Interface Control Document

For: Shelter (SHL)

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Change Record

Version	Date	Affected Section(s)	Reason/Initiation/Remarks
A	2009-3-26	All	Initial Draft
B	2009-4-10	4.6.3	MCS Common ICD v 1.0 format in examples
C	2009-7-8	4.6.1.2	MIB labels for changed to unique
D	2012-11-1	3.3.1, 4.1.3, 4.1.4, 4.6.1.4, 4.6.2.1 4.6.1.2 4.6.2.2, 4.6.2.3, 4.6.2.4	Specified fiber connection count and type. Updated the number of racks in various places. Added new MIB entries for monitoring the PDUs and UPSs. Added comments that TMP and DIF do nothing. Added MIB entries for the weather station parameters.
E	2014-5-29	4.6.1.5	Added MIB entries for lightning monitoring

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1 DESCRIPTION

1.1 Purpose

The purpose of this document is to define the Station Monitor and Control, Level-1 interface between the Shelter Monitor & Control (SHL-MCS). The SHL described here contains the SHL Power Conditioning & Distribution (SHL-PCD) and the SHL Environmental Control System (SHL-ECS).

1.2 Scope

The document contains a list of monitor points and commands for the SHL subsystem.

1.3 Related Documents and Drawings

MCS Common ICD [1]
PCD Common Interfaces [2]
LWA Shelter Specifications [3]

All EMs, LWA Memos, schematics, module drawings, wiring diagrams, other ICDs; in the SHL section of LWA Engineering Memos.

1.4 Applicable Documents and Drawings

LWA Station Architecture [4]
LWA Station Shelter, Packaged Configuration Drawings and Specifications [5]
LWA Technical Requirements [6]

1.5 Order of precedence

In the event of conflict between the text of this document and applicable documents, the applicable documents shall take precedence unless explicitly mentioned in this document.

2 ABBREVIATIONS AND ACRONYMS

See [4]

2.1 Glossary

See [4]

3 PHYSICAL SYSTEM INTERFACES

3.1 Mechanical Interface

See [3]

3.2 Electrical Power Interface

The SHL is powered from a single 220 - 240 VAC Main line directly from the station's 50 kVA transformer's metering and power distribution utility box.

3.3 Electronic Interface

3.3.1 List of Connectors

Table 1: List of Connectors

Subsystem	Signals	No. of connectors	Type of connector
ASP, DP, MCS, TCD, DAC, ABE	120 VAC or 240 VAC	8	TBD
MCS	Monitor/Control	1	RJ-45
SHL-PCD	Networked Power Monitor & Control	6	RJ-45
SHL	Main-Line AC Power	1	TBD
SHL	Fiber Termination	4	FC
SEP	RF signal from antennas	520+	N-type

4 SOFTWARE/CONTROL FUNCTION INTERFACE

4.1 Overview

The SHL-MCS computer consists of a single software controllable component.

4.1.1 MCS Interface

The SHL Monitor/Control interface accepts a CAT-7 cable from the Station MCS and fully controllable through the MCS Common ICD defined in [1].

4.1.2 Power Conditioning & Distribution (SHL-PCD)

The SHL-PCD provides power to individual subsystems and monitors the power status. A single networked Remote Power Management (RPM) unit is installed in each of 8 shelter racks. The SHL-PCD provides remote access for each of the switchable power ports.

4.1.3 Environmental Control System (ECS)

The shelter's ECS (or HVAC) sets the internal temperature and controls heat exchange for all the shelter electronics.

4.1.4 Weather Station (SHL-WX)

The shelter's weather station monitors outside conditions.

4.1.5 Lightning Monitor (SHL-LIGHTNING)

The shelter's electric field mill monitors lightning in the vicinity of the station.

4.2 Software/Control Function

See Sections 4.4 and 4.5.

4.3 Monitor & Control Functions

See Sections 4.4 and 4.5

4.4 Summary of Monitor Points

Table 2: Summary of Monitor Points

MIB Label	MIB Index	Section
MCS-RESERVED	1	4.6.1.1
SHL-POWER	2	4.6.1.2
SHL-ECS	3	4.6.1.3
SHL-WX	4	4.6.1.4

4.5 Summary of Commands

Table 3: Summary of Commands

Message Type	Description	Section
INI	SHL Initialization	4.6.2.1
TMP	Thermostat Set-point	4.6.2.2
DIF	Thermostat Differential	4.6.2.3
PWR	Power Port Control	4.6.2.4

4.6 Other Software

None.

4.6.1 Monitor Points in Detail

Monitor data shall be polled by the MCS system according to the protocol specified in the MCS Common ICD, using the MIB structure described in MCS Common ICD, section 3 [1].

4.6.1.1 MCS-RESERVED

SHL MIB Index 1 provides the MCS-required MIB entries as specified in [1].

Table 4: List of MCS Related MIB Entries

Index	Label	Data	Format
1	MCS-RESERVED		
1.1	SUMMARY	Defined in [1]	[7 bytes, ASCII]
1.2	INFO	Defined in [1]	[256 bytes, ASCII]
1.3	LASTLOG	Log items specified in [7]	[256 bytes, ASCII]
1.4	SUBSYSTEM	Value always “SHL”	[3 bytes, ASCII]
1.4	SERIALNO	Serial number of SHL-MCS computer	[5 bytes, ASCII]
1.5	VERSION	Software version of SHL-MCS	[256 bytes, ASCII]
1.X ($X \geq 6$)	reserved	TBD	TBD

4.6.1.2 SHL-POWER

SHL MIB Index 2 provides information about the SHL Power. The assignments between power ports in each rack and the devices connector to corresponding ports is constantly updating and is documented in [8].

Table 5: List of Power Related MIB Entries

Index	Label	Data	Format
2	SHL-POWER		
2.1	PWR-RACK-1		
2.1.1	PORTS-AVAILABLE-R1	This is number of ports available on the power distribution unit in rack 1. Values will be between 0 and 50. If this data field is 0, rack 1 is not currently installed and there will be no information for 2.1.2 (below).	[2 bytes, base-10 integer]
2.1.2	PORT-STATUS-R1		
2.1.2.1	PWR-R1-1	Values are “ON ” or “OFF” (note the space character used for ON). This indicates if the power for port 1 is on or off.	[3 bytes, ASCII]
...	...	...	
2.1.2.X	PWR-R1-X	X is the number returned from MIB index 2.1.1 Values are “ON ” or “OFF” (note the space character used for ON). This indicates if the power for port X is on or off.	[3 bytes, ASCII]
2.1.3	CURRENT-R1	This is the total current drawn from all available ports in rack 1. Value is in Amps.	[10 bytes, ASCII, base-10, decimal point allowed]
2.1.4	VOLTAGE-R1	This is the input line voltage for rack 1. Value is in volts AC.	[10 bytes, ASCII, base-10, decimal point allowed]
2.1.5	FREQUENCY-R1	This is the input line frequency for rack 1. Value is in hertz.	[10 bytes, ASCII, base-10, decimal point allowed]
2.1.6	BATCHARGE-R1	This is the battery charge percentage for the rack 1 if it is connected to a UPS. If rack 1 is not connected to a UPS, reporting this value will result in an error.	[10 bytes, ASCII]
2.1.7	BATSTATUS-R1	This is the battery status for the rack if it is connected to a UPS. If rack 1 is not connected to a UPS, reporting this value will result in an error.	[10 bytes, ASCII]
2.1.8	OUTSOURCE-R1	Power source used to supply the output for rack 1. If rack 1 is not connected to a UPS, reporting this value will result in an error.	[10 bytes, ASCII]
2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8	...	Repeats everything in MIB index 2.1 for racks 2, 3, 4, 5, 6, 7, and 8 of the shelter racks.	...

4.6.1.3 SHL-ECS

SHL MIB Index 3 provides information about the SHL Environmental Control System (ECS). The shelter has a temperature set point and a read-back of the current interior temperature (as read by the shelter thermostat).

Table 6: List of Environmental Control Related MIB Entries

Index	Label	Data	Format
3	SHL-ECS		
3.1	SET-POINT	This is the thermostat set point temperature. Value in degrees F.	[10 bytes, ASCII, base-10, decimal point allowed]
3.2	DIFFERENTIAL	This is the thermostat level of control and consequently the cycle rate. Value is set between 0.5°F and 5.0°F.	[10 bytes, ASCII, base-10, decimal point allowed]
3.3	TEMPERATURE	This is the current temperature, as read by the shelter thermostat. Value in degrees F.	[10 bytes, ASCII, base-10, decimal point allowed]

4.6.1.4 SHL-WX

SHL MIB Index 4 provides information about the SHL weather station and the current weather conditions.

Table 7: List of Weather Station Related MIB Entries

Index	**Label**	**Data**	**Format**
4	SHL-WX		
4.1	WX-UPDATE	Time of last weather update in UTC.	[20 bytes, ASCII]
4.2	WX-TEMPERATURE	Outside temperature in degrees F.	[10 bytes, ASCII, base-10, decimal point allowed]
4.3	WX-HUMIDITY	Outside relativity humidity as a percentage.	[10 bytes, ASCII, base-10, decimal point allowed]
4.4	WX-PRESSURE	Barometric pressure in inches of mercury.	[10 bytes, ASCII, base-10, decimal point allowed]
4.5	WX-WIND	Wind speed in mph and direction.	[25 bytes, ASCII]
4.6	WX-GUST	Wind gust speed in mph and direction.	[25 bytes, ASCII]
4.7	WX-RAINFALL		
4.7.1	WX-RAINFALL-RATE	Current rainfall rate in inches per hour.	[10 bytes, ASCII, base-10, decimal point allowed]

4.7.2	WX-RAINFALL-TOTAL	Total rainfall fo the past 24 hours in inches. The value resets at local midnight.	[10 bytes, ASCII, base-10, decimal point allowed]

4.6.1.5 SHL-LIGHTNING

SHL MIB Index 5 provides information about the SHL lightning monitor and the current number of nearby lightning strikes.

Table 8: List of Weather Station Related MIB Entries

Index	Label	Data	Format
5	SHL-LIGHTNING		
5.1	LIGHTNING-RADIUS	Radius in km to monitor for lightning strikes.	[10 bytes, ASCII]
5.2	LIGHTNING-10MIN	Number of lightning strikes within the detection radius recorded in the last 10 minutes.	[10 bytes, ASCII, base-10]
5.3	LIGHTNING-30MIN	Number of lightning strikes within the detection radius recorded in the last 30 minutes.	[10 bytes, ASCII, base-10]

4.6.2 Commands in Detail

Control of the SHL is accomplished using the Message Type format described in the MCS Common ICD, section 5 [1].

4.6.2.1 INI - SHL Initialization

"INI" = SHL Initialization. Upon SHL-MCS boot-up, the station MCS must send the INI command before any other command can be sent. The purpose of this message TYPE is to inform the SHL-MCS of the set point, and differential of the HVAC system. The INI command also sets the number of installed racks at the site (which corresponds to the available power ports). The data field for this message TYPE is "Set-Point", "Differential", and "Racks Installed" (separated by the "&" character). The first 5 bytes are the shelter's thermostat set point (in degrees F, increments of 0.5°F), this is followed by the "&" ASCII character. The second 3 bytes are the heat/cooling differential set point (values accepted are between 0.5°F and 5.0°F, in 0.5°F increments), and this is also followed by the "&" character. The next 8 bytes correspond to racks 1 thru 8. An ASCII "0" corresponds to "Rack NOT present" and an ASCII "1" corresponds to "Rack Present". The data field for the "Shelter Configuration" message type is 16 bytes, ASCII base-10, decimal point allowed. Example: Data field = 00072&1.0&11100000

corresponds to a thermostat set point of 72°F, a differential of 1.0°F, and racks 1, 2, and 3 installed (racks 4, 5, 6, 7, and 8 are not installed).

4.6.2.2 TMP - Thermostat Set-point

"TMP" = Shelter's Thermostat Set-Point (degrees F). The purpose of this message TYPE is to provide the ability to change the shelter temperature set-point. The data field for this message type is "Temperature". The format is 5 bytes, ASCII base-10, decimal point allowed. Valid temperatures range from 60°F to 110°F in 0.5°F increments. Example: Data field = 00072 corresponds to a thermostat set-point of 72°F.

This command currently has no affect on the shelter's thermostat.

4.6.2.3 DIF - Thermostat Differential

"DIF" = Shelter's Thermostat Differential Set-Point. The purpose of this message TYPE is to provide the ability to change the shelter temperature differential (level of control and consequently the HVAC cycle rate). The data field for this message type is "Differential". The format is 3 bytes, ASCII base-10, decimal point allowed. Valid temperature differentials range from 0.5°F to 5.0°F, in 0.5°F increments. Example: Data field = 1.5 corresponds to a thermostat differential set-point of 1.5°F (heat/cooling will turn on/off when the shelter's temperature is +/- 1.5°F from the thermostat set-point).

This command currently has no affect on the shelter's thermostat.

4.6.2.4 PWR - Power Port Control

"PWR" = Power Port Control. The purpose of this message TYPE is to provide the ability to turn on and off each power port in each electronics rack. The data field for this message type is "Rack", "Port", and "Control". The format is 6 bytes, ASCII base-10 integer. Valid ranges "Rack" are integers 1 thru 8. Valid ranges for Port are defined by MIB entries 2.1.1, 2.2.1, 2.3.1, 2.4.1, 2.5.1, and 2.6.1 for the 6 racks. Valid ranges for "Control" are "ON " or "OFF" (note the space character used for "ON "). Example: Data field = 204OFF corresponds to rack number 2, port number 4, turn off.

4.6.3 Command/Response Examples

Example 1 - Report Temperature (see [1] for format description)

MCS sends the RPT command to SHL:
SHLMCSRPT”””1391”11’54828’12345678’TEMPERATURE

DESTINATION is the SHL subsystem.
SENDER is MCS
TYPE = “RPT”
REFERENCE = 1391
DATALEN = 11 bytes.
MJD = 54828, so Dec 28, 2008 UT.
MPM = 12345678, about 3.4 hours past UT midnight.
Mandatory space following the MPM field.
TEMPERATURE is the data field corresponding to MIB index 3.3

In response, SHL sends the message:
MCSSHLRPT”””1391”10’54828’12345698’A’NORMAL”””71.5

DESTINATION is the MCS subsystem.
SENDER is SHL
TYPE = “RPT”
REFERENCE = 1391
DATALEN = 10 bytes (per MIB 3.3 data format).
MJD = 54828, so Dec 28, 2008 UT.
MPM = 12345698, so SHL sent the response 20 ms after MCS sent the command.
Mandatory space following the MPM field.
R-Response & R-SUMMARY are ‘Accepted’ & ‘Normal Operation’
The DATA field contain the 10-byte ASCII decimal point numeric “71.5” indicating an thermostat current shelter temperature reading of 71.5°F.

5 SAFETY INTERFACE

The SHL mandates monitoring MIB entry 3.3 (SHL-ECS TEMPERATURE) at an access rate of at least once every 10 minutes. The MCS system should be capable of shutting down all the station electronics if this temperature falls above or below the safe operating temperature (currently TBD).

6 REFERENCES

[1] S. Ellingson, "MCS Common ICD, Ver. 1.0," LWA Engineering Memo MCS0005, April 4, 2009. http://panda.unm.edu/lwa/engineering.

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[4] J. Craig, "Long Wavelength Array Station Architecture Ver. 2.0," LWA Memo 119, Feb 26, 2009. http://www.ece.vt.edu/swe/lwa/

[5] J. Copeland, *et. al.*, "LWA Station Shelter, Packaged Configuration Drawings and Specifications," LWA Engineering Memo SHL0026, Sept. 29, 2008. http://panda.unm.edu/lwa/engineering/

[6] C. Janes, "The Long Wavelength Array System Technical Requirements," LWA Memo 118, Nov 19, 2007. http://www.ece.vt.edu/swe/lwa/

[7] J. Craig, "Shelter LOG Item Definitions, Version 0.1," LWA Engineering Memo SHL0034, March 9, 2009. http://panda.unm.edu/lwa/engineering.