10 GPS Surface Observing System (GSOS)

The GPS Surface Observing System (GSOS) is a low-cost meteorological data acquisition system originally designed to provide barometric pressure, air temperature and humidity measurements required by the GPS-IPW Observing System to calculate water vapor measurements (see Figure 10-1). GSOS was developed through a joint effort between the Forecast Systems Laboratory (FSL) and the National Data Buoy Center (NDBC). NDBC manufactures the GSOS assemblies, serves as the repair facility, and provides depot support for GSOS components. Some of the GSOS key features are:

Designed using COTS Components	GSOS system components are commercial off-the-shelf parts.
Wide Operational Temperature Range	-40^{o} C to $+40^{o}$ C operational temperature range.
All Digital Sensors	High quality digital sensors manufactured by Vaisala.
Expandible Architecture	Expandable architecture allows anemometer and precipitation sensors to be added to the base configuration.
Flexible Communications Options	Communication interface options include RS422/ RS485 or RS-232.
Several Mounting Options	Mounting hardware allows the Payload to be affixed to a variety of fence post diameters or rhone towers.
Fold-down Arm	Fold-down arm provides easy access to sensors for maintenance or replacement.

Figure 10-1 GSOS Payload Assembly

10.1 System Description

As shown in Figure 10-2, GSOS consists of two primary assemblies; the Payload, and the Power Supply and Communications Interface. The payload communication interface is RS-485/RS-422, which allows the power supply and communications interface to be located up to 4000 feet from the payload. The transducers are self contained digital sensor/transmitters that communicate with the controller via RS-485 and RS-232 interfaces. The interface between the payload and power supply and communications interface is protected by two surge suppression devices.

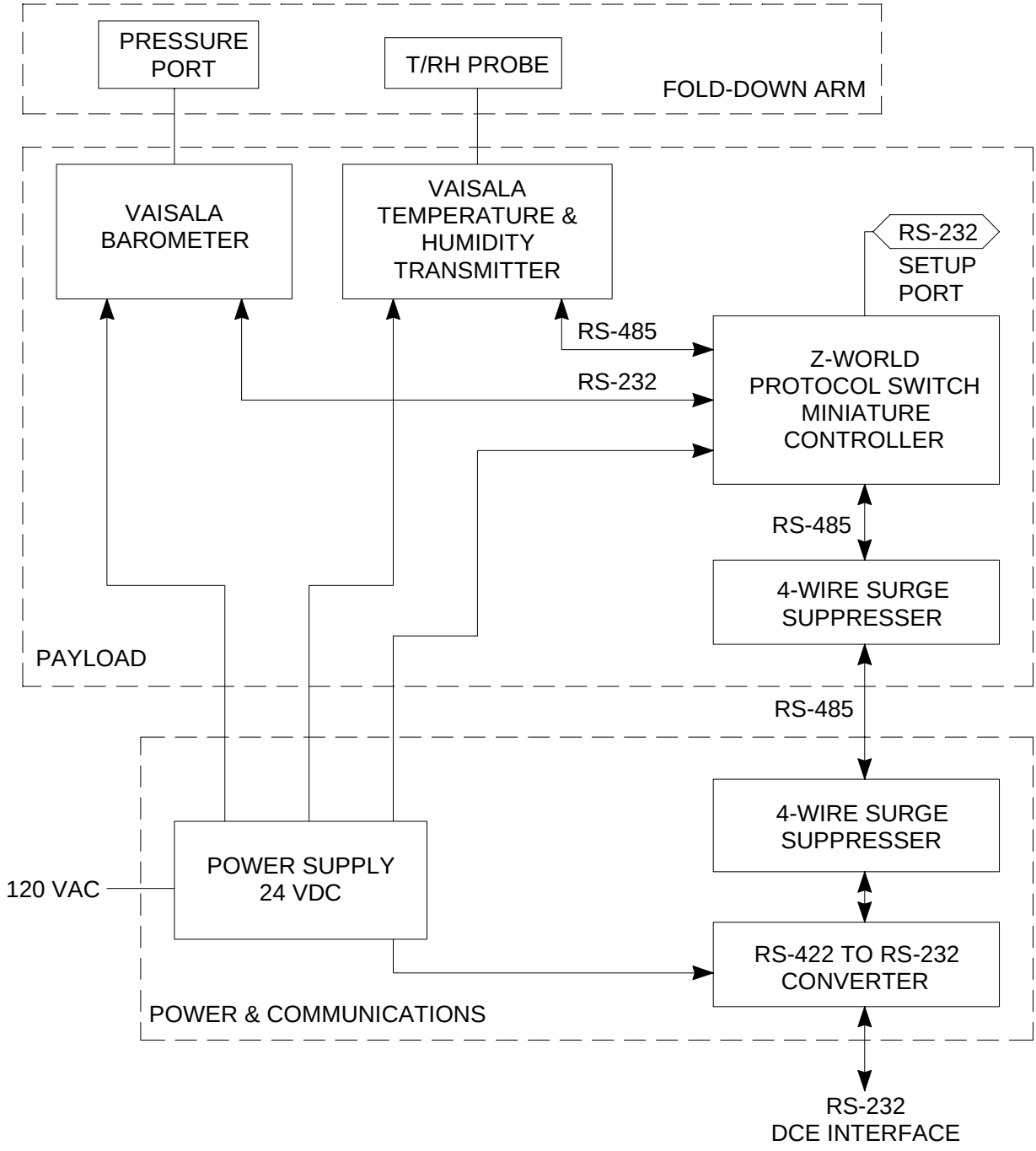

Figure 10-2 GSOS Block Diagram

10.1.1 Payload

The GSOS Payload electronics are housed in a Hoffman NEMA 4X enclosure containing a four-slot card cage and interconnection panel (see Figure 10-3). The electronic components housed in the enclosure consist of a 4-wire communications surge suppressor, micro controller, barometric pressure sensor, and an integrated temperature/ humidity sensor. Each component is mounted on a removable shelf for easy access and replacement. Figure 10-4 provides a detailed wiring schematic for the GSOS Payload Assembly. All payload interface connection are located on the bottom of the enclosure as shown in Figure 10-5

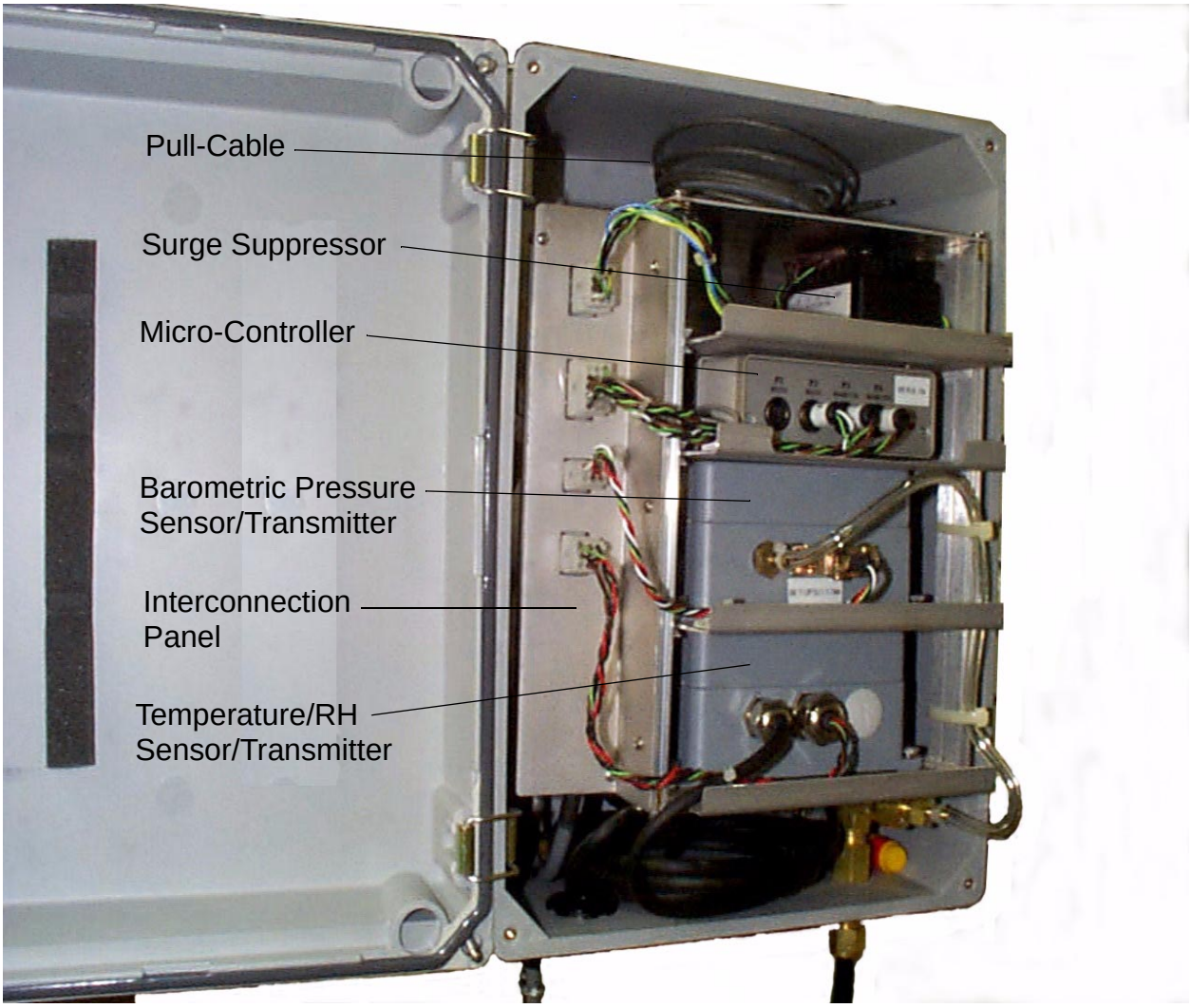

Figure 10-3 GSOS Payload Electronics Assembly

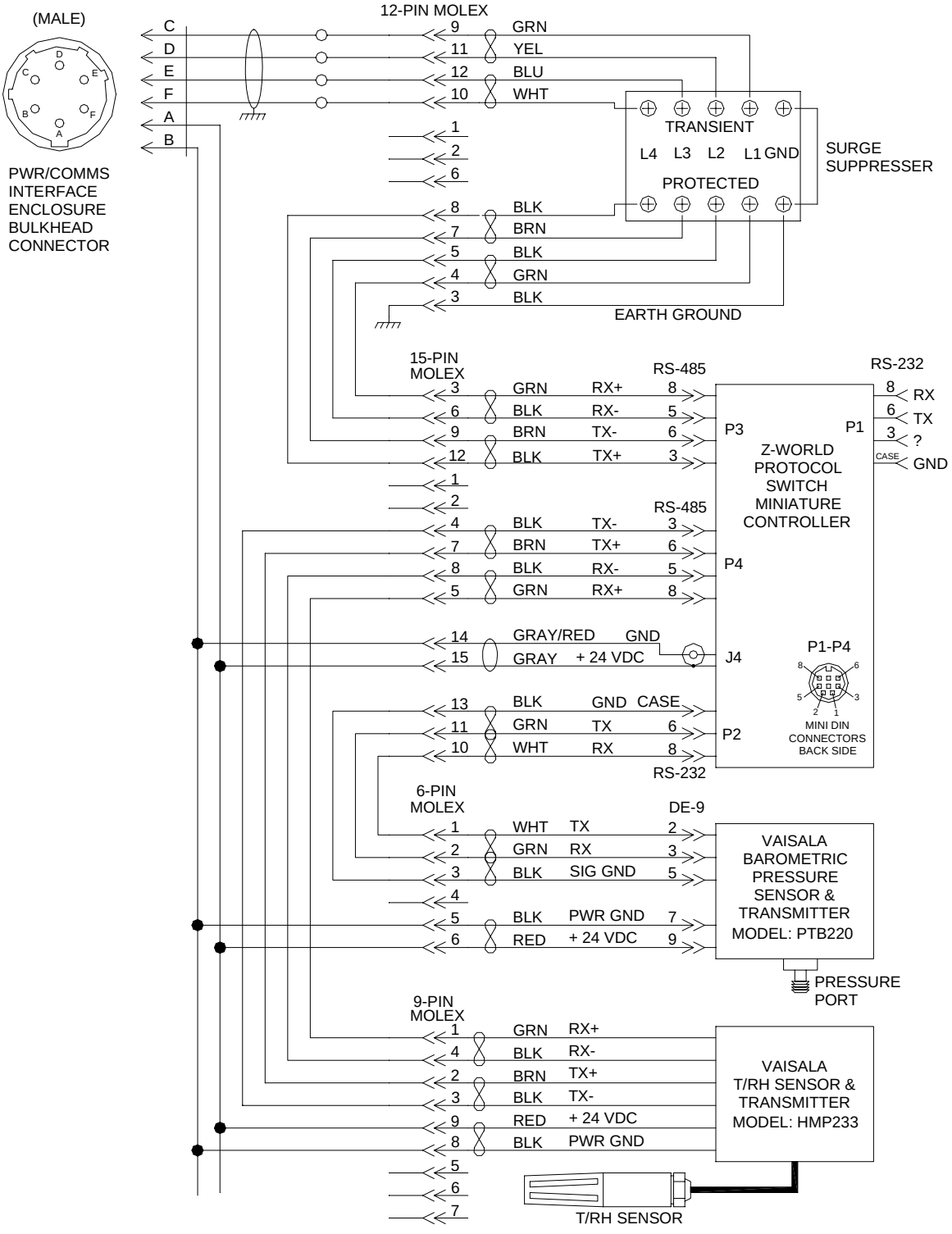

Figure 10-4 GSOS Payload Wiring Schematic

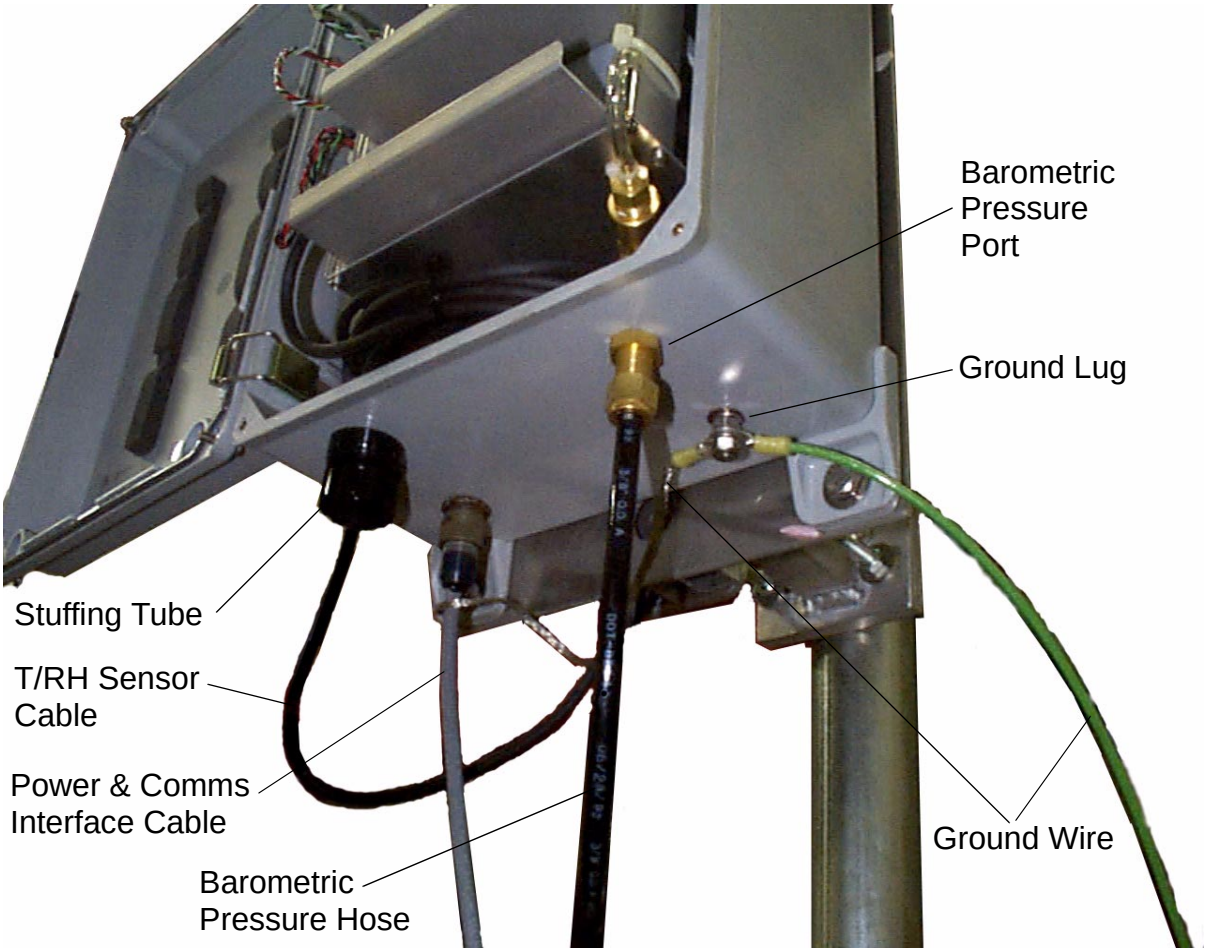

Figure 10-5 GSOS Payload Interfaces

10.1.1.1 Controller Assembly

The GSOS Controller Assembly is a Z-World model BL1300 Protocol Switch Micro-Controller build around the 9 MHz Z180 micro-processor chip. The controller has a built-in Real-Time Clock and Watch-Dog Reset Timer. The controller has two RS232 serial ports (P1 and P2) and two serial port (P3 and P4) that can be configured as RS485/ RS422 or RS232 (see Figure 10-6). The controller is equipped with sufficient SRAM to store 7-days of data at 5-minute intervals. However, should the controller lose power, all data samples will be lost. Critical site specific parameters are stored in non-volatile memory and are un-affected by loss of power. The DC power input connector is located on the controller rear panel (see Figure 10-7) is labeled as *+9 VDC*. However, the controller will operate with any DC supply voltage between 9 VDC and 36 VDC.

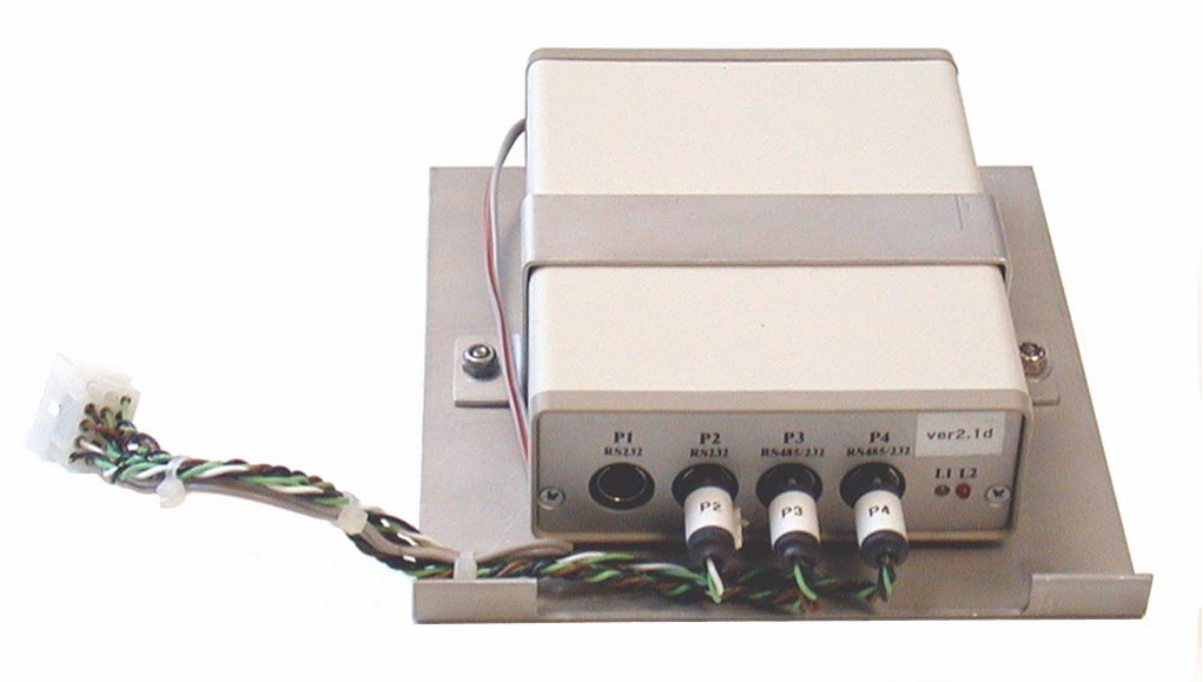

Figure 10-6 GSOS Controller Assembly Front View

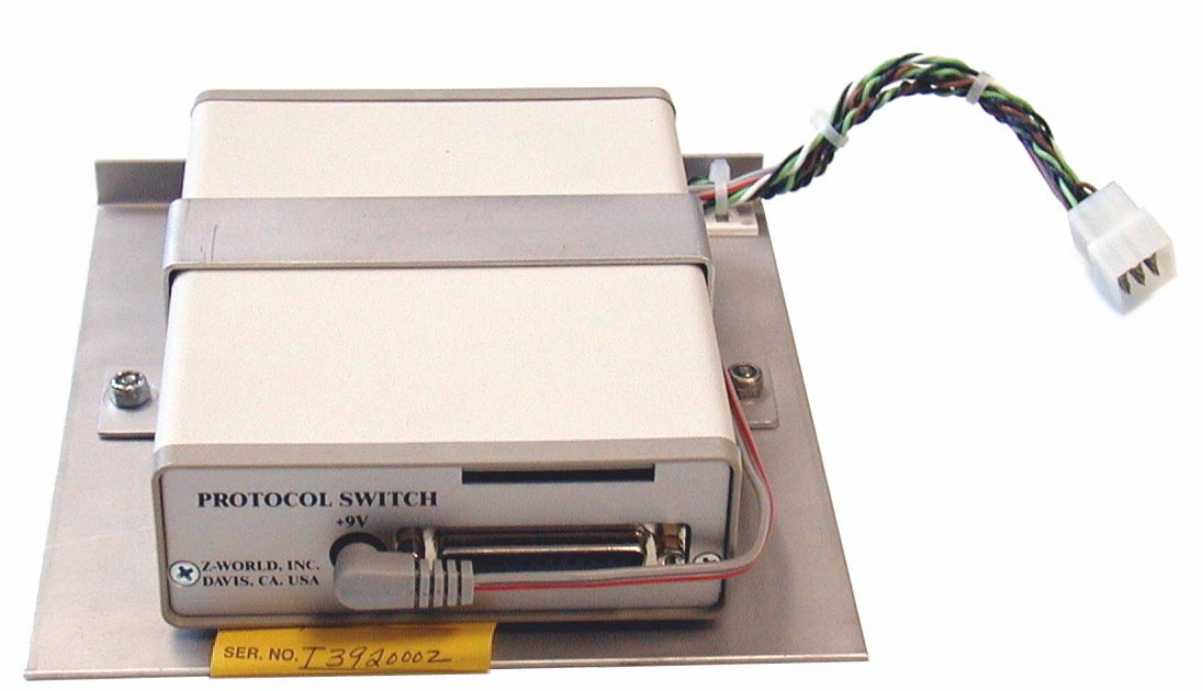

Figure 10-7 GSOS Controller Assembly Rear View

10.1.1.2 Barometric Pressure Sensor-Transmitter Assembly

The pressure sensor is a *Vaisala PTB220 Series Digital Barometer* (see Figure 10-8). This barometer has excellent hysteresis and repeatability characteristics and outstanding temperature and long-term stability. The barometer communicates with the GSOS Controller via RS232 interface. The barometer's key specifications are shown below:

Pressure Range	500 ... 1100 hPa
Temperature Range	-40 ... +60 ^{o}C
Total Accuracy	±0.25 hPa
Long-term Stability	±0.1 hPa/year
Supply Voltage	10 ... 30 VDC

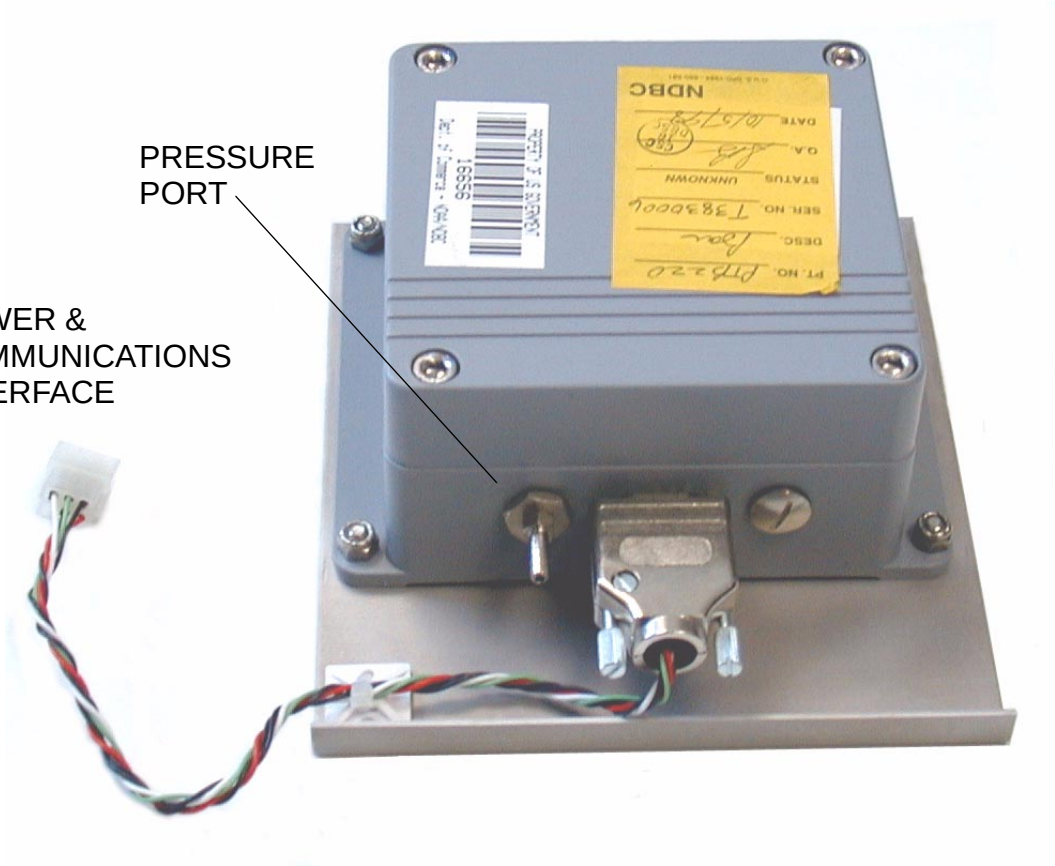

Figure 10-8 Barometric Pressure Sensor-Transmitter Assembly

10.1.1.3 Temperature/Relative Humidity Sensor-Transmitter Assembly

The Temperature/Relative Humidity (T/RH) Sensor is a *Vaisala Model HMP233*. As shown in Figure 10-9, the sensor probe and the transmitter unit are integrated into one assembly. If either the probe or transmitter fails, the entire assembly is replaced. The T/RH assembly communicates with the GSOS Controller via RS485/RS422 interface.

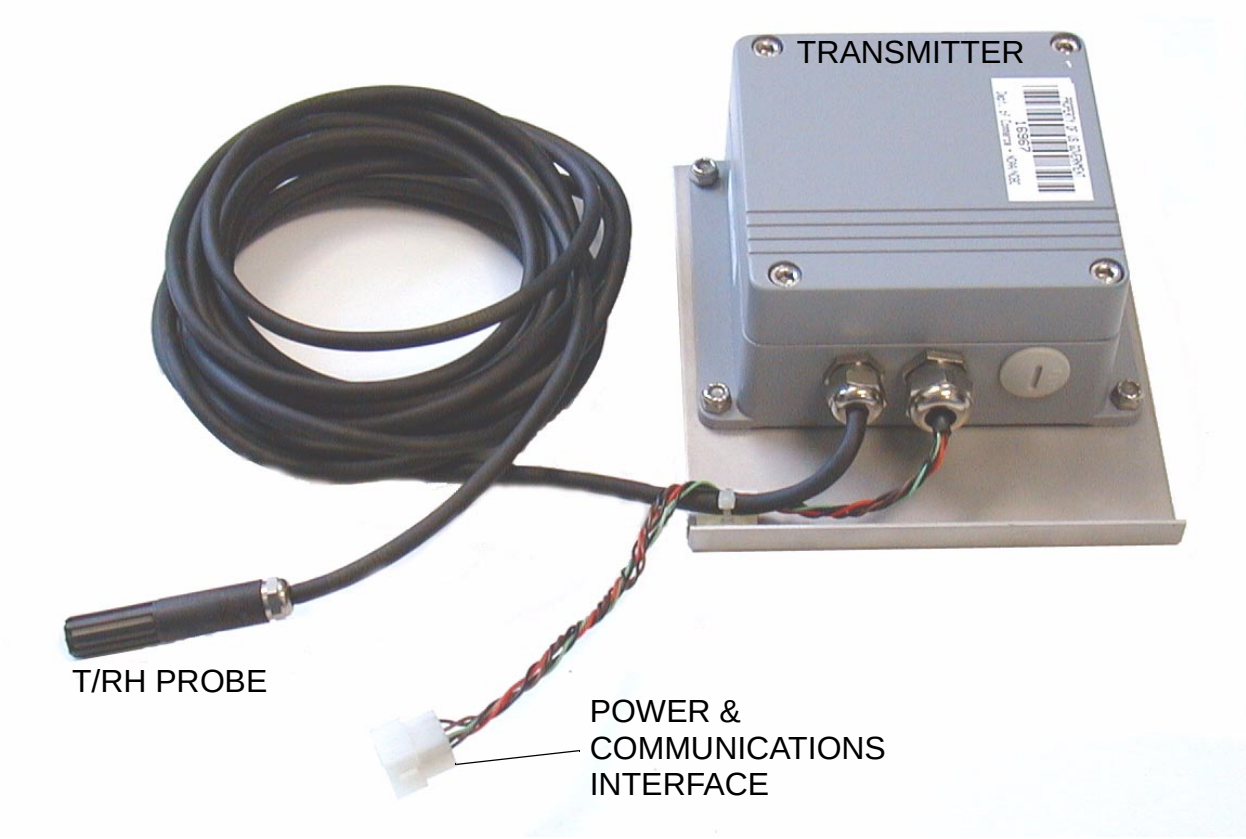

Figure 10-9 T/RH Sensor-Transmitter Assembly

10.1.1.4 Surge Suppressor Assembly

This Surge Suppressor Assembly is an *Amber Industries Model 1148-12* (see Figure 10-10). The suppressor provides two-stage protection for 4-wire communications circuits, dissipating both positive and negative voltage transients. The model 1148-12 specifications are show below:

Operating Voltage:	±12 Vpk
Let-through Voltage:	±24v (l-g)
Series Resistance:	10 Ohms
Max. Transient Voltage:	10 KV (8 x 20 microseconds)
Mix. Transient Current:	20 KA/line (8 x 20 microseconds)
Response Time:	less than 5 microseconds

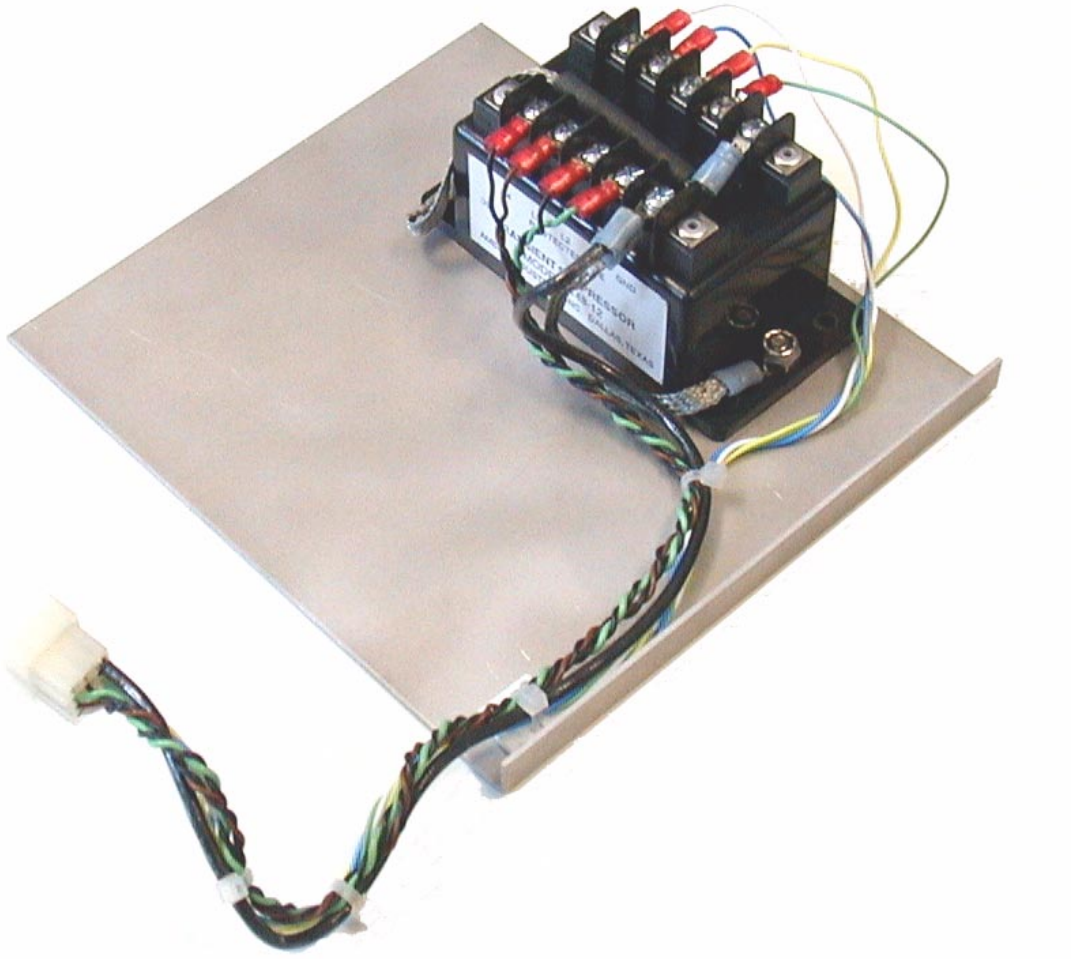

Figure 10-10 Surge Suppressor Assembly

10.1.2 Mounting Assembly and Fold-Down Arm

The GSOS Mounting Assembly attaches to one of the fence posts surrounding the profiler antenna compound (see Figure 10-11). The fold-down arm is hollow and serves as conduit to route the barometric pressure hose and T/RH sensor cable to the top of arm. The Fold-down arm is held in the vertical position by a Cotter Pin.

At the top of the fold-down arm, a radiation shield surrounds the T/RH sensor probe to protect it from the elements (see Figure 10-12). The metallic disk below the radiation shield is the barometric pressure port opening.

The gray PVC tube shown in Figure 10-12 provides the mounting mechanism for the T/RH probe. The PVC tube can be removed from the aluminum cube by loosening the thumb screw and pulling the PVC tube out from the bottom.

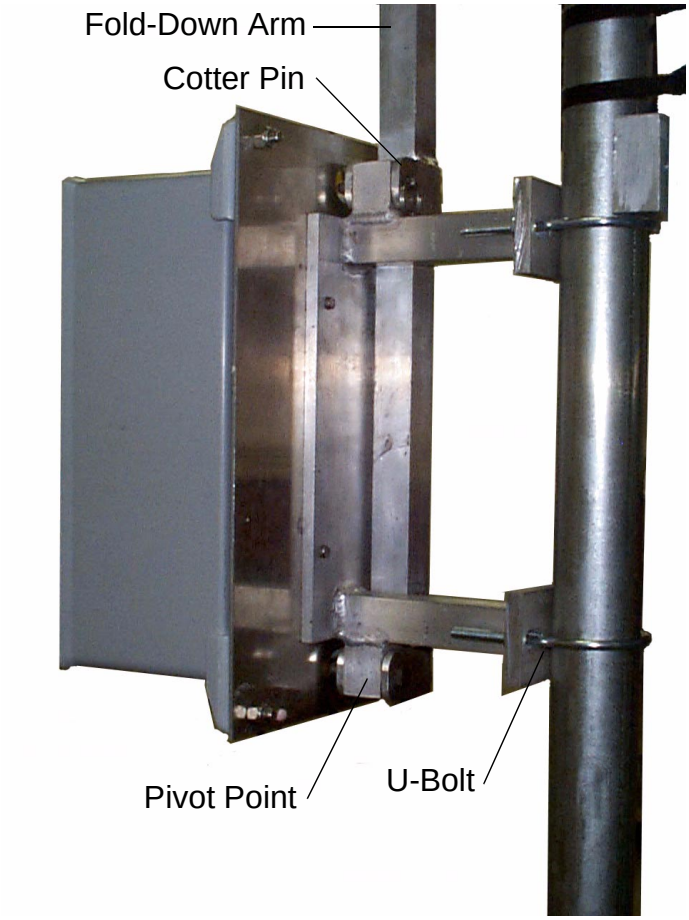

Figure 10-11 GSOS Mounting Assembly and Fold-Down Arm

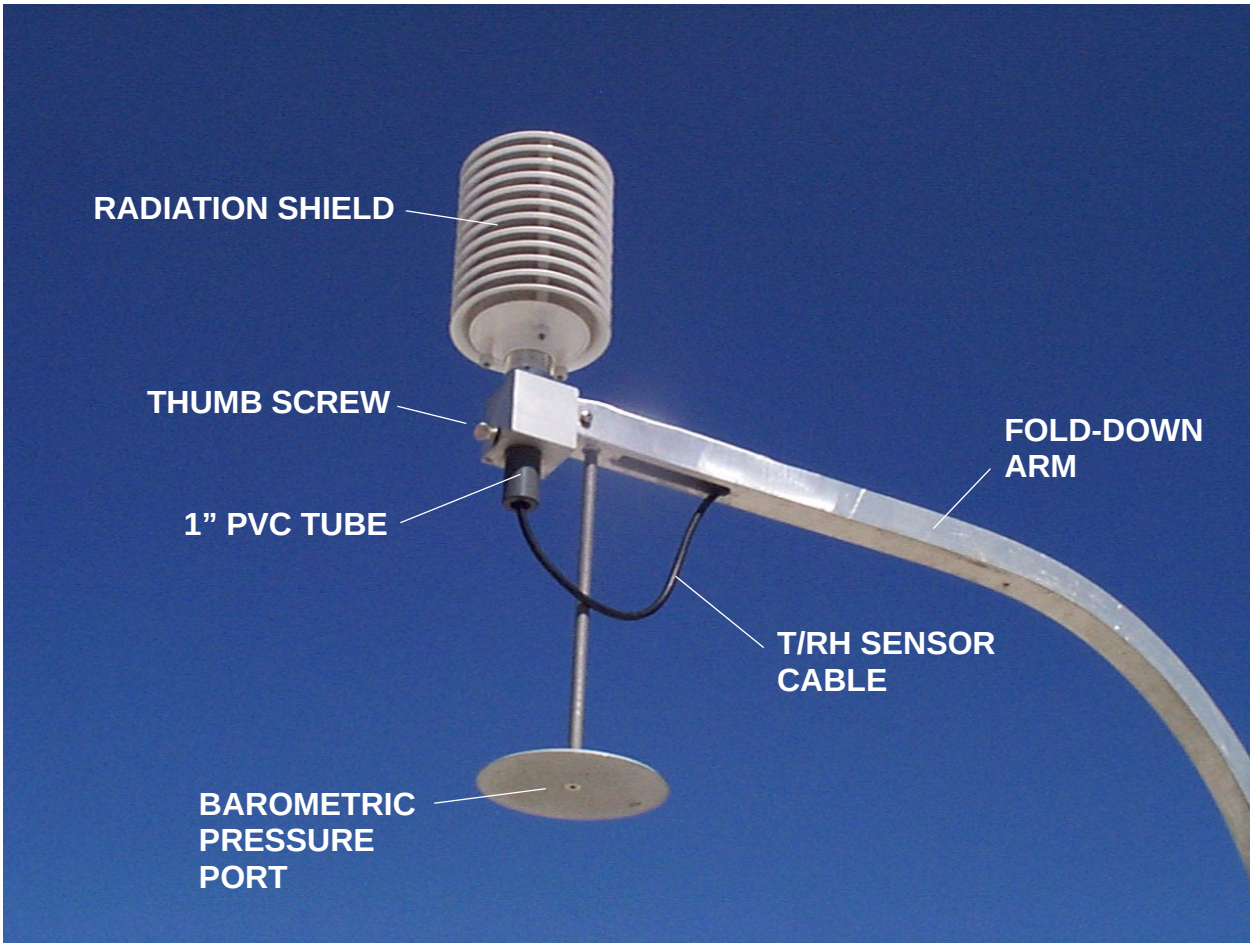

Figure 10-12 GSOS Fold-Down Arm Assembly

10.1.3 Power Supply and Communications Interface Assembly

The Power Supply and Communications Interface (PSCI) Assembly consists of a +24 VDC Power Supply Module, an RS422 to RS232 Converter, and a 4-wire communications line surge suppressor (see Figure 10-13). The power and communications interface cable’s quick-disconnect connector provides a convenient method to power cycle the payload from inside the shelter, and simplifies replacement of the PSCI assembly. A wiring schematic for the PSCI is shown in Figure 10-14.

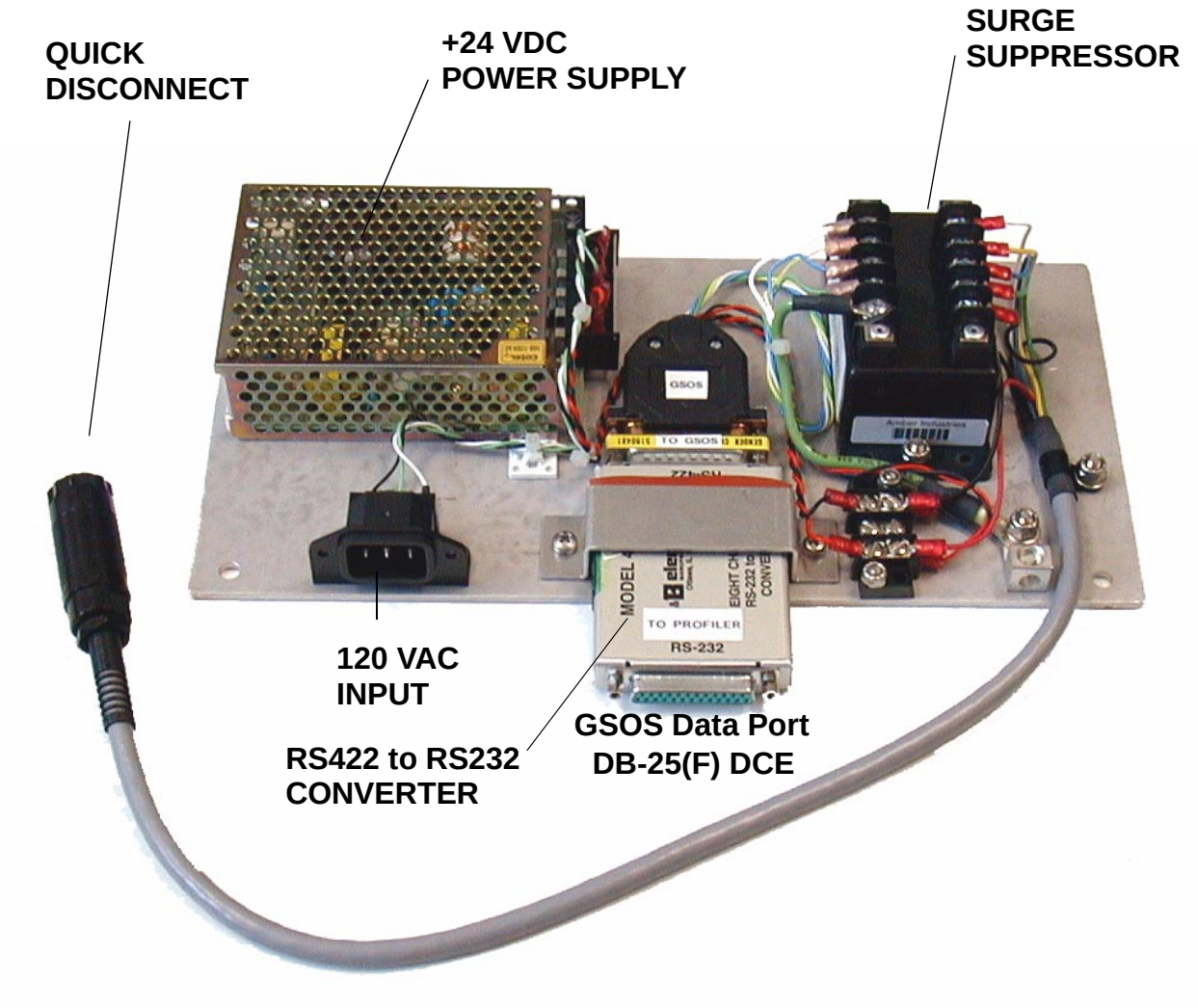

Figure 10-13 GSOS Power Supply and Communications Interface Assembly

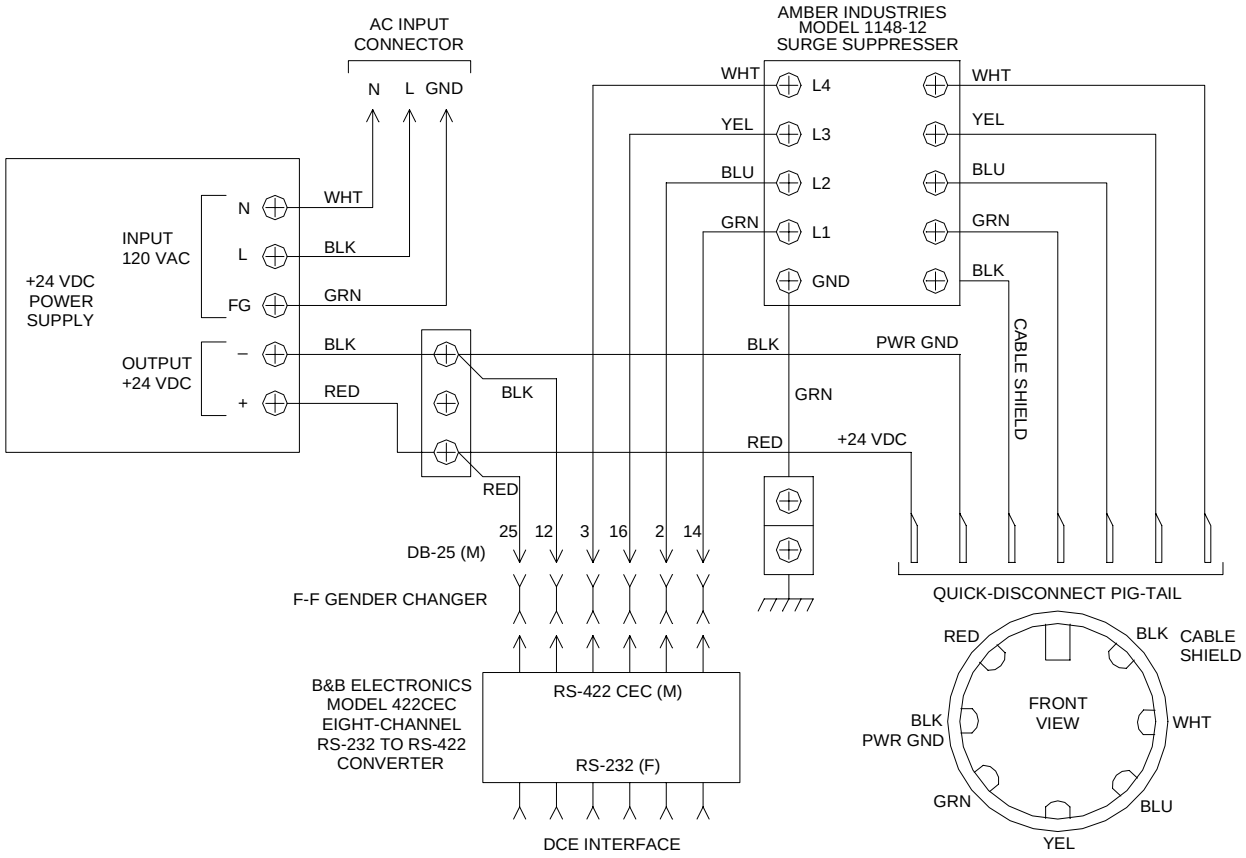

Figure 10-14 GSOS Power & Communications Interface Schematic Diagram

10.2 Operations

When power is first applied to the GSOS payload, the controller begins its boot-sequence. During this time, the *L1* and *L2* LED indicators on the contoller's front panel blink, alternating between *L1* and *L2* (about 1-2 times per second). This rapid blink cycle continues until the controller's internal real-time clock reaches a 5-minute boundary (hh:05, hh:10, hh:15 ..... hh:00). Once a 5-minute boundary is reached, the controller enters its normal 5-minute data logging cycle. While the controller is logging data, the *L1* or *L2* LED indicator on the contoller front panel illuminate alternating at each 5-minute boundary. If the controller does not exhibit this behavior, it is most likely damaged.

The controller takes several reading during the 5-minute sample period and calculates the average at the end of the cycle. The averaged reading are stored in a circular-buffer in memory. The buffer can store about 7-days of data before the buffer fills and begins over-writing the oldest data. Power-cycling (or power outage) the GSOS controller will cause all data stored in the circular-buffer to be lost.

GSOS barometer measures *station* pressure and controller calculates *sea-level* pressure. The algorithm requires current *station* barometric pressure and air temperature readings and an air temperature reading from 12 hours earlier to derive a *sea-level* pressure reading. Once power is applied to the GSOS payload (or if the GSOS is power-cycled or loses power) it takes 12 hours of continuous operation before *sea-level* pressure readings will be available.

GSOS is a polled-system, meaning it does not transmit any data unless it receives a request from a host computer. The GSOS controller responds to ACSII character commands. The commands are used to configure site specific parameters and request data. The command syntax covered in the Section 10.2.3.

GSOS has two communications ports P1 (GSOS Setup Port) and P3 (GSOS Data Port). Both ports provide similar functionality, with the following exceptions:

- P1 is configured for RS-232 communications.
- P2 is configured for RS485/RS422 communications.
- A computer terminal connected to port P1 allows a user to change the serial port settings for port P3. P3 does not respond to the *PORT* command
- P1 does not respond to data request commands such as *L*, *G*, *CURRENT*, *AVG*, *HOUR*, or *DAY*.

10.2.1 GSOS Setup Port

The GSOS Setup Port (P1 on the controller front panel, see Figure 10-6) is an RS232 port primarily used to configure the GSOS with site specific parameters using the command syntax described in the Section 10.2.3. A special interface cable is required to use this port, the cable's wiring diagram is shown in Figure 10-15. The serial communications parameter setting for port P1 are fixed at the following values:

Baud Rate:	9600
Data Bits:	8
Stop Bits:	1
Parity:	No
Flow Control:	None

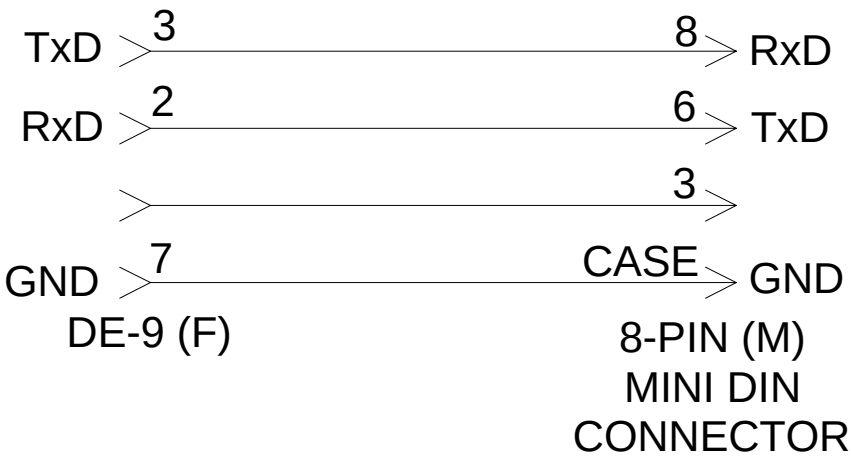

Figure 10-15 GSOS Setup Port (P1) Interface Cable Specifications

10.2.2 GSOS Data Port

The GSOS Data Port (P3 on the controller front panel) is an RS-485/RS422 port that interfaces with the host computer through the Power Supply & Communications Interface Assembly (see Figure 10-13). At NOAA Profiler sites, the host computer is the Data Processor Assembly. The Data Processor has an RS-232 port (C1) that is used to interface with auxiliary devices such as GSOS. The cable required to connect the GSOS Power & Communications Interface to the Data Processor (Port C1) is a straight-through DB25P (Male) to DB25S (Female) about 6-FT in length.

The Data Processor polls the GSOS every 6 minutes during the vertical low mode by sending the GSOS an ASCII “L” character. When GSOS receives a poll-character, it transmits a 64-byte string containing the latest 5-minute data samples.

10.2.2.1 Configuring the Data Processor to interface with GSOS

Several of the Data Processor’s setup parameters must be configured to accept GSOS data. The Profiler Maintenance Terminal (PMT) provides the means to modify these parameters.

1. Connect the PMT interface cable to the DB25 connector on the front panel of the Status Monitor. Start the PMT program on the notebook computer and login to the wind profiler system.

2. Using the Profiler Maintenance Terminal (PMT), place the profiler into *Maintenance Mode*.

3. Select *System Parameters* for the PMT *Main Menu* options.

4. Select *Communications* from the *System Parameters Menu*. The following screen is displayed on the PMT (see Figure 10-16). Use the arrow keys to move cursor to the desired field. Press the *F5* key to select the field. Modify the field as required, and commit the change to the field by pressing the *F6* key.

```
3 WPS-234, PASSWORD REQUIRED                        Maintenance
4 This could take 6 minutes
5 COMMAND EXECUTED
                  Communications Parameters Menu

 Communication Method          BOTH            Landline, Goes, Both

 Goes Id                       750126DA        00000000-FFFFFFFE Hex
 Channel Number                 93             001-199 Decimal
 Transmission Minute            7              00..59
 Transmit Frequency            1               1..6
 Preamble Length               S               S[hort] or L[ong]
 Vertical Parity               Y               Yes or No

 Landline Parameters
 Landline Baud Rate            1200            0300,1200,2400,4800,9600
 x/ON x/OFF Enable             N               Yes or No
 Radiometer Data Inc.          Y               Yes or No
 Radiometer Data Block Length  064             002 to 512 - Even number

 Radiometer Baud Rate          1200            0300,1200,2400,4800,9600



1 Prev  2       3       4       5 select 6Enter  7     8     9      0
```

Figure 10-16 PMT Communications Parameters Menu

5. Set ***Radiometer Data Inc.*** to *Y*. This informs to Data Processor that a GSOS unit is connected to port C1, and to poll the GSOS every 6-minutes.

6. Set ***Radiometer Data Block Length*** = *064*. This tells the Data Processor how many bytes of data to expect to be received from the GSOS.

7. Set ***Radiometer Baud Rate*** = *1200*. The baud rate must match the GSOS Data Port baud rate.

8. Return the profiler to *Operational* Mode.

10.2.2.2 Verifying the Data Processor is receiving data from GSOS

If the Data Processor parameters are configured to expect Radiometer Data (GSOS), the Data Processor will transmit as ASCII "L" character to the GSOS during the vertical low mode of the radar's 6-minute cycle. If the GSOS fails to send a response back to the Data Processor, an *AUXILIARY DEVICE* fault is generated and placed in the radar's Failure Data Log (the Failure Data Log is viewed using the PMT).

The data received from GSOS can be viewed using the PMT Radiometer Data Display. Select *Display Current Output* from the PMT *Main Menu*, select *Landline*, then *Radiometer Data*. A display similar to Figure 10-17 will appear on the PMT screen. The 64-byte ASCII string received from the GSOS is displayed as 1-byte hexadecimal values, refer to Table 10-1 for a Hexadecimal to ASCII Conversion Chart. If all 64 bytes are "00" then no data was received from the GSOS.

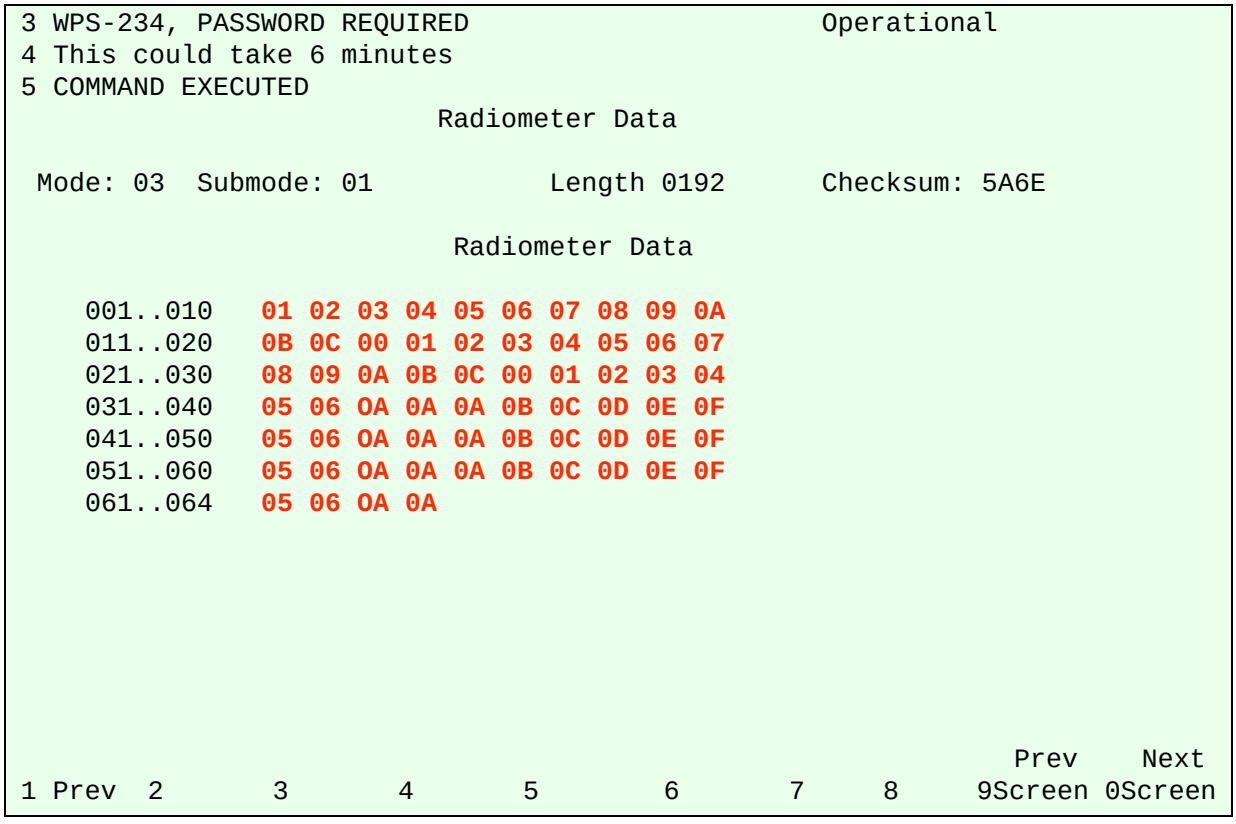

Figure 10-17 PMT - Landline Output - Radiometer Data

Table 10-1 Hexadecimal to ASCII Conversion Chart

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
0	00	Null	32	20	Space	64	40	@	96	60	‘
1	01	Start of heading	33	21	!	65	41	A	97	61	a
2	02	Start of text	34	22	“	66	42	B	98	62	b
3	03	End of text	35	23	#	67	43	C	99	63	c
4	04	End of transmit	36	24	$	68	44	D	100	64	d
5	05	Enquiry	37	25	%	69	45	E	101	65	e
6	06	Acknowledge	38	26	&	70	46	F	102	66	f
7	07	Audible bell	39	27	‘	71	47	G	103	67	g
8	08	Backspace	40	28	(	72	48	H	104	68	h
9	09	Horizontal tab	41	29	)	73	49	I	105	69	i
10	0A	Line feed	42	2A	*	74	4A	J	106	6A	j
11	0B	Vertical tab	43	2B	+	75	4B	K	107	6B	k
12	0C	Form feed	44	2C	,	76	4C	L	108	6C	l
13	0D	Carriage return	45	2D	-	77	4D	M	109	6D	m
14	0E	Shift out	46	2E	.	78	4E	N	110	6E	n
15	0F	Shift in	47	2F	/	79	4F	O	111	6F	o
16	10	Data link Escape	48	30	0	80	50	P	112	70	p
17	11	Device Control 1	49	31	1	81	51	Q	113	71	q
18	12	Device Control 2	50	32	2	82	52	R	114	72	r
19	13	Device Control 3	51	33	3	83	53	S	115	73	s
20	14	Device Control 4	52	34	4	84	54	T	116	74	t
21	15	Neg. acknowledge	53	35	5	85	55	U	117	75	u
22	16	Synchronous idle	54	36	6	86	56	V	118	76	v
23	17	End trans. ack	55	37	7	87	57	W	119	77	w
24	19	Cancel	56	38	8	88	58	X	120	78	x
25	19	End of medium	57	39	9	89	59	Y	121	79	y
26	1A	Substitution	58	3A	:	90	5A	Z	121	7A	z
27	1B	Escape	59	3B	;	91	5B	[	123	7B	{
28	1C	File separator	60	3C	<	92	5C	\	124	7C	|
29	1D	Group separator	61	3D	=	93	5D	]	125	7D	}
30	1E	Record separator	62	3E	>	94	5E	^	126	7E	~
31	1F	Unit separator	63	3F	?	95	5F	_	127	7F	

10.2.3 GSOS Command Syntax

GSOS commands are one-or-more ASCII characters, terminated by a carriage return <CR>. The commands are not case sensitive, any upper case characters received by the GSOS are converted to lower case. The GSOS commands are divided into two groups, configuration commands and data query commands.

10.2.3.1 GSOS Command Prompt

The GSOS command prompt is a greater-than character (>). If a terminal is used to interface with GSOS controller, press carriage return <CR> several times until the command prompt “>” is displayed on the terminal screen.

10.2.3.2 Query Commands

?<CR> or STATUS<CR>

The status commands (? or status) display the current GSOS status, configuration parameters, and help display. Both the Setup Port (P1) and Data Port (P3) respond to the *STATUS* command. However, the responses to the *STATUS* command are slightly different depending on which port is used.

Figure 10-18 is an example response to a *STATUS* command when a terminal is connected to the GSOS Setup Port (P1). Note the command help menu does not include options to query data, this is because the Setup Port does not respond to query commands. The last six 5-minute averaged readings are automatically appended at the end of the *STATUS* message response. If the GSOS controller is reset or power-cycled within 30-minutes of the status command, the number of data sample messages displayed are reduced accordingly.

Figure 10-19 is an example response to a *STATUS* command when a terminal is connected to the GSOS Data Port (P3) through the GSOS Power and Communications Interface. Note the menu provides limited configuration commands. Although the *STATION* and *COEFF* are not listed as available commands, the GSOS will respond to these *hidden* commands if they are received through the Data Port.

```
>?
Status of GSOS system.          V 2.1d
Station ID                    = SITE
Temp/Humidity Sensor          = OK
Pressure Sensor               = OK
Number Measurements in Buffer = 3
Serial Port settings          = 1200, No Parity, 8 Data, 1 Stop
Current Date and Time         =  5 16 2000 22 10 17
Sea Level Coeff. A = 1.0000E+0 B = 1.0000E+0 C = 1.0000E+0 D = 1.0000E+0

   time     = Allows the user to reset the date/time.
   reset    = Will cause the GSOS computer to do a hardware reset.
                   (Use with caution, will lose stored data.)
   status,? = This command.
   port     = Used to setup data port.
   station  = Used to set the Station ID.
   coeff    = Setup Sea Level Pressure Conversion Coefficients.
 Current Data
test 2000 137 21:40  820.72mb  21.75C  46.27%    0.00mb/SL
test 2000 137 21:45  820.58mb  21.76C  46.04%    0.00mb/SL
test 2000 137 21:50  820.40mb  21.75C  46.12%    0.00mb/SL
>
```

Figure 10-18 GSOS Setup Port (P1) Status Display and Help Menu

```
Status of GSOS system.          V 2.1d
Station ID                    = PATB

Temp/Humidity Sensor          = OK
Pressure Sensor               = OK
Number Measurements in Buffer = 0
Serial Port settings          = 1200, No Parity, 8 Data, 1 Stop
Current Date and Time         =  5  3 2000 23  6  1

Sea Level Press Coefficients A = 3.3863E-1  B = 1.0000E+0
                             C = 1.7632E-38  D = 1.7632E-38

   l,current,g = Displays the last 5 minute average stored.
   day[1,2,3,4,5,6] = Displays data for each day, 'day' most current data.
   avg      = Displays the last 30 minutes of data stored.
   hour     = Displays the last hour & 30 minutes of data stored.
   clock    = Displays the current clock date/time setting.
   time     = Allows the user to reset the date/time.
   time MM/DD/YYYY HH:MM:SS = Allows resetting date/time.(No prompting)
   reset    = Will cause the GSOS computer to do a hardware reset.
                   (Use with caution, will lose stored data.)
   status,? = This command.
>
```

Figure 10-19 GSOS Data Port (P3) Status Display and Help Menu

L or G

These commands simulate the request generated every 6-minutes (in vertical low mode) by a wind profiler system. The L is for Landline (latest 6-minute), and G is for GOES (latest hourly average). The GSOS responds with a 64-byte message conforming to the following format:

```
>lEKY1 2000  18  0: 0  914.00mb  31.00C  76.20% 1002.00mb/SL<cr><lf><cr><lf><lf>
 lssss yyyy jjj hh:mm pppp.pp   ±tt.tt  hhh.hh  PPPP.PP
 12345678901234567890123456789012345678901234567890123456789
          1         2         3         4         5          60  61  62  63  64

where: L,l,G,g = poll command character echoed by the GSOS when received.
          ssss = site name or ID.
          yyyy = Year Timestamp (based on GSOS controller Real-Time Clock).
           jjj = Julian Date Timestamp (based on GSOS controller Real-Time Clock).
            hh = Hour Timestamp (based on GSOS controller Real-Time Clock).
            mm = Minute Timestamp (based on GSOS controller Real-Time Clock).
       pppp.pp = station barometric pressure in millibar.
        ±tt.tt = Air Temperature in degrees Celsius.
        hhh.hh = Relative Humidity from 0 - 100%
       PPPP.PP = Sea-Level (derived) Barometric Pressure in millibar.
          <cr> = ASCII Carriage Return character.
          <lf> = ASCII Line-Feed character.
```

CURRENT<CR>

Same as L or G, except the poll character (L,l,G,or g) are not echoed in the response.

AVG<CR>

The *AVG* command causes GSOS to transmit the six most-recent 5-minute data samples as shown in the example below:

```
>avg<CR>
WLCI 2000 123 18:10  995.36mb  19.68C  53.98% 1020.78mb/SL
WLCI 2000 123 18:15  995.42mb  19.86C  52.74% 1020.84mb/SL
WLCI 2000 123 18:20  995.40mb  19.83C  51.79% 1020.82mb/SL
WLCI 2000 123 18:25  995.36mb  20.07C  50.37% 1020.78mb/SL
WLCI 2000 123 18:30  995.45mb  20.27C  50.87% 1020.86mb/SL
WLCI 2000 123 18:35  995.48mb  20.27C  48.84% 1020.90mb/SL
```

HOUR<CR>

The *HOUR* command causes GSOS to transmit the last several hours of 5-minute data samples as shown in the example below:

```
>hour<CR>
WLCI 2000 123 17:10  995.43mb  18.82C  60.07% 1020.85mb/SL
WLCI 2000 123 17:15  995.46mb  18.84C  55.69% 1020.88mb/SL
WLCI 2000 123 17:20  995.48mb  19.19C  57.64% 1020.90mb/SL
WLCI 2000 123 17:30  995.45mb  19.11C  55.46% 1020.87mb/SL
  .
  .
  .
WLCI 2000 123 18: 5  995.32mb  19.87C  55.57% 1020.73mb/SL
WLCI 2000 123 18:10  995.36mb  19.68C  53.98% 1020.78mb/SL
WLCI 2000 123 18:15  995.42mb  19.86C  52.74% 1020.84mb/SL
WLCI 2000 123 18:20  995.40mb  19.83C  51.79% 1020.82mb/SL
WLCI 2000 123 18:25  995.36mb  20.07C  50.37% 1020.78mb/SL
WLCI 2000 123 18:30  995.45mb  20.27C  50.87% 1020.86mb/SL
WLCI 2000 123 18:35  995.48mb  20.27C  48.84% 1020.90mb/SL
```

10.2.3.3 Configuration Commands

STATION<CR>

Changes the name of the Station ID stored in the GSOS. The following prompt is displayed:

```
Enter Station ID (4 char)
>
```

COEFF<CR>

Changes of values of four coefficients (A,B,C,and D) stored in the GSOS used to calculate Sea-Level Pressure. Coefficient values are different for every site location. GSOS prompts individually for each of the coefficient values as show below:

```
Coefficient A
>0.0000234
Coefficient B
>0.0000045
Coefficient C
>1
Coefficient D
>0
>
```

Number less than zero should be entered with a leading zero (0.0...). Numbers equal to 1 or 0 should be entered as integer values.

TIME<CR>

Used to interactively set the GSOS internal Real-Time Clock. A continuously updating time is shown, the user can then choose to update the clock by selecting Y (yes) or keep the existing time by selecting N (no). If Yes is selected, the following prompt is displayed:

```
Please Initialize Time

MM DD YYYY HH MM SS
_
```

Enter values with leading zeros (if less than 10) and separate with spaces. Press Enter <CR> to commit values.

TIME mm/dd/yyy hh:mm:ss<CR>

Used to non-interactively set the GSOS internal Real-Time Clock. After the new date/ time values have been entered, by GSOS displays the following message.

```
Sampling Time Reset
Please Wait
.....................
>
```

The GSOS prints a succession of dots, until the internal clock reaches the next 5-minute boundary, at which point the command prompt (>) is displayed. You must wait until the command prompt is displayed before attempting to enter any commands.

PORT<CR>

Changes the serial communications parameters for port P3 (GSOS Data Port). The *PORT* command can only be executed when connected to the Setup Port (P1). The following prompts are displayed: (Select values by entering the number on left)

```
Set Output Port Baud Rate
1 = 1200
2 = 2400
3 = 4800
4 = 9600
5 = 19200
>
```

```
  Set Output Port Stop Bits
  1 = 1 Stop Bit
  2 = 2 Stop Bit

  >

  Set Output Port Data Bits
  1 = 7
  2 = 8

  >

  Set Output Port Parity
  1 = No Parity
  2 = Even Parity
  3 = Odd Parity

  >

Use the RESET command to make communication setting take affect.

>
```

RESET<CR>

The RESET command resets the controller's CPU, having the same effect as power-cycling the GSOS. All stored measurements stored in memory are lost. During the boot-up process the following message is displayed:

```
  Power UP.
  ..................................
  GSOS Version 2.1d

  >
```

GSOS prints a succession of dots until its internal clock reaches a 5-minute boundary. GSOS then enters its normal 5-minute data logging cycle and prints the controller's firmware version and command prompt (>) on the screen.

10.3 Replacement Procedures

The following tools are required to and replace GSOS components:

- #2 Phillips Head Screwdriver
- #2 Flat Blade Screwdriver
- Small Flat Blade Screwdriver
- 1/16” Allen Head Wrench
- 3/4” Adjustable Wrench (Crescent Wrench) or
- 3/4”, 5/8”, 9/16”,1/2”, and 5/16” Open-end Wrenches
- Diagonal Cutters/Utility Knife

10.3.1 Payload Replacement

1. Disconnect the Power & Communications Interface Cable from the bottom of the GSOS Payload enclosure (see Figure 10-20).

2. Unscrew the four captive fasteners on the enclosure door and open enclosure. The door is hinged on the left side of the enclosure (see Figure 10-20).

3. Disconnect the barometric pressure hose from bulk-head fitting on the bottom of the GSOS Payload enclosure (see Figure 10-20).

4. Disconnect the ground wires from the bottom the GSOS enclosure (see Figure 10-20).

5. Remove the cotter pin from the fold-down arm and lower the arm counter-clockwise (see Figure 10-21).

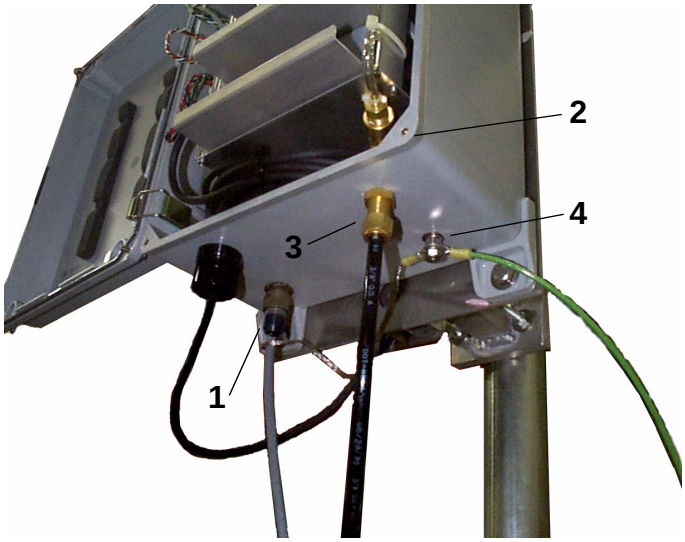

Figure 10-20 Payload Interfaces

Figure 10-21 Lower Fold-Down Arm

6. Loosen the thumb screw at the top of the arm and remove the sensor mounting assembly (1" gray PVC tube) from the arm (see Figure 10-22).

7. Unscrew the allen-head setscrew holding the T/RH Probe inside the PVC tube and remove the probe from the tube.

8. At the base of the fold-down arm, pull the T/RH cable out of the arm, while feeding the probe through the slot at the top on the arm.

9. Unscrew the compression nut from the stuffing tube where the T/RH cable enters the GSOS enclosure (see Figure 10-23).

10. Feed in the T/RH cable into the GSOS enclosure through the stuffing tube and coil the sensor cable inside the enclosure below the card cage.

11. Re-assemble and tighten the T/RH cable stuffing tube.

12. Close and fasten the door in the GSOS enclosure.

13. Remove the four mounting screws fastening the GSOS enclosure to the mounting assembly and remove the enclosure from the mounting assembly.

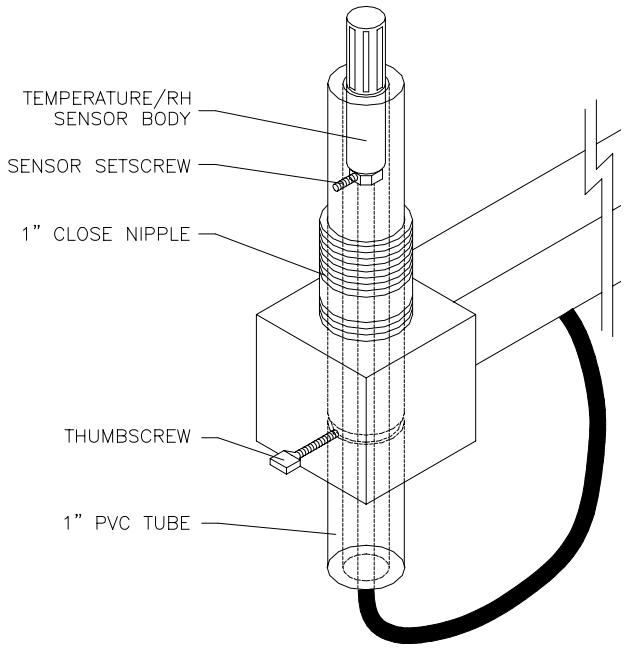

Figure 10-22 T/RH Sensor Removal

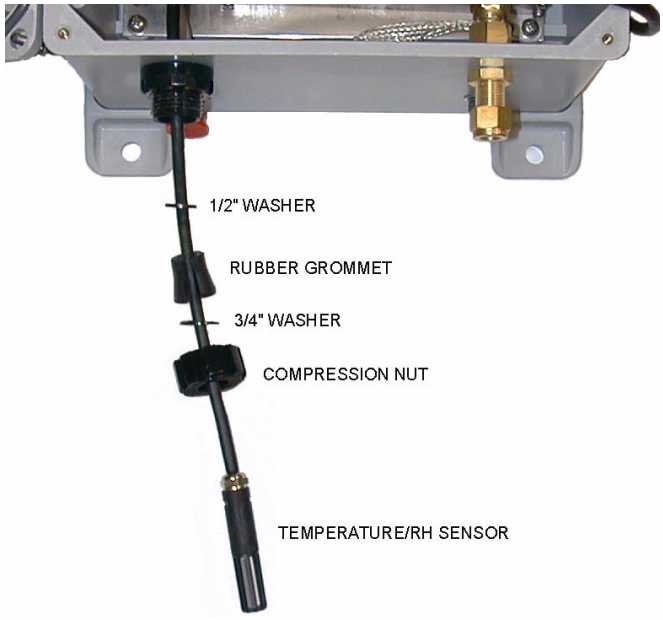

Figure 10-23 Payload Stuffing Tube

14. Mount the replacement GSOS enclosure to the mounting assembly and secure the four fasteners.

15. Open the GSOS enclosure and un-coil the T/RH Cable. Straighten the cable and remove any kinks.

16. Feed the T/RH sensor though the stuffing tube (and its washers and grommet) as shown in Figure 10-23. The T/RH probe body is too large to fit through the stuffing tube washers and grommet. Make diagonal cuts in the washers and grommet with diagonal cutters or a utility knife.

17. Feed the pull-cord (provided with the payload) from the slot at the top of fold-down arm, though the arm towards the base.

18. Remove the yellow protective cover from the T/RH sensor and attach the pull-cord to the T/RH sensor with electrical tape.

19. Feed the T/RH Sensor through the fold-down arm with your right hand, while pulling the pull-cord with your left hand. Pull enough cable through the arm to form an adequate drip-loop in the sensor cable.

20. Position the T/RH probe inside the mounting assembly such that the metallic base of the probe body aligns with the sensor setscrew (a port hole drilled in the PVC tube opposite the setscrew provides the means to visually align the probe in the PVC tube). Tighten the setscrew to secure the sensor.

21. Insert the PVC tube into the aluminum housing until the scribe line on the PVC tube is flush with the aluminum housing. (This ensures the thumb screw will properly seat in the groove milled in the PVC tube.) Tighten the thumb screw to secure the PVC tube in position.

22. Gather the excess T/RH sensor cable and coil it in the bottom of the GSOS enclosure.

23. Rise the Fold-Down arm and install the cotter pin to secure the arm in the vertical position.

24. Adjust the length of the T/RH sensor cable to allow the Fold-Down Arm to be lowered or raised without stressing the T/RH cable. Tighten the stuffing tube compression nut.

25. Connect the barometric pressure hose and ground wires to the GSOS enclosure as shown in Figure 10-20.

26. Connect the Power & Communications cable to the GSOS enclosure interface connector.

27. Refer to “Operations” in Section 10.2 to verify proper operation of the GSOS controller.

28. Secure the cover on the GSOS enclosure. **DO NOT OVER-TIGHTEN THE SCREWS OR THE CORNERS OF THE ENCLOSURE DOOR WILL CRACK!**

10.3.2 Controller Replacement

1. Disconnect the Power & Communications Interface Cable from the bottom of the GSOS Payload enclosure.

2. Unscrew the four captive fasteners on the enclosure door. The door is hinged on the left side of the enclosure.

3. Unplug the controller’s 15-pin *Molex* connector from the panel to the left of the card cage.

4. Slide the controller assembly from the card cage.

5. Slide the replacement controller into the card cage.

6. Connect the controller’s 15-pin Molex connector to panel to the left of the card cage.

7. Connect the Power & Communications Interface Cable on the bottom of the enclosure.

8. Refer to “Operations” in Section 10.2 to verify proper operation of the GSOS controller.

9. Close and enclosure door and fasten the four captive screws. **DO NOT OVER-TIGHTEN THE SCREWS OR THE CORNER OF THE ENCLOSURE DOOR WILL CRACK!**

10.3.3 Barometric Pressure Sensor Replacement

1. Disconnect the Power & Communications Interface Cable from the bottom of the GSOS Payload enclosure.

2. Unscrew the four captive fasteners on the enclosure door. The door is hinged on the left side of the enclosure.

3. Unplug the barometer's 6-pin *Molex* connector from the panel to the left of the card cage.

4. Cut the nylon cable tie securing the pressure hose at the barometer input port. Disconnect the hose from the barbed fitting.

5. Slide the barometer assembly from the card cage.

6. Slide the replacement barometer assembly into the card cage.

7. Connect the barometer's 6-pin Molex connector to panel to the left of the card cage.

8. Connect the pressure hose to the barbed fitting the barometer. Secure the hose to the fitting with the supplied cable tie.

9. Connect the Power & Communications Interface Cable on the bottom of the enclosure.

10. Refer to "Operations" in Section 10.2 to verify proper operation of the GSOS controller.

11. Close and enclosure door and fasten the four captive screws. **DO NOT OVER-TIGHTEN THE SCREWS OR THE CORNER OF THE ENCLOSURE DOOR WILL CRACK!**

10.3.4 Temperature/RH Sensor Replacement

1. Disconnect the Power & Communications Interface Cable from the bottom of the GSOS Payload enclosure.

2. Unscrew the four captive fasteners on the enclosure door. The door is hinged on the left side of the enclosure.

3. Unplug the T/RH sensors's 9-pin *Molex* connector from the panel to the left of the card cage.

4. Remove the cotter pin from the fold-down arm and lower the arm counter-clockwise (see Figure 10-24).

Figure 10-24 Lower Fold-Down Arm

5. Loosen the thumb screw at the top of the arm and remove the sensor mounting assembly (1" gray PVC tube) from the arm (see Figure 10-25).

6. Unscrew the allen-head setscrew holding the T/RH Probe inside the PVC tube and remove the probe from the tube.

7. At the base of the fold-down arm, pull the T/RH cable out of the arm, while feeding the probe through the slot at the top on the arm.

8. Unscrew the compression nut from the stuffing tube where the T/RH cable enters the GSOS enclosure (see Figure 10-26).

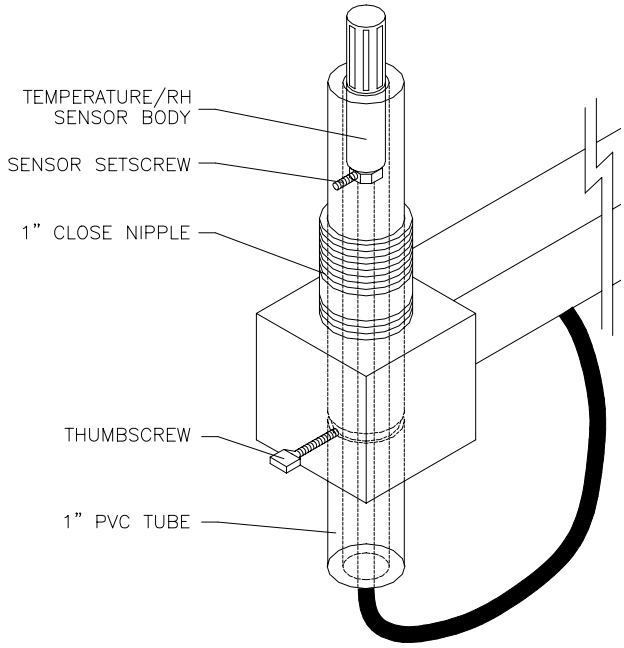

Figure 10-25 T/RH Sensor Removal

9. Feed in the T/RH cable into the GSOS enclosure through the stuffing tube and coil the sensor cable.

10. Slide the T/RH sensor assembly from the card cage.

11. Slide the replacement T/RH sensor assembly into the card cage.

12. Connect the sensor's 9-pin Molex connector to panel to the left of the card cage.

13. Feed the T/RH sensor though the stuffing tube (and its washers and grommet) as shown in Figure 10-26. The T/RH probe body is too large to fit through the stuffing tube washers and grommet. Make diagonal cuts in the washers and grommet with diagonal cutters or a utility knife.

14. Feed the pull-cord (provided with the payload) from the slot at the top of fold-down arm, though the arm towards the base.

15. Remove the yellow protective cover from the T/RH sensor and attach the pull-cord to the T/RH sensor with electrical tape.

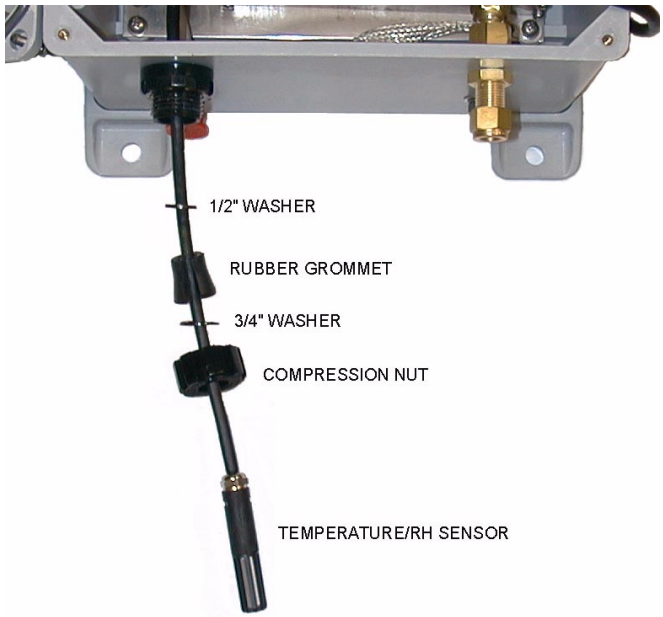

Figure 10-26 Payload Stuffing Tube

16. Feed the T/RH Sensor through the fold-down arm with your right hand, while pulling the pull-cord with your left hand. Pull enough cable through the arm to form an adequate drip-loop in the sensor cable.

17. As shown in Figure 10-25, position the T/RH probe inside the mounting assembly such that the metallic base of the probe body aligns with the sensor setscrew (a port hole drilled in the PVC tube opposite the setscrew provides the means to visually align the probe in the PVC tube). Tighten the setscrew to secure the sensor.

18. Insert the PVC tube into the aluminum housing until the scribe line on the PVC tube is flush with the aluminum housing. (This ensures the thumb screw will properly seat in the groove milled in the PVC tube.) Tighten the thumb screw to secure the PVC tube in position.

19. Gather the excess T/RH sensor cable and coil it in the bottom of the GSOS enclosure.

20. Rise the Fold-Down arm and install the cotter pin to secure the arm in the vertical position.

21. Adjust the length of the T/RH sensor cable to allow the Fold-Down Arm to be lowered or raised without stressing the T/RH cable. Tighten the stuffing tube compression nut.

22. Connect the Power & Communications Interface Cable on the bottom of the enclosure.

23. Refer to “Operations” in Section 10.2 to verify proper operation of the GSOS controller and T/RH sensor.

24. Close and enclosure door and fasten the four captive screws. **DO NOT OVER-TIGHTEN THE SCREWS OR THE CORNER OF THE ENCLOSURE DOOR WILL CRACK!**

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