to the windscreen frame.

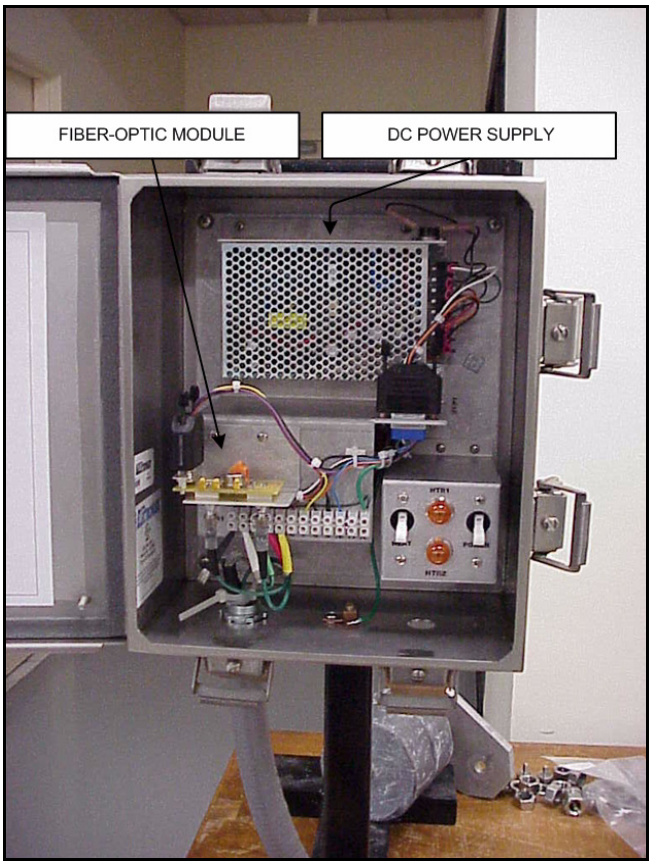


Figure 10A.1.2.14-1. Electronics Enclosure Assembly Components

10A.1.2.15 Fiber-Optic Module (S100-2MT6-3A2A1)

The fiber-optic module is the standard ASOS module used in other sensors. It provides a data communication link between the AWPAG sensor and the Data Collection Package (DCP) or Acquisition Control Unit (ACU).

10A.1.2.16 DC Power Supply (S100-2MT6-3A2PS1)

The DC power supply is located in the electronics enclosure assembly. The main supply voltage is 115V AC. The DC power supply module (3A2PS1) is the main operating element of the assembly. It provides closely regulated +5 volts and +12 volts DC. The 12-volt output powers the ASOS instrument; the 5-volt powers the fiber-optic module. RF filters attenuate interference from the DC output, providing filtering in both directions. The output power for the AWPAG is terminated at TB1 terminals 9 and 10.

10A.1.2.17 AWPAG Power Control Module (S100-2A1A3A11)

The power control module (see Figure 10A.1.2.17-1) is the standard type of module used for other ASOS sensors. It provides circuit overload protection and monitoring for the AWPAG electronics and heaters.

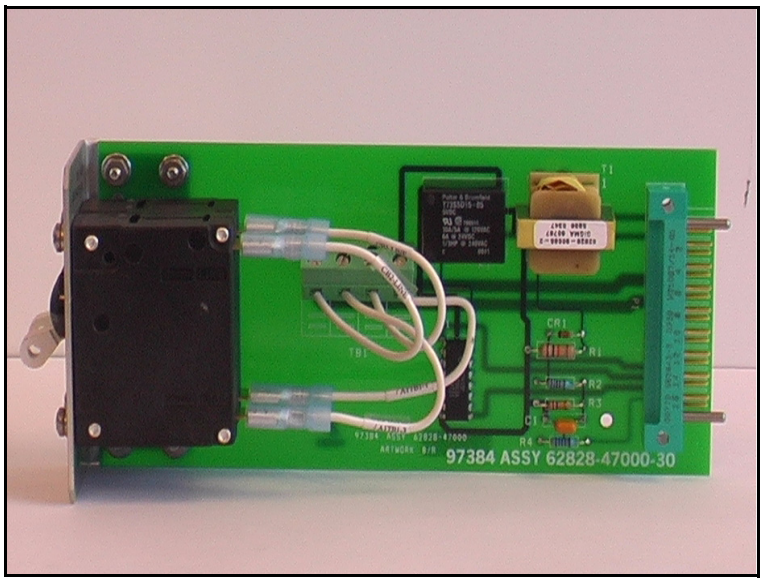


Figure 10A.1.2.17-1. ASOS/AWPAG Power Control Module

10A.1.3 SENSOR CONFIGURATIONS

A single type of sensor supports all ASOS configurations.

SECTION II.

(This section is reserved for future use.)

(This page intentionally left blank.)

SECTION III. OPERATION

10A.3.1 DESCRIPTION

The AWPAG Sensor is an unattended device operating continuously under the control of the ASOS DCP, SCA, or ACU. The precipitation readings are displayed on the 12-hour data screen. This screen is shown and explained in Chapter 1.

The AWPAG provides the current total of the bucket in 1-minute intervals. The AWPAG filters this value and then calculates the increase in precipitation as accumulated precipitation. Filtering the total contents leads to a delayed output (up to 3 minutes) of the accumulated precipitation value. Filtering eliminates undesirable influences from wind and vibration.

10A.3.2 SENSOR POWER

Sensor power is accessed by opening the electronic enclosure assembly door and turning the power switch to ON or OFF as needed. The sensor is designed for continuous operation and should be turned off only for maintenance.

10A.3.3 HEATER OPERATION

In the temperature range of 18 to 41 °F, the AWPAG heats the collection orifice using a ring heater to avoid frozen precipitation buildup.

The analysis electronics enclosure contains a temperature sensor and heating element. The heating element is switched on when temperatures reach a low of 14 °F.

10A.3.4 SERIAL INTERFACE SETTINGS

Communication between the ASOS and the AWPAG is *accomplished by an* RS-232 serial port implemented through a fiber-optic modem using separate send and receive lines. The command and response messages use ASCII characters. The bit structure is as follows:

1 start bit

8 data bits

1 stop bit

No parity

2400 bits per second (programmable to 9600)

Half duplex

Flow control X ON / X OFF

10A.3.5 POLL REQUEST COMMANDS

Message responses are transmitted to the ASOS following receipt of a POLL command. Each message contains a checksum parameter permitting verification that the entire message was received by the ASOS and the message was not corrupted during transmission. Table 10A.3.5-1 describes the available ASOS POLL commands.

The AWPAG provides a response message within 250 ms following a received POLL command, excluding PM, PT and PX commands. The response time for a PM/PT command is 270 ms at 2400 baud.

Table 10A.3.5-1. ASOS POLL Commands

Command	Result
P1	Precipitation accumulation message
PD	Sensor diagnostic results message
PF	Fixed sensor message
PRESET	Software reset
PRACC	Reset of accumulated precipitation
PTIMEhh:mm:ss	Set time
PDATEdd:mm:yy	Set date
PM	For service purposes only (complete measuring and diagnostic data)
PT	For service purposes only (test data "pipehouse fail flag" will be set)
PX	For service purposes only (test data of measured and calculated values)
PPFAIL	For service purposes only (simulation of a "LOGOSense board fail flag")
PRIREST	For service purposes only (reset of the internal intensity rest value)

10A.3.5.1 P1 Command

In response to the P1 command, the AWPAG provides reporting measurement data and one Pass/Fail flag. An ASOS POLL command requesting measurement and diagnostic data normally occurs each minute. Important measured data and status information are included in the response message. The AWPAG measurement operation and associated calculations begin at the start of each minute and require approximately 6 seconds to complete. The P1 response message contains the calculated general status of the last full minute interval, the amount of the accumulated precipitation, and the total of the bucket. A P1 POLL command received after the 15th second of a full minute interval results in an AWPAG response containing data representing the previous full minute calculation. Measurement data and one Pass/Fail flag are both included in the message to obtain diagnostic information as to whether the measurement is pass, fail, or restarted.

If a power-off period is detected and precipitation accumulates during power-off, the AWPAG calculates this missing precipitation within the first few minutes after restart. Any precipitation output that is calculated after a power-off period is marked with an R-flag. Diagnostic data corresponds to the accumulated precipitation of the same interval. The "accumulated precipitation" value represents the filtered amount of precipitation received since the last accumulated precipitation reset command (PRACC). The resolution is 0.01 inch. The reported accumulated precipitation is not rounded; instead it is truncated. This satisfies the requirement that the AWPAG does not report 0.01 inch of accumulation unless such accumulation was actually received. For example, with a resolution of 0.01 inch, 0.0099 inch would be reported as 0.00 until the actual catch reaches 0.01. Should a power failure be detected, the AWPAG writes the accumulated precipitation and the filtered total of the bucket parameter to nonvolatile memory. The accumulated precipitation is available for the next data transmission once power is returned and the first measurement is taken.

After power-up, a 95-second warm-up procedure begins. Within this 95-second period, the "total of the bucket" is set to 99.99. The "total of the bucket" is a raw value of the total amount of water in the bucket at the current time. This is not a filtered value. The P1 messages that appear in response to a POLL command of P1 <CR> (Request Measurement and Pass/Fail flag) are listed in Table 10A.3.5.1-1.

Table 10A.3.5.1-1. P1 POLL Command Responses

Byte	Description	Unit	Message
1	Start of transmission		STX
2-3	Sensor ID, Message ID		P1
4	Pass/Fail flag		P/F/R
5-9	Accumulated precipitation inches	inches	xx.xx
10-14	Total of the bucket inches	inches	xx.xx
15-16	Checksum		xx
17	End of transmission		ETX
18	Carriage return		CR
19	Line feed		LF

10A.3.5.2 PD Command

In response to the PD command, the AWPAG provides a PD response that reports diagnostic data. If a "Fail" flag is received following a P1 command, a PD command must be sent to the AWPAG so that the diagnostic data can be checked. Supply voltage is added to the response string for checking the power supply. This value is filtered, and transients do not interfere with measurements. The pipehouse flag will be reset after successful transmission of the PD, PM, PT, PX commands. The PD messages that appear in response to a POLL command of PD <CR> (Request Diagnostic Data as Pass/Fail flags) are listed in Table 10A.3.5.2-1.

Table 10A.3.5.2-1. PD Command Responses

Byte	Description	Unit	Message
1	Start of transmission		STX
2-3	Sensor ID, Message ID		PD
4	Pipehouse switch Pass/Fail flag		P/F
5	Bucket Pass/Fail flag		P\F
6	Balance system Pass/Fail flag		P\F
7	LOGOSense board Pass/Fail flag		P\F
8	Ring heating control Pass/Fail flag		P\F
9	Ring heating selftest Pass/Fail flag		P\F
10	Power supply Pass/Fail flag		P\F
11	Internal heating Pass/Fail flag		P\F
12-15	Supply voltage	V	x.xx
16-20	Ambient temperature	°F	-xx.x
21-25	Internal temperature	°F	-xx.x
26	Heating on/off status		Y/N
27-28	Checksum		xx
29	End of transmission		ETX
30	Carriage return		CR
31	Line feed		LF

If an error is detected in supply voltage, ambient temperature, or analysis electronics enclosure internal temperature, each digit in the failed value is set to 9 (voltage 99.9, temperature 999.9).

10A.3.5.3 PF Command

The PF command is used for verifying the communication link by initiating a known response from the AWPAG. The PF messages in response to a POLL command of PF <CR> (Request Fixed Data) are listed in Table 10A.3.5.3-1.

Table 10A.3.5.3-1. PF Command Responses

Byte	Description	Unit	Message
1	Start of transmission		STX
2-3	Sensor ID, Message ID		PF
4	Pass/Fail flag		P
5-9	Fixed data (accumulation)	inches	
10-14	Fixed data (total)	inches	
15-16	Checksum		xx
17	End of transmission		ETX
18	Fixed data (accumulation)	inches	
19	Line feed		LF

10A.3.5.4 PRESET Command

The PRESET command is used to initiate a software reset of the AWPAG system. (Use of more than 2 characters [PR] for execution of a complete software reset provides more safety in communication.) The PRESET messages that appear in response to a POLL command of PRESET <CR> (Request Software Reset) are listed in Table 10A.3.5.4-1.

Table 10A.3.5.4-1. PRESET Command Response

Byte	Description	Message
1	Start of transmission	STX
2-3	Sensor ID, Message ID	PR (always 2 characters)
4	Space	
5-6	Checksum	xx
7	End of transmission	ETX
8	Carriage return	CR
9	Line feed	LF

A software reset follows transmission of the response message. All measurement parameters and calibration factors are stored in nonvolatile memory. These values will not be reset by the PRESET command. Important RAM variables will also not be lost with a “PRESET command,” e.g., rest of accumulation less than 0.01 inch.

10A.3.5.5 PTIMEhh:mm:ss Command

The PTIMEhh:mm:ss command provides a means of synchronizing AWPAG time with the ASOS. The PTIMEhh:mm:ss messages that appear in response to a POLL command of PTIMEhh:mm:ss <CR> (Set Time) are listed in Table 10A.3.5.5-1.

Table 10A.3.5.5-1. PTIMEhh:mm:ss Command Responses

Byte	Description	Message
1	Start of transmission	STX
2-3	Sensor ID, Message ID	PT
4-11	Time	hh:mm:ss
12	Space	
13-14	Checksum	xx
15	End of transmission	ETX
16	Carriage return	CR
17	Line feed	LF

10A.3.5.6 PRACC Command

The PRACC command is used to initiate a reset of the accumulated precipitation parameter. The PRACC messages that appear in response to a POLL command of PRACC <CR> (Request Reset of Accumulated Precipitation) are listed in Table 10A.3.5.6-1.

Table 10A.3.5.6-1. PRACC Command Responses

Byte	Description	Message
1	Start of transmission	STX
2-3	Sensor ID, Message ID	PA
4	Space	
5-6	Checksum	xx
7	End of transmission	ETX
8	Carriage return	CR
9	Line feed	LF

10A.3.5.7 Checksum Calculation

To verify that the intended response message parameters are received at the ASOS, a checksum is calculated and included in the message body for each message response sent. The checksum is a numerical summation of all message components from the “Sensor ID” parameter to the line before the “checksum” parameter, calculated as follows: Bytes 17-18 form a two byte field containing an ASCII encoded HEX value that is a Modulus 256 checksum for the data in bytes 2-16. Byte 17 represents the most significant four bits of the checksum (MSB); byte 18 represents the least significant four bits (LSB). Refer to Table 10A.3.5.7-1 for checksum command responses.

Table 10A.3.5.7-1. Checksum Command Responses

Byte	Description	Message	DEC	HEX	HEX-Sum
1	Start of transmission	STX	02	02	
2-3	Sensor, Message ID	PF	80,70	50,46	96
4	Pass/Fail flag	P	80	50	E6
5	Space		32	20	106
6-10	Fixed data (accumulated)	12.34		F8	1FE
11	Space		32	20	21E
12-16	Fixed data (total)	12.34		F8	318
17-18	Checksum	16			
19	End of transmission	ETX	03	03	
20	Carriage return	CR	13	0D	
21	Line feed	LF	10	0A	

SECTION IV. THEORY OF OPERATION

10A.4.1 BALANCE SYSTEM

Specially designed transverse bars (see Figure 10A.4.1-1) provide a tension-free force concentration to the load cell. The balance system used in the AWPAG was optimized to meet the following criteria:

a. The highest possible stability in handling the bucket

b. Compensating the temperature influence

c. High accuracy and repetitive accuracy (hysteresis)

d. Long-term stability (hermetically sealed load cell)

e. Maintenance free (no friction points)

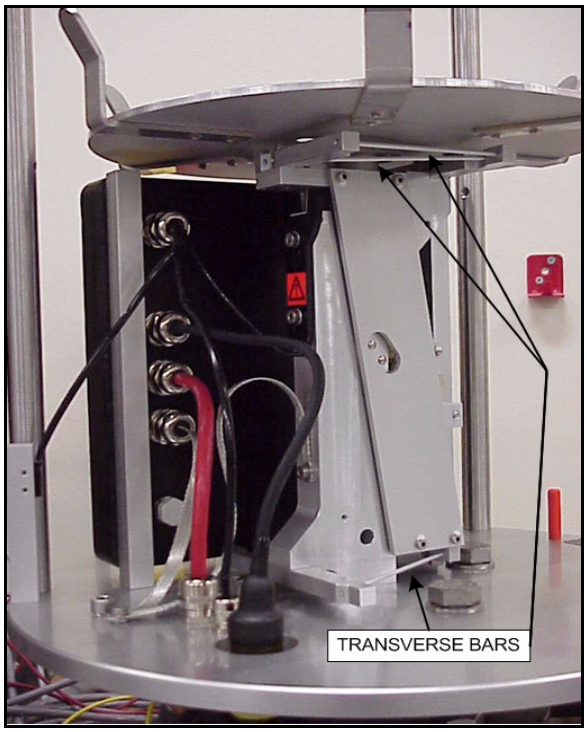


Figure 10A.4.1-1. Balance System Transverse Bars

10A.4.2 LOAD CELL

A load cell is defined as a force transducer. This device converts a force or weight acting on it into an electrical signal. It is mounted on the balance system as shown in Figure 10A.4.2-1.

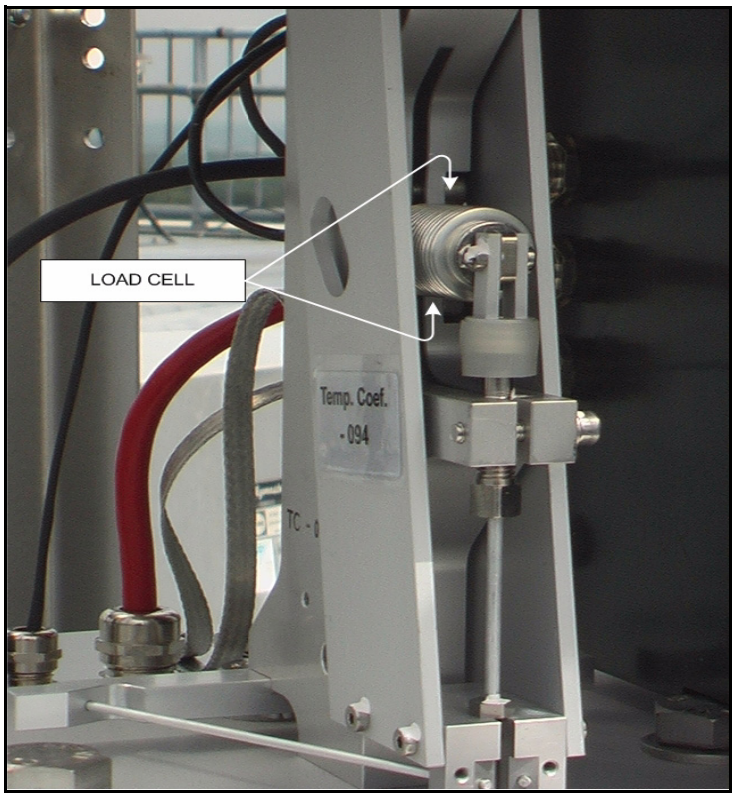


Figure 10A.4.2-1. Load Cell

10A.4.3 OVERVIEW OF LOAD CELL CIRCUITRY

As shown in Figure 10A.4.3-1, the sensor bucket collects precipitation, thus applying an ever-increasing force to the load cell. The load cell converts the increase in weight to an electrical signal used as an input to the amplifier. The amplified signal is then routed to the analog-to-digital convertor. The digitized signal is fed to the processor. The precipitation is calculated based on the signal sent from the load cell. This process is transparent to the end user. The data is displayed in inches of accumulated precipitation reported over time.

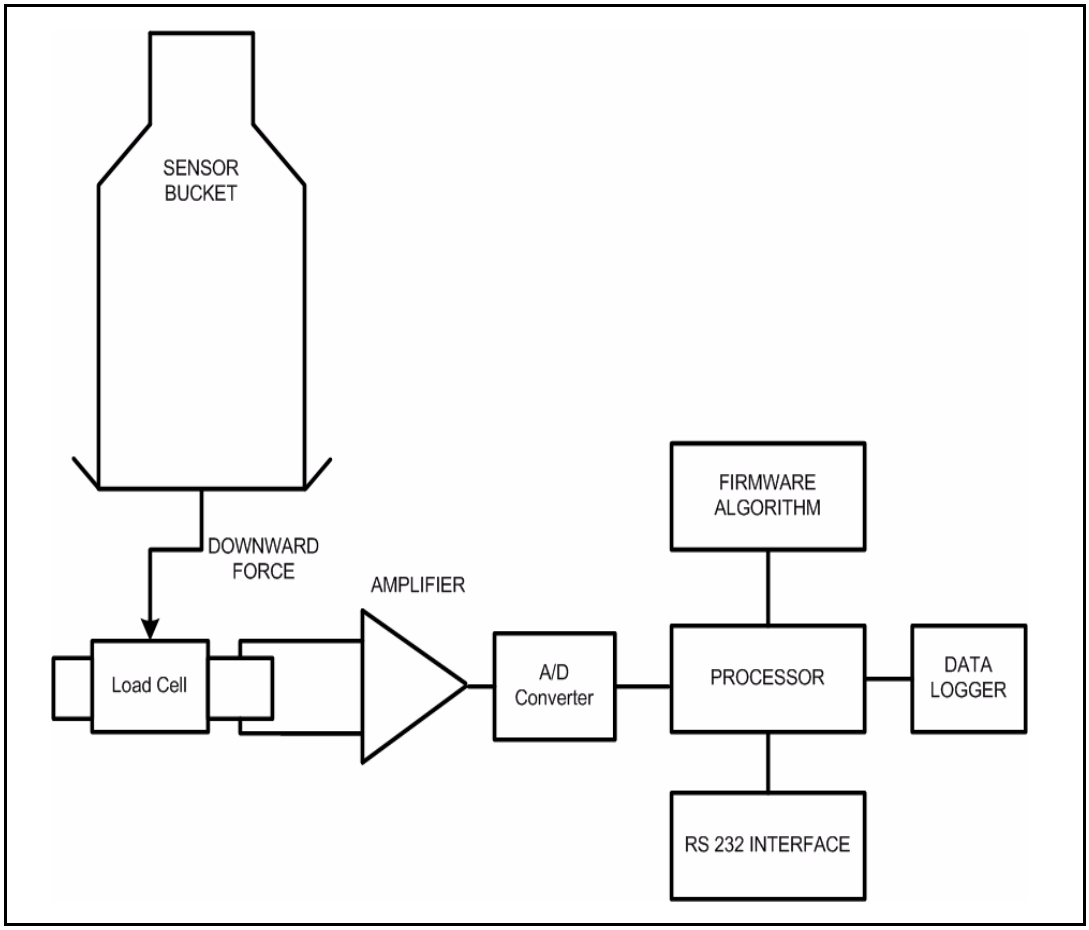


Figure 10A.4.3-1. Load Cell Wiring Schematic

10A.4.4 CONTINUOUS MONITORING RING HEATING SELFTEST

All AWPAG units are built with an additional ring heating element. The heating unit consists of a separate control board inside the analysis electronics enclosure and the following peripheral elements, as shown in Figure 10A.4.4-1:

a. Temperature sensor (orifice)

b. Ring heating element (orifice)

The operational status of the heating device will be transmitted to the LOGOSense board. Several pulses determine the actual state of the heating device.

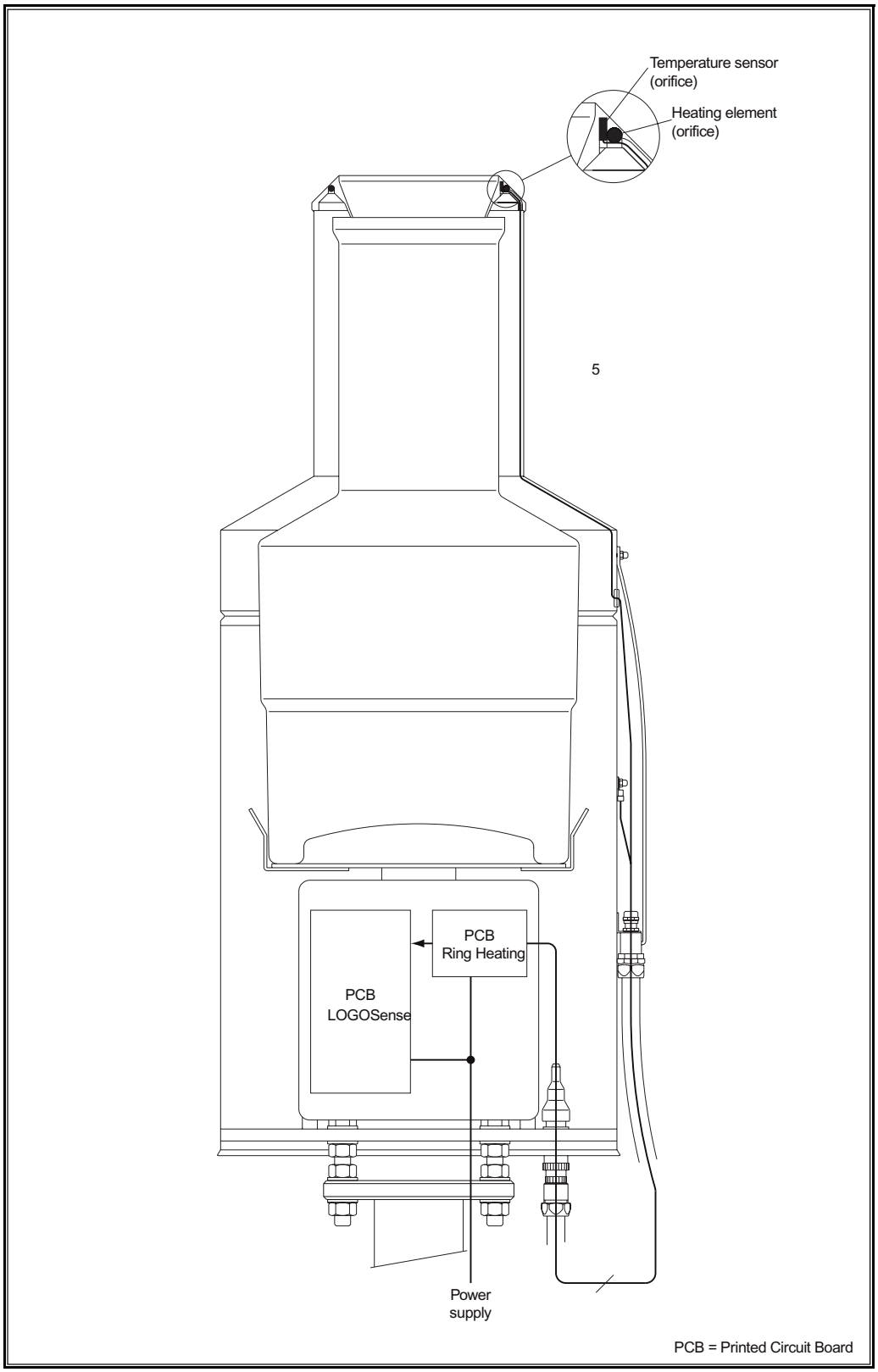


Figure 10A.4.4-1. Block Diagram – Ring Heating

10A.4.4.1 Diagnostic Tests – Ring Heating

Two diagnostic tests will be executed automatically:

a. Ring heater controller board operational status. Interval time: 1 minute.

b. Pipehouse ring heating element operational status. Interval time: 12 hours, in case of fail 1 hour.

The purpose of these tests is to ensure frequent checks of the heating board and the pipehouse ring heating element, including wiring connections, over the whole temperature range.

A selftest procedure will be executed two times a day for a duration of 1 to 5 minutes. The normal interval time is 12 hours. In case of a failed test, the interval time changes to 1 hour. A selftest operation switches the heating element on continuously for 1 to 5 minutes. It will be successful if an increase appears at the orifice temperature sensor. Selftest duration depends on the increase of the rim temperature. If the expected temperature increase of approximately +1 °F (+0.5 °C) is reached, the selftest will be finished and confirmed with a pass flag for "ring heating selftest." In case of no temperature increase, the time period is extended to 5 minutes. At the end of the selftest period, a fail flag for "ring heating selftest" will be set.

A ring heater selftest will not initiate at ambient temperatures above 104 °F (40 °C).

A wired connection to the LOGOSense board allows the ring heater to be turned off at ambient temperatures below 17.6 °F.

An ambient temperature sensor is installed on the LOGOSense board; it is a PT100 resistor mounted at a cable fitting at the bottom plate.

10A.4.4.2 Diagnostics

Two Pass/Fail flags at the PD response are set according to Table 10A.4.4.2-1.

Table 10A.4.4.2-1. Pass/Fail Flags at PD Response

POLL Response	Affected System	Action
Pass/Fail flag "ring heating control"	Signal for the control board itself	Check operation and communication
Pass/Fail flag "ring heating selftest"	Selftest procedure for the ring heating periphery	Check functionality and connection to the orifice.

If any fault appears at the PT100 of the LOGOSense, the following diagnostics are available for the ambient temperature sensor:

Short circuit of the wires or broken wire: Displayed value at PD-response is 999.9 and fail flag at P1 appears in the ambient temperature field.

NOTE: With a large temperature decrease in the field, the ring heating element may not be able to recognize a temperature increase at the orifice during selftest procedure. In this case interval time changes to 1 hour to check the ring in a shorter period. Under tough weather conditions the selftest may fail for a few hours.

The LOGOSense board monitors heating status. If a selftest fails, the LOGOSense board will collect all selftest failures for a 5-hour and 15-minute period through a maximum of six selftests. During this 5:15 hour period, all received fail flags will be set to pass. No fail flag will be received in response to a PD POLL command. If ring heating selftest failures are still occurring after this 5:15 hour period, a pipehouse fail flag will appear in response to a PD POLL command. A successful selftest will immediately send a pass flag and reset the 5:15 hour monitoring period.

Exception:

At the first hour after power-up or PRESET command at the LOGOSense, all fail flags will be displayed at the PD response. This means at the first hour after installation each existing fail can be viewed; no flags will be converted.

10A.4.5 CONTINUOUS MONITORING SENSOR STATUS

An ASOS POLL command requesting measurement and diagnostic data will occur each minute. The LOGOSense board monitors inputs from all the FRUs listed in Table 10A.4.5-1. A failed FRU will trigger the LOGOSense board to communicate to the ASOS which component is malfunctioning.

The ASOS polls the AWPAG every minute. The P1 command requests measurement data and one Pass/Fail flag. The P1 response field reports accumulated precipitation, total accumulated precipitation stored in the bucket, and one Pass/Fail flag.

The PD POLL command returns information identifying a failed FRU. It is the PD POLL command response that produces real-time Pass/Fail status of all FRUs. The status of each FRU is displayed on the AWPAG maintenance screen.

Table 10A.4.5-1. PD POLL Command Response

Byte	Description	Unit	Message
1	Start of transmission		STX
2-3	Sensor ID, Message ID		PD
4	Pipehouse switch Pass/Fail flag		P/F
5	Bucket Pass/Fail flag		P\F
6	Balance system Pass/Fail flag		P\F
7	LOGOSense board Pass/Fail flag		P\F
8	Ring heating control Pass/Fail flag		P\F
9	Ring heating selftest Pass/Fail flag		P\F
10	Power supply Pass/Fail flag		P\F
11	Internal heating Pass/Fail flag		P\F
12-15	Supply voltage	V	x.xx
16-20	Ambient temperature	°F	-xx.x
21-25	Internal temperature	°F	-xx.x
26	Heating on/off status		Y/N
27-28	Checksum		xx
29	End of transmission		ETX
30	Carriage return		CR
31	Line feed		LF

10A.4.6 FOREIGN BODY

A large increase in the bucket weight will set a status information byte at the PM response string. If an increase of 0.59 inch is exceeded in one full minute interval to the next interval, status information of 00 10 00 is transmitted. This status code is only a warning; no fail flag will be set. The message is only displayed at the PM or PX response.

The ASOS will recognize this increase as an error because it is impossible to accumulate such a large amount of precipitation in a 1-minute period. The ASOS will also check data from the present weather sensor to verify that precipitation is occurring at the site. A precipitation event detected by the AWPAG and not by the present weather sensor produces conflicting data, thus setting failure in the system log and daily precipitation screens.

Errors caused by a foreign body will be reflected in the system log screen. The system log will report "Official Precipitation Accumulation Sensor Data Quality Error." The daily precipitation screen will reflect foreign body errors by flagging the 24 HOUR PRECIPITATION and INCREMENTAL PRECIPITATION VALUE fields with an "E." The "E" informs the observer that erroneous data have been detected by ASOS and only an estimated value for accumulated precipitation is available.

10A.4.7 EMI CONCEPT

For protection against electromagnetic interference (EMI) and radiation, the AWPAG's analysis electronics and power supply electronics are enclosed within grounded metal cases. Service lines are shielded and filtered as well. Figure 10A.4.7-1 details EMI protective measures in the AWPAG.

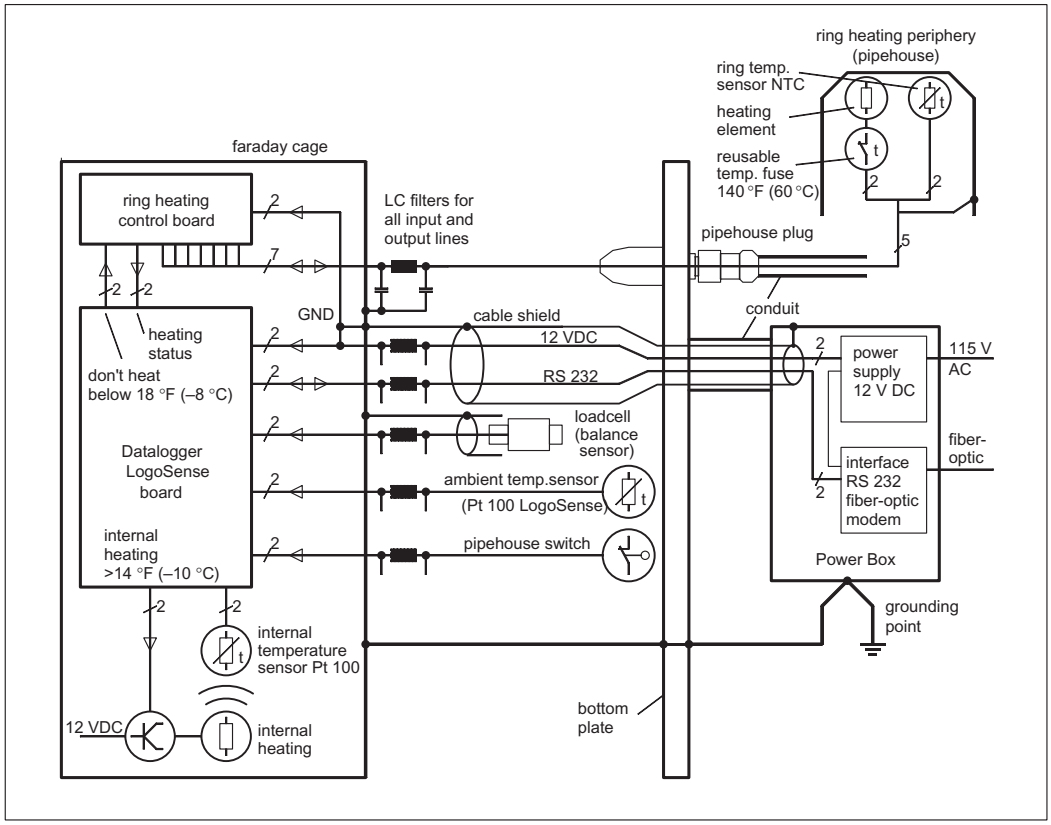


Figure 10A.4.7-1. Block Diagram of EMI Protective Measures

(This page intentionally left blank.)

SECTION V. MAINTENANCE

10A.5.1 INTRODUCTION

This section contains preventive and corrective maintenance procedures for the AWPAG. Preventive maintenance ensures that the AWPAG remains operational. Corrective maintenance allows fault isolation to a faulty FRU. The procedures for removal and replacement of a faulty FRU are also provided in this section. Malfunctions within the AWPAG are identified by the ASOS continuous selftest (CST).

CAUTION

Propylene glycol, a chemical component of antifreeze, is classified by the Environmental Protection Agency (EPA) as wastewater that may not be poured onto the ground. If the AWPAG bucket contains propylene glycol, it must be captured in the 6-gallon container provided with the pump kit and be disposed of according to applicable sections of NWSM50-5116.

10A.5.2 PREVENTIVE MAINTENANCE

The ASOS electronics technician is provided with a kit to remove the water/antifreeze (if used) mixture from the AWPAG. This kit consists of a manual pump with integral mounting bracket, intake hose, exhaust hose, wastewater bucket, and absorbent mat to be used in case of spill.

On the AWPAG maintenance screen the AMOUNT IN BUCKET field indicates, in inches, the weight on the AWPAG measurement scale. The amount includes the weight of the catch bucket, the weight of any antifreeze that has been added, and the weight of rain that has fallen into catch bucket. The AWPAG is designed to hold 40 inches of precipitation in addition to adequate antifreeze. The total amount of liquid the AWPAG is capable of holding is 7 gallons, which corresponds to 52.05 inches of rain. With an empty catch bucket, the AWPAG reports a TOTAL AMOUNT IN BUCKET of 7.62 inches. The actual minimum rainwater capacity of the catch bucket in the AWPAG is 40 inches of liquid. When the amount of water in the catch bucket begins to reach capacity, the AMOUNT IN BUCKET field displays in yellow, and a message is posted in the maintenance log (SYSLOG). The bucket should be emptied at this time.

The following is a summary of the AWPAG bucket capacity levels and reporting results. (The amounts may vary as a result of the accumulation of foreign material such as dirt and insects, which will increase the weight reported.)

a. Without the bucket, the AWPAG reports 3.17 inches in the AMOUNT IN BUCKET field.

b. With the bucket empty, the AWPAG reports 7.62 inches in the AMOUNT IN BUCKET field.

c. With 6 total gallons (44.61 inches of liquid), the AWPAG reports 52.23 inches in the AMOUNT IN BUCKET field.

d. With 7 total gallons (52.05 inches of liquid), the AWPAG reports 59.67 inches in the AMOUNT IN BUCKET field.

e. When 42 inches are reported in the AMOUNT IN BUCKET field, the AWPAG maintenance screen/SYSLOG displays a warning to indicate that the bucket contains 80% of its total working capacity of liquid.

During winter months in climates that experience freezing temperatures, propylene glycol is added to the AWPAG to act as an antifreeze agent. Propylene glycol is hydrophilic and will therefore absorb moisture from the air until it becomes saturated, resulting in a false report of precipitation. For this reason, it is necessary to add a small amount of water whenever propylene glycol is added. The recommended ratio is four parts propylene glycol to one part tap water. For example, for every 2 gallons of propylene glycol added to the AWPAG, add 1/2 gallon of tap water and stir until thoroughly mixed.

When the AWPAG is emptied, it is necessary to know if the catch contains propylene glycol. If the AWPAG catch does not contain propylene glycol, it can be drained directly onto the ground. If, however, the catch does contain antifreeze, it must be disposed of properly according to the National Weather Service Manual (NWSM) 50-5116, Environmental Management. To facilitate transport of the mixture, a 6-gallon bucket and lid are provided. Because propylene glycol is not naturally occurring, it cannot be dumped directly onto the ground. Any spilled propylene glycol mix must be absorbed using the absorbent mats contained in the manual pump kit.

A pump is needed because when the bucket is full, it contains approximately 7 gallons of liquid, which corresponds to a weight of approximately 50 pounds. The Electronics Technician will perform preventive maintenance on the AWPAG at 90-day intervals. Every 90 days the following procedures will be performed on the AWPAG:

1. Perform routine inspection of bucket contents and measurement system assembly. (Refer to the maintenance instructions in paragraph 10A.5.2.1, Routine Inspection.)
2. Drain the contents of the bucket when necessary. (Refer to the maintenance instructions in paragraph 10A.5.2.2, AWPAG Bucket Emptying.)
3. Charge the AWPAG with a water and propylene glycol mixture in regions that experience freezing temperatures. (Refer to the maintenance instructions in paragraph 10A.5.2.4, Antifreeze Charging.)
4. Test the protection level of the of water and propylene glycol mixture in regions that experience freezing temperatures. (Refer to the maintenance instructions in paragraph 10A.5.2.5, Antifreeze Check.)
5. Run a calibration test as a final check to ensure proper operation. (Refer to the maintenance instructions in paragraph 10A.5.2.6, AWPAG Calibration Test.)

10A.5.2.1 Routine Inspection

10A.5.2.1.1 Routine Inspection Setup

Tools required: Technician laptop

> **NOTE:** A laptop computer initialized as a DCP operator interface device (OID) (see Chapter 3, Section III), or any other available OID, may be used for the following procedure.

The following requires that the user be logged on to the ASOS with the maintenance password.

This procedure cannot be executed if precipitation is occurring at the site.

1. At the OID, display the sensor status screen by sequentially pressing the REVIEW-SENSOR-STAT function keys from 1-minute display. On the sensor status screen, set report processing for Precipitation Accumulation sensor to OFF.

2. At the OID, display the maintenance screen for the OTT AWPAG by pressing MAINT; use the NEXT or PREVIOUS keys to highlight DCP (if the AWPAG is installed as a DCP sensor) or ACU; then press the SEL key. Note the value in the AMOUNT IN BUCKET field. If the amount in the bucket is approaching the 42-inch capacity, it is recommended that the bucket be drained according to the maintenance instructions in paragraph 10A.5.2.2, AWPAG Bucket Emptying.
3. If the AWPAG is installed as a local ACU sensor, or installed in a Single Cabinet ASOS Configuration, proceed to step 4. If installed in the sensor array of the DCP, open the door to the DCP to access the AWPAG power control module. Set both circuit breakers on the AWPAG power control module to the OFF position. Proceed to maintenance instructions in paragraph 10A.5.2.1.2, Routine Inspection Procedure.
4. Locate the circuit breaker for the AWPAG either inside of the Single Cabinet ASOS, or externally to the ACU. Set the circuit breaker for the AWPAG to the OFF position.

10A.5.2.1.2 Routine Inspection Procedure

1. Examine the components of the AWPAG windscreen to verify that no components are bent. If a bent lamella is found, apply pressure to bend it back to its original form. Verify that all windscreen frame hardware is tight.
2. Open the AWPAG electronics enclosure assembly. Verify that the interior of the enclosure is dry and there is no sign of corrosion. Clean any corrosion or water. Close the enclosure.
3. Verify that the liquid tight conduit fitting on the bottom of the electronics enclosure is free from corrosion. If corrosion is found, clean and apply anticorrosion grease.
4. Verify that the ground lug on the bottom of the electronics enclosure is free from corrosion. If corrosion is found, clean and apply anticorrosion grease.
5. Remove the four large knurled screws securing the lamella ring to the windscreen frame, remove the lamella ring from the windscreen frame and place on the ground (see Figure 10A.5.2.1.2-1).

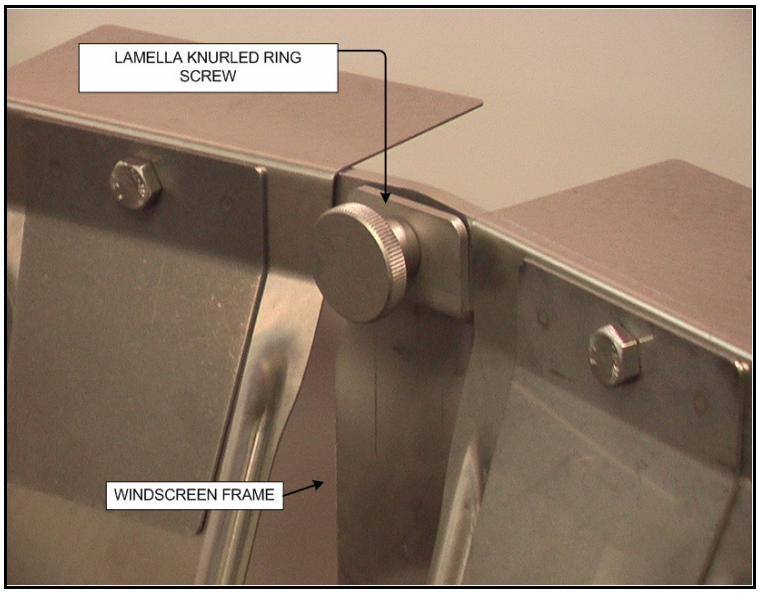


Figure 10A.5.2.1.2-1. Lamella Ring Fasteners

6. Remove the pipehouse bayonet connector cable, which goes between the pipehouse and the bottom of the AWPAG gauge, by disconnecting the connector from the socket at the bottom of the gauge (see Figure 10A.5.2.1.2-2).

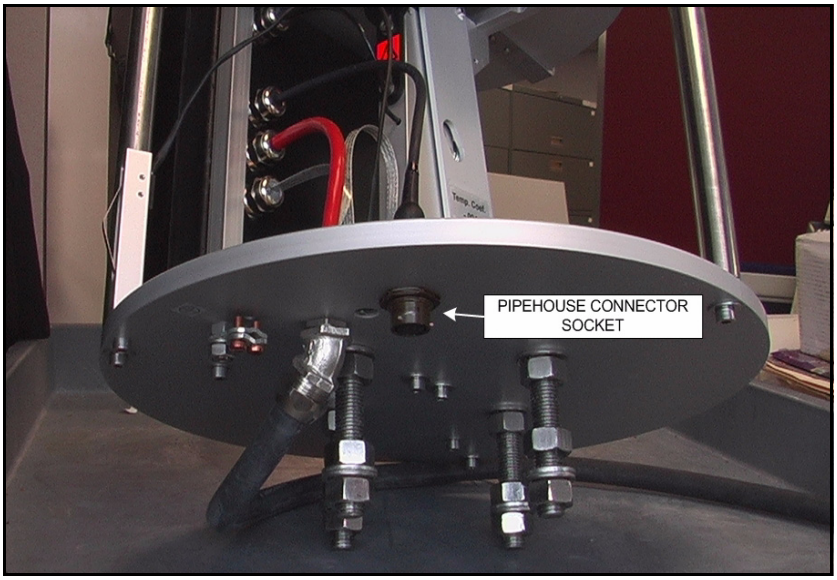


Figure 10A.5.2.1.2-2. Pipehouse Connector

7. Remove the three large knurled fasteners securing the pipehouse to the AWPAG gauge.
8. Remove the pipehouse from the AWPAG gauge by grasping the two large handles on either side of the pipehouse and lifting it straight up. Place the pipehouse on the ground.
9. Visually inspect the interior of the AWPAG gauge to verify that there are no foreign objects or evidence of standing water. Inspect the weighing mechanism to verify there are no insects or spider webs. Remove any foreign matter or insects from the gauge. If standing water is found, remove using disposable absorbent paper towels.
10. Inspect the contents of the catch bucket. If the bucket requires emptying, follow the instructions in paragraph 10A.5.2.2, AWPAG Bucket Emptying.
11. Carefully slide the pipehouse back onto the AWPAG gauge by grasping the two large handles on either side of the pipehouse, lifting it over the windscreen frame, and lowering it onto the AWPAG. Ensure that the three mounting holes in the side of the pipehouse are aligned with the three threaded mounting holes on the AWPAG gauge.
12. Apply and tighten the three large knurled fasteners, securing the pipehouse to the AWPAG gauge.
13. Connect the pipehouse ring heater cable connector to the bottom of the AWPAG gauge.
14. Reinstall the windscreen lamella ring onto the windscreen mounting frame, and secure it with the four large knurled fasteners. Ensure that the fasteners are tight.
15. Set the circuit breakers for the AWPAG to the ON position.
16. Close and secure the door to the electronics enclosure.
17. Close and secure the DCP and/or the ACU.

10A.5.2.1.3 Routine Inspection System Restoration

1. At the OID on the AWPAG maintenance screen, press the PRACC key to set the accumulated precipitation value to 0.00 inches.
2. On the sensor status screen, set report processing for the PRECIP ACCUM sensor to ON.
3. Log off the ASOS.

10A.5.2.2 AWPAG Bucket Emptying

WARNING

Always secure the transportation lock before servicing the sensor bucket. Do not attempt to lift the bucket off the measurement system until all the contents have been pumped out using the manual pump kit. Accidently dropping a partially full bucket onto the AWPAG can permanently damage the measurement system's balance mechanism.

10A.5.2.2.1 AWPAG Emptying Bucket Setup

Tools required: AWPAG Manual Pump Kit Assembly - S100-TE165

NOTE: A laptop computer initialized as DCP OID (Chapter 3, Section III), or any other available OID, may be used for the following procedure.

The following requires that the user be logged on to the ASOS with the maintenance password.

This procedure cannot be executed if precipitation is occurring at the site.

1. At the OID display sensor status screen by sequentially pressing the REVIEW-SENSOR-STAT function keys from 1-minute display.
2. On the sensor status screen, set report processing for Precipitation Accumulation sensor to OFF.

10A.5.2.2.2 AWPAG Emptying Bucket Procedure

1. Locate the components of the AWPAG manual pump kit (see Figure 10A.5.2.2.2-1). These consist of a manual pump assembly with hoses, an absorbent pad for spills, and a 6-gallon plastic bucket for safe transport of propylene glycol and rainwater.
2. Remove the four large knurled fasteners securing the lamella ring to the windscreen frame, remove the lamella ring from the windscreen frame and place on the ground.
3. Remove the pipehouse ring heater cable, which goes between the pipehouse and the bottom of the AWPAG gauge, by disconnecting the connector at the bottom of the gauge.
4. Remove the three large knurled fasteners securing the pipehouse to the AWPAG gauge.
5. Remove the pipehouse from the AWPAG gauge by grasping the two large handles on either side of the pipehouse and lifting the pipehouse straight up. Place the pipehouse on the ground.

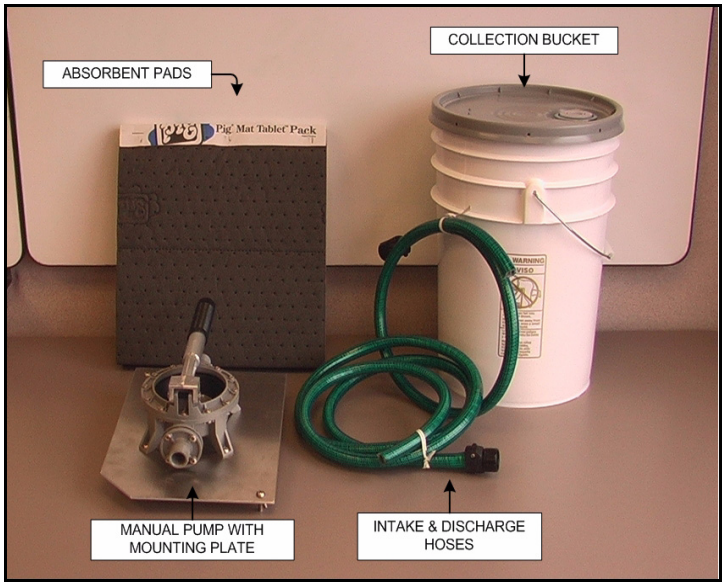


Figure 10A.5.2.2.2-1. Manual Pump Assembly Kit (ASN S100-TE163)

6. Engage the transportation lock.
7. Ensure that the long hose is attached to the manual pump intake, and the short hose is attached to the manual pump output, and that the hose fittings are hand tight.
8. Attach the manual pump to the AWPAG windscreen frame as shown in Figure 10A.5.2.2.2-2. Two bolts and wing nuts are provided to attach the pump to the frame members as shown. Ensure that the orientation of the pump is such that the long hose (intake) is positioned up, and the shorter hose (output) is down. Secure the pump to the frame by finger-tightening the wing nuts.

Figure 10A.5.2.2.2-2. Attached Manual Pump Assembly

9. Place the long hose into the AWPAG. The hose should be of adequate length to reach the bottom of the bucket. Empty the contents of the AWPAG bucket by manually operating the pump handle.
10. Lift the empty bucket off the measuring unit for removal of foreign objects.
11. When the bucket is empty, drain the pump and pump hoses.
12. Remove the wing nuts securing the pump assembly to the windscreen frame, and remove and store the manual pump.
13. With bucket installed, disengage the transportation lock (see Figure 10A.5.2.2.2-3) and place the pipehouse back onto the measuring unit and reinstall the three knurled fasteners.
14. Plug the pipehouse ring heater cable in.
15. Place the lamella ring back on top of the windscreen frame and reinstall the four knurled fasteners.
16. If the AWPAG bucket was emptied into the 6 gallon container, ensure that the lid is tight before moving the container, and dispose of the propylene glycol and rainwater mixture according to NWSM 50-5116. Refer to paragraph 10A.5.2.3.1, Disposing of Antifreeze/Rainwater Mixture, for more information.
17. In regions expected to experience freezing temperatures, antifreeze must be added to the bucket. Refer to paragraph 10A.5.2.4.2, Antifreeze Charging Procedure.

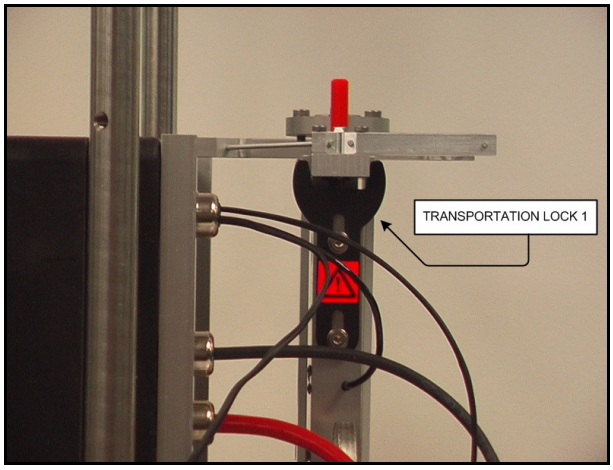


Figure 10A.5.2.2.2-3. Transportation Lock

10A.5.2.3 AWPAG Bucket Emptying System Restoration

1. At the OID, display the maintenance screen for the AWPAG by pressing MAINT; use the NEXT or PREVIOUS keys to highlight DCP (if the AWPAG is installed as a DCP sensor) or ACU; then press the SEL key.
2. At the OID on the AWPAG maintenance screen, press the PRACC key to set the accumulated precipitation value to 0.00 inches.
3. Log off the ASOS.

10A.5.2.3.1 Disposing of Antifreeze/Rainwater Mixture

Environmental regulations prohibit the discharge of diluted propylene glycol directly onto the ground. The propylene glycol mixed with rainwater drained from the AWPAG must be treated as a wastewater product, and therefore must be captured. A 6-gallon plastic bucket with lid is provided for the purpose of containing the AWPAG bucket contents and transporting it to a disposal location. It is recommended that the antifreeze/water mixture be discharged into the sanitary sewer system; however, at some locations this may require a special license. This is because propylene glycol consumes oxygen that may be required to sustain beneficial bacteria in the sewer system. If the mixture cannot be discharged into the sewer system, it is recommended that the mixture be added to the antifreeze/water mixture collected from servicing the diesel generator, or propylene glycol/oil mixture collected from the Cooperative Observation Fischer and Porter rain gauges.

If propylene glycol is spilled while the bucket is being emptied, every effort must be made to capture the spilled liquid using the absorbent pads provided with the pump kit. Tear one of the absorbent pads from the holder, place it on the spilled liquid, and apply pressure to the top of the pad by stepping on it. Once the spilled liquid has been absorbed, the pads can be disposed of as normal nontoxic solid waste.

10A.5.2.4 Antifreeze Charging

10A.5.2.4.1 Antifreeze Charging Setup

Tools required: Propylene Glycol - NSN 6850-01-288-7922 / ASN 0111-153
Water
36-inch wooden stick

NOTE:	A laptop computer initialized as DCP OID (Chapter 3, Section III), or any other available OID, may be used for the following procedure.

The following requires that the user be logged on to the ASOS with the maintenance password.

This procedure cannot be executed if precipitation is occurring at the site.

1. At the OID display sensor status screen by sequentially pressing the REVIEW-SENSOR-STAT function keys from 1-minute display.
2. On the sensor status screen, set report processing for Precipitation Accumulation sensor to OFF.
3. At the OID, display the maintenance screen for the AWPAG by pressing MAINT; use the NEXT or PREVIOUS keys to highlight DCP (if the AWPAG is installed as a DCP sensor) or ACU; then press the SEL key. If the AMOUNT IN BUCKET is greater than 10 inches, it is recommended that the bucket be emptied according to the procedures noted in paragraph 10A.5.2.2 prior to proceeding with paragraph 10A.5.2.4.2, Antifreeze Charging Procedure, step 1.

10A.5.2.4.2 Antifreeze Charging Procedure

Tools required: Propylene Glycol - NSN 6850-01-288-7922 / ASN 0111-153
Water
36-inch wooden stick

> **NOTE:** A laptop computer initialized as DCP OID (see Chapter 3, Section III), or any other available OID, may be used for the following procedure.

The following requires that the user be logged on to the ASOS with the maintenance password.

This procedure cannot be executed if precipitation is occurring at the site.

The recommended charge ratio of 4:1 indicates charging the AWPAG with 2 gallons of propylene glycol to protect the total gauge capacity of 7 gallons. This yields about a 30% mixture, which protects a completely full AWPAG down to approximately 0 °F. Using the vendor-recommended ratio of 4 parts glycol to 1 part water for the initial charge requires 0.5 gal. of water to be mixed with the 2 gallons of propylene glycol. The total rainfall capacity of the gauge is reduced to 4.5 gallons, which represents 34 inches of precipitation.

Each AWPAG site should determine the lowest temperature anticipated and use this information to calculate the amount of propylene glycol and water needed for a 4:1 charge. Refer to Table 10A.5.2.4.2-1 for mixture ratios.

Table 10A.5.2.4.2-1. Propylene Glycol-Water Mixture Ratios

Temperature (°F)	Propylene Glycol Required (Quarts)	Tap Water Required (Quarts)	Precipitation Accumulation Capacity (Inches)
20	4	1	42
10	6	1.5	38
0	8	2	34

1. Add the required amount of tap water to the AWPAG bucket.
2. Add the required amount of propylene glycol to the AWPAG bucket.
3. Using a 36-inch wooden stick, thoroughly mix the propylene glycol and water mixture in the AWPAG bucket.

10A.5.2.4.3 Antifreeze Charging System Restoration

1. At the OID on the AWPAG maintenance screen, press the PRACC key to set the accumulated precipitation value to 0.00 inch.
2. On sensor status screen, set report processing for the PRECIP ACCUM sensor to ON.
3. Log off the ASOS.

10A.5.2.5 Antifreeze Check

10A.5.2.5.1 Antifreeze Check Setup

Tools required: Propylene Glycol Test Strip - S100TE169
36-inch wooden stick

1. At the OID, display sensor status screen by sequentially pressing the REVIEW-SENSOR-STAT function keys from 1-minute display. On the sensor status screen, set report processing for Precipitation Accumulation sensor to OFF.
2. Using a 36-inch stick, stir the contents of the AWPAG catch bucket to ensure uniformity of the water/propylene glycol mixture.
3. Remove one propylene glycol test strip from the container and attach it to the end of the 36-inch stick. Follow the instructions on the propylene glycol test strip container (see Figure 10A.5.2.5.1-1) to determine the protection level of the propylene glycol and water mixture.

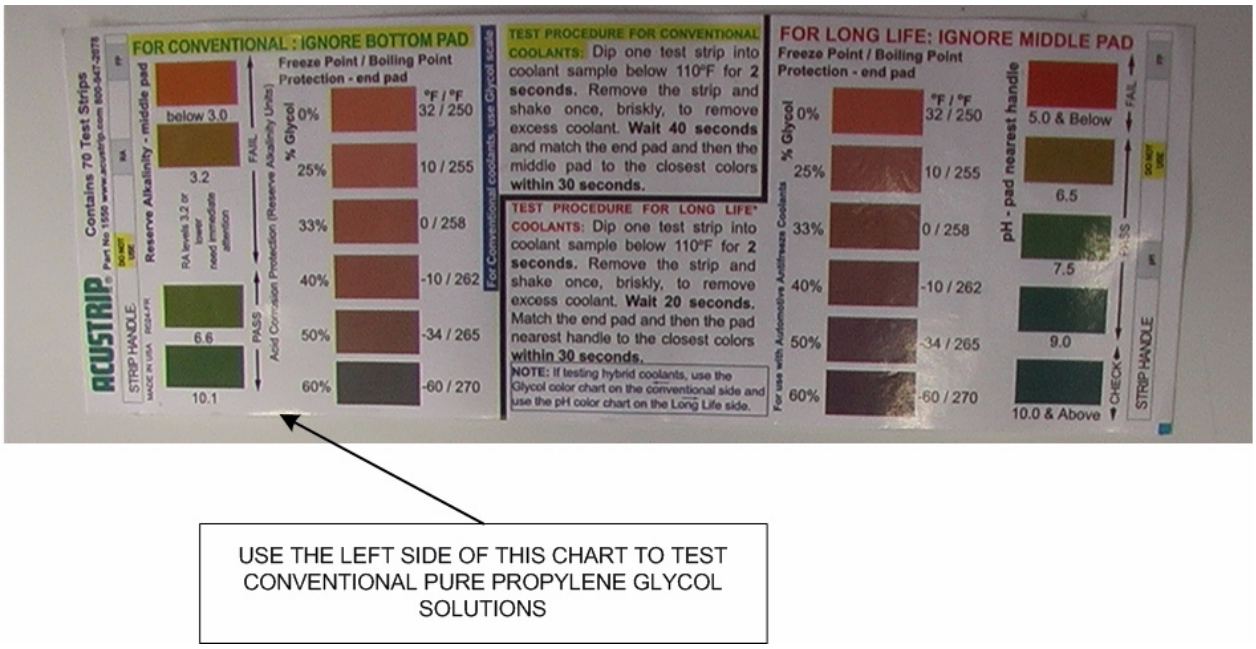


Figure 10A.5.2.5.1-1. Test Strip Chart

10A.5.2.5.2 Antifreeze Check System Restoration

1. At the OID on the AWPAG maintenance screen, press the PRACC key to set the accumulated precipitation value to 0.00 inch.
2. On the sensor status screen, set report processing for the PRECIP ACCUM sensor to ON.
3. Log off the ASOS.

10A.5.2.6 AWPAG Calibration Test

10A.5.2.6.1 AWPAG Calibration Test Setup

Tools required: Technician Laptop
Flask, 500 mL – S100-TE165
Water

NOTE:	A laptop computer initialized as DCP OID (Chapter 3, Section III), or any other available OID, may be used for the following procedure.

The following requires that the user be logged on to the ASOS with the maintenance password.

This procedure can not be executed if precipitation is occurring at the site.

1. At the OID, display sensor status screen by sequentially pressing the REVIEW-SENSOR-STAT function keys from 1-minute display. On the sensor status screen, set report processing for Precipitation Accumulation sensor to OFF.
2. At the OID, display the hardware definition screen by sequentially pressing the REVIEW-SITE-CONFIG-DEFINE function keys. If the PRECIP ACCUM field is not set to OTT AWPAG, change the definition (press CHANGE, use the NEXT key to position to the PRECIP ACCUM field, and press SEQUENCE until OTT AWPAG is selected).
3. At the OID, display the maintenance screen for the OTT AWPAG by pressing MAINT; use the NEXT or PREVIOUS keys to highlight DCP (if the AWPAG is installed as a DCP sensor) or ACU; then press the SEL key. Note the values in the AMOUNT IN BUCKET and ACCUMULATED PRECIP fields.

10A.5.2.6.2 AWPAG Calibration Test Procedure

1. Note the amount in bucket field as displayed on the OID maintenance screen before proceeding to step 2.
2. Fill the volumetric flask to the 500 mL line using ordinary tap water. Pour the water into the AWPAG slowly, such that the entire flask requires approximately 1 minute to empty.
3. At the OID, display the maintenance screen for the AWPAG if not already displayed. Verify that within 4 minutes of adding the water the ACCUMULATED PRECIP field indicates an increase of 0.98 inch (± 0.02) and the AMOUNT IN BUCKET field indicates an increase of 0.98 inch (± 0.02) of precipitation from the values displayed in paragraph 10A.5.2.6.1, step 3.

10A.5.2.6.3 AWPAG Calibration Test System Restoration

1. At the OID on the AWPAG maintenance screen, press the PRACC key to set the accumulated precipitation value to 0.00 inch.
2. On the sensor status screen, set report processing for the PRECIP ACCUM sensor to ON.
3. Log off the ASOS.

10A.5.2.7 AWPAG Calibration - NRC Only

NOTE: The AWPAG calibration is not a field procedure. If the AWPAG fails the calibration test described in paragraph 10A.5.2.6, replace the AWPAG sensor assembly. Calibrations will be performed by the NRC only.

10A.5.3 FRU DIAGNOSTIC AND REPLACEMENT PROCEDURES

Table 10A.5.3-1 lists AWPAG FRUs and their associated Agency Stock Numbers (ASN). The following paragraphs provide diagnostic testing and replacement procedures for major AWPAG FRUs.

Table 10A.5.3-1. AWPAG Field Replaceable Units (FRUs)

Item Name	ASN
AWPAG System	S100-2MT6-3
AWPAG Sensor Assembly	S100-2MT6-3A1
Sensor Bucket	S100-2MT6-3A1A1
Sensor Pipehouse	S100-2MT6-3A1A2
Measurement System Assembly	S100-2MT6-3A1A3
LOGOSense Board	S100-2MT6-3A1A3A1
Ring Heater Controller Board	S100-2MT6-3A1A3A2
LOGOSense Internal Heater	S100-2MT6-3A1A3HR1
Ambient Temperature Sensor	S100-2MT6-3A1A3RT1
Analysis Electronics Ambient Temperature Sensor	S100-2MT6-3A1A3RT2
Sensor Pipehouse Switch	S100-2MT6-3A1A3S1
Electronics Enclosure Assembly	S100-2MT6-3A2
Fiber-optic Module	S100-2A3A1-1
DC Power Supply	S100-2MT6-3A2PS1
Windscreen Assembly	S100-2MT6-3A3
Lamella	S100-2MT6-3A3MP1
Manual Pump Assembly Kit	S100-TE163
Volumetric Flask	S100-TE165
Calibration Weight Set	S100-TE167
Antifreeze Test Strips	S100-TE169
ASOS/AWPAG Power Control Module	S100-2A1A3A5-1

10A.5.3.1 Fault Isolation Overview

In response to the P1 POLL command, the AWPAG provides reporting measurement data and one Pass/ Fail flag. Supply voltage is added to the response string for checking the power supply. Refer to Figure 10A.5.3.1-1 for an example P1 POLL command response and Table 10A.5.3.1-1 for byte string definition.

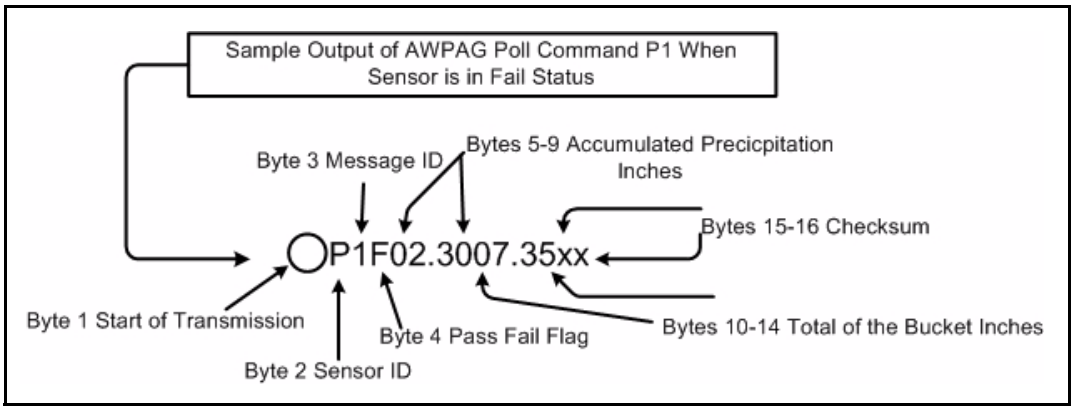


Figure 10A.5.3.1-1. Sample Output P1 POLL Command

Table 10A.5.3.1-1. P1 POLL Command Responses

Byte	Description	Unit	Message
1	Start of transmission		STX
2-3	Sensor ID, Message ID		P1
4	Pass/Fail flag		P/F/R
5-9	Accumulated precipitation inches	inches	xx.xx
10-14	Total of the bucket inches	inches	xx.xx
15-16	Checksum		xx
17	End of transmission		ETX
18	Carriage return		CR
19	Line feed		LF

If a fail flag is received following a P1 POLL command, a PD POLL command must be sent to the AWPAG so that the diagnostic data can be checked. The response to the PD command provides diagnostic data identifying the specific cause of trouble. Refer to Figure 10A.5.3.1-2 for byte number and definition. Bytes 4 through 11 represent diagnostic data for a particular failed FRU. The codes are pass fail. Refer to Figure 10A.5.3.1-3 for PD POLL command response example.

If an error is detected in temperature or voltage measurements, the following fields will be flagged.

a. Supply Voltage: Bytes 12-15 will be set to 9.99

b. Ambient Temperature: Bytes 16-20 will be set to 999.9

c. Internal Temperature: Bytes 21-25 will be set to 999.9

Refer to Figure 10A.5.3.1-3 for byte locations contained in the PD responses.

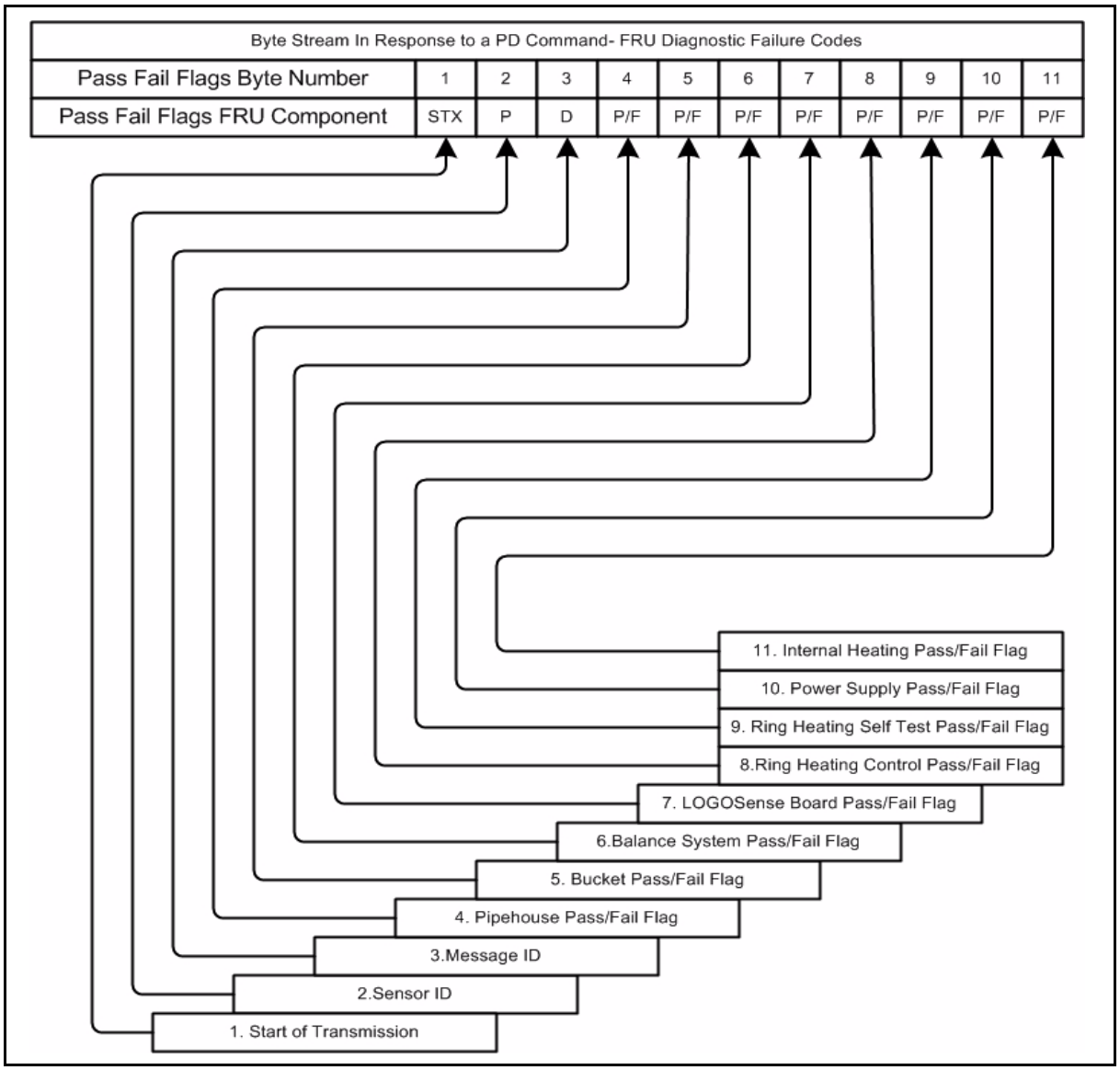


Figure 10A.5.3.1-2. Byte String Definition

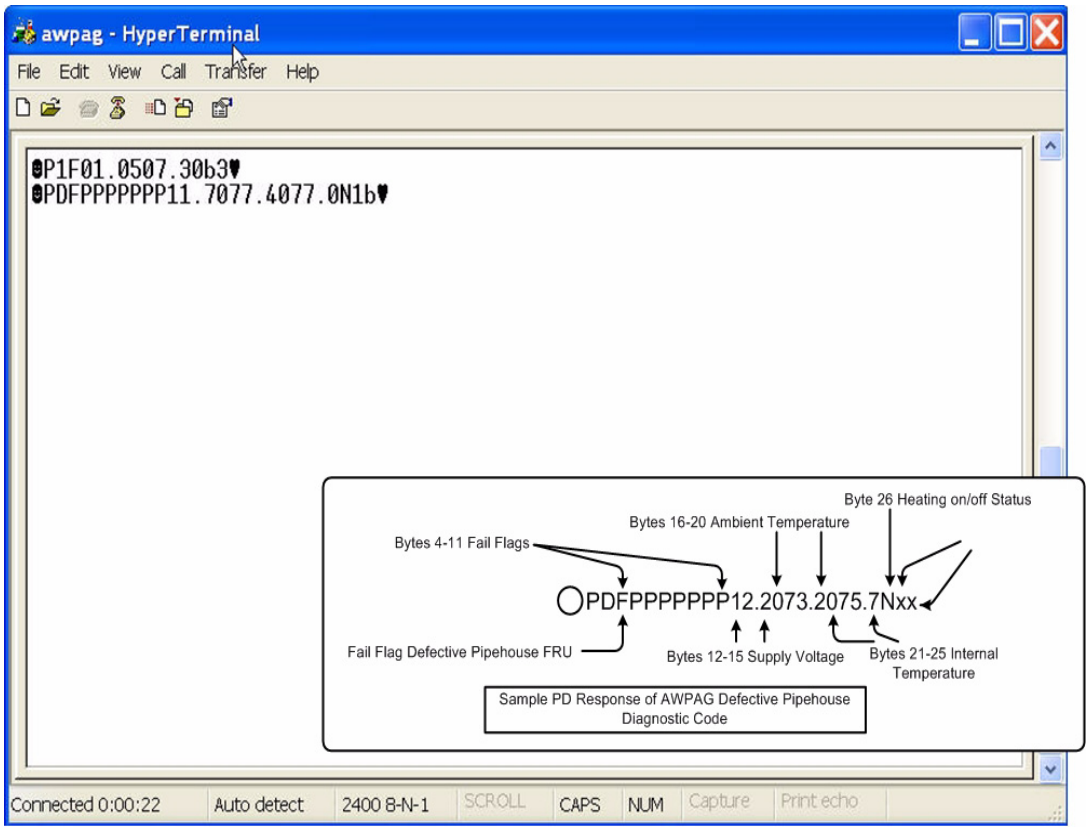


Figure 10A.5.3.1-3. Fail Flag PD POLL Command Response Example – Defective Pipehouse

10A.5.3.1.1 Error Diagnostics

NOTE:	A laptop computer initialized as DCP OID (see Chapter 3, Section III), or any other available OID, may be used for the following procedure.

The following requires that the user be logged on to the ASOS with the maintenance password.

This procedure cannot be executed if precipitation is occurring at the site.

1. At the OID display sensor status screen by sequentially pressing the REVIEW-SENSOR-STAT function keys from 1-minute display.
2. On the sensor status screen, set report processing for Precipitation Accumulation sensor to OFF.
3. At the OID, display the maintenance screen for the AWPAG by pressing MAINT; use the NEXT or PREVIOUS keys to highlight DCP (if the AWPAG is installed as a DCP sensor) or ACU; then press the SEL key (see Figure 10A.5.3.1.1-1).

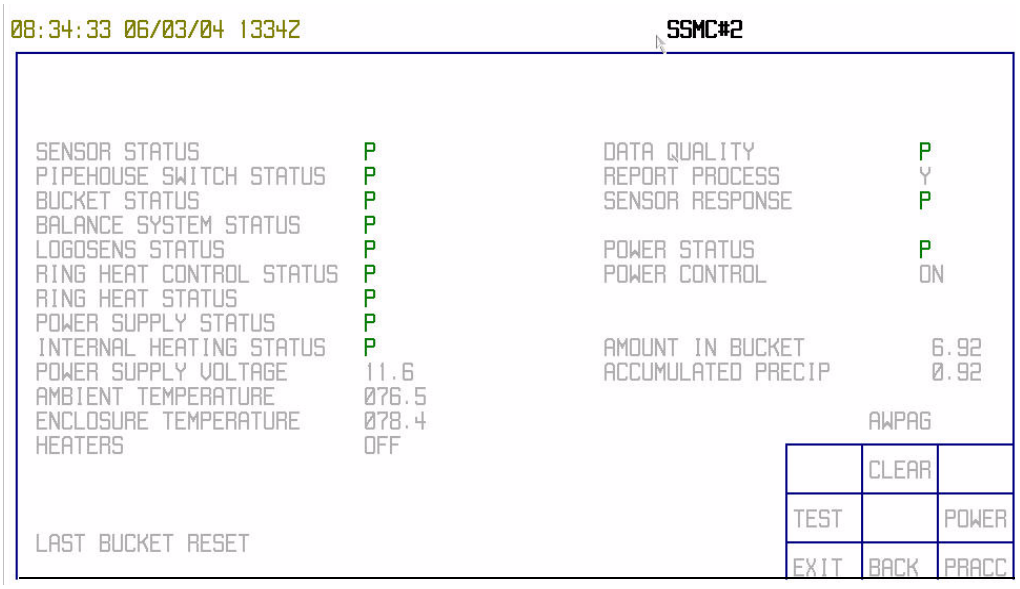


Figure 10A.5.3.1.1-1. AWPAG Maintenance Screen

Failure flags for a particular failed FRU can be viewed on the left side of the screen. POLL testing can be done with this interface by pressing the TEST key.

10A.5.3.1.2 DCP Site RS-232 Communications Interface and Fault Diagnostics

Communication between the ASOS and the AWPAG are via an RS-232 serial port implemented through a fiber-optic modem utilizing separate send and receive lines. The command and response messages use ASCII characters.

To communicate with the AWPAG, use a laptop computer with Windows Hyper terminal or Procomm Plus installed. Connect a serial cable between the computer's COM 1 port and the RS 232 fiber-optic module serial interface located in the electronics enclosure assembly. Refer to paragraph 10A.5.3.12 for RS-232 communications troubleshooting procedures. The byte structure is as follows:

1 start bit

8 data bits

1 stop bit

No parity

2400 bits per second

Half duplex Caps Lock On

Flow control Xon/Xoff

Use the following procedure to obtain diagnostic data.

1. Dispatch POLL commands P1 and PD.
2. Check the response for P/F flags.
3. Refer to Table 10A.5.3.1.2-1 for diagnostic trouble code identification and FRU diagnostic and replacement procedure.

Table 10A.5.3.1.2-1. Diagnostic FRU Fault Codes PD POLL Command Response

Byte	Description	Unit	Message	Fail Code	Refer to Paragraph
1					N/A
2-3	Sensor ID, Message ID		PD		N/A
4	Sensor pipehouse switch Pass/Fail flag		P/F	F	10A.5.3.2
5	Sensor bucket Pass/Fail flag		P/F	F	10A.5.3.3
6	Measurement system assembly Pass/Fail flag		P/F	F	10A.5.3.4
7	LOGOSense board Pass/Fail flag		P/F	F	10A.5.3.5
8	Ring heating controller board Pass/Fail flag		P/F	F	10A.5.3.6
9	Ring heating selftest Pass/Fail flag		P/F	F	10A.5.3.8
10	Power supply Pass/Fail flag		P/F	F	10A.5.3.7
11	Internal heating Pass/Fail flag		P\F	F	10A.5.3.9
12-15	Supply voltage	V	x.xx	9.99	10A.5.3.7
16-20	Ambient temperature	°F	-xx.x	999.9	10A.5.3.10
21-25	Internal temperature	°F	-xx.x	999.9	10A.5.3.9
26	Heating on/off status		Y/N		N/A
27-28	Checksum		xx		N/A
29	End of transmission		ETX		N/A
30	Carriage return		CR		N/A
31	Line feed		LF		N/A
1	Start of transmission		STX		N/A

10A.5.3.2 Pipehouse Fault Isolation and Replacement Instructions

PD POLL Command Response: 0PDFPPPPPPP12.2073.2075.7Nxx

Refer to Table 10A.5.3.2-1 before replacing the pipehouse.

Table 10A.5.3.2-1. Pipehouse – Possible Causes for Error

Error	Action	Refer to Paragraph	Fault Flag
Pipehouse not attached	Attach the pipehouse.	10A.5.3.2.1	Yes
Pipehouse not properly closed	Close the pipehouse.	10A.5.3.2.1	Yes
Pipehouse switch defective	Replace the pipehouse switch.	10A.5.3.2.2	Yes
Pipehouse has mechanical damage	Replace the pipehouse.	10A.5.3.2.1	No

10A.5.3.2.1 Pipehouse Replacement Instructions

1. Turn off the power to the sensor by switching off the circuit breakers contained in the electronics enclosure assembly.
2. Disconnect the pipehouse bayonet connector from the underside of the measurement system assembly by turning the fitting counter clockwise 1/4 turn (see Figure 10A.5.3.2.1-1).

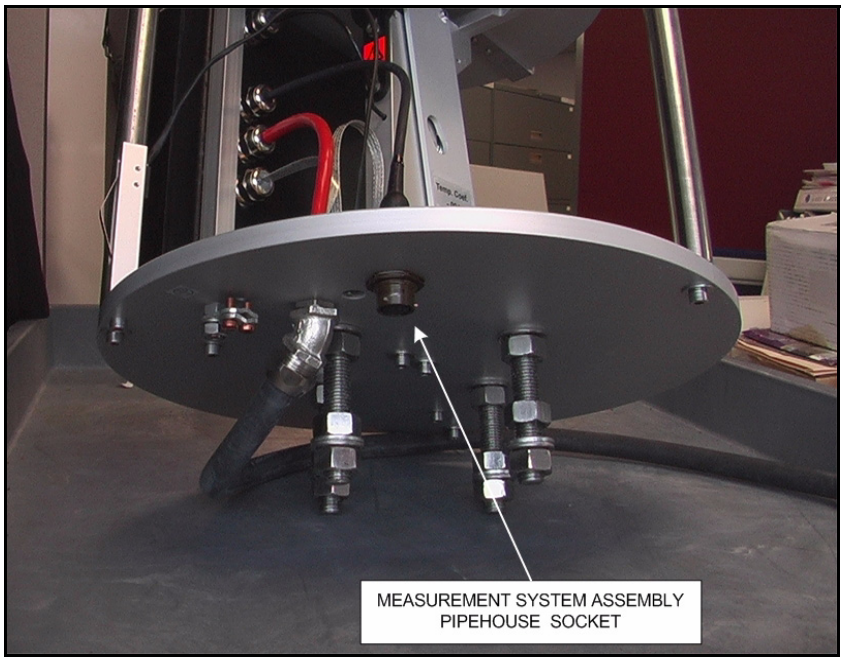


Figure 10A.5.3.2.1-1. Measurement System Assembly Pipehouse Socket

3. Unscrew the three knurled screws on the pipehouse (see Figure 10A.5.3.2.1-2).

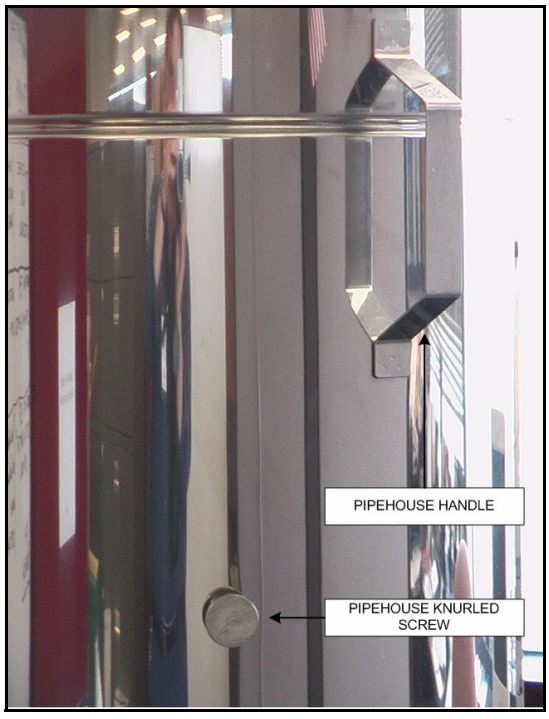


Figure 10A.5.3.2.1-2. Pipehouse Screws and Handles

4. Carefully detach the defective pipehouse using the handles.
5. Carefully reattach the replacement pipehouse.
6. Screw the three knurled screws back onto the unit.
7. Plug the pipehouse bayonet connector back into the pipehouse socket located underneath the measuring system assembly. The plug is keyed and will only seat when properly aligned. Rotate the plug 360° while applying upward pressure. When the plug seats in the socket, tighten the fitting by turning it clockwise 1/4 turn.
8. Turn the power on by resetting the circuit breakers located in the electronics enclosure assembly.
9. After 3 minutes, dispatch P1 and PD POLL commands.
10. Check the response for P/F flags:
    P1P02.3007.35xx
    PDPPPPPPPP12.2073.2075.7Nx

10A.5.3.2.2 Pipehouse Switch Replacement Instructions

PD POLL Command Response: 0PDFPPPPPPP12.2073.2075.7Nxx

1. Turn off the power to the sensor by switching off the circuit breakers contained in the electronics enclosure assembly.
2. Pipehouse must be removed prior to replacing this FRU. Refer to paragraph 10A.5.3.2.1, Pipehouse Replacement Instructions.
3. Remove the black plastic housing lid by removing the eight Phillips head screws (see Figure 10A.5.3.2.2-1).

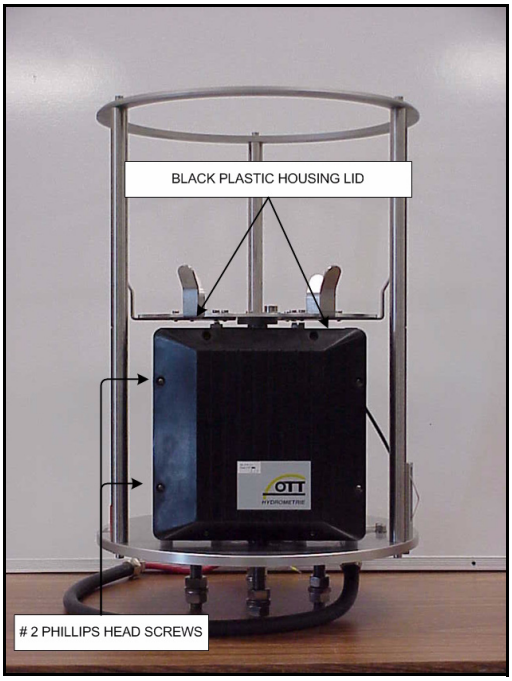


Figure 10A.5.3.2.2-1. Analysis Electronics Enclosure External View

4. Remove the analysis electronics metal cover by removing the two Phillips head screws (see Figure 10A.5.3.2.2-2).

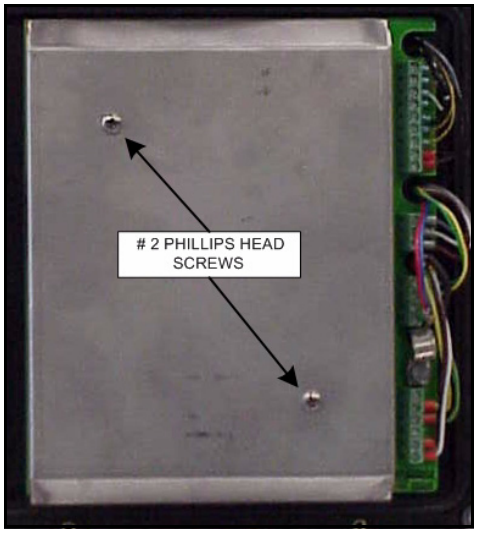


Figure 10A.5.3.2.2-2. Analysis Electronics Metal Cover

5. Disconnect the black and gray wires attached to the terminal block labeled switch by loosening the screws (see Figure 10A.5.3.2.2-3).

NOTE:	The pipehouse switch (2MT63A1A3S1) measures greater than 1 MΩ open circuit and less than 2Ω closed circuit.

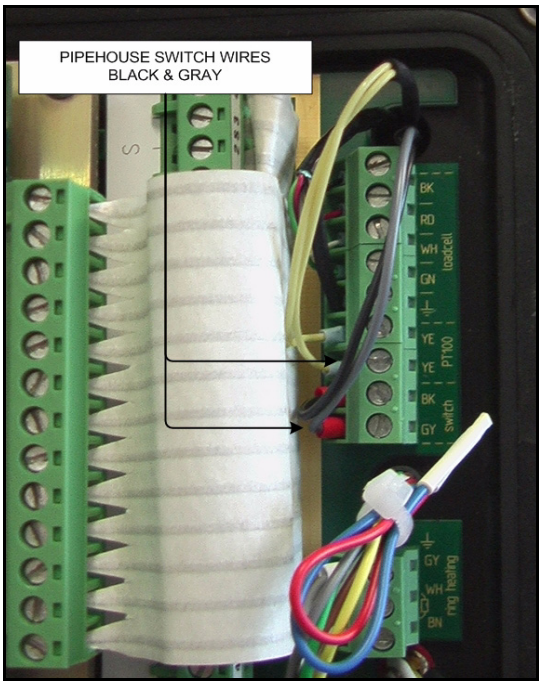


Figure 10A.5.3.2.2-3. Pipehouse Switch Wiring

6. Loosen the plug compression fitting on the back of the analysis electronics enclosure and remove it from the housing (see Figure 10A.5.3.2.2-4).

Figure 10A.5.3.2.2-4. Analysis Electronics Enclosure Compression Fitting

7. With the plug compression fitting removed, pull the wires through the grommet and then through the fitting.
8. Locate the pipehouse switch mounted on the measurement system assembly and remove the hex bolt from underneath (see Figure 10A.5.3.2.2-5).

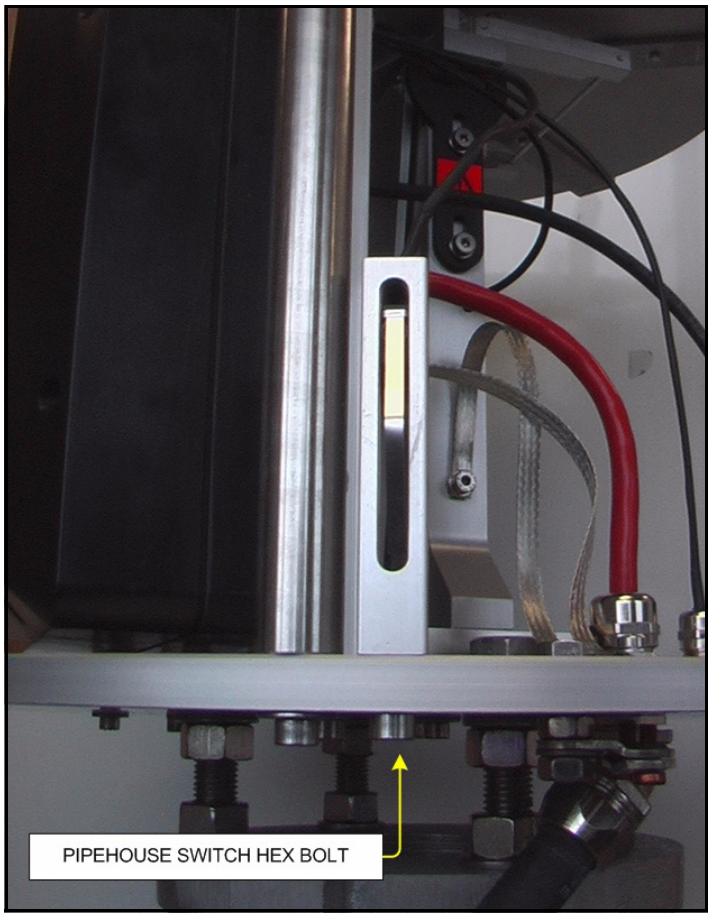


Figure 10A.5.3.2.2-5. Pipehouse Switch Attaching Bolt

9. Install the new switch.
10. Run the switch connecting wires through the fitting and then through the grommet.
11. Tighten the compressing fitting.
12. Connect the black and gray wires to the terminal block shown in Figure 10A.5.3.2.2-3.
13. Reinstall the analysis electronics metal cover and tighten the two Phillips head screws.
14. Reinstall the black plastic housing lid and tighten the eight Phillips head screws.
15. Reinstall the pipehouse and tighten the three knurled attaching bolts.
16. Plug the pipehouse bayonet connector back into the pipehouse socket located underneath the measuring system assembly. The plug is keyed and will only seat when properly aligned. Rotate the plug 360° while applying upward pressure. When the plug seats into the socket, tighten the fitting by turning it clockwise 1/4 turn.
17. Turn on the power by resetting the circuit breakers located in the electronics enclosure assembly.
18. After 3 minutes, dispatch P1 and PD POLL commands.

19. Check the response for P/F flags:
    P1P02.3007.35xx
    PDPPPPPPP12.2073.2075.7Nx

10A.5.3.3 Bucket Fault Isolation and Replacement Instructions

Bucket Fault Code PD Response: 0PDPFPPPPPP12.2073.2075.7Nxx

Refer to Table 10A.5.3.3-1 before replacing the bucket.

Table 10A.5.3.3-1. Bucket – Possible Causes for Error

Error	Action	Refer to Paragraph	Fault Flag
Bucket is missing	Attach the bucket.	10A.5.3.3.1	Yes
Bucket is broken	Replace bucket.	10A.5.3.3.1	Yes
Faulty measurement	Check bucket for freedom of movement.	NA	Yes

10A.5.3.3.1 Bucket Replacement Instructions

1. Turn off the power to the sensor by switching off the circuit breakers located in the electronics enclosure assembly.
2. Pipehouse must be removed prior to replacing this FRU. Refer to paragraph 10A.5.3.2.1, Pipehouse Replacement Instructions.

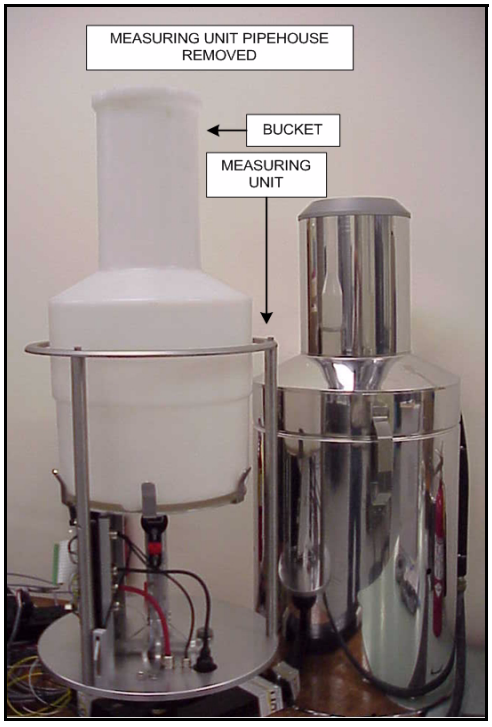


Figure 10A.5.3.3-1. Replace Sensor Bucket

3. Engage the transportation lock.
4. Carefully replace the bucket.
5. Disengage the transportation lock.
6. Reinstall the sensor pipehouse.
7. Turn on the power switch in the electronics enclosure assembly.
8. After 3 minutes, dispatch P1 and PD POLL commands.
9. Check for P/F flags:
   P1P02.3007.35xx
   0PDPPPPPPPP12.2073.2075.7Nxx

10A.5.3.4 Measurement System Assembly Fault Isolation and Replacement Instructions

Measurement System Fault Code PD Response: 0PDPPFPPPPP12.2073.2075.7Nxx

Refer to Table 10A.5.3.4-1 before replacing the measurement system assembly.

Table 10A.5.3.4-1. Measurement System Assembly – Possible Causes for Error

Error	Action	Refer to Paragraph	Fault Flag
Bucket weight over maximum value	Replace measurement system assembly.	10A.5.3.4.1	Yes
Power/ Downward force shunt.	Check for free movement of the bucket.	10A.5.3.3	Yes
Faulty total weight.	Replace measurement system assembly.	10A.5.3.4.1	Yes

10A.5.3.4.1 Measurement System Assembly Replacement Instructions

1. Turn off the power to the sensor by switching off the circuit breakers contained in the electronics enclosure assembly.
2. Pipehouse must be removed prior to replacing this FRU. Refer to paragraph 10A.5.3.2.1, Pipehouse Replacement Instructions.
3. Detach the wires connecting the measuring unit to the electronics enclosure assembly by loosening the conduit fitting and then disconnecting the wires from the terminal block (see Figure 10A.5.3.4.1-1).

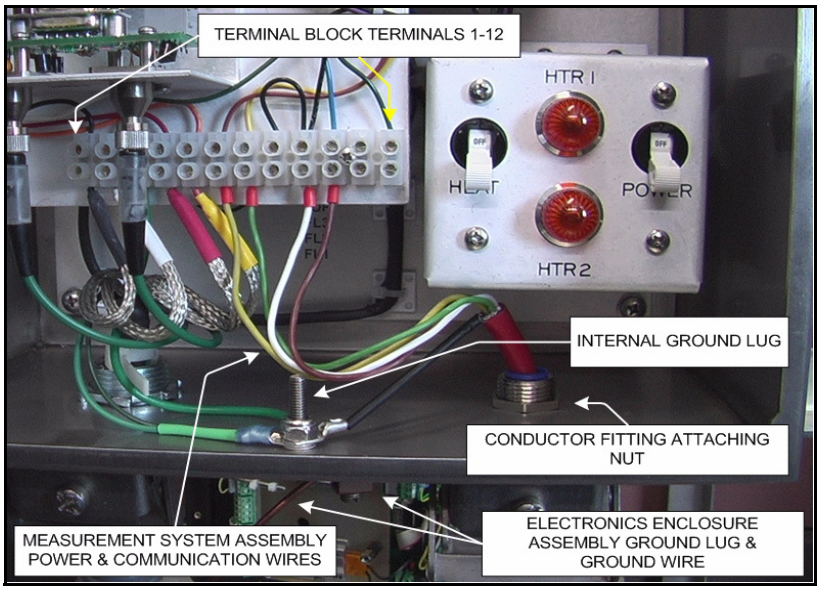


Figure 10A.5.3.4.1-1. Measurement System Assembly Connections

4. Detach the grounding wire on the underside of the measuring unit.
5. Affix transportation locks 1 and 2 (see Figure 10A.5.3.4.1-2).

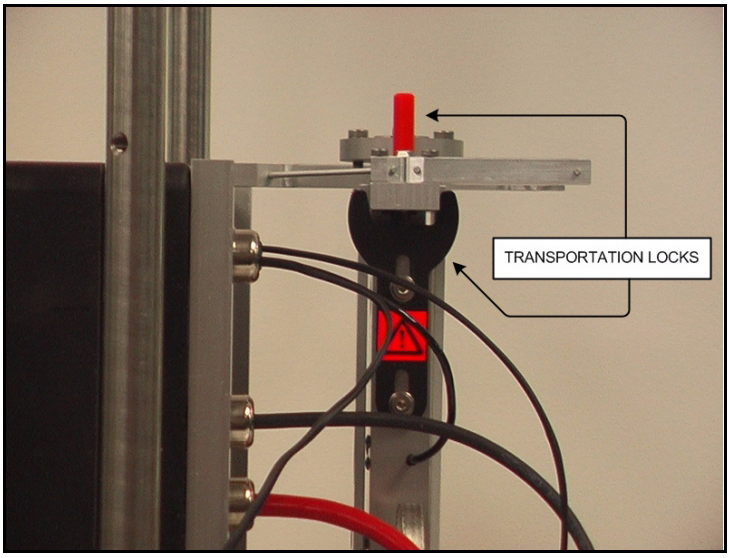


Figure 10A.5.3.4.1-2. Transportation Locks

6. Remove the four nuts on the pedestal (see Figure 10A.5.3.4.1-3).

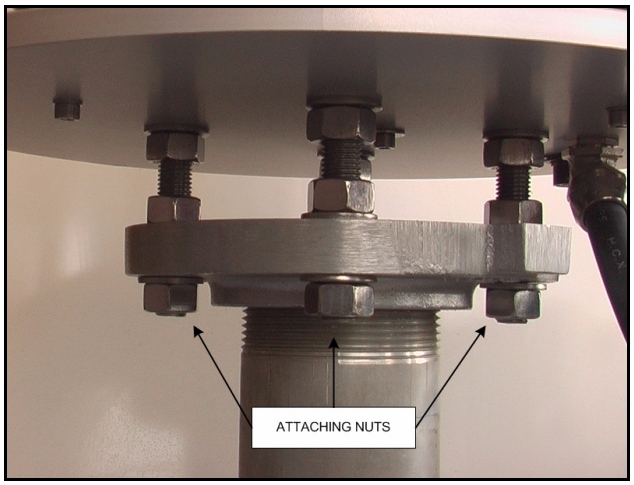


Figure 10A.5.3.4.1-3. Pedestal Attaching Nuts

7. Remove the defective measuring unit.
8. Attach the new measuring unit.
9. Align the measuring unit by adjusting the pedestal nuts. Use the level indicator to determine if the assembly is aligned properly (see Figure 10A.5.3.4.1-4).
10. Tighten the pedestal nuts to seat the unit, and recheck the alignment using the level indicator.

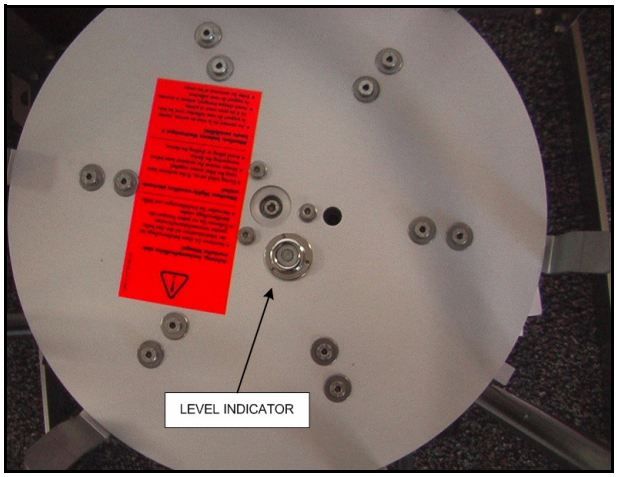


Figure 10A.5.3.4.1-4. Level Indicator

11. Reattach the grounding wire to the underside of the measuring unit.
12. Reattach the conduit fitting.
13. Reattach the wires connecting the measuring unit to the electronics enclosure assembly. A wiring schematic is glued to the door of the electronics enclosure assembly. Verify the connecting wires are terminated on the proper terminals see Figure 10A.5.3.4.1-6 and Figure 10A.5.3.4.1-5.

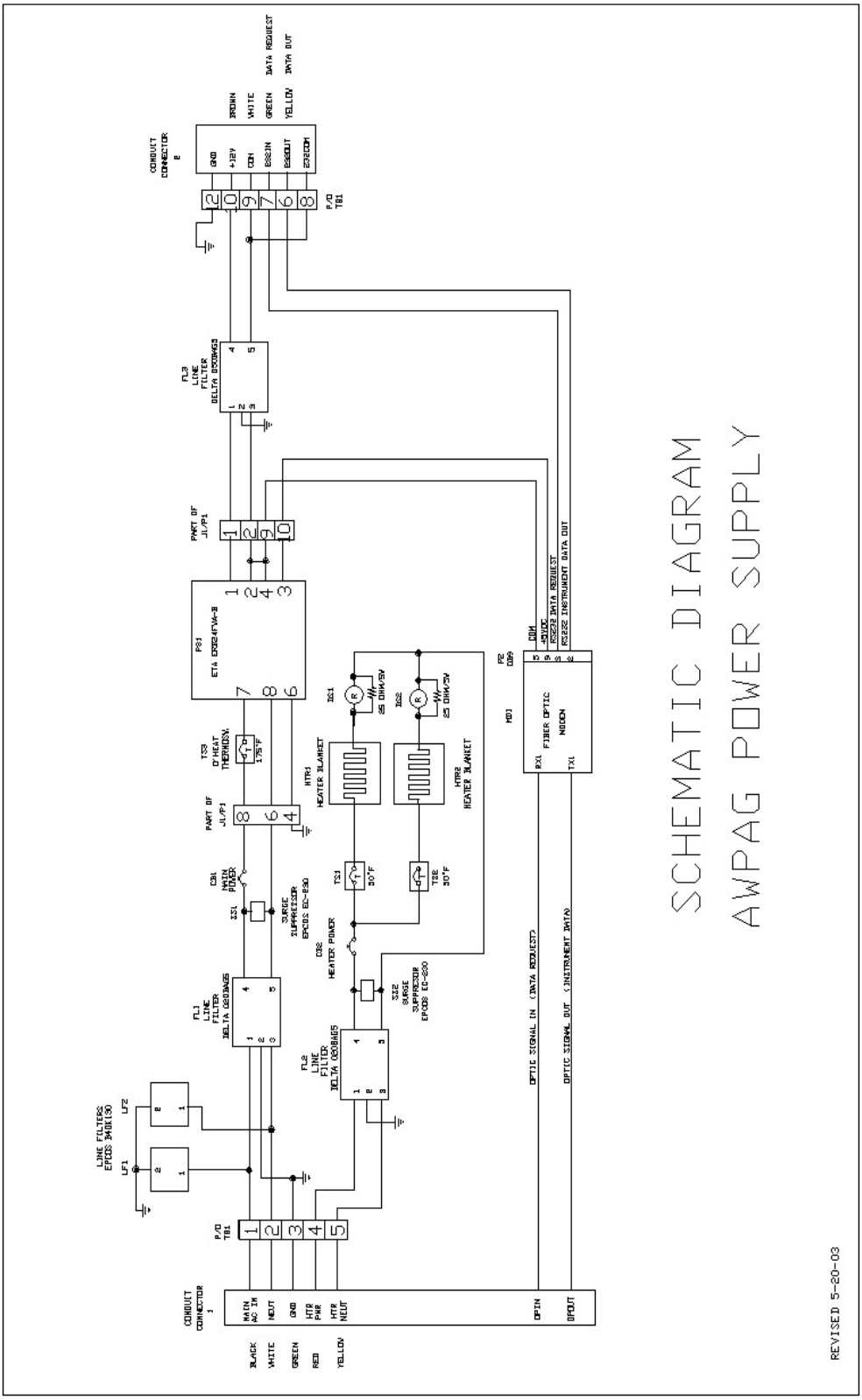


Figure 10A.5.3.4.1-5. AWPAG Wiring Schematic (Click here for 11" x 17" version)

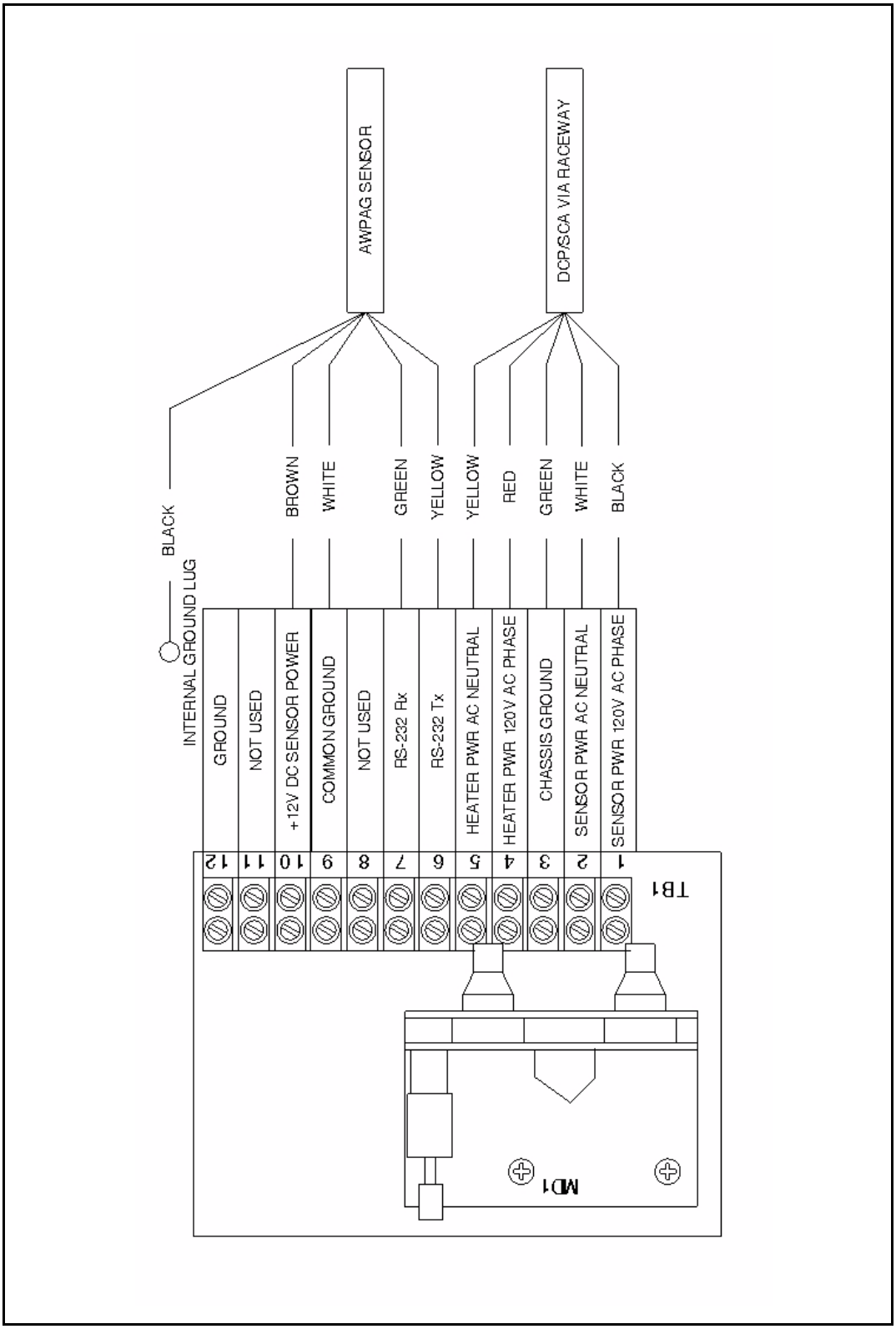


Figure 10A.5.3.4.1-6. Electronics Enclosure Assembly Terminal Block Assignments

14. Loosen transportation locks.
15. Carefully attach the bucket.
16. Reinstall the sensor pipehouse.
17. Turn the power switch in the electronics enclosure assembly to ON.
18. After 3 minutes, dispatch P1 and PD POLL commands.
19. Check the response for P/F flags:
    P1P02.3007.35xx
    0PDPPPPPPPP12.2073.2075.7Nxx

10A.5.3.5 LOGOSense Board Fault Isolation and Replacement Instructions

LOGOSense Board Fault Code PD Response: 0PDPPPFPPPP12.2073.2075.7Nxx

> **NOTE:** Replacement of the LOGOSense board requires the measurement system assembly to be recalibrated. Recalibration of the measurement system assembly is to be performed by the NRC only under laboratory conditions. It is recommended the field technician replace the measurement system assembly in the case of a failed LOGOSense board.

Refer to Table 10A.5.3.5-1 before replacing the LOGOSense board.

Table 10A.5.3.5-1. LOGOSense Board – Possible Causes for Error

Error	Action	Refer to Paragraph	Fault Flag
Operating parameters are no longer available	Replace measurement system assembly.	10A.5.3.4.1	Yes
Calibration values are no longer available	Replace measurement system assembly.	10A.5.3.4.1	Yes
AC converter is defective	Replace measurement system assembly.	10A.5.3.4.1	Yes
Measurement values faulty/ implausible	Replace measurement system assembly.	10A.5.3.4.1	Yes

10A.5.3.6 Ring Heater Controller Board Fault Isolation and Replacement Instructions

Ring Heater Controller Board Fault Code PD Response: OPDPPPPFPPP12.2073.2075.7Nxx

Refer to Table 10A.5.3.6-1 before replacing the ring heater controller board.

Table 10A.5.3.6-1.

Error	Action	Refer to Paragraph	Fault Flag
Ring heater controller board defective	Replace ring heater controller board.	10A.5.3.6.1	Yes

10A.5.3.6.1 Ring Heater Controller Board Replacement Instructions

1. Turn off the power to the sensor by switching off the circuit breakers located in the electronics enclosure assembly.
2. Pipehouse must be removed prior to replacing this FRU. Refer to paragraph 10A.5.3.2.1, Pipehouse Replacement Instructions.
3. Remove the black plastic housing lid (8 Phillips head screws) (see Figure 10A.5.3.6.1-1).

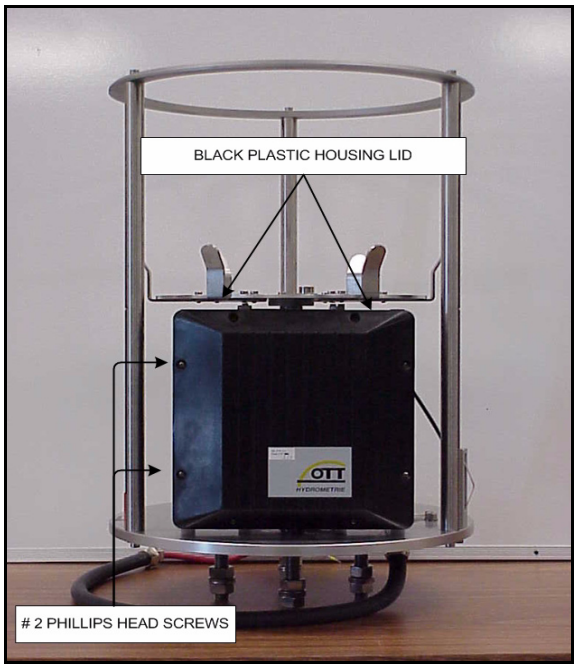


Figure 10A.5.3.6.1-1. Analysis Electronics Enclosure External View

4. Remove the metal housing cover (2 Phillips head screws) (see Figure 10A.5.3.6.1-2.).

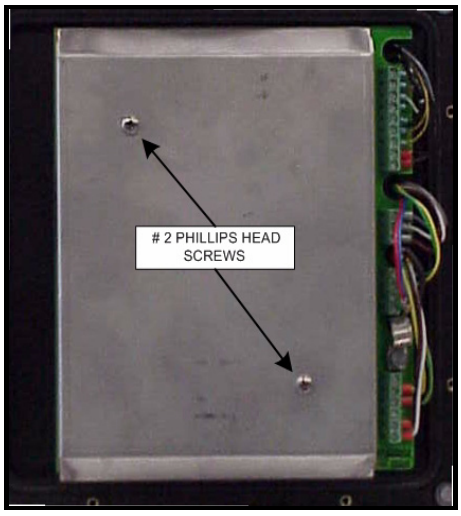


Figure 10A.5.3.6.1-2. Analysis Electronics Enclosure Metal Cover

5. Remove the 13-pole screw terminal block from the ring heating controller board (use a screwdriver for assistance) (see Figure 10A.5.3.6.1-3).
6. Replace the ring heating controller board (4 cylinder screws) (see Figure 10A.5.3.6.1-3).
7. Install the metal housing cover and tighten (2 Phillips head screws).

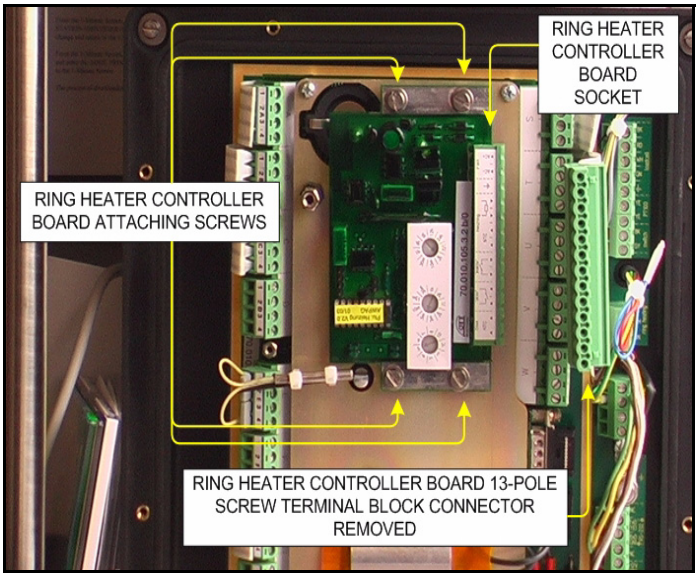


Figure 10A.5.3.6.1-3. Ring Heater Controller Board Components

8. Install the black plastic housing lid and tighten (8 Phillips head screws).
9. Reinstall the sensor pipehouse.
10. Turn on the power switch in the electronics enclosure assembly
11. After 3 minutes, dispatch P1 and PD POLL commands.
12. Check the response for P/F flags:
    P1P02.3007.35xx
    PDPPPPPPPP12.2073.2075.7Nxx

10A.5.3.7 DC Power Supply Fault Isolation and Replacement Instructions

Power Supply Fault Code PD Response: 0PDPPPPPPFP12.2073.2075.7Nxx

Refer to Table 10A.3.5.7-1 before replacing the DC power supply.

Table 10A.5.3.7-1. DC Power Supply – Possible Causes for Error

Error	Action	Refer to Paragraph	Fault Flag
Power supply defective.	Replace power supply.	10A.5.3.6.1	Yes

1. Check for proper power supply ground (pin 2 common ground).
2. Check for proper AWPAG sensor ground (pin 9 terminal block 1 common ground).
3. Check power supply 12V DC OUT (see Figure 10A.5.3.7-1). Measure the voltage between pin 1 12V DC OUT AWPAG and pin 2 common ground. Does the voltage measure 12V +/- 10%?
   a. Yes – Go to step 4.
   b. No – Go to step 5.

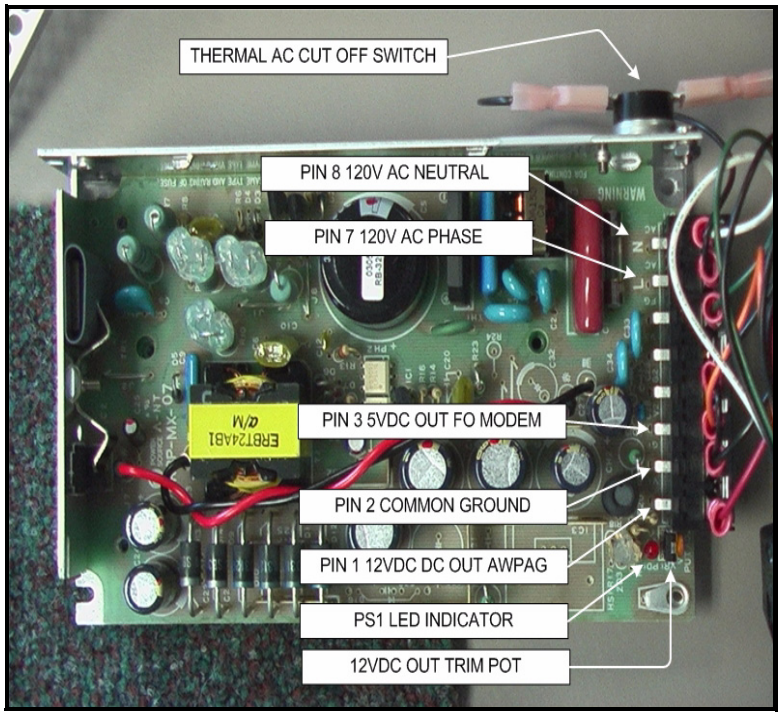


Figure 10A.5.3.7-1. Power Supply Voltage Test Points

4. Verify the wiring connection between power supply pin 1 12 V DC OUT and terminal block 1 pin 10 (see Figure 10A.5.3.7-2). Measure the voltage between pins 9 and 10 on terminal block 1. Pin 9 is ground. Pin 10 is 12V DC OUT from power supply. Does the voltage measure 12V +/- 10%?
   a. Yes – Check to see if the wires connecting the electronics enclosure assembly to the AWPAG sensor assembly are not damaged or broken.
   b. No – Repair open circuit.
5. Check to see if AC power is being supplied the power supply. Using a DVOM, measure for 120V AC +/- 10V across pins 7 and 8. Pin 7 is phase. Pin 8 is neutral. Does the meter read 120V AC +/- 10V?
   a. Yes – Replace the power supply.
   b. No – Go to step 6.

6. Check for an open thermal AC cutoff switch. Measure the voltage between each terminal on the thermal cutoff switch and pin 8 120V AC neutral. Does the voltage read 120V AC +/- 10V between both sides of the thermal switch and pin 8 AC neutral?

   a. Yes – Replace the power supply.

   b. No – Voltage is detected only on the phase side of the switch: Replace the power supply. The thermal switch is not an FRU. Refer to paragraph 10A.5.3.7.1

   c. No – No voltage is detected at either terminal on thermal switch: Service the AC power distribution fault. Refer to Figure 10A.5.3.4.1-5 for the AWPAG wiring schematic.

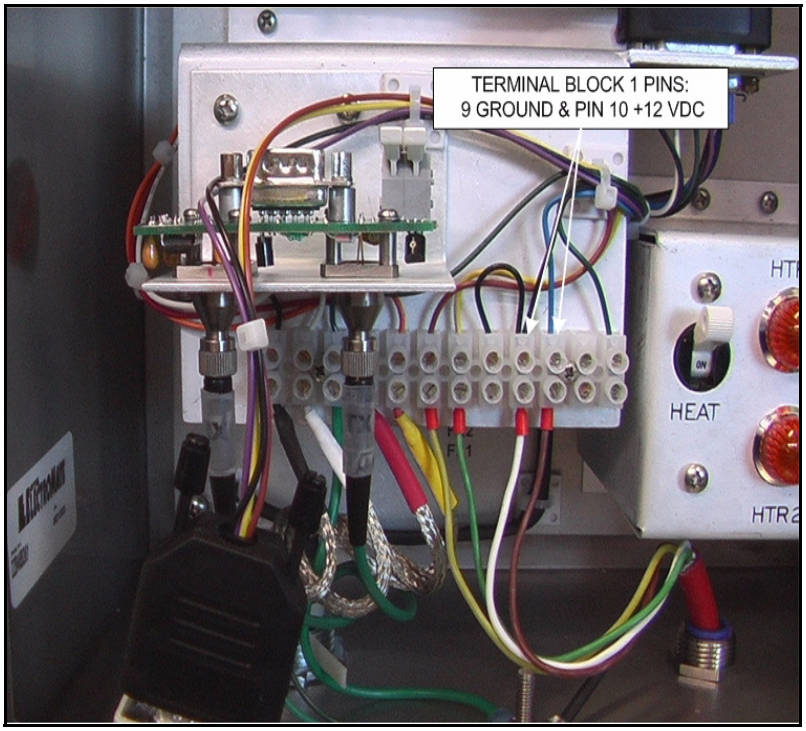


Figure 10A.5.3.7-2. Power Supply Terminal Block 1 Connections

10A.5.3.7.1 DC Power Supply Replacement Instructions

1. Turn off power to the sensor from the circuit breaker module located in the in the DCP enclosure or SCA enclosure.
2. Open the access door to the electronics enclosure assembly.
3. Remove the connector.
4. Remove the cover screen by unscrewing the one Phillips head attaching screw (see Figure 10A.5.3.7.1-1).

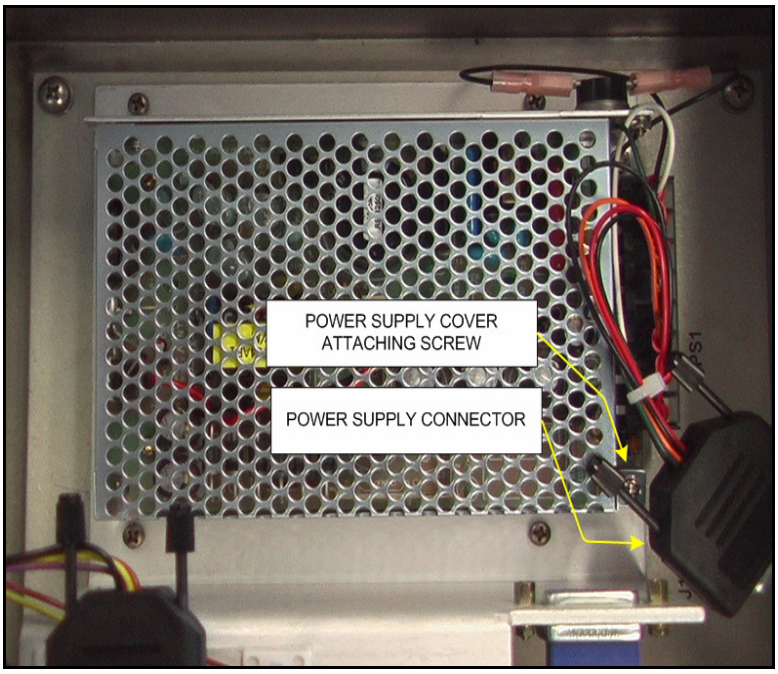


Figure 10A.5.3.7.1-1. DC Power Supply Removal (View A)

5. Remove the two attaching nuts and slide the power supply off the mounting studs (see Figure 10A.5.3.7.1-2).

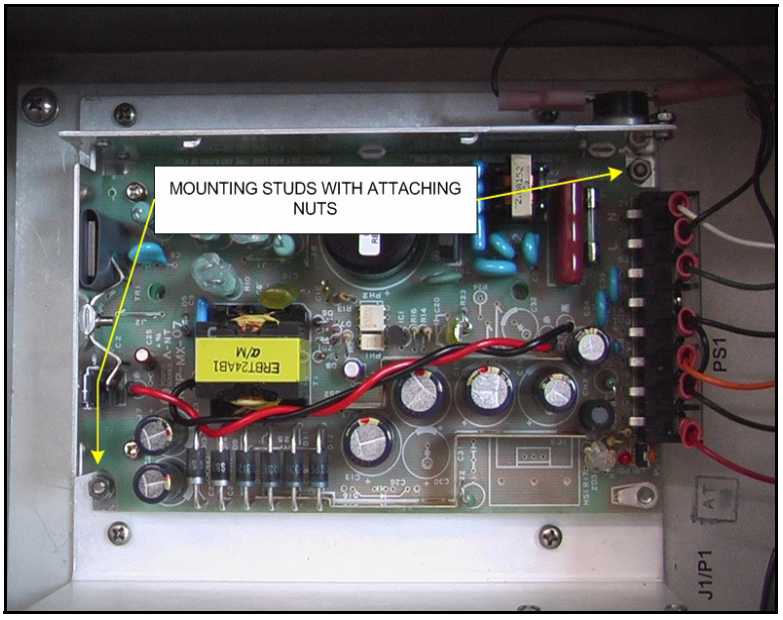


Figure 10A.5.3.7.1-2. DC Power Supply Removal (View B)

6. Install new power supply.
7. Tighten the attaching nuts.

8. Install the cover screen.
9. Reconnect the power supply connector
10. Turn on power.
11. After 3 minutes, dispatch P1 and PD POLL commands.
12. Check the response for P/F flags:
    P1P02.3007.35xx
    PDPPPPPPPP12.2073.2075.7Nxx

10A.5.3.8 Internal Ring Heating Fault Isolation and Replacement Instructions

Internal Ring Heating Fault Code PD Response: 0PDPPPPPFPP12.2073.2075.7Nxx

Refer to Table 10A.5.3.8-1 before replacing the pipehouse.

Table 10A.5.3.8-1. Internal Ring Heating – Possible Causes for Error

Error	Action	Refer to Paragraph	Fault Flag
Ring temperature sensor defective	Replace sensor pipehouse.	10A.5.3.2	Yes
Bayonet connector defective	Replace sensor pipehouse.	10A.5.3.2	Yes

10A.5.3.9 Internal Heating Fault Isolation and Replacement Procedures

Internal Heating Fault Code PD Response: 0PDPPPPFPPF12.2073.2075.7Nxx

Refer to Table 10A.5.3.9-1 before replacing the internal housing heating element and the analysis electronics enclosure.

Table 10A.5.3.9-1. Internal Housing Heating – Possible Causes for Error

Error	Action	Refer to Paragraph	Fault Flag
Internal housing heating element defective	Replace internal housing heating element and temperature sensor.	10A.5.3.9.1	Yes
Analysis electronics enclosure ambient temperature sensor defective	Replace internal housing heating element and temperature sensor.	10A.5.3.9.1	No. Temperature value will be set to 999.9. See Figure 10A.5.3.9-1.

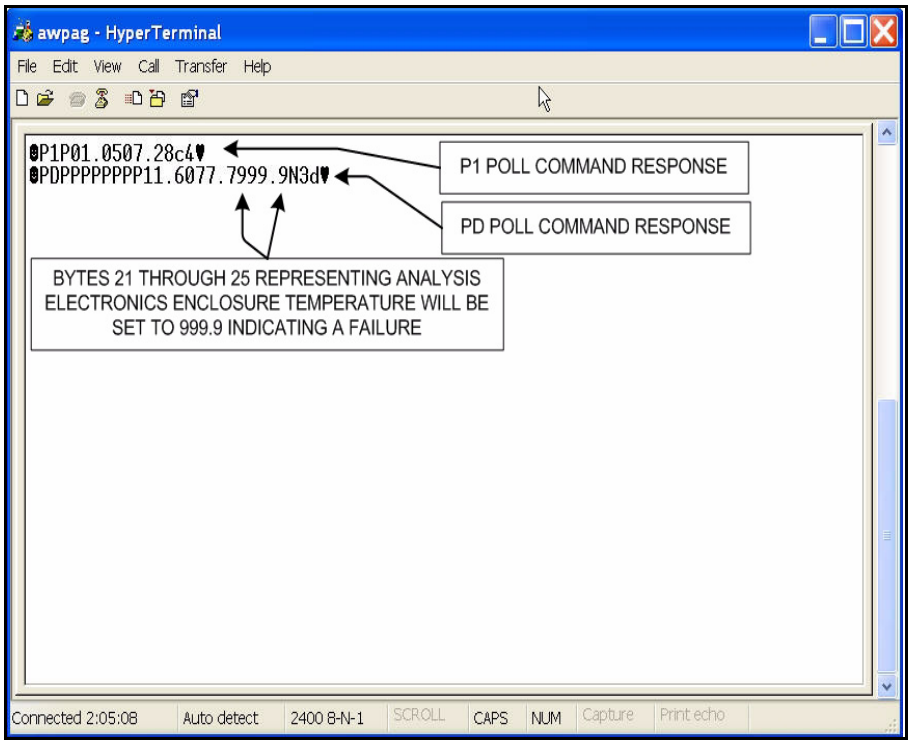


Figure 10A.5.3.9-1. Analysis Electronics Enclosure Ambient Temperature Sensor Failure

10A.5.3.9.1 LOGOSense Internal Heater and Analysis Electronics Ambient Temperature Sensor Replacement Procedures

1. Turn off the power to the sensor by switching off the circuit breakers contained in the electronics enclosure assembly.
2. Pipehouse must be removed prior to replacing this FRU. Refer to paragraph 10A.5.3.2.1, Pipehouse Replacement Instructions.
3. Remove the black plastic housing lid (8 Phillips head screws). (See Figure 10A.5.3.9.1-1.)

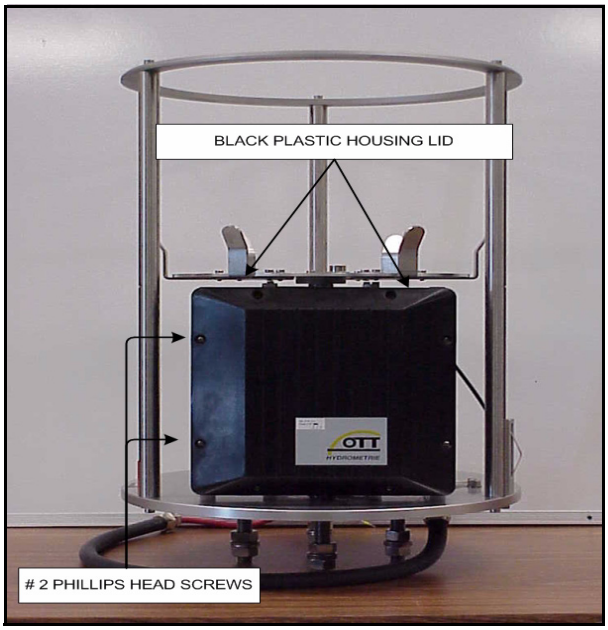


Figure 10A.5.3.9.1-1. Analysis Electronics Enclosure External View

4. Remove the metal housing cover (2 Phillips head screws). (See Figure 10A.5.3.9.1-2.)

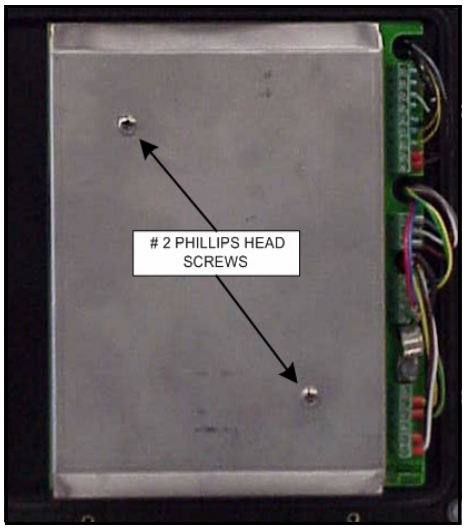


Figure 10A.5.3.9.1-2. Analysis Electronics Enclosure Metal Cover

5. Replace the screw terminal block E with temperature sensor (see Figure 10A.5.3.9.1-3).
6. Replace LOGOSense Internal Heater (2 cylinder screws and 2 wires on the screw terminal block) (see Figure 10A.5.3.9.1-3).

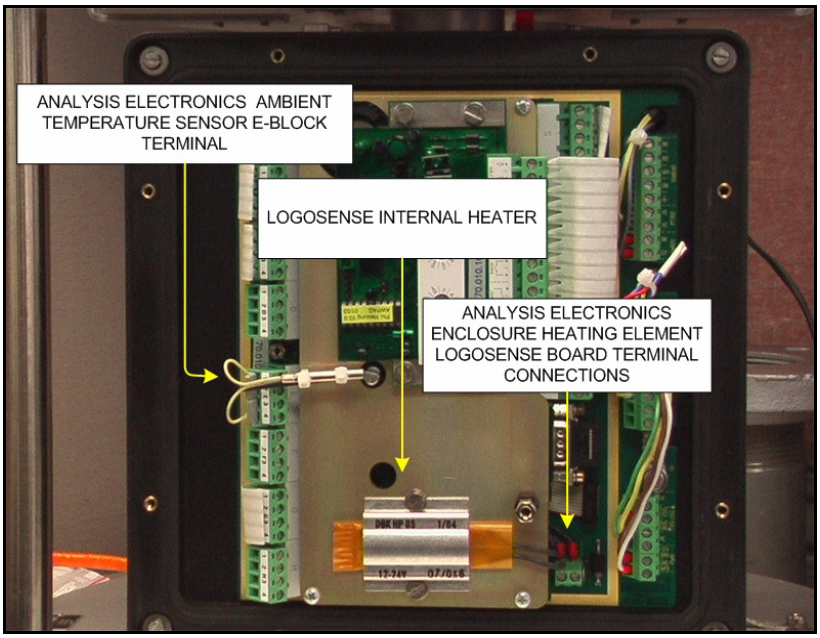


Figure 10A.5.3.9.1-3. Internal Temperature Sensor and Heating Element

7. Install the metal housing cover and tighten (2 Phillips head screws).
8. Install the black plastic housing lid (8 Phillips head screws).
9. Reinstall the sensor pipehouse.
10. Turn on the power switch in the electronics enclosure assembly.
11. After 3 minutes, dispatch P1 and PD POLL commands.
12. Check the response for P/F flags:
    P1P02.3007.35xx
    PDPPPPPPPP12.2-04.0014.0Nxx

10A.5.3.10 Ambient Temperature Sensor Fault Isolation and Replacement Instructions

Ambient Temperature Fault Code P1 Response: P1F02.3007.35xx

The PD POLL command response will reflect all pass flags. In the event of a failed ambient temperature sensor, the PD command will return a temperature reading of 999.9 (see Figure 10A.5.3.10-1).

Refer to Table 10A.5.3.10-1 before replacing the ambient temperature sensor.

Table 10A.5.3.10-1. Internal Heating – Possible Causes for Error

Error	Action	Refer to Procedure	Fault Flag
Ambient temperature sensor defective	Replace ambient temperature sensor.	10A.5.3.11	Yes P1 POLL Response

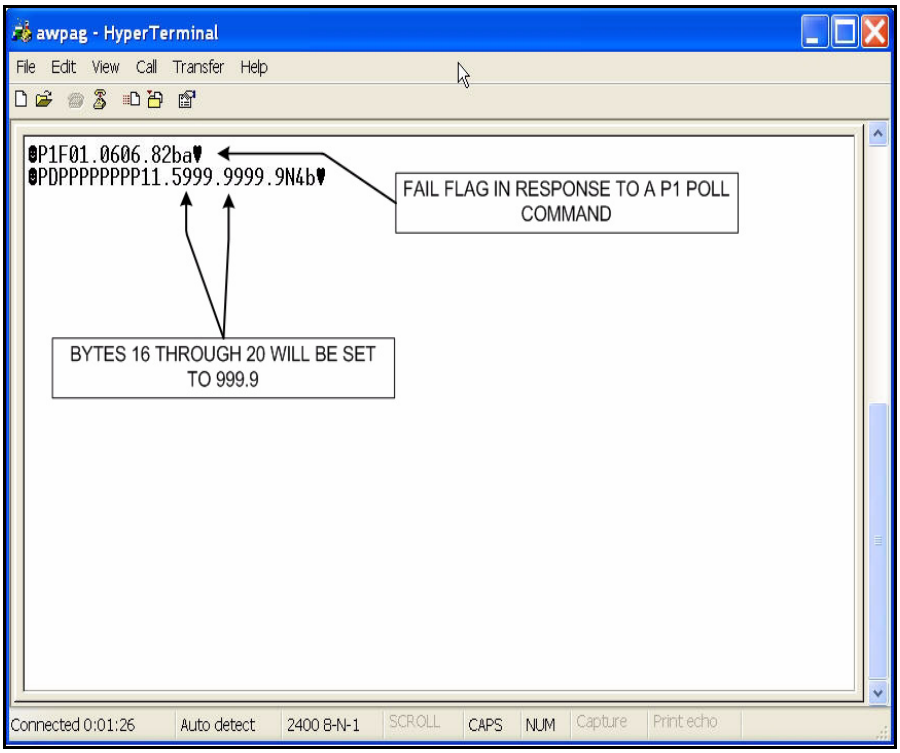


Figure 10A.5.3.10-1. Ambient Air Temperature Fault Flag Description

A fail flag response will only be received when a P1 POLL command is dispatched. The PD command will return all pass flags with the ambient temperature byte field set 999.9, as shown in Figure 10A.5.3.10-1.

10A.5.3.11 Ambient Temperature Sensor Replacement Instructions

1. Turn off the power to the sensor by switching off the circuit breakers contained in the electronics enclosure assembly.
2. Pipehouse must be removed prior to replacing this FRU. Refer to paragraph 10A.5.3.2.1, Pipehouse Replacement Instructions.
3. Remove the black plastic housing lid (8 Phillips head screws). (See Figure 10A.5.3.11-1.)

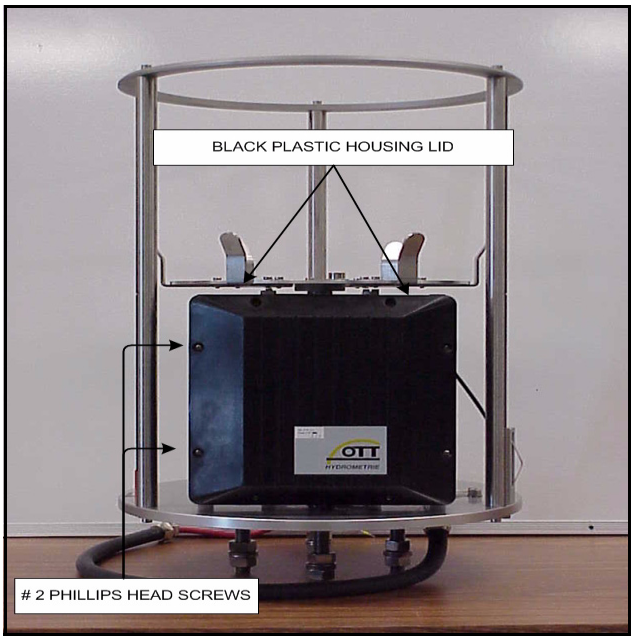


Figure 10A.5.3.11-1. Analysis Electronics Enclosure External View

4. Remove the metal housing lid (2 Phillips head screws). (See Figure 10A.5.3.11-2.)

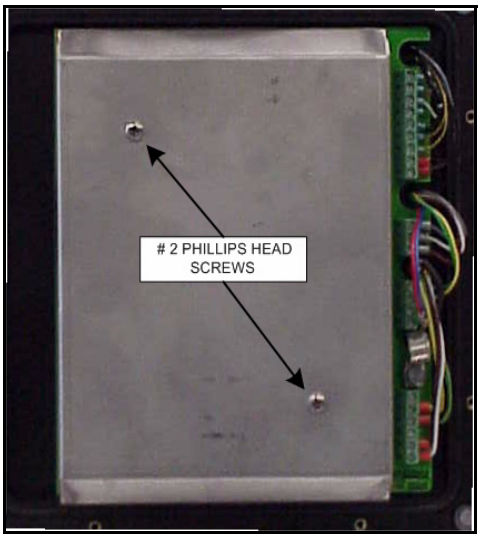


Figure 10A.5.3.11-2. Analysis Electronics Enclosure Metal Cover

5. Disconnect the two yellow wires from the LOGOSense board by loosening the terminals and pulling off the wires (see Figure 10A.5.3.11-3).

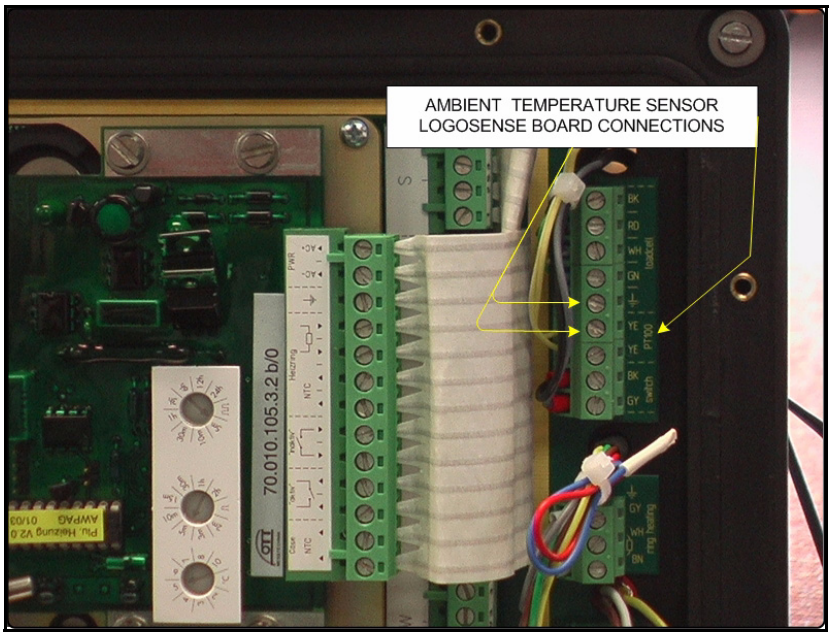


Figure 10A.5.3.11-3. Ambient Temperature Sensor LOGOSense Board Connection

6. Remove the compression fitting located on the back of the analysis electronics enclosure.Figure 10A.5.3.11-4.

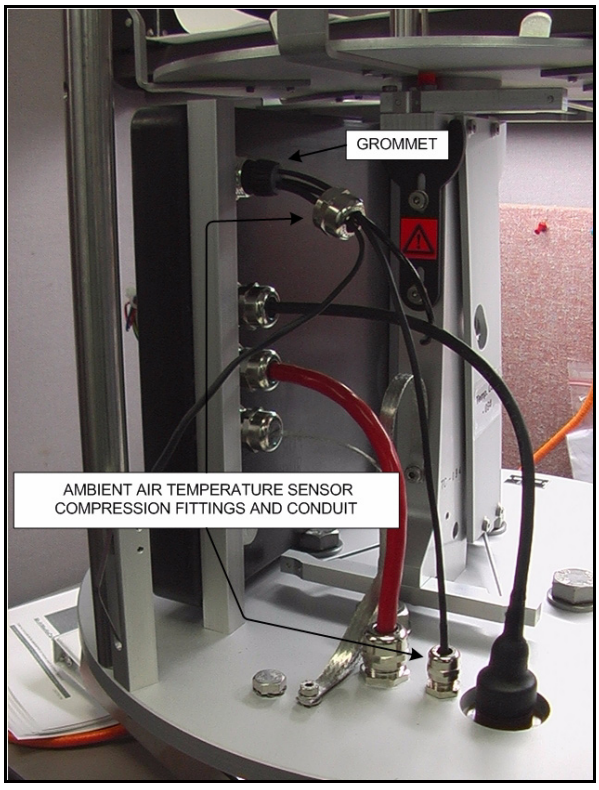


Figure 10A.5.3.11-4. Ambient Temperature Sensor Mounting

7. Loosen the compression fitting located on the measurement system assembly.
8. Pull the wires through the grommet and remove ambient temperature sensor (see Figure 10A.5.3.11-5 and Figure 10A.5.3.11-6).

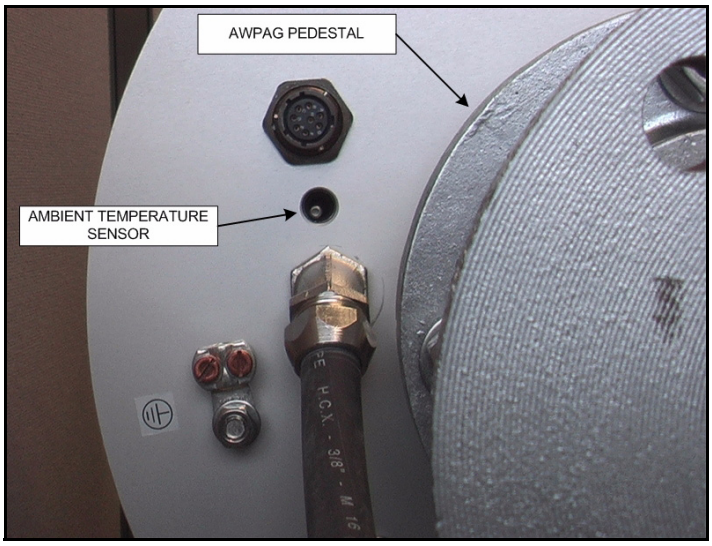


Figure 10A.5.3.11-5. Ambient Temperature Sensor Location

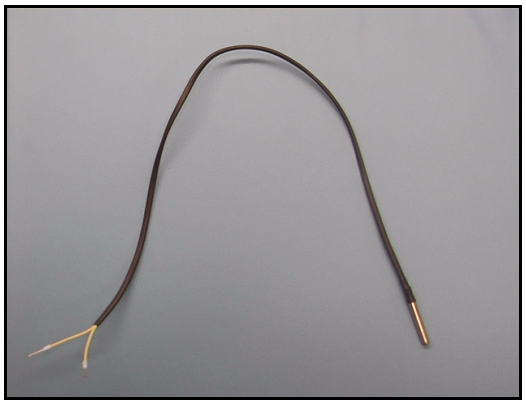


Figure 10A.5.3.11-6. Ambient Temperature Sensor Removed

9. Install the new sensor onto the measurement system assembly and tighten fitting.
10. Run the yellow connecting wires through the large compression fitting and then through the grommet. Tighten fitting.
11. Reconnect yellow wires on the LOGOSense board on terminals labeled PT-100 (see Figure 10A.5.3.11-3).
12. Install the metal housing cover and tighten (2 Phillips head screws).
13. Install the black plastic housing lid (8 Phillips head screws).
14. Reinstall the sensor pipehouse.

15. Turn on the power switch in the electronics enclosure assembly.
16. After 3 minutes, dispatch P1 and PD POLL commands.
17. Check the response for P/F flags:
    P1P02.3007.35xx
    PDPPPPPPPP12.2-04.0014.0Nxx

10A.5.3.12 AWPAG Communications Failure

A serial communications failure between the AWPAG and DCP will produce fail status flags in the DCP and AWPAG maintenance screens.

NOTE:	A laptop computer initialized as DCP OID (see Chapter 3, Section III), or any other available OID, may be used for the following procedure.

1. At the OID, display the maintenance screen for the AWPAG by pressing MAINT; use the NEXT or PREVIOUS keys to highlight DCP (if the AWPAG is installed as a DCP sensor) or ACU; then press the SEL key.
2. Tab down to the AWPAG and press the SEL key.
3. At the AWPAG maintenance screen press the TEST key. This will display the screen illustrated in Figure 10A.5.3.12-1. The SENSOR RESPONSE field will be flagged "F" indicating a communication failure between the DCP and the AWPAG. All Pass/Fail flags reflecting FRU status, except for the SENSOR STATUS field, will be set to "T".

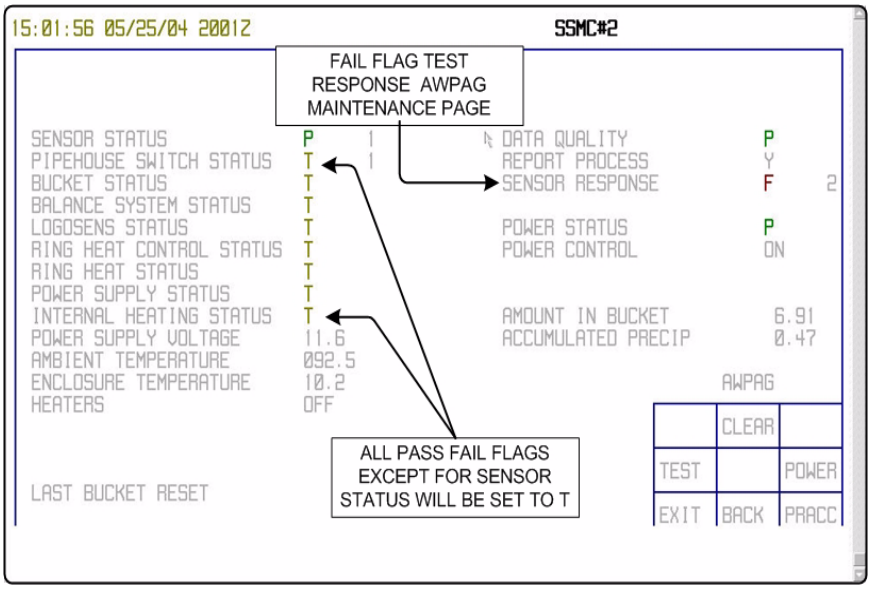


Figure 10A.5.3.12-1. AWPAG Communication Failure Screens

4. At the OID display sensor status screen by sequentially pressing the REVIEW-SENSOR-STAT function keys from 1-minute display. On the sensor status screen, set report processing for Precipitation Accumulation sensor to OFF.

5. Try to establish communications with the AWPAG from the DCP fiber-optic module 2A3A4. Connect a laptop computer loaded with Windows Hyper Terminal or Procomm Plus to the fiber-optic module using the computer's COM 1 serial port. Refer to paragraph 10A.5.3.1.2 for COM port settings.
6. Dispatch POLL commands P1 and PD. Do not be concerned with Pass/Fail flags at this time. This test is only to determine the status of the communications link.
7. Was a response received from the AWPAG?
    a. Yes – Refer to Chapter 3, Data Collection Package, paragraph 3.5.3.4, and service SIO fault.
    b. No – Proceed to step 6.
8. Try to establish a direct connection with the AWPAG using the RS-232 connector attached to the fiber-optic module located in the AWPAG electronics enclosure assembly. Unplug the RS-232 connector from the fiber-optic module. Connect the laptop computer's COM 1 serial port to the RS-232 connector.
9. Dispatch POLL commands P1 and PD.
10. Was a response received from the AWPAG?
    a. Yes – Flash-test fiber-optic Tx and Rx cables. Check fiber-optic module.
    b. No – Check for damaged wires in the electronics enclosure assembly. Refer to paragraph 10A.5.3.7 for possible power distribution fault.

10A.5.3.12.1 AWPAG Fiber-Optic Module Replacement Instructions

1. Turn off the power to the sensor by switching off the circuit breakers contained in the electronics enclosure assembly.
2. Open the electronics enclosure assembly door and disconnect the two fiber-optic cables from the fiber-optic module.
3. Disconnect the RS-232 cable from the fiber-optic module.
4. Remove the screws that fasten the mounting bracket to the enclosure (2 Phillips head screws). Remove mounting bracket and fiber-optic module.
5. Remove the screws that fasten the fiber-optic module to the mounting bracket (2 Phillips head screws). (See Figure 10A.5.3.12.1-1.)

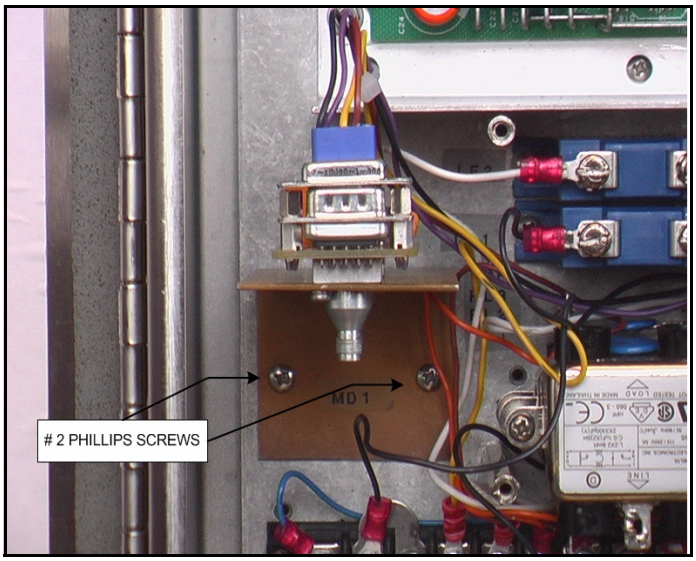
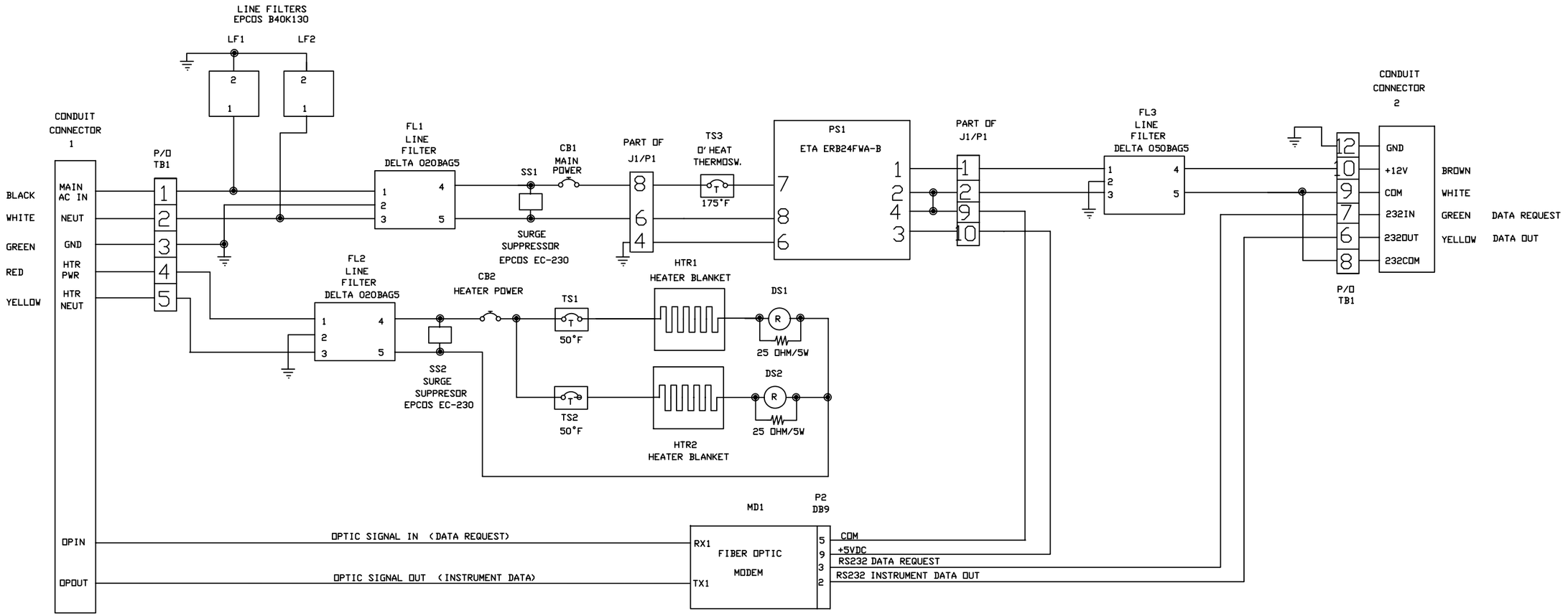


Figure 10A.5.3.12.1-1. Fiber-Optic Module

6. Install the new fiber-optic module to the mounting bracket and tighten the screws.
7. Install the mounting bracket with the fastened fiber-optic module back into the electronics enclosure assembly and tighten the screws.
8. Connect DB9 RS232 connector.
9. Connect the fiber-optic cables to the fiber-optic module. Make sure the cable marked “transmit” is connected to the port labeled “transmit.” Make sure cable labeled “receive” is connected to the port labeled “receive.”
10. Turn on the circuit breakers.

(This page intentionally left blank.)



SCHEMATIC DIAGRAM
AWPAG POWER SUPPLY

Figure 10A.5.3.4.1-5
AWPAG Wiring Schematic

REVISED 5-20-03