

**TO:** LFEV-ESCM Team  
**FROM:** Naing Minn Htet  
**DATE:** 23 March 2014  
**SUBJECT:** Communication Interface Protocol for Central SCADA

**ABSTRACT:**

This memo describes the Communication Interface Protocol used for communication between the Pack Manager(PM) board and Central SCADA. Central SCADA connects to the PM board using serial communication.

**COMMUNICATION PROTOCOL**

1. Data format

Serial data format is 8 bit, one start bit and one stop bit with no parity bit.

2. End of Message

The end of message is the End Of Transmission Character (ASCII 4 or Ctrl+D in RealTerm).

3. Acknowledge

The transmitter of the message should receive an “OK” message from the recipient of the message. If an error is detected, the recipient will return an error message instead.

4. Protocol

The messages will be transmitted and received in ASCII for human readability. Central SCADA will act as the master and the PM board, the slave. This means that the PM board should only transmits message if the request from Central SCADA is addressed to it.

1) The first part of the message will be the pack number. For Central SCADA, this will be the pack number that the message is addressed to and for the PM board, this will be its own pack number.

2) The second part of the message will be the command. In an acknowledgement message, this will be either “OK” or one of the error messages.

3) The third part of the message is the argument of the command. This may be omitted if the command does not require argument. For the response message from PM board, this will be the response to the command. If there is more than one response, all the responses will be listed with 'Spaces' between them.

4) The parts of the message will be separated by Space characters (ASCII 32).

An example message -

CENTRAL SCADA

PM BOARD

**1 V? 1**

(Pack number + space + command + space + argument)

This is a command to pack 1 asking for voltage of cell number 1.

**1 OK**

(Pack number + ACK)

This is an ACK to the command.

**1 ??**

(Pack number + response)

The response is the voltage of cell number 1. Please note that while the returned response is 'double', it will be displayed in ASCII and thus, not human readable.

**1 OK**

(Pack number + ACK)

This is an ACK by the Central SCADA to the response by PM Board.

## 5. Command List

Command	Description
V? n	Gets the cell voltage of 'n' cell. If 'n' is omitted, all cell voltages will be returned in the order of increasing cell numbers.
T? n	Gets the cell temperature of 'n' cell. If 'n' is omitted, all cell temperatures will be returned in the order of increasing cell numbers.
XT? n	Gets the temperature from external sensor 'n'. If 'n' is omitted all external sensor readings will be returned in order of increasing sensor numbers
C?	Gets the current in the discharge path of the battery pack
BPSS? n	Gets the bypass resistor switch state of 'n' cell. If 'n' is omitted, all bypass

	resistor switch states will be returned in the order of increasing cell numbers.
ADDR?	Gets the PM board address.
CELLCNT?	List the addresses of I2C devices connected to it.
TEST?	Returns '42'. (Test Command)
BPST? n	Gets the bypass time in minutes of 'n' cell. If 'n' is omitted, all times will be returned in the order of increasing cell numbers.
SAFETY?	Gets the current state of the safety loop relay on the pack manager
SOC?	Gets the current state of charge of the battery pack
<b>Test Commands</b>	
TESTMODE n	Turns test mode on/off. 0 - Test mode off 1 - Test mode on
TWD n	Turns the watchdog timer's input on/off. This command is only available in test mode. If 'n' is omitted, WD input will be turned on by default 0 - Watchdog input off 1 - Watchdog input on
TOB n	Fakes an out-of-bounds sensor reading for test purposes. This command is only available in test mode. If 'n' is omitted, defaults to 0 (use normal readings) 0 - Use normal sensor readings 1 - Emulate out-of-bound sensor reading
TLVT n	Turns the low voltage threshold alarm on/off. This command is only available in test mode. If 'n' is omitted, defaults to 1 (Low voltage threshold on) 0 - Low Voltage threshold alarm off 1 - Low Voltage threshold alarm on

Note : More commands will be added as necessary.

## 6. Error Message List

Error	Description
EBADFRMT	The format of the message is wrong or unknown. Usually happens when the message has missing spaces.
EBADCMD	The command is illegal or unknown.

EBADARG	The argument is in a bad format or missing.
ENOCCELL	The specified cell is not connected or found. Checks with CELLCNT? command.
EERROR	This should not happen. This error message is returned when an unexpected error occurs within the PM board. This is the default error message if the none of the errors fits in the above categories. Checks the log file of PM board for more information.

Note: Central SCADA should always return “OK” even if the response from the PM board is different from what is expected.

Example Error Message:

CENTRAL SCADA

PM BOARD

**1 V? abcd**

**1 EBADARG**