

## **MONITORING EXPANSION FOR USE WITH THE SAGEON PSMC I**

**PRODUCT MANUAL FOR  
103-3000-XX +24/-48 Vdc Model**

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C&D Technologies, Inc.  
Integrated Power Systems,  
Power Systems Division  
65 Industrial Park Road, Dunlap, TN 37327  
Customer Service, Voice: (800) 440-3504  
Customer Service, Fax: (423) 949-3647  
Field Service: (800) 299-3907  
Web site – <http://www.cdtechno.com>



## **RECEIVING INSTRUCTIONS & GENERAL EQUIPMENT INFORMATION**

*Please Note: For your protection, the following information and the product manual should be read and thoroughly understood before unpacking, installing, or using the equipment.*

C&D Technologies presents all equipment to the delivering carrier securely packed and in perfect condition. Upon acceptance of the package from us, the delivering carrier assumed responsibility for its safe arrival to you. Once you receive the equipment, it is your responsibility to document any damage the carrier may have inflicted, and to file your claim promptly and accurately.

### **1. PACKAGE INSPECTION**

- 1.1** Examine the shipping crate or carton for any visible damage: punctures, dents, and any other signs of possible internal damage.
- 1.2** Describe any damage or shortage on the receiving documents, and have the carrier sign their full name.
- 1.3** If your receiving freight bill notes that a Tip-N-Tell is attached to your freight, locate it. If the Tip-N-Tell arrow has turned even partially blue, this means the freight has been tipped in transport. Make sure the carrier notes this on your receipt before you sign for the freight.

### **2. EQUIPMENT INSPECTION**

- 2.1** Within fifteen days, open the crate and inspect the contents for damages. While unpacking, be careful not to discard any equipment, parts, or manuals. If any damage is detected, call the delivering carrier to determine appropriate action. They may require an inspection.

**\*SAVE ALL SHIPPING MATERIAL FOR THE INSPECTOR TO SEE!**

- 2.2** After the inspection has been made, call C&D Technologies. We will determine if the equipment should be returned to our plant for repair, or if some other method would be more expeditious. If it is determined that the equipment should be returned to C&D Technologies, ask the delivering carrier to send the packages back to C&D Technologies at the delivering carrier's expense.
- 2.3** If repair is necessary, we will invoice you for the repair so that you may submit the bill to the delivering carrier with your claim form.

It is your responsibility to file a claim with the delivering carrier. Failure to properly file a claim for shipping damages may void warranty service for any physical damages later reported for repair.

**3. HANDLING**

Equipment can be universally heavy or top-heavy. Use adequate human-power or equipment for handling. Until the equipment is securely mounted, be careful to prevent the equipment from being accidentally tipped over.

**4. NAMEPLATE**

Each piece of C&D Technologies' equipment is identified by a part number on the nameplate. Please refer to this number in all correspondence with C&D Technologies.

**5. INITIAL SETTINGS**

All equipment is shipped from our production area *fully checked and adjusted*. Do not make any adjustments until you have referred to the technical reference or product manual.

**6. SPARE PARTS**

To minimize downtime during installation or operation, it is suggested that spare fuses, circuit boards and other recommended components be purchased as listed on the Recommended Spare Parts List in the back of the product manual. If nothing else, it is strongly recommend that spare fuses be stocked for all systems.

## Issue History

ISSUE	PAGE (S) ALTERED	DESCRIPTION OF CHANGE	APPR'D /DATE
A	--	Preliminary issue	CJM 04/15/09
1	ALL	See ECN 16849. Initial Release. CJM 6/3/09	DBW 6/3/09

## DOCUMENT SUMMARY

This document explains the installation, operational, maintenance and troubleshooting methods for the C&D Technologies SAGEON PSMC I MONITORING EXPANSION.

## LEGAL DISCLAIMERS

C&D Technologies, Inc. believes that all information contained in this manual is accurate and reliable. However, this information does not constitute any guarantee or warranty by C&D Technologies, nor does it make C&D Technologies responsible for any damage that might occur during the installation, use, or maintenance of the equipment described in this manual.

C&D Technologies, Inc. also does not guarantee that the suggested equipment uses given in this manual do not infringe upon any existing or pending patents.

Installers, users, and maintainers of this equipment should not assume that all possible safety measures that could be taken with this equipment are mentioned in this manual. Where unusual environmental conditions or circumstances dictate otherwise, said personnel should not assume that no other precautionary measures may be required for the safe installation, use, and maintenance of this equipment.

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## TABLE OF ABBREVIATIONS

ABBREVIATION, ACRONYM OR SYMBOL	MEANING
ANSI	American National Standards Institute
AWG	American wire gauge
BTU	British thermal unit
CEV	controlled environment vault
CM	circular mils
CEMF	Counter Electro-motive Force
DIP	dual in-line package
EMI	electromagnetic interference
ESD	electrostatic discharge
EXP.	PSMC Monitoring Expansion unit
FA	fuse and/or breaker alarm
FS	full-scale (reading)
FSO	female slip-on (lug)
HVA	high voltage alarm
HVSD	high voltage shutdown
IEC	International Electrical Commission
IEEE	Institute of Electrical and Electronic Engineers
LED	light emitting diode
LSD	least significant digit
LVA	low voltage alarm
LVD	low voltage disconnect
PCB	printed circuit board
PDR	power distribution rack
PN	part number (drawing)
PSMC	Power Systems Monitor & Controller
RBOC	Regional Bell Operating Company
RFA	rectifier failure alarm
RU	rack unit
VLVA	very low voltage alarm
Vdc	volts direct current
NEMA	National Electrical Manufacturers Association
NEC	National Electric Code
U	rack unit
UL	Underwriters Laboratory
UBC	Uniform Building Code

## TABLE OF REFERENCES

<b>DOCUMENT NUMBER</b>	<b>TITLE</b>
ANSI C 39.1	Requirements for Electrical Analog Indicating Instruments
ANSI T1.311-1991	DC Power Systems – Telecommunications Environment Protection
ANSI/IEEE C 62.41-1980	IEEE Guide for Surge Voltages in Low-Voltage AC Power Circuits, ANSI
IEC 801-2	IEC Electromagnetic Compatibility for Industrial-Process Measurement and Control Equipment. October 1987
NEC 1993	NEC Handbook 1993, National Fire Protection Association
No Number	OI-28 Standards
No Number	Central Office Telecommunications Equipment Engineering Standards. December 1984
PUB 77350	U S West Telecommunications Equipment Installation & Removal Guidelines. June 1990
PE-7-1985	Communications Type Battery Chargers, NEMA/ANSI
STD 487-1980	IEEE Guide For The Protection of Wire-Line Communications Facilities Serving Electrical Power Stations
TR-EOP-000151	Bellcore Generic Requirements for 24-, 48-, 130-, & 140-Volt Central Office Power Plant Rectifiers. May 1985
TR-NWT-000154	Bellcore Generic Requirements for 24-, 48-, 130-, & 140-Volt Central Office Power Plant Control and Distribution. May 1985
TR-NWT-000063	Bellcore Network Equipment-Building System Generic Equipment Requirements. Issue 4, July 1991
TR-NWT-000078	Bellcore Generic Physical Design Requirements for Telecommunication Products and Equipment



## CHAPTER ONE: INTRODUCTION

- 1.1 General Description
- 1.2 Features
- 1.3 Specifications

### 1.1 GENERAL DESCRIPTION

The SAGEON PSMC I MONITORING EXPANSION is a microprocessor based, single rack space, analog monitoring expansion for use with the SAGEON PSMC I. The MONITORING EXPANSION was designed to increase the analog monitoring capabilities of the SAGEON PSMC I; specifically, to increase the number of shunts that can be monitored. In addition to shunts, the MONITORING EXPANSION can be used to measure string voltages, current transducers, and additional temperature sensors. When used in conjunction with the SAGEON PSMC I, the MONITORING EXPANSION has all of the standard metering and alarm functions for these additional channels, as well as a number of added features, which are outlined below:

The SAGEON PSMC I MONITORING EXPANSION can be used to monitor:

- 50mV or 100mV shunts,
- String voltages up to 60V,
- Current transducers,
- Temperature sensors.

Up to 18 differential inputs (shunts or string voltages), 3 current transducers, and 3 temperature sensors can be measured in a 19" rack, and 24 differential inputs, 4 current transducers, and 4 temperature sensors can be measured in a 23" rack.

Alarming is accomplished using SAGEON PSMC I's output relays; specifically, it has the following alarm and control output relays (all relay contacts rated 60W / 62.5VA) that are used to output alarms from the ANALOG MONITORING EXPANSION:

- Dual Form C contacts for Major and Minor alarms
- Single Form C contacts for the following alarms:
  - High Voltage (HVA)
  - Low Voltage (LVA)
  - Temperature Alarm (TEMP)
  - Auxiliary relay (AUX) (user defined)
- Front panel LED's that visually indicate alarm & control status
- Built-in audible alarm

### 1.2 FEATURES

- Compact single rack space design,
- Simple, single-cable, serial connection to the SAGEON PSMC I facilitates easy installation,
- All menus and display is automatically integrated on the SAGEON PSMC I's display upon connection,
- Screw terminals for easy connection of users' inputs,

- RS-232 serial output of MONITORING EXPANSION measurements, SAGEON PSMC I measurements and alarm status can be viewed using any standard terminal program (Hyper-Terminal©, Tera-Term©, etc.).

### 1.3 SPECIFICATIONS

#### 1.3.1 Physical Specifications

**Width:** 19" or 23" (103-3000-19A or 103-3000-23A, respectively)  
**Height:** 1.75" (1U or 1RU)  
**Depth:** 9.0"  
**Weight:** 10.0 lbs.

#### 1.3.2 Environmental Specifications

<b>Operating temperature</b>	0°C to +50°C (+32°F to +122°F)
<b>Storage temperature</b>	-40°C to +85°C (-40°F to +185°F)
<b>Shipping and handling</b>	Shipped in a padded box when ordered as a separate item, or installed in rack and pre-wired to the plant when ordered as part of a custom power plant
<b>Humidity</b>	0 to 95 %, non-condensing
<b>Altitude</b>	10,000 feet (3,048 meters)
<b>Heat dissipation</b>	~150 BTU/hour maximum
<b>Cooling</b>	Natural convection
<b>Seismic</b>	UBC seismic zone 4 (Calculated response)

#### 1.3.3 Electrical Specifications

Power/Supply

**Input:** +24 Vdc @ 400 mA (worst case)

-48 Vdc @ 200 mA (worst case)

**Maximum Supply Voltage:** 60 Vdc

**Minimum Supply Voltage:** 20 Vdc

INPUT NAME	MIN.	NOMINAL	MAX.	UNITS
VOLTAGE	0.00	52.80 (26.40)	60.00	VOLTS
CURRENT (50 mV shunt)	-50	25	50	mV
CURRENT (100 mV shunt)	-100	50	100	mV
CURRENT (Transducer)	-4	-	4	VOLTS
TEMPERATURE	0.000 (0.0°F)	.750 (75.0°F)	2.300 (230.0°F)	VOLTS

**Table 1: Analog input ranges**

1.3.4 General Plant Performance Specifications

\* See PN Drawings and Menu Flow Charts, located in the back of this manual, for electro-mechanical details and user menu information.

Analog measurements will be displayed with the following accuracies and display resolution:

- String voltages are measured within +/-0.5% of FS and a display resolution of 10mV,
- Shunt current readings within +/-0.5% of FS with a 1 amp display resolution,
- Current transducer measurements within +/- 0.5% of FS with a 1 amp display resolution, and
- Temperature readings within +/-0.5% of FS and 0.1 °F display resolution.

**Note:** The accuracies listed are for the measurement capabilities of the MONITORING EXPANSION; system accuracy will be limited by the accuracy and measurement resolution of the device connected to it. i.e. A 1% accurate current transducer will NOT provide 0.5% accurate measurements when connected to the MONITORING EXPANSION.

1.3.5 Alarm Specifications

All alarming is accomplished using the SAGEON PSMC I led display panel and alarm output relays. Any alarm condition on the MONITORING EXPANSION is interpreted by the PSMC I and translated to the appropriate alarm display and relay. The MONITORING EXPANSION provides the following alarm capabilities:

<u>Alarm Name</u>	<u>Alarm Condition</u>
MAJOR ALARM	Any 2 minor alarms or any over-current condition.
MINOR ALARM	Any single alarm condition.
HIGH EXP. VOLTAGE	Any measured high voltage when channel is enabled as a “string voltage”.

LOW EXP. VOLTAGE	Any measured low voltage when channel is enabled as a “string voltage”.
HIGH EXP. CURRENT	Any measured high expansion shunt current (when channel is enabled as a “shunt”) or current transducer reading. Triggers MAJOR alarm.
HIGH EXP. TEMP	Any high expansion temperature sensor.
LOW EXP. TEMP	Any low expansion temperature sensor.

Alarm triggering is controlled by user-configurable “alarm thresholds” that are set via the SAGEON PSMC I front keypad. A listing of default thresholds is provided at the back of this manual. See Chapter 3 for more details on alarming and SAGEON PSMC I and MONITORING EXPANSION operation.

## CHAPTER TWO: MONITORING EXPANSION INSTALLATION

- 2.1 Introduction
- 2.2 Selecting a location
- 2.3 Cabling Requirements
- 2.4 Installation procedure outline
- 2.5 Installation guidelines
- 2.6 Wiring the MONITORING EXPANSION

### 2.1 INTRODUCTION

- 2.1.1 These instructions provide general information for installing the MONITORING EXPANSION in custom applications as a stand alone unit. Units ordered as part of custom power plants will be installed, wired, and tested at the factory. These instructions are meant to be used with the MONITORING EXPANSION product drawings, PN 103-3000-XX. If the appropriate drawings are not included in this manual, contact Customer Support at 1-800-440-3504.
- 2.1.2 If questions or problems arise during installation, please call one of our Field Service technicians at 1-800-299-3907 for assistance. A name plate on the right hand side of the cabinet gives the part number for the MONITORING EXPANSION. Reference this number when requesting service.
- 2.1.3 To install the MONITORING EXPANSION you will need:
  - Standard installation tools
  - Standard small screwdriver for screw terminals (i.e. Xcelite® USA R3322)
  - MONITORING EXPANSION PN drawing set (PN 103-3000-XX)
  - SAGEON PSMC I PN drawing set (PN 103-2999-XX)
  - Power plant schematic diagram (recommended)
  - Connection datasheet for the SAGEON PSMC I
  - Completed connection MONITORING EXPANSION datasheet (in the rear of this manual)
  - Inline fuse and/or resistor kits (sold separately; see Chapter 6 )
  - Cable/wire for input connections (see section 2.3 CABLING REQUIREMENTS)
  - Any current transducer or temperature sensor kits (sold separately; see Chapter 6)
  - Telephone style communications cable (included)
  - Rack mounting hardware
  - Cable termination hardware (spade lugs, ring lugs, FSO lugs, screws, etc.)
  - Manufacturer approved crimping tools for cable lugs to be used
  - Cable management hardware (tie-wraps, cable bundling, etc.)
  - Wire strippers

## 2.2 SELECTING A LOCATION

**Note:** This procedure assumes a custom installation with an accompanying SAGEON PSMC I installation in an existing power plant.

2.2.1 The MONITORING EXPANSION should be mounted within 1 to 2 RU of the SAGEON PSMC I to accommodate the communications connection to the PSMC I. The unit requires only one rack space for mounting. No precautions are necessary for internal cooling. If the unit is to be mounted over high heat producing equipment, such as a ferro-resonant rectifier, a heat shield should be installed between the units.

## 2.3 CABLING REQUIREMENTS

2.3.1 All connections to the SAGEON PSMC I and MONITORING EXPANSION utilize screw terminal connections. Care should be exercised to tighten the screws without breaking the wires. Make sure there is no bare wire showing that could possibly short to other wires. Good electrical contact should be checked for each connection.

2.3.2 Solid 20 - 24 AWG wire is recommended but not required for screw terminal connections. This type of wire is readily available in single twisted pairs, or multiple-conductor jacketed cabling to facilitate the typical wiring associated with this monitor & controller product. If solid conductors are NOT used, then “tinning” the end of the conductor is suggested.

2.3.3 Overall system performance and safety depends on the proper wiring and the installation of inline protection devices where needed. Cable runs that will utilize overhead cable racks should be plenum rated jacketed cables and carefully routed to protect the wiring to the SAGEON PSMC I and MONITORING EXPANSION.

## 2.4 INSTALLATION PROCEDURE OUTLINE

**WARNING:** The MONITORING EXPANSION utilizes connections to battery for power and sensing connections that must include inline protection (fuses or current-limiting resistors) to eliminate potential hazards to personnel and equipment due to accidentally shorted battery connections. Optional inline fuse and inline current limiting resistor kits are available; see PN 103-3000-XX or CHAPTER SIX: SPARING / ACCESSORIES, OPTIONAL PARTS for listing of optional equipment.

### GENERAL PROCEDURE OUTLINE

2.4.1 Verify the part number on the MONITORING EXPANSION before installation. The MONITORING EXPANSION functions with +/-24 Vdc or +/-48 Vdc input power without adjustment. Maximum voltage input is 60 Vdc; minimum is 20 Vdc.

2.4.2 Locate the unit as directed in the “Selecting a Location” section and mount with four standard rack-mount screws; two of the screws must have “paint-cutting” washers installed to assure proper grounding for ESD protection. If “paint-cutting” washers are not used in the installation a separate connection to chassis ground must be provided at on the rear of the unit at the power input terminal block.

- 2.4.3 Locate power source for battery power; be sure to observe polarity. These connections must be fused at the source with inline protection. Ideally, both the battery and ground leads should be protected; the minimum requirement is a fuse in the battery leg. See PN 103-3000-XX drawing for fusing requirements.
- 2.4.4 A list of connections should be created for all the MONITORING EXPANSION wiring before actual wiring begins using the datasheet in the back of this manual. The datasheet will greatly simplify the wiring process and provide a permanent record of the MONITORING EXPANSION wiring. The datasheet should be kept with the similar datasheet filled out for the SAGEON PSMC I.
- 2.4.5 Locate each sense point for voltage and shunts to determine what type of inline protection and cable routing is required. Note connection and protection requirements on datasheet. See PN 103-3000-XX for typical connection types to the MONITORING EXPANSION.
- 2.4.6 If temperature sensors are included in the installation, determine the mounting locations. The temperature sensors should be bolted to a large thermal mass, such as the rack itself or battery midpoint terminals, to limit response to short term changes. Thermal grease is recommended between the lug and sense point. See PN 103-3000-XX for a listing of optional temperature sensor assemblies that can be ordered.

Sensors are designed with lead plated ring lugs to be connected with battery strap hardware. Sensor detection circuits are galvanically isolated from the ring mounting lugs and battery potential. Optional temperature sensor kits come with 30 ft. leads standard and a 3-position screw terminal block plug for easy connection to the MONITORING EXPANSION. Contact the factory for different cable lengths.

Cable runs in excess of 100 ft. may degrade temperature readings due to voltage drops. No inline protection is required for temperature sensors. Determine best cable routing, connection requirements and add this information to the datasheet.

- 2.4.7 If current transducer assemblies are included in the installation, determine mounting locations. If necessary current transducers can be cable tied to the battery cables and left free hanging. It is preferred, however, that the mounting holes be used to permanently mount the current transducer to a sturdy structure, such as the equipment/battery rack.

Be sure to observe the direction of positive current flow as indicated by the arrow on the sensor; failure to do so would indicate an incorrect charge or discharge condition.

See PN 103-3000-XX for a listing of optional current transducer assemblies that can be ordered. Current transducers assembly kits have 8ft. cable length standard and a 5-position screw terminal block plug for easy connection to the MONITORING EXPANSION. Contact the factory for different cable lengths.

## 2.5 INSTALLATION GUIDELINES

The following topics provide guidelines and suggestions to facilitate wiring the MONITORING EXPANSION in a fast and efficient manner, producing a quality installation that looks professional and limits potential problems.

- 2.5.1 Sketch out the wire routing from the MONITORING EXPANSION on paper to determine the best routing that allows the maximum number of wires to be bundled together from the MONITORING EXPANSION to the furthestmost possible connection point. Creating wiring bundles facilitates routing and provides protection to individual

wires.

- 2.5.2 Always use multi-conductor twisted pair or jacketed cables whenever possible; plenum rated cable is preferred. Cabling should be started from the MONITORING EXPANSION, filling in the wire color codes on the datasheet as connections to the MONITORING EXPANSION are made. If same color coded wires must be used repeatedly, use sticky wire labels to uniquely label each wire. This will greatly speed up the wiring process at the destination end and make troubleshooting easier. Be sure to use good routing practices and observe cable bend radius requirements.
- 2.5.3 Familiarize yourself with the screw terminal board layout before starting the wiring process. Refer to the labels located above the input connections and/or PN 103-3000-XX for connection and wiring details. Develop a wiring progression such as power, voltage channels, shunt channels, temperature sensors, current transducers, communications, etc. Do not forget to connect the MONITORING EXPANSION to the SAGEON PSMC I via the provided telephone style cable (4 conductor RJ14 cable). This will help eliminate wiring errors or missed connections.
- 2.5.4 The MONITORING EXPANSION power and sense inputs are protected against reverse polarity; however, the analog inputs are polarity sensitive. Reversed connections will not cause any damage but the MONITORING EXPANSION will be unable to read the input properly or at all. This requirement can be confusing, especially on shunt inputs. Using the power plant SD (schematic) drawing to determine shunt polarities will save time later when troubleshooting analog channels.
- 2.5.5 The MONITORING EXPANSION provides pluggable screw terminal blocks for ease of wiring. Take care to properly insert and seat the terminal blocks after wiring. If front access is required be sure to leave enough cable length (~3-4 ft) to remove the EXPANSION from the rack without disconnecting the terminal blocks.

## 2.6 WIRING THE MONITORING EXPANSION

**Note:** Refer to the datasheet for specific wiring information. Be sure to add wire color references as connections are completed. Should actual wiring require any changes update the datasheet immediately. The PN 103-3000-XX drawing provides general wiring diagrams for the typical MONITORING EXPANSION connections, mechanical views, and fusing information.

At this point, the installer should have a completed datasheet detailing the required connections and a wiring plan that provides the most efficient cable routing. The installer should be familiar with the wiring connections to the SAGEON PSMC I. The PN 103-3000-XX drawings should be available for reference to the actual MONITORING EXPANSION connections in addition to this manual. Availability of a plant schematic diagram is also recommended to facilitate wiring of the MONITORING EXPANSION.

### 2.6.1 Power

Power should be connected to the **BAT+** and **BAT-** terminals of the 3 position screw terminal block header located on the rear of the unit. Be careful to observe polarity of the connections. The SAGEON PSMC I and MONITORING EXPANSION can utilize +/- 24Vdc or +/-48Vdc plant/battery voltage without jumpering or modification. A separate connection to chassis ground must also be provided at this terminal if paint cutting washers are not used to mount the MONITORING EXPANSION in the rack at the time of installation. See the following table and Fig. 1 of the PN drawing for connections to

power the MONITORING EXPANSION:

**Table 2. Power supply connections**

System Voltage	Battery terminal	Connection to Expansion
+24V System	+24V (Battery)	BAT+
	0V (Plant GND)	BAT-
-48V System	-48V (Battery)	BAT-
	0V (Plant GND)	BAT+
-24V System	-24V (Battery)	BAT-
	0V (Plant GND)	BAT+
+48V System	+48V (Battery)	BAT+
	0V (Plant GND)	BAT-

**Note:** See the PN 103-3000-XX drawing Table E for SAGEON PSMC I power fusing requirements.

### 2.6.2 Communications

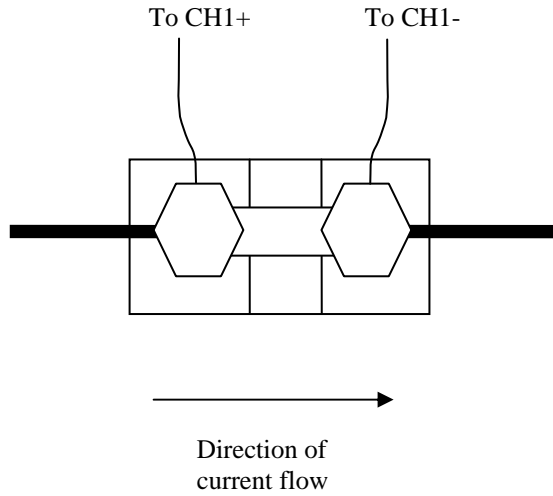
Use the included telephone style cable (1ft. flat 4 conductor cable with RJ-14 connectors) to connect the corresponding communications port labeled “**IOIOI PSMC**” on the MONITORING EXPANSION to the “**DIGITAL COMMS**” port on the SAGEON PSMC I. Refer to PN 103-3000-XX and PN 103-2999-XX for more information on the location of the communications ports.

**Note:** The SAGEON PSMC I should contain firmware version 1.02 in order to communicate with the MONITORING EXPANSION. Verify the software version under the SYSTEM OPTIONS menu. If software version 1.02 is not installed a firmware upgrade will be required; contact field service for further details.

### 2.6.3 Analog Inputs

**Note:** Analog inputs for voltage, shunts, and current transducers should be left open at the measurement (sense) point on the power plant at installation to facilitate calibration zeroing, which requires shorting the leads.

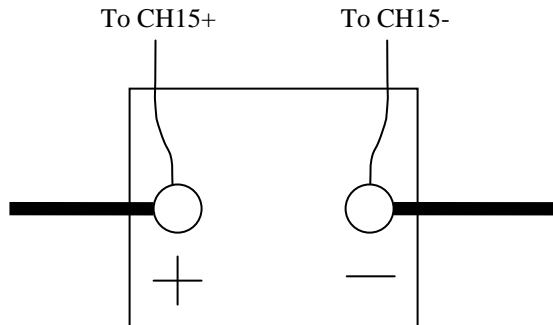
2.6.3.1 Analog Channels (See Figs. 2-5 of PN drawing) may be configured as voltages or shunts. Connect the analog channels to their respective inputs, **CHx+** and **CHx-** (where “x” is the channel number of the input), while observing polarity of the inputs. For example: a 600 amp shunt is connected to CH1 with the side of the shunt that has a lower potential connected to the (-) input of the channel. See figure below:



**Figure 1. Shunt monitoring connections**

**Note:** The standard convention for the direction of current flow is assumed; that is: The flow direction of the current is *OPPOSITE* that of the physical movement of electrons.

If the analog channel is to be connected to a voltage, connect the higher potential to **CHx+** and the lower potential to **CHx-**. For example, it is desired to connect a battery string voltage to CH15. Connect the positive output terminal of the battery string to **CH15+** and the negative output terminal to **CH15-**. See the figure below:



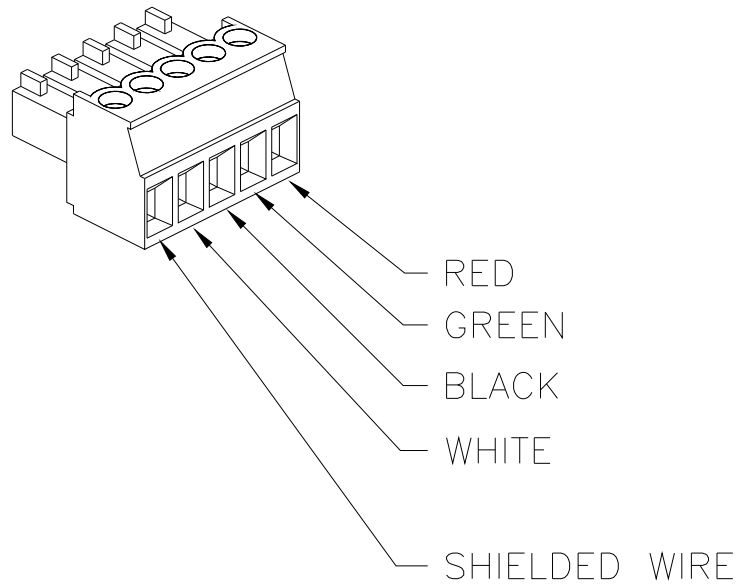
**Figure 2. Battery terminal connections**

2.6.3.2 Connect the current transducers to their respective inputs. Refer to Fig. 7 of the PN drawing for current transducer connections. Each current transducer requires a connection to +15V, -15V, current transducer return, current transducer signal, and a connection for a shield wire is provided.

**Note:** The shield wire should be connected to chassis ground on one side of the cable only. Typically this connection will be provided via the terminal block at the MONITORING EXPANSION.

Current transducers should come preassembled with all appropriate connections to the terminal block provided. The following information is provided for reference only in the event maintenance on the current transducer connections is required. See the PN drawing for available current transducer kits.

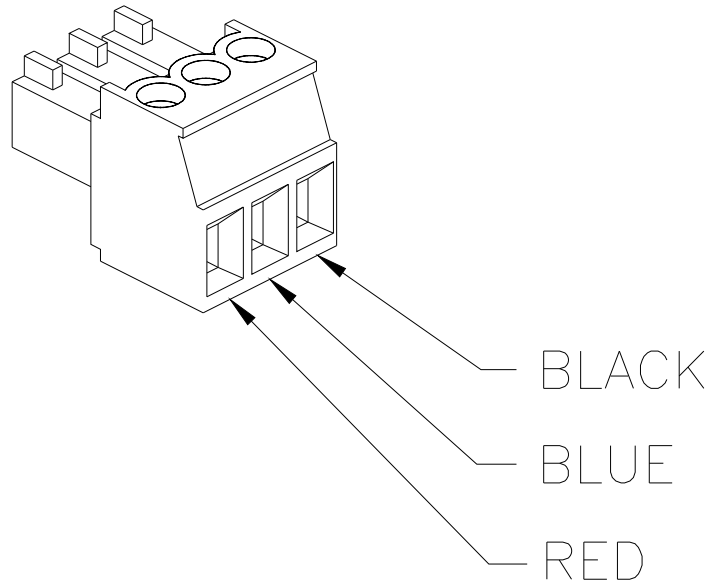
**WARNING:** Improper current transducer connection may damage the sensors. Always verify proper connections, and avoid shorting leads, especially when connecting to a powered MONITORING EXPANSION unit. **The current transducer return lead is isolated, and MUST NOT be connected to PLANT GROUND.**



**Figure 3. Current transducer connector: Red = +15V, Green = Return, Black = -15V, White = Signal**

2.6.3.3 Connect the temperature sensors to their respective inputs. Each sensor requires a connection to power (**P**), temperature return (**R**), and temperature signal input (**S**). These connections correspond to the red, black, and blue leads (respectively) of the temperature sensors. If the temperature sensor wires have been extended refer to the datasheet for proper connections. (See Fig. 6 of PN drawing)

**WARNING:** Improper temperature sensor connection may damage the sensors. Always verify proper connections, and avoid shorting leads, especially when connecting to a powered MONITORING EXPANSION unit. **The temperature sensor return lead (RTN) is isolated, and MUST NOT be connected to PLANT GROUND.**



**Figure 4. Temperature sensor connector: Red = +5V, Blue = Signal, Black = Return**

This completes the analog input connections. Stop and verify these connections and update the datasheet if necessary. Go to the Analog Channel Calibration section next to continue with commissioning of the MONITORING EXPANSION.

## CHAPTER THREE: MONITORING EXPANSION OPERATION

- 3.1 Introduction
- 3.2 Programming the MONITORING EXPANSION via the SAGEON PSMC I
- 3.3 Enabling Thresholds
- 3.4 Set Thresholds
- 3.5 Enabling Channels
- 3.6 Analog Calibration
- 3.7 Set Shunt Scales
- 3.8 System Options Menu

### 3.1 INTRODUCTION

#### 3.1.1 General Description

The MONITORING EXPANSION was designed to work in conjunction with the SAGEON PSMC I to increase the number of analog inputs that can be metered and alarmed in an extremely compact, single rack space unit. The unit utilizes the alphanumeric display and keypad of the SAGEON PSMC I to seamlessly provide increased and familiar functionality. The simple four-key front panel of the SAGEON PSMC I allows for the following:

- Polling for status on each input,
- Detailed alarm identification,
- Enabling/disabling of inputs and outputs,
- Zero and Gain calibration for each analog channel,
- System configuration including alarm thresholds,
- Test and verification of all functions.

MONITORING EXPANSION menus will automatically be integrated into the default SAGEON PSMC I menus (underneath the appropriate menu tree) upon a successful connection to the PSMC I. The SAGEON PSMC I utilizes simple intuitive menu structures to access any function. Four keys, “**Select**”, “**Next**”, “**Previous**”, and “**Escape**” allow the user to move up or down through the menus or change values with ease. The “**Escape**” key always allows the user to easily return to the last menu or all the way back to the default idle screen. References to key presses and/or menus will be highlighted in bold print.

On the +24/-48v unit, the user selects the operation voltage in software after which the SAGEON PSMC I and MONITORING EXPANSION automatically default to the proper alarm thresholds. No jumpers or switch settings are required to accommodate voltage changes. The SAGEON PSMC I and MONITORING EXPANSION are by default 48V. The lower right hand corner of the LCD at the start up screen will display the present voltage configuration of the unit. The present voltage configuration can also be viewed under the system options menu.

The SAGEON PSMC I will automatically time-out and default to the idle screen from any sub-menu within 5 minutes. The default idle screen always displays plant voltage ( $V_b$ ) and number of alarms.

LED indicators on the front of the MONITORING EXPANSION provide a quick indication of communications status and power. With a “good” connection to the SAGEON PSMC I the ‘STATUS’ LED on the MONITORING EXPANSION will remain green. If communications with the PSMC I is lost for more than 5 seconds the “status” LED on the MONITORING EXPANSION will turn red. The ‘PWR’ LED should remain green when power is applied to the MONITORING EXPANSION.

**Note:** Test jacks on the front of the SAGEON PSMC I do not provide access to the signals measured on the MONITORING EXPANSION.

Measurements for calibration of the MONITORING EXPANSION should be taken at the sense point of the analog input channel. Measuring at the sense point should remove any errors due to voltage drops along the cables.

The SAGEON PSMC I and MONITORING EXPANSION’s functionality is menu driven. Menu flowcharts are provided in the back of this manual to help the user find a particular function. There are three main menus below the default idle display screen that apply to the MONITORING EXPANSION: **Status**, **Alarms**, and **Configure**. Other menus strictly apply to the functionality of the SAGEON PSMC I and the user is encouraged to review the user manual of the PSMC I for detailed descriptions of its functionality. The operation section of the manual will first explain the menu structure of the SAGEON PSMC I and additional menus added by the connection of the MONITORING EXPANSION. Then each function block will be discussed in a logical order such as, enabling channels, calibration, setting thresholds, etc.

### 3.1.2 MONITORING EXPANSION Menu Structure

**Note:** Referring to the menu flowcharts in the back of the manual provides a visual representation of the material in this section.

As described in the introduction, the SAGEON PSMC I divides the functional modes of the MONITORING EXPANSION unit into three of the five main menus of the SAGEON PSMC I:

1. Status:           Polling analog channels
2. Alarms:           Detailed alarm information
3. Configure:       System custom set-up and calibration

**Note:** A complete description of the menus as they apply to the SAGEON PSMC I can be found in its own user manual; descriptions of menus discussed here will specifically pertain to the additional menus added upon connection of a MONITORING EXPANSION unit.

- Status:** The Status menu only displays the current status of the analog channels. There are no sub-menus for other tasks under this main menu.
- Alarm:** The UP/DOWN keys can be used to scroll through the active alarms. There are no other sub-menus under this main menu. (The audible alarm can be disabled in the Configure/System Options menu.)
- Configure:** The Configuration menu provides sub-menus organized for functionality in custom configuring the MONITORING EXPANSION for the user's application. It also provides menus for calibrating analog input channels, setting alarm thresholds, and system options.

**Note:** If the SAGEON PSMC I has been already been commissioned, testing output relays and alarm conditions of the MONITORING EXPANSION will initiate nuisance alarm conditions.

### 3.1.3 Accessing the Menus

The SAGEON PSMC I always defaults to the idle display screen if no key presses occur within 5 minutes from any menu. This prevents the user from inadvertently leaving the unit in a sub-menu where operation could be impaired, such as a test mode. The display backlight can be configured to turn off after 5 minutes of inactivity unless there is an active alarm present. This option is selected in the Configurations/Systems Options menu. The display will always remain in the lit state when an alarm is present.

The idle display screen always displays Plant Voltage, Plant Current, and the number of active alarms, if any. A sub-menu selection allows the display to toggle between plant current and ambient temperature, if desired. When the Load Voltage channel is enabled the idle screen also displays the Load Voltage.

The user interface is limited to four push button keys:

- Escape:** This key is used to return to the last menu. Pressing “**Escape**” from anywhere within the menu structure will abort the current activity and return the user to the next higher level in the menu structure. Multiple presses of the escape key will always bring the user back to the idle display screen.
- Select:** This key, as its name implies, is used to select, or access, a particular menu or sub-menu. The select key is also used within many menus to toggle the status of some parameter, such as, yes/ no, enable/disable. It is also used to select a variable where the “**Next**” and “**Previous**” keys walk the user through a list of choices and the user presses the “**Select**” key for the desired choice.

**Next & Previous:** These keys provide three functions:

1. The means to move between menu selections in either direction from the current location.
2. Selecting parameter choices within a menu where a predefined set of choices exist for a given parameter and the user must choose one.
3. Calibration, threshold and timer changes. The keys change the displayed value up (next) or down (prev.) to reach a desired value.

From the idle display menu pressing “**Select**”, “**Next**”, or “**Previous**” brings the user to the Status menu. From the Status menu the “**Next**” and “**Previous**” keys can be used to access any of the main menus. Once the desired main menu is reached pressing “**Select**” drops the user down one level allowing access to any of the sub-menus under that main menu using the “**Next**” and “**Previous**” keys as before to access the desired sub-menu.

The “**Escape**” key can be used as an exit from any menu. Depending on where the user currently is in the menu structure one, or more, presses of the “**Escape**” key may be required to reach the top-level idle display screen. Pressing the “**Escape**” from the idle display screen will refresh the display; this function is useful if an error has occurred in communications between the microprocessor and the LCD.

### 3.1.4 Menu Functionality

The main menus group common functions together simplifying access. The following descriptions highlight the basic functions of each main menu. Menus are presented in the order that they are accessed in, by pressing the “**Next**” key, starting at the **Status** menu.

**Note:** If any channels have been disabled in the Configure/Enable Channels menu they will not appear in any subsequent menus, nor will any alarm conditions be triggered from input to that particular channel.

**Status:** The status menu provides a means of polling each analog input channel for its current status. Pressing “**Select**” when the Status menu appears drops the user down to the first analog channel. Pressing “**Next**” progresses the user through the channels in order. MONITORING EXPANSION channels will automatically be integrated into this menu upon a successful communications connection to the SAGEON PSMC I. i.e. EXPANSION temperature channels will be grouped with PSMC temperature channels, EXPANSION shunt channels will be grouped with PSMC shunt channels, EXPANSION voltage channels will be grouped with PSMC voltage channels, etc.

Press “**Escape**” once to return to the main **Select Mode** menu.

**Alarms:** The **Alarm** menu provides quick access to detailed alarm identification. The menu is accessed with the “**Next**” or “**Previous**” keys and entered with the “**Select**” key. The initial screen displays the current number of active alarms and the status of the audible alarm cut-off (ACO control will not be displayed if the audible alarm has been disabled in Configure/System options). Here, the “**Select**” key toggles the audible alarm on or off when it is enabled.

The “**Next**” and “**Previous**” keys take the user through each active alarm, showing the source of the alarm; i.e., Alarm 1 of 3: RFA 10; or Alarm 1 of 1: LOW VOLTAGE.

The LED alarm indicators on the front panel provide general information that corresponds to the detailed alarm information. The LED’s may indicate a fuse alarm and a rectifier fail alarm currently exist. The **Alarm** menu tells the user which specific fuse type and rectifier is in alarm. Pressing “**Escape**” when completed, will return the user to the main **Select Mode** Menu.

**Configure:** The **Configure** menu provides all of the sub-menus necessary to custom

configure the SAGEON PSMC I and MONITORING EXPANSION for a particular application. Pressing “**Select**” when the **Configure** menu appears allows access to the configuration menus. “**Next**” and “**Previous**” keys are used to locate the desired sub-menu. Pressing “**Select**” again accesses the displayed menu. The **Configure** menu consists of eight standard and one optional sub-menu (**Equalize**):

**Enable Thresholds:** Lets the user decide which alarm thresholds are active and which are not. The user presses “**Select**” to enter the menu, then “**Next**” or “**Previous**” to access each alarm threshold. The “**Select**” key can be used to toggle each alarm threshold on or off. See Setting up the Analog Channels section of this manual for more details. Pressing the “**Escape**” key when complete returns the user to the **Enable Thresholds** menu.

**Set Thresholds:** Permits the user to make changes to each individual alarm threshold. To change an alarm threshold the user presses “**Select**” when the desired alarm threshold appears in sequence using the “**Next**” and/or “**Previous**” keys. The alarm's current threshold will appear below the alarm threshold's name. The words “**Set at**” will change to “**modify**” when select is pressed then the user presses the “**Next**” (up) or the “**Previous**” (down) keys to adjust the value of the alarm threshold. Once the desired value is displayed the user presses “**Select**” again to save the new threshold value which changes the wording back from “**Modify**” to “**Set at**”. If an error is made while in “**Modify**” pressing “**ESC**” will abort the operation and restore the original value. See Setting up the Analog Channels section of this manual for more details. Pressing “**Escape**” returns the user to the **Set Thresholds** menu under the Configure menu.

**Enable Channels:** Lets the user to turn off unused channels to simplify access and possible confusion. Channels that are disabled will not appear in other menus, such as, **Set Thresholds**, eliminating possible confusion and confining activity to only pertinent parameters.

<p><b>Note:</b> If a hardware connection is not made to the rear panel of the MONITORING EXPANSION for a particular channel it is suggested that the channel be disabled in this menu. This will prevent erroneous readings from being displayed by reading a floating input that may be susceptible to ambient noise.</p>
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As before the user enters with the “**Select**” key using the “**Next**” and “**Previous**” keys to move from channel to channel. Pressing “**Select**” toggles the channel on or off. When completed, pressing “**Escape**” returns the user to the **Enable Channels** menu.

**Calibrate Zero:** Part of analog channel calibration; eliminates measurement errors due to sense lead length and noise. This menu requires the user to short the measurement leads at the actual sense point to null out line losses. See **Setting up the Analog Channels** section of this manual to use this menu.

**Calibrate Gain:** Part of analog channel calibration scales the particular channel to accurately read the input value. The user must measure and verify the input manually first; this measurement should be performed at the sense point of the wire leads. Then the displayed value is adjusted up or down with the “**Next**” or “**Previous**” keys to match the manual reading. Once set the SAGEON PSMC I automatically scales the input linearly to accurately read any input value for that

channel. See **Setting up the Analog Channels** section of this manual to use this menu.

**Set Shunt Scales:** Before the shunt inputs can be accurately read the individual shunts full scale rating must be entered. The MONITORING EXPANSION defaults to a 600A full scale setting for all shunt inputs. To change the full scale setting the user presses “**Select**” to enter the menu, then using the “**Next**” and “**Previous**” keys to display the desired shunt input. Pressing “**Select**” again allows the user to change the full scale rating in 5A increments from 5 to 10,000 amps using the “**Next**” and “**Previous**” keys to change the value up and down. When the desired value is reached press “**Select**” again to enter the value. The “**Next**” and “**Previous**” keys can then be used to select another shunt input. Pressing the “**Escape**” key returns the user to the “**Set Shunt Scales**” menu. The SAGEON PSMC I is configured to use 50mV shunts only; however, the MONITORING EXPANSION can read both 50mV shunts and 100mV shunts.

**System Options:** Contains several sub-menus for setting system level parameters:

- Password:** Enables or disables a pre-defined sequence of numbers that will prevent access to the Configure and output relay Test menus. Once enabled, after 5 min. these menus will be inaccessible without the password. If the user attempts to enter the Configure or output relay Test menus they will be prompted for the password. (See the Security section of the SAGEON PSMC I manual).
- Neg. Volts:** Toggles **NO/YES** to place a Negative sign in front of the voltage readings to correspond with use in -48 volt power plant.
- Neg. Amps:** Toggles **NO/YES** to place a Negative sign in front of the current readings to correspond with use in -48 volt power plant.
- Temp. Units:** Toggles °C (Celsius) or °F (Fahrenheit) for temperature readings.
- Idle Display:** Changes idle display screen parameter for current only, ambient temperature only, or toggling between current and ambient temperature.
- Audible Alarm:** Enables audible alarm in response to major or minor alarms, and sets the ACO time-out (See Audible Alarm section of manual).
- System Voltage:** Sets SAGEON PSMC I and MONITORING EXPANSION for use in a +24vdc, -48vdc power plant operation.
- Equalize:** Enables Equalize mode (See Setting Up Equalize section of manual).
- Aux. Relay:** Sets up Auxiliary Relay parameters (See Setting up Auxiliary Relay section of manual).
- Backlight Usage:** Toggles between having the Backlight turn on with any key press, remain on constantly, or always off.

**SW version:** Displays the presently installed software version.

## 3.2 PROGRAMMING THE MONITORING EXPANSION VIA THE SAGEON PSMC I

This section will deal with the Configure menus only. The Configure menu provides all of the menus necessary to customize the MONITORING EXPANSION for the user's specific requirements. Each sub-menu will be covered in detail which will enable the user to completely configure the MONITORING EXPANSION for their specific application. The user should read through this material then experiment with their unit to become familiar and comfortable with programming the unit. None of the functions under Configure are capable of damaging the equipment.

### 3.2.1 Factory Default Settings

The MONITORING EXPANSION as shipped from the Factory is initially programmed for use in a very basic power plant. The temperature sensor and current transducer channels and functions are programmed to be initially disabled. All analog measurement channels will be enabled and configured as shunts. If desired, the channels can be disabled and/or changed to voltage monitoring channels in the "ENABLE CHANNELS" menu. This allows the user to install the MONITORING EXPANSION ready to use with the most basic monitoring and control functions already programmed into the unit. The user can then add whatever additional channels and functions that are required to customize the MONITORING EXPANSION for their specific application.

The Configure menu descriptions detail the full implementation for each menu. Since the MONITORING EXPANSION has been factory programmed, some of the channels and alarm thresholds will not appear when the user first enters some menus. Use the following tables of Factory settings to determine the initial status for these menus.

## 3.3 ENABLING THRESHOLDS

This sub-menu allows the user to disable any analog threshold. Disabling a threshold will disable the associated alarm. Only the thresholds of enabled channels will appear in this menu. By default all alarm thresholds are enabled.

Enter the "Enabling Thresholds" menu from the Configure menu by pressing "Select", then press "Next" until the "Enabling Thresholds" menu appears. Press "Select" again to access the first threshold. The full list of alarm thresholds appears below in the order they would be accessed using the "Next" key. Use the "Next" or "Previous" key to walk through the thresholds as shown below; pressing "Select" to disable the unneeded thresholds. When completed, press "Escape" to return to the initial "Enabling Thresholds" menu. Use "next" or "Previous" to reach other Configure sub-menus, or "Escape" again to return to the top Configure menu.

## 3.4 SET THRESHOLDS

The "Set Thresholds" menu allows the user to change default thresholds to any desired value. Only the enabled thresholds will appear in sequence. The MONITORING EXPANSION allows thresholds to be set for all shunts; an over-current on any shunt will automatically trigger a major alarm. The Auxiliary alarm output relay can also be configured to trigger from an over-current threshold (See section 3.8.1 AUXILIARY RELAY SUB-MENU for setting up the Aux. relay). The table below lists the MONITORING EXPANSION's default thresholds for 24V, 48V operation.

Enter the “**Set Thresholds**” menu from the Configure menu by pressing “**Select**”, then press “**Next**” until the “**Set Thresholds**” menu appears. Press “**Select**” again to access the first threshold. Use the “**Next**” key to walk through the thresholds as shown below. Press “**Select**” when you reach a threshold you want to change. When you press “**Select**”, the screen will change from **Set at: (value)** to **Modify: (value)**. The user then uses the “**Next**” (up) or “**Previous**” (down) to scroll to the desired threshold value. Once the correct value is displayed, pressing “**Select**” loads the new value and returns the display screen to **Set at: (new value)**. The “**Next**” and/ or “**Previous**” keys can then be used to select another threshold. When completed, press “**Escape**” to return to the initial “**Set Thresholds**” menu. Use “**Next**” or “**Previous**” to reach other Configure sub-menus, or “**Escape**” again to return to the top Configure menu.

**Alarm Triggering Thresholds**

**48V PLANT**

ALARM THRES.	FROM	TO	DEFAULT
High Voltage:	50.0 V	60.0 V	56.5 V
Low Voltage:	44.0 V	54.0 V	51.5 V
Shunt Over-Current:	0 A	10000 A	600 A
High Temp:	0 F	200 F	95.0 F
Low Temp:	0 F	200 F	32.0 F
High Current (Trans.)	0 A	10000 A	600 A

**24V PLANT**

ALARM THRES.	FROM	TO	DEFAULT
High Voltage:	25.0 V	30.0 V	28.5 V
Low Voltage:	22.0 V	27.0 V	25.7 V
Shunt Over-Current:	0 A	10000 A	600 A
High Temp:	0 F	200 F	95.0 F
Low Temp:	0 F	200 F	32.0 F
High Current (Trans.)	0 A	10000 A	600 A

**3.5 ENABLING CHANNELS**

The “**Enable Channels**” menu lets the user select only the channels needed for their application. Removing unused channels allows the MONITORING EXPANSION to scan through the enabled channels at a higher rate and the user to access information faster without scanning through unused channels and thresholds. When Enable Channels is “selected”, the “**Next**” key scrolls through the channels in order. Available enable types for the MONITORING EXPANSION are:

- 50mV SHNT (50 mV shunt – up to 10000 Amps)
- 100mV SHNT (100 mV shunt – up to 10000 Amps)

- STRING V (voltage measurement – up to 60V)
- DISABLED (channel is disabled)

Enter the “**Enable Channels**” menu from the Configure menu by pressing “**Select**”, then press “**Next**” until the “**Enable Channels**” menu appears. Press “**Select**” again to access the first channel. Use the “**Next**” key to cycle through the available channels. Press “**Select**” on a particular channel to access the available enable types for that particular channel. Use the “**Next**” or “**Previous**” keys to cycle through the channel types. Press “**Select**” again to save the enable type. Be sure to disable any unneeded channels. When completed, press “**Escape**” to return to the initial “**Enabling Channels**” menu. Use “**Next**” or “**Previous**” to reach other Configure sub-menus, or “**Escape**” again to return to the top Configure menu.

**Channel Enable factory defaults**

<b>Channels Name</b>	<b>Default State</b>
EXPANSION CHANNEL 1	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 2	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 3	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 4	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 5	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 6	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 7	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 8	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 9	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 10	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 11	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 12	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 13	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 14	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 15	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 16	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 17	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 18	<b>ENABLED AS 50 mV SHUNT</b>
EXPANSION CHANNEL 19	<b>ENABLED AS 50 mV SHUNT (23”)</b>
EXPANSION CHANNEL 20	<b>ENABLED AS 50 mV SHUNT (23”)</b>
EXPANSION CHANNEL 21	<b>ENABLED AS 50 mV SHUNT (23”)</b>
EXPANSION CHANNEL 22	<b>ENABLED AS 50 mV SHUNT (23”)</b>
EXPANSION CHANNEL 23	<b>ENABLED AS 50 mV SHUNT (23”)</b>
EXPANSION CHANNEL 24	<b>ENABLED AS 50 mV SHUNT (23”)</b>
TEMPERATURE SENS. 1	DISABLED
TEMPERATURE SENS. 2	DISABLED
TEMPERATURE SENS. 3	DISABLED
TEMPERATURE SENS. 4	DISABLED (23”)

CURRENT TRANS. 1	DISABLED
CURRENT TRANS. 2	DISABLED
CURRENT TRANS. 3	DISABLED
CURRENT TRANS. 4	DISABLED (23")

Note: Channels with (23") are only included on the 23" version of the MONITORING EXPANSION.

### 3.6 ANALOG CALIBRATION

The next two menus are used to calibrate the analog channel inputs. The first menu, “**Calibrate Zero**” nulls out any offset due to amplifier zero-offset and/or analog to digital converter zero-error. The second menu “**Calibrate Gain**” sets up each channel to accurately read that channels input. Proper calibration is critical to the MONITORING EXPANSION’s performance and customer satisfaction. Properly completed, the MONITORING EXPANSION should only require a yearly verification of the measurement accuracy.

#### 3.6.1 Calibrate Zero

The “**Calibrate Zero**” menu provides a fast and simple means to null out the analog measurement sense leads. This process requires the user to short the measurement leads together as close to the actual measurement point as possible. For this reason sense leads should be left open at the measurement end to facilitate this procedure on start-up.

**WARNING:** Zeroing an analog channel without shorting the measurement leads can dramatically offset the display measurement. While no physical damage will result the user may require a service call, to open then short and zero the input, in order to restore proper operation.

**DANGER:** NEVER short analog measurement leads that are connected to their sense points on the power plant. Arcing and damage to inline protection devices and equipment may result.

The menu structure provides a prompt: “**INPUTS SHORTED? CONFIRM? NO**” that the user must toggle to “**YES**” with the “**Next**” or “**Prev**” key before the SAGEON PSMC /MONITORING EXPANSION will allow the user to press “**Select**” and zero the channel as a safety measure.

This procedure assumes a new installation where each analog channel would require a full calibration before use:

**Note:** At installation time perform steps 1 to 6 with the input leads shorted. Each channel should display a value close to zero. Whether it does or not, calibrate the value for zero with its inputs shorted. Doing so fixes the proper offset values into memory. Once these steps are complete connect the inputs to their respective sources, repeat steps 1 to 6 and adjust for the proper levels.

#### Calibrate Zero Procedure

1. Enter the “**Calibrate Zero**” menu from the **Configure** menu by Pressing “**Select**”, then press “**Next**” until the **Calibrate Zero** menu appears, then press “**Select**” again

to access the first channel:

**EXP. SHUNT 8**  
**READING: (present value)**

2. Short the sense leads together at the measurement point; the reading will show the zero offset value.
3. Press “**Select**” again, and the SAGEON PSMC I will prompt:

**INPUT SHORTED?**  
**CONFIRM? NO**

4. Verify proper shorting of the input leads then press “**Next**” or “**Previous**” to toggle the input to “**YES**”
5. Press “**Select**” again and the MONITORING EXPANSION will zero the channel and return to the initial display showing the offset as zero:

**EXP. SHUNT 8**  
**READING: 0.00**

6. Only those analog channels that were enabled in the Enable Channels menu will appear in sequence. Press “**Next**” to reach the next analog channel; repeat this procedure to zero all the analog channels. Shunt channels are displayed in mV (millivolts), temperatures are displayed in °F (degrees Fahrenheit), and voltage channels are displayed in V (volts).

**Note:** The temperature sensors by construction do not support shorting at the measurement point. These channels can only be zeroed at the screw terminals of the MONITORING EXPANSION when the standard sensor and cable assembly are disconnected. In cases where an extension cable was necessary the user can zero out the extension cable before connection to the actual sensor wiring. BE SURE to short ONLY the **SIG** and **RTN** leads. DO NOT short PWR to any other point. See Figure 4.

**Note:** The current transducer channels can be calibrated while connected to the MONITORING EXPANSION. Be sure that zero current is running through the window of the transducer. DO NOT short any connections. Perform steps 1-6 (skipping step 2) with zero load through the transducer.

When all the analog channels have been zeroed, leave the sense leads open to prepare for the Calibrate Gain procedure. Press “**Escape**” to return to the initial “**Calibrate Zero**” menu. Use “**Next**” or “**Previous**” to reach other Configure sub-menus, or “**Escape**” again to return to the Save Configurations menu.

### 3.6.2 Calibrate Gain

The Calibrate Gain menu allows the user to quickly calibrate any analog channel to provide an accurate reading scaled for volts, amps, or degrees. Since the overall performance of the MONITORING EXPANSION is tied directly to the accuracy of its measurements careful attention to detail is mandatory when calibrating the MONITORING EXPANSION.

By performing the Zero calibration first any losses due to lead length should be removed and the accuracy should be quite good. However, during the initial installation calibration, users should confirm the measurement at the screw terminal blocks accuracy by measuring the inputs at their

source and comparing the results.

A suitable DVM with at least 4-digit accuracy should be used for all analog input measurements.

See sections 3.6.3 and 3.6.4 before calibrating the gain of shunt and temperature inputs. To maximize the accuracy of the shunt input calibrations certain precautions should be followed. Temperature inputs require a simple calculation before the gain is adjusted.

### **Calibrate Gain Procedure**

1. Enter the “**Calibrate Gain**” menu from the main **Configure** menu by Pressing “**Select**”, then press “**Next**” until the **Calibrate Gain** menu appears, then press “**Select**” again to access the first channel:

**EXP. STRING VOLTAGE 16**  
**READS:** *(current value)*

2. Measure the actual input between ‘signal’ and ‘return’ (CH+ and CH-) at the measurement source for that channel; see Figure 1 and Figure 2. See below for required shunt and temperature calibration calculations.
3. Press “**Select**” again, and the SAGEON PSMC I will prompt:

**EXP. STRING VOLTAGE 16**  
**GAIN:** *(current value)*

4. Use “**Next**” (up) / “**Previous**” (down) to make the display value match the measured value.
5. Press “**Select**” again to load the new calibrated value. The display will change to confirm the new calibrated value that was entered:

**EXP. STRING VOLTAGE 16**  
**READS:** *(calibrated value)*

6. The user can press “**Select**” again to re-adjust the current calibration value, or press “**Next**” to access the next enabled channel. Repeat the procedure for each active analog channel.

When all the analog channels have been calibrated press “**Escape**” to return to the initial “**Calibrate Gain**” menu. Use “**Next**” or “**Previous**” to reach other Configure sub-menus, or “**Escape**” again to return to the top Configure menu.

### 3.6.3 Shunt Calibration Calculations

In order to calibrate shunts, a suitable load current must be passing through it to use it for calibration. The load current should be at least 70% or 80% of the full scale rating to get an accurate calibration. A load box connected to the shunts output may be required to generate the required current levels during calibration. Shunts are displayed in millivolts so they can be compared to the DVM readings connected to the inputs.

<p><b>Note:</b> The MONITORING EXPANSION can read 50mV or 100mV shunts; this is in contrast to the SAGEON PSMC I which is hardware limited to reading only 50mV full-scale rated shunts.</p>
--

The resulting displayed calibrated current reading can be verified against the actual shunt input performing the following calculation. Measure the actual millivolt input at the shunt terminals. Determine the shunts full scale rating; such as, 600A @ 50mV full-scale. Then multiply the measured value by the full scale rating and divide the result by 50 or 100mV (depending on the type of shunt) to get the actual current value. This calculated value should agree with the number of amps passing through the load; within 0.5% of the shunts full scale rating.

Example: 50mV shunt

$$\text{Measured value} = 30 \text{ mV}, \quad \text{Actual\_Amps} = \frac{30\text{mV}(600\text{Amps})}{50\text{mV}} = 360\text{Amps}$$

Example: 100mV shunt

$$\text{Measured value} = 45 \text{ mV}, \quad \text{Actual\_Amps} = \frac{45\text{mV}(600\text{Amps})}{100\text{mV}} = 270\text{Amps}$$

### 3.6.4 Temperature Calibration Calculations

The MONITORING EXPANSION utilizes C&D Technologies' standard temperature sensors that provide a calibrated output of 10 mV per degree Fahrenheit. For SAGEON PSMC I Calibration the easiest method is to measure the sensor output on the temperature inputs at the rear of the SAGEON PSMC I. Reading between the **SIG** and **RTN** with a DVM on the millivolt range provides a voltage that can be read directly as Degrees Fahrenheit. For example, a reading of 782 mV can be read as 78.2°F for entry as the calibration value.

$$\frac{782\text{mV}}{10\text{mV}/^{\circ}\text{F}} = 78.2^{\circ}\text{F}$$

The PSMC measures temperatures from 0°F to 230°F, i.e. voltage ranges from 0 to 2.30 Volts.

### 3.7 SET SHUNT SCALES

The MONITORING EXPANSION can monitor up to 18 additional shunts in a 19" rack and 24 additional shunts in a 23" rack; this is in addition to the 10 shunts the SAGEON PSMC I can monitor. The calibrate zero and gain menus set-up the hardware analog input channels to accurately read a 50mv OR 100mV shunts. In order to display the correct ampere reading for each particular shunt the full-scale rating must be entered. The factory default setting is 600A for all shunts connected to the MONITORING EXPANSION, with a possible range of 5 to 10,000 Amps.

Enter the "**Set Shunt Scales**" menu from the main Configure menu by pressing "**Select**", then press "**Next**" or "**Previous**" until the "**Set Shunt Scales**" menu appears. Pressing "**Select**" again enters the menu with the display showing:

**EXP Shunt 5 Scale**  
**Set at: 600A**

Press "**Select**" again to modify the current setting and the display changes to:

**EXP Shunt 5 Scale**  
**Modify: 600A**

Press the "**Next**" key to raise the value, or the "**Previous**" key to lower the value, in 5A increments. When the desired shunt value is reached press "**Select**" again to enter the value.

The display will return the “**Set at**” display with the selected value shown. The user can then use the “**Next**” or “**Previous**” keys to select any of the other nine shunt feeder channels to change the scaling as needed in the same manner. When all the channels have been set, press “**Escape**” one or more times to return to the Configure menu or to main default screen.

### 3.8 SYSTEM OPTIONS MENU

The only “system options” menu that pertains to the MONITORING EXPANSION specifically is the Auxiliary sub-menu. Refer to the user manual of the SAGEON PSMC I for a detailed description of the remainder of this menu.

#### 3.8.1 Auxiliary Relay Sub-Menu

The Auxiliary Relay menu allows the user to define the Auxiliary relay as one of the following: an extra Major or Minor alarm output, an Equalize alarm relay, an Audible alarm relay, or any Alarm Condition output. If the user “**Selects**” **Alarm Cond**, any enabled analog or binary channel's threshold is made available for the Auxiliary Relay trigger.

The user presses the “**Select**” key to enter the sub-menu, then “**Next**” to scroll through the choices. Pressing “**Select**” at any point sets the Aux relay to “**Energize**” when an alarm occurs. Pressing “**Select**” again changes it to “**De-Energize**” (FAIL-SAFE MODE) when an alarm occurs. Pressing “**Select**” third time will disable the Aux relay. When the selection is “**Energize**” or “**De-Energize**” all previous selections are disabled. Pressing “**Select**” when the **Alarm Cond** display appears sends the user to a listing of the enabled analog thresholds and binary channels. The user presses the “**Next**” key to scroll through the choices, and the “**Select**” key to pick one. After making a choice, press “**Escape**” to return to the top of the Auxiliary Relay menu.

## CHAPTER FOUR: SERIAL TERMINAL INTERFACE

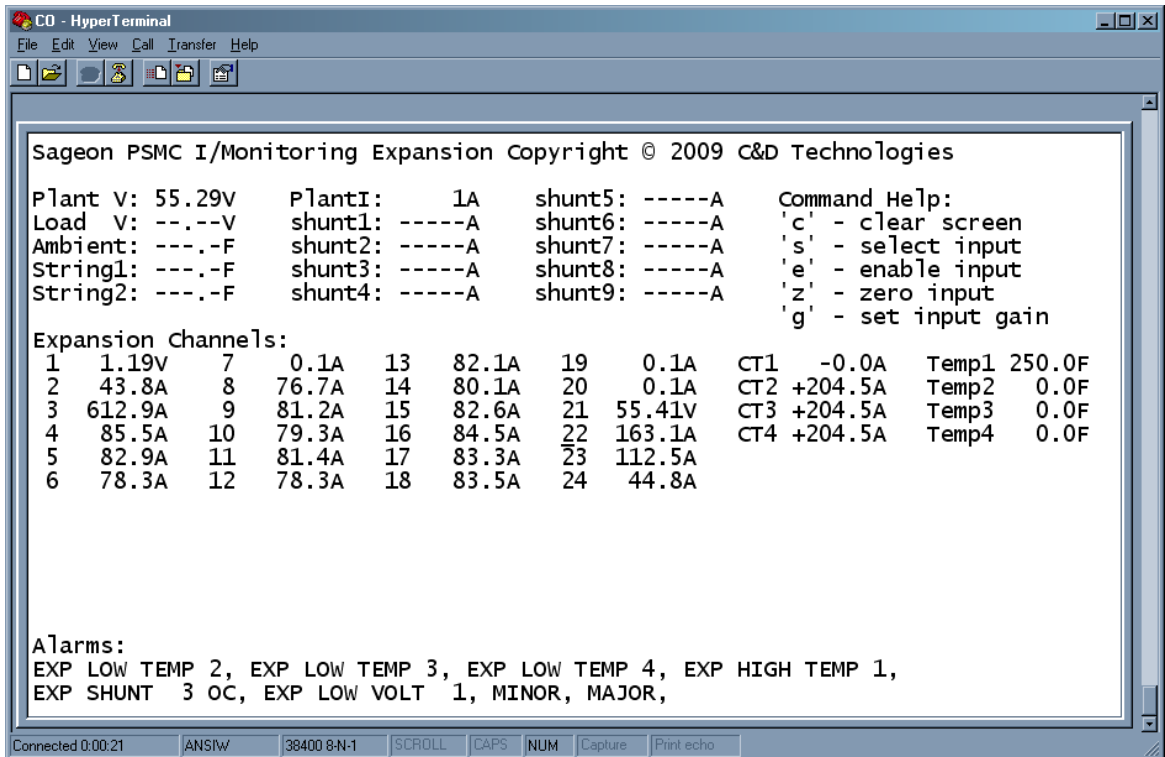
The RS-232 communications interface adds the functionality to view analog measurement outputs from the MONITORING EXPANSION, analog measurements from SAGEON PSMC I, and the current alarm state of the SAGEON PSMC I on a serial terminal program. The serial information is viewed through any standard ANSI serial terminal; such as HyperTerminal® (which typically comes standard with a Windows install). A standard DB-9F to DB-9M “straight-thru” serial cable is required (not included) to use the serial terminal interface; the MONITORING EXPANSION is by default configured as DCE (Data Communications Equipment) and therefore the communications crossover is provided internally to the unit.

Configuration of the serial terminal program must be as follows:

**Table 3. Serial port configuration**

Baud Rate	38400
Data Bits	8
Parity	None
Stop Bit	1
Flow Control	None
ASCII Terminal Emulation	ANSI or VT100
Font type	Courier New
Window size (W x H)	80 x 24

The serial interface allows the user to view all of the analog inputs to the PSMC and the MONITORING EXPANSION concurrently and allows a full view of current system status. A screen shot of the interface using HyperTerminal© is provided below:



**Figure 5. Interface on HyperTerminal©**

When the serial terminal is the “active window” a group of serial commands (provided via keyboard key presses) is listed below. These commands are case-sensitive:

**Table 4. List of ASCII serial keyboard commands**

Keyboard command	Command Action
c	Reset screen and clear cursor
s	Enter/exit ‘active channel’ select mode
z	Zero ‘active channel’
g	Enter/exit gain adjust mode for ‘active channel’
e	Cycle through channel types/enable
Up arrow	Change ‘active channel’ or adjust gain up
Down arrow	Change ‘active channel’ or adjust gain down
Ctrl + v	Copy zero and gain to all channels of same type
Ctrl + q	Reset expansion unit via watchdog timeout

The active window is selected by entering the appropriate password in the serial terminal. The password is `_cdtech` (underscore followed by `cdtech`). After entering the password press the Enter key. A “Command Help” list of the commands should appear if the password was entered correctly. If the command list does not appear, press enter to clear the serial buffer and enter the password again, followed by another Enter key press. The password mode will time-out after 5 minutes of idle time.

Press ‘s’ to enter channel select mode; press ‘s’ again to exit channel select mode. In channel select mode the active channel will appear green in color and go into “high-speed scan mode”. The raw input value will be displayed for the active channel i.e. millivolts will be displayed for shunt types, and volts for all other channel types. Use the up and down arrows on the keyboard to cycle through the active channel.

Press ‘z’ in channel select mode to zero the active channel; the raw reading displayed will be subtracted from the total value and be stored in eeprom. Press ‘g’ for gain adjust mode; the active channel color will change to ‘light blue’ when in gain adjust mode. Use the up and down arrows while to adjust the value while in gain adjust mode. Press ‘g’ again to return to channel select mode and store the new value to eeprom.

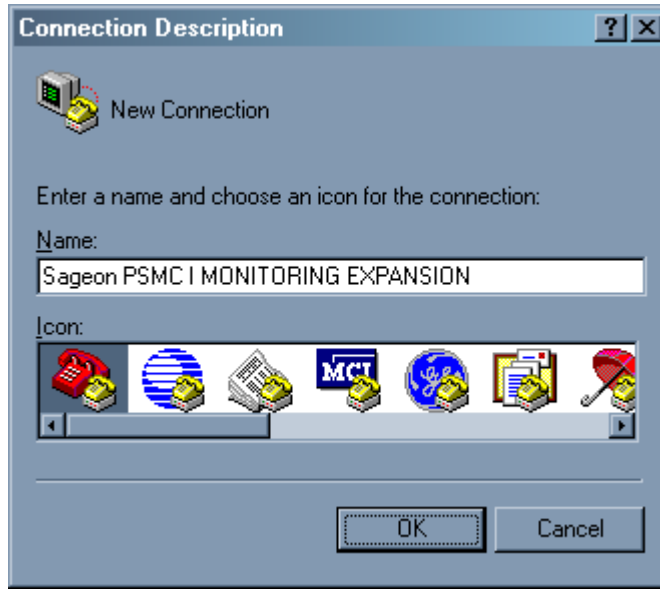
After calibrating the channel press ‘Ctrl’ and ‘v’ simultaneously to copy the zero and gain of the active channel to all other channels of the same type. i.e. after calibrating the zero and gain of channel 1 (which is enabled as a 50mV shunt, pressing ‘Ctrl’ and ‘v’ simultaneously will calibrate all other channels that are also enabled as 50mV shunts. This command can save enormous amounts of time when there are many similar expansion channels to be calibrated.

Pressing ‘e’ in channel select mode will cycle through the channel enable types: 50mV shunt (mV05), 100mV shunt (mV10), String voltage (str), disabled (-----).

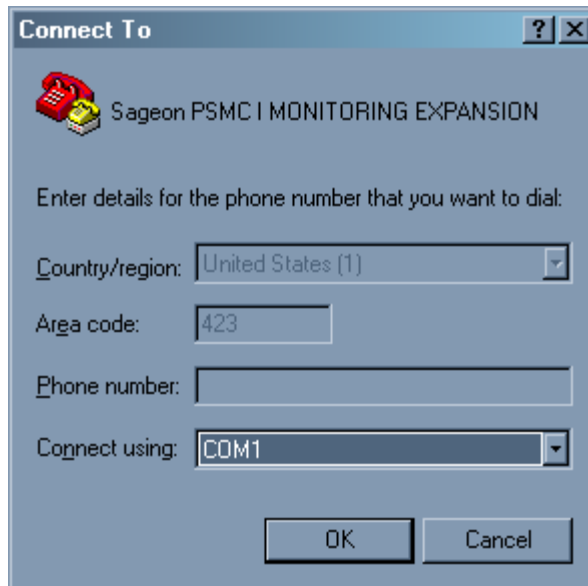
Note: Changing the channel type will reset the zero and gain calibration numbers to their defaults. The channel will have to be recalibrated.

#### 4.1 CONFIGURING THE SERIAL CONNECTION FOR HyperTerminal®

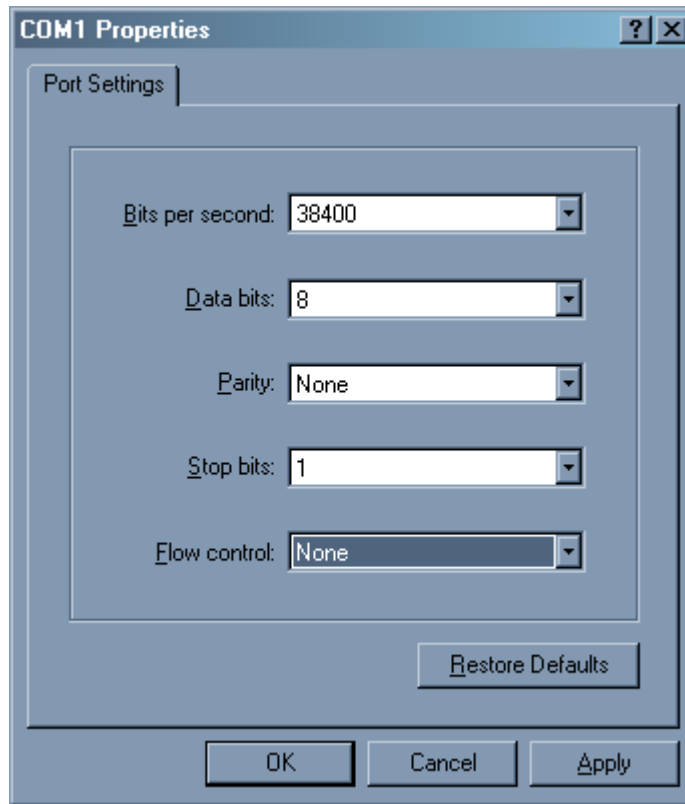
Upon opening a new HyperTerminal window, the user will be prompted to name the new connection and select an icon for the connection:



Click 'OK' after naming the connection. The following window will prompt for the connection port; select COM1 under 'Connect using'. Click 'OK'.



Connect the DB-9 serial cable to the serial port on the MONITORING EXPANSION and the COM1 serial port of a laptop or computer. If a DB-9 serial port is not available on the computer or laptop a USB to serial converter cable will be required. Contact the factory for more information. COM ports can be configured under the 'Device Manager' of the computer. Continue to setup the connection as described in Table 3 in the window that follows.



Click 'OK'. The connection should be established and data be transferred automatically to the terminal window. It is suggested that this connection be saved for future use and a shortcut to the connection be provided on the desktop for convenience. Saving the connection will prevent the setup process from having to be repeated every time a connection needs to be established.

## **CHAPTER FIVE: MAINTENANCE**

The SAGEON PSMC I MONITORING EXPANSION should not require any regular maintenance. Once a year, the analog channel calibration should be verified against actual measurements. On a 2 to 5 year basis, a complete system test should take place that checks all alarm and output functions to make sure alarm detection, control functions, and output relays work properly.

**CHAPTER SIX: SPARING / ACCESSORIES, OPTIONAL PARTS**

SAGEON PSMC I MONITORING EXPANSION parts can be shipped from the factory for critical replacements if necessary. The following list of internal parts and accessories can be used to order spares, replacements, and optional equipment:

<b><u>Part Description</u></b>	<b><u>C&amp;D Technologies P/N</u></b>	<b><u>Where Used</u></b>
Control Board	306-2998-00	PSMC Expansion
Interface board	306-2997-00	PSMC Expansion
Mux board (shunt)	306-2996-01	PSMC Expansion
Screw Terminal Block, 3-pos.	214-2726-03	Power input connector/Temperature sensors connection
Screw Terminal Block, 5-pos.	214-2726-05	Current transducers connection
Screw Terminal Block, 13-pos.	214-2726-13	Analog channels, customer connection
Communications cable kit	385-8078-12	Communications with SAGEON PSMC I
<b>Optional equipment:</b>		
Temperature Sensor Kit	385-5627-21	30ft. cable. Direct Connect to PSMC expansion. Measurement of ambient or battery string temperatures. Longer cable lengths available; contact factory.
Inline fuse, 0.5A Kit	385-2778-01	Protection of PSMC wiring
Inline fuse, 2.0A Kit	385-2778-03	Protection of PSMC wiring
Inline fuse, 3.0A Kit	385-2778-04	Protection of PSMC wiring
Inline Resistor Kit	385-2789-00	Protection of shunt wire connections
Current transducer, 200A, open window	385-5973-200	Battery/Plant current measurement, 8ft
Current transducer, 400A, open window	385-5973-400	Battery/Plant current measurement, 8ft
Current transducer, 600A, open window	385-5973-600	Battery/Plant current measurement, 8ft
Current transducer, 200A, split core	385-5974-200	Battery/Plant current measurement, 8ft
Current transducer 400A, split core	385-5974-400	Battery/Plant current measurement, 8ft
Current transducer, 800A, split core	385-5974-800	Battery/Plant current measurement, 8ft

## CHAPTER SEVEN: APPENDIX LISTINGS

### 7.1 FLOW CHARTS FOR SAGEON PSMC I MENU STRUCTURES

Appendix A: Main Menus

Appendix B: Configuration Menu

Appendix C: Enable Channels Menu

Appendix D: Enable Thresholds Menu

Appendix E: Set Thresholds Menu

Appendix F: Calibrate Zero Menu

Appendix G: Calibrate Gain Menu

Appendix H: Set Shunt Scales Menu

Appendix I: System Options Menu

Appendix J: Auxiliary Relay Menu

### 7.2 PROGRAMMING DATA WORK SHEET

◆ Sageon PSMC I MONITORING EXPANSION Datasheet

### 7.3 REFERENCE DRAWINGS

PN 103-3000-XX	SAGEON PSMC I ANALOG MONITORING EXPANSION PART DRAWING
Sht 1:	Cover Sheet, PSMC Ordering Information, Optional Equipment, Reference Tables, Fusing Requirements, Engineering Notes
Sht 2:	Engineering Notes (Cont'd)
Sht 3:	Mechanical Layout
Sht 4:	Electrical Block Diagram, Wiring Interface PCB Detail
Sht 5:	Figures 1 to 7, Installation Wiring Details

## APPENDIX A: MAIN MENUS

The top level menus of the PSMC:

\*This menu will only appear if enabled.

<i>Idle Menu</i>	<i>Select Mode</i>	<i>Description</i>										
Idle screen w/o load voltage	<table border="1"> <tr> <td>STATUS</td> <td>Shows the latest reading for all enabled analog input channels.</td> </tr> <tr> <td>MANUAL EQUALIZE*</td> <td>If enabled will show if manual equalization is active, the number of hours equalization has been both active and the total number of hours.</td> </tr> <tr> <td>TEST</td> <td>See appendix K for details.</td> </tr> <tr> <td>CONFIG</td> <td>See appendix B for details.</td> </tr> <tr> <td>ALARMS</td> <td>Shows descriptions for all active alarm outputs.</td> </tr> </table>	STATUS	Shows the latest reading for all enabled analog input channels.	MANUAL EQUALIZE*	If enabled will show if manual equalization is active, the number of hours equalization has been both active and the total number of hours.	TEST	See appendix K for details.	CONFIG	See appendix B for details.	ALARMS	Shows descriptions for all active alarm outputs.	
STATUS		Shows the latest reading for all enabled analog input channels.										
MANUAL EQUALIZE*		If enabled will show if manual equalization is active, the number of hours equalization has been both active and the total number of hours.										
TEST		See appendix K for details.										
CONFIG		See appendix B for details.										
ALARMS	Shows descriptions for all active alarm outputs.											
Idle screen with load voltage												

<i>Main Menu</i>	<i>Status submenu</i>	<i>Description</i>
STATUS	Plant Voltage	Voltage reading of the Battery or Plant
	Plant Current	Current reading from plant.
	Ambient Temp *	Temperature reading from the ambient temperature sensor (external).
	Temp String *	Temperature reading from the first battery string temperature sensor (external).
	Temp String 2 *	Temperature reading from the second battery string temperature sensor (external).
	Exp. Temp 1 *	Expansion temperature sensor 1
	⋮	
	Exp. Temp. 4 *	Expansion temperature sensor 4
	PSMC Temp.	The temperature of the PSMC's Printed Circuit Board (PCB)
	Load Voltage *	Voltage reading on the load.
	Exp. String V 1 *	The voltage reading from expansion channel 1 (if enabled as String V)
	Exp. String V 2 *	The voltage reading from expansion channel 1 (if enabled as String V)
	⋮	
	Exp. String V 23 *	The voltage reading from expansion channel 23 (if enabled as String V)
	Exp. String V 24 *	The voltage reading from expansion channel 24 (if enabled as String V)
	Shunt Current 1 *	The current reading from PSMC shunt #1
	Shunt Current 2 *	The current reading from PSMC shunt #2
	⋮	
	Shunt Current 8 *	The current reading from PSMC shunt #8
	Shunt Current 9 *	The current reading from PSMC shunt #9
	Exp Shunt 1 *	The current reading from expansion channel 1 (if enabled as shunt)
	Exp Shunt 2 *	The current reading from expansion channel 2 (if enabled as shunt)
	⋮	
	Exp Shunt 23 *	The current reading from expansion channel 23 (if enabled as shunt)
	Exp Shunt 24 *	The current reading from expansion channel 24 (if enabled as shunt)
	Exp. XDCR 1 *	The current reading from expansion current transducer 1
	⋮	
	Exp. XDCR 4 *	The current reading from expansion current transducer 4

\*Note: Channel will only appear if enabled

Note: PSMC channels are listed in gray; EXPANSION channels are listed in black and will automatically appear in the order listed when connected to the PSMC and the channel is enabled.

## APPENDIX B: CONFIGURATION MENU

Top level of the CONFIGURE set of menus.

<i>Menu</i>	<i>Submenu</i>	<i>Description</i>
CONFIGURE	MANUAL EQ TIME*	Selecting this menu allows setting the number of hours for a manual equalize.
	SYSTEM OPTIONS	Submenus allow enabling system password, backlight on/off, aux relay mapping, choosing equalization/sleep modes.
	SET SHUNT SCALES	Allows selecting the size of the current shunts for all the shunt inputs.
	CALIBRATE ZEROS	Allows setting zeros for analog inputs.
	CALIBRATE GAINS	Allows setting gains for analog inputs.
	ENABLE CHANNELS	Allows enabling/disabling reading analog and binary inputs
	SET THRESHOLDS	Allows setting of alarm thresholds
	ENABLE THRESHOLDS	Enables alarms.
		Note: * This menu will not exist if the Manual Equalization timer is not enabled.

## APPENDIX C: ENABLE CHANNELS MENU

<i>Configure Menu</i>	<i>Submenu</i>	<i>Description</i>
ENABLE CHANNELS	←→ AMBIENT TEMP	Enables or disables the ambient temperature input.
	TEMP STRING 1	Enables or disables the battery string 1 temperature input.
	TEMP STRING 2	Enables or disables the battery string 2 temperature input.
	EXP TEMP 1	Enables or disables the EXP string 1 temperature input.
	:	
	EXP TEMP 4	Enables or disables the EXP string 4 temperature input.
	LOAD VOLTAGE	Enables or disables the load voltage input.
	EXP CHANNEL #1	Enables Expansion channel 1 as voltage or shunt or disables channel.
	:	
	EXP CHANNEL #24	Enables Expansion channel 24 as voltage or shunt or disables channel.
	SHUNT CURRENT 1	Enables or disables PSMC shunt current 1 input.
	SHUNT CURRENT 2	Enables or disables PSMC shunt current 2 input.
	SHUNT CURRENT 3	Enables or disables PSMC shunt current 3 input.
	SHUNT CURRENT 4	Enables or disables PSMC shunt current 4 input.
	SHUNT CURRENT 5	Enables or disables PSMC shunt current 5 input.
	SHUNT CURRENT 6	Enables or disables PSMC shunt current 6 input.
	SHUNT CURRENT 7	Enables or disables PSMC shunt current 7 input.
	SHUNT CURRENT 8	Enables or disables PSMC shunt current 8 input.
	SHUNT CURRENT 9	Enables or disables PSMC shunt current 9 input.
	CURRENT XDCR 1	Enables or disables EXPANSION Current Transducer 1
	:	
	CURRENT XDCR 4	Enables or disables EXPANSION Current Transducer 4
	EXTERNAL LVD	Enables or disables external low voltage disconnect input.
	CEMF CELL 1	Enables or disables the CEMF CELL #1 input.
	CEMF CELL 2	Enables or disables the CEMF CELL #2 input.
	CTRL INHIBIT	Enables or disables the CTRL INHIBIT input.
	RECT FAIL 1	Enables or disables the rectifier failure # 1 input.
	:	
	RECT FAIL 16	Enables or disables the rectifier failure #16 input.
	SPARE FUSE	Enables or disables the spare fuse input.
	BATTERY FUSE	Enables or disables the battery fuse input.
	DISCHG FUSE	Enables or disables the dischg fuse input.
CHARGE FUSE	Enables or disables the charge fuse input.	
SENSE FUSE	Enables or disables the sense fuse input.	

Note: Each of these listed channels is either on (enabled), or off (disabled). Note that disabled channels will not appear in other menus. Plant voltage, plant current, and PCB Temperature readings are always enabled, and do not show up in this menu.

## APPENDIX D: ENABLE THRESHOLDS MENU

<i>Configure Menu</i>	<i>Submenu</i>	<i>Description</i>
ENABLE THRESH.	HVSD VOLTAGE	Enables the high voltage shutdown alarm threshold.
	PLANT CURRENT	Enables the plant over-current alarm threshold.
	STR 1 TEMP DIFF	Enables the battery string 1 temperature difference alarm threshold.
	STR 2 TEMP DIFF	Enables the battery string 2 temperature difference alarm threshold.
	LOW AMB TEMP	Enables the low ambient temperature alarm threshold.
	HIGH AMB TEMP	Enables the high ambient temperature alarm threshold.
	LOW BAT TEMP S1	Enables the low battery string 1 temperature alarm threshold.
	LOW BAT TEMP S2	Enables the low battery string 2 temperature alarm threshold.
	HI BAT TEMP S1	Enables the high battery string 1 temperature alarm threshold.
	HI BAT TEMP S2	Enables the high battery string 2 temperature alarm threshold.
	EXP HIGH TEMP	Enables the high temp. threshold for all Expansion temp sensors
	EXP LOW TEMP	Enables the low temp. threshold for all Expansion temp sensors
	SHUNT 1 CURRENT	Enables the PSMC shunt 1 over current alarm threshold.
	⋮	
	SHUNT 9 CURRENT	Enables the PSMC shunt 9 over current alarm threshold.
	EXP AMP SHUNT 1	Enables the over-current threshold for Expansion shunt 1
	⋮	
	EXP AMP SHUNT 24	Enables the over-current threshold for Expansion shunt 24
	LOW VOLTAGE	Enables the low voltage alarm threshold.
	VERY LOW VOLTAGE	Enables the very low voltage alarm threshold.
HI LOAD VOLTAGE	Enables the high load voltage alarm threshold.	
HIGH VOLTAGE	Enables the high voltage alarm threshold.	
HIGH EXP VOLTAGE	Enables the high voltage threshold for all Expansion voltages	

## APPENDIX E: SET THRESHOLDS MENU

<i>Configure Menu</i>	<i>Submenu</i>	<i>Description</i>
SET THRESHOLDS ←	HVSD VOLTAGE	Changes the high voltage shutdown alarm threshold.
	PLANT CURRENT	Changes the plant over-current alarm threshold.
	STR 1 TEMP DIFF	Changes the battery string 1 temperature difference alarm threshold.
	STR 2 TEMP DIFF	Changes the battery string 2 temperature difference alarm threshold.
	LOW AMB TEMP	Changes the low ambient temperature alarm threshold.
	HIGH AMB TEMP	Changes the high ambient temperature alarm threshold.
	LOW BAT TEMP S1	Changes the low battery string 1 temperature alarm threshold.
	LOW BAT TEMP S2	Changes the low battery string 2 temperature alarm threshold.
	HI BAT TEMP S1	Changes the high battery string 1 temperature alarm threshold.
	HI BAT TEMP S2	Changes the high battery string 2 temperature alarm threshold.
	EXP HIGH TEMP	Changes the high temp. threshold for all Expansion temp sensors
	EXP LOW TEMP	Changes the low temp. threshold for all Expansion temp sensors
	SHUNT 1 CURRENT	Changes the PSMC shunt 1 over current alarm threshold.
	⋮	
	SHUNT 9 CURRENT	Changes the PSMC shunt 9 over current alarm threshold.
	EXP AMP SHUNT 1	Changes the over-current threshold for Expansion shunt 1
	⋮	
	EXP AMP SHUNT 24	Changes the over-current threshold for Expansion shunt 24
	LOW VOLTAGE	Changes the low voltage alarm threshold.
	VERY LOW VOLTAGE	Changes the very low voltage alarm threshold.
	HI LOAD VOLTAGE	Changes the high load voltage alarm threshold.
	HIGH VOLTAGE	Changes the high voltage alarm threshold.
	HIGH EXP VOLTAGE	Changes the high voltage threshold for all Expansion voltages
	LOW EXP VOLTAGE	Changes the low voltage threshold for all Expansion voltages

## APPENDIX F: CALIBRATE ZERO MENU

<i>Configure Menu</i>	<i>Submenu</i>	<i>Description</i>
CALIBRATE ZEROS	PLANT VOLTAGE	Remove offset from the "PLANT VOLTAGE" analog input.
	PLANT CURRENT	Remove offset from the "PLANT CURRENT" analog input.
	AMBIENT TEMP	Remove offset from the "AMBIENT TEMP" analog input.
	TEMP STRING 1	Remove offset from the "TEMP STRING 1" analog input.
	TEMP STRING 2	Remove offset from the "TEMP STRING 2" analog input.
	EXP TEMP 1	Remove offset from the "EXP TEMP 1" analog input.
	:	
	EXP TEMP 2	Remove offset from the "EXP TEMP 4" analog input.
	LOAD VOLTAGE	Remove offset from the "LOAD VOLTAGE" analog input.
	EXP STRING V 1	Remove offset from the "EXP STRING V 1" analog input.
	:	
	EXP STRING V 24	Remove offset from the "EXP STRING V 24" analog input.
	FEED CURRENT 1	Remove offset from the "SHUNT CURRENT 1" analog input.
	FEED CURRENT 2	Remove offset from the "SHUNT CURRENT 2" analog input.
	FEED CURRENT 3	Remove offset from the "SHUNT CURRENT 3" analog input.
	FEED CURRENT 4	Remove offset from the "SHUNT CURRENT 4" analog input.
	FEED CURRENT 5	Remove offset from the "SHUNT CURRENT 5" analog input.
	FEED CURRENT 6	Remove offset from the "SHUNT CURRENT 6" analog input.
	FEED CURRENT 7	Remove offset from the "SHUNT CURRENT 7" analog input.
	FEED CURRENT 8	Remove offset from the "SHUNT CURRENT 8" analog input.
	FEED CURRENT 9	Remove offset from the "SHUNT CURRENT 9" analog input.
	EXP SHUNT 1	Remove offset from the "EXP SHUNT 1" analog input.
	:	
	EXP SHUNT 24	Remove offset from the "EXP SHUNT 24" analog input.
EXP XDCR 1	Remove offset from the "EXP XDCR 1" analog input.	
:		
EXP XDCR 24	Remove offset from the "EXP XDCR 24" analog input.	

## APPENDIX G: CALIBRATE GAIN MENU

<i>Configure Menu</i>	<i>Submenu</i>	<i>Description</i>
CALIBRATE GAINS	PLANT VOLTAGE	Set gain for "PLANT VOLTAGE" analog input.
	PLANT CURRENT	Set gain for "PLANT CURRENT" analog input.
	AMBIENT TEMP	Set gain for "AMBIENT TEMP" analog input.
	TEMP STRING 1	Set gain for "TEMP STRING 1" analog input.
	TEMP STRING 2	Set gain for "TEMP STRING 2" analog input.
	EXP TEMP 1	Set gain for "EXP TEMP 1" analog input.
	⋮	
	EXP TEMP 2	Set gain for "EXP TEMP 4" analog input.
	LOAD VOLTAGE	Set gain for "LOAD VOLTAGE" analog input.
	EXP STRING V 1	Set gain for "EXP STRING V 1" analog input.
	⋮	
	EXP STRING V 24	Set gain for "EXP STRING V 24" analog input.
	FEED CURRENT 1	Set gain for "SHUNT CURRENT 1" analog input.
	FEED CURRENT 2	Set gain for "SHUNT CURRENT 2" analog input.
	FEED CURRENT 3	Set gain for "SHUNT CURRENT 3" analog input.
	FEED CURRENT 4	Set gain for "SHUNT CURRENT 4" analog input.
	FEED CURRENT 5	Set gain for "SHUNT CURRENT 5" analog input.
	FEED CURRENT 6	Set gain for "SHUNT CURRENT 6" analog input.
	FEED CURRENT 7	Set gain for "SHUNT CURRENT 7" analog input.
	FEED CURRENT 8	Set gain for "SHUNT CURRENT 8" analog input.
	FEED CURRENT 9	Set gain for "SHUNT CURRENT 9" analog input.
	EXP SHUNT 1	Set gain for "EXP SHUNT 1" analog input.
	⋮	
	EXP SHUNT 24	Set gain for "EXP SHUNT 24" analog input.
EXP XDCR 1	Set gain for "EXP XDCR 1" analog input.	
⋮		
EXP XDCR 24	Set gain for "EXP XDCR 24" analog input.	

## APPENDIX H: SET SHUNT SCALES MENU

<i>Configure Menu</i>	<i>Submenu</i>	<i>Description</i>
SET SHUNT SCALES	PLT SHUNT SCALE	Allows changing the maximum current rating of the plant shunt.
	SHUNT 1 SCALE	Allows changing the maximum current rating of the PSMC shunt 1.
	SHUNT 2 SCALE	Allows changing the maximum current rating of the PSMC shunt 2.
	SHUNT 3 SCALE	Allows changing the maximum current rating of the PSMC shunt 3.
	SHUNT 4 SCALE	Allows changing the maximum current rating of the PSMC shunt 4.
	SHUNT 5 SCALE	Allows changing the maximum current rating of the PSMC shunt 5.
	SHUNT 6 SCALE	Allows changing the maximum current rating of the PSMC shunt 6.
	SHUNT 7 SCALE	Allows changing the maximum current rating of the PSMC shunt 7.
	SHUNT 8 SCALE	Allows changing the maximum current rating of the PSMC shunt 8.
	SHUNT 9 SCALE	Allows changing the maximum current rating of the PSMC shunt 9.
	EXP SHNT 1 SCALE	Allows changing the maximum current rating of the EXP shunt 1.
	⋮	
	EXP SHNT 24 SCALE	Allows changing the maximum current rating of the EXP shunt 24.

## APPENDIX I: SYSTEM OPTIONS MENU

<i>Configure Menu</i>	<i>Submenu</i>	<i>Description</i>
SYSTEM OPTIONS	PASSWORD	This menu allows turning the system password protection on or off.
	ABOUT PSMC	Shows the software version of the PSMC.
	BK LIGHT	Can choose if backlight stays on, off, or turns off after 5 minutes in the absence of any alarms or keypad input.
	AUX RELAY MENU	Allows selecting an alarm condition that will (energize/de-energize) the auxiliary alarm relay.
	EQUALIZE MENU	This menu allows enabling manual equalization and automatic low voltage equalization.
	SYS VOLTS	Displays and allows changing the plant voltage setting.
	AUD. ALRM MENU	Allows enabling an audible alarm for a Major, or Minor alarm. Also allows setting the amount of time the audible confirmation can be disabled in the alarm menu.
	IDLE DISP	Allows choosing plant current, temperature, or toggle between both on the idle screen.
	TEMP UNITS	Toggle all temperature reading units between °C and °F
	NEG. AMPS	Enable/disable the display of a minus sign for all amperage readings.
	NEG. VOLTS	Enable/disable the display of a minus sign for all voltage readings.

## APPENDIX J: AUXILIARY RELAY MENU

<i>System Options Menu</i>	<i>Submenu</i>	<i>Description</i>
AUX RELAY MENU	AUX. RELAY FUNCT IS: x	Displays whether or not the auxiliary relay function is enabled or disabled.
	ALRM CND x	Leads to a set of menus for using the auxiliary relay to be triggered by any of a number of different alarm conditions.
	AUD ALRM x	Allows triggering the auxiliary relay if the audible alarm is triggered.
	EQUALIZE x	Allows triggering the auxiliary relay if equalization is in progress.
	MINOR x	Allows triggering the auxiliary relay if the minor alarm is active.
	MAJOR x	Allows triggering the auxiliary relay if the major alarm is active.
		'x' represents either "enabled", or "disabled"

<i>Auxiliary Relay Menu</i>	<i>Submenu</i>	<i>Description</i>
ALRM CND MENU	HVSD ALARM	The auxiliary relay maps to the high voltage shutdown alarm.
	CTRL. INHIBIT	The auxiliary relay maps to the controller inhibit alarm.
	RECT FAIL 1	The auxiliary relay maps to rectifier failure alarm 1.
	RECT FAIL 2	The auxiliary relay maps to rectifier failure alarm 2.
	RECT FAIL 3	The auxiliary relay maps to rectifier failure alarm 3.
	⋮	
	RECT FAIL 15	The auxiliary relay maps to rectifier failure alarm 15.
	RECT FAIL 16	The auxiliary relay maps to rectifier failure alarm 16.
	ANY RECT FAILURE	The auxiliary relay maps to any rectifier failure alarm.
	SPARE FUSE	The auxiliary relay maps to the spare fuse alarm.
	BATTERY FUSE	The auxiliary relay maps to the battery fuse alarm.
	SENSE FUSE	The auxiliary relay maps to the sense fuse alarm.
	DISCHARGE FUSE	The auxiliary relay maps to the discharge fuse alarm.
	CHARGE FUSE	The auxiliary relay maps to the charge fuse alarm.
	EXTERNAL LVD	The auxiliary relay maps to the external low voltage disconnect alarm.
	CEMF CELL 1	The auxiliary relay maps to the CEMF cell 1 alarm.
	CEMF CELL 2	The auxiliary relay maps to the CEMF cell 2 alarm.
	STR 1 TEMP DIFF	The auxiliary relay maps to the battery string 1 temperature difference alarm.
	STR 2 TEMP DIFF	The auxiliary relay maps to the battery string 2 temperature difference alarm.
	LOW AMB TEMP	The auxiliary relay maps to the low ambient temperature alarm.
HIGH AMB TEMP	The auxiliary relay maps to the high ambient temperature alarm.	
LOW BATT TEMP S1	The auxiliary relay maps to the low battery string 1 temperature alarm.	
LOW BATT TEMP S2	The auxiliary relay maps to the low battery string 2 temperature alarm.	
HI BATT TEMP S1	The auxiliary relay maps to the high battery string 1 temperature	

	alarm.
HI BATT TEMP S2	The auxiliary relay maps to the high battery string 2 temperature alarm.
EXP LOW TEMP 1	The auxiliary relay maps to the low temp alarm for EXP TEMP 1
⋮	
EXP LOW TEMP 4	The auxiliary relay maps to the low temp alarm for EXP TEMP 4
EXP HIGH TEMP 1	The auxiliary relay maps to the high temp alarm for EXP TEMP 1
⋮	
EXP HIGH TEMP 4	The auxiliary relay maps to the high temp alarm for EXP TEMP 4
HI LOAD VOLTAGE	The auxiliary relay maps to the high load voltage alarm.
HIGH PLT CURRENT	The auxiliary relay maps to the high plant current alarm.
SHUNT CURRENT 1	The auxiliary relay maps to the PSMC shunt current 1 alarm.
SHUNT CURRENT 2	The auxiliary relay maps to the PSMC shunt current 2 alarm.
SHUNT CURRENT 3	The auxiliary relay maps to the PSMC shunt current 3 alarm.
⋮	
SHUNT CURRENT 8	The auxiliary relay maps to the PSMC shunt current 8 alarm.
SHUNT CURRENT 9	The auxiliary relay maps to the PSMC shunt current 9 alarm.
EXP SHUNT 1 OC	The auxiliary relay maps to the EXP SHUNT 1 current alarm.
⋮	
EXP SHUNT 24 OC	The auxiliary relay maps to the EXP SHUNT 24 current alarm.
EXP XDCCR 1 OC	The auxiliary relay maps to the EXP XDCCR 1 current alarm.
⋮	
EXP XDCCR 4 OC	The auxiliary relay maps to the EXP XDCCR 4 current alarm.
ANY OVER CURRENT	The auxiliary relay maps to any over current alarm.
HIGH VOLTAGE	The auxiliary relay maps to the high voltage alarm.
LOW VOLTAGE	The auxiliary relay maps to the low voltage alarm.
VERY LOW VOLTAGE	The auxiliary relay maps to the very low voltage alarm.
EXP LOW VOLT 1	The auxiliary relay maps to the EXP channel 1 low voltage alarm.
⋮	
EXP LOW VOLT 24	The auxiliary relay maps to the EXP channel 24 low voltage alarm.
EXP ANY LOW VOLT	The auxiliary relay maps to ANY EXP channel low voltage alarm.
EXP HIGH VOLT 1	The auxiliary relay maps to the EXP channel 1 low voltage alarm.
⋮	
EXP HIGH VOLT 24	The auxiliary relay maps to the EXP channel 24 low voltage alarm.
EXP ANY HI VOLT	The auxiliary relay maps to ANY EXP channel low voltage alarm.

SAGEON PSMC I MONITORING EXPANSION DATA SHEET

SITE:		EMERGENCY PHONE NUMBERS		DATE:	
ADDRESS:		NAME:	PH:	PROG'D BY:	
RESP. ENGR:		NAME:	PH:	C & D CUSTOMER SERVICE:	
PH:		NAME:	PH:	1-800-440-3504	

ANALOG CHANNELS

ENB Y/N	ANALOG CHANNEL	POL:	TYPE	WIRE COLOR	WIRE DESIG.	PROTECTION			SIGNAL SOURCE
						ILF	ILR	PANEL	
	CH 1	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 2	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 3	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 4	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 5	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 6	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 7	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 8	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 9	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 10	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 11	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 12	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 13	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 14	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 15	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 16	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 17	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 18	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 19	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 20	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 21	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 22	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 23	+	VOLT						SHUNT RATING:
		-	SHNT						
	CH 24	+	VOLT						SHUNT RATING:
		-	SHNT						

TEMPERATURE SENSORS

TEMP. SENS.	DEFAULT COLORS	EXT COLOR	WHERE LOCATED
PWR	RED		
SIG	BLUE		
RTN	BLACK		
TEMP. SENS. 2	DEFAULT COLORS	EXT COLOR	WHERE LOCATED
PWR	RED		
SIG	BLUE		
RTN	BLACK		
TEMP. SENS. 3	DEFAULT COLORS	EXT COLOR	WHERE LOCATED
PWR	RED		
SIG	BLUE		
RTN	BLACK		
TEMP. SENS. 4	DEFAULT COLORS	EXT COLOR	WHERE LOCATED
PWR	RED		
SIG	BLUE		
RTN	BLACK		

THRESH.	DEFAULTS		ACTUAL	
	HI	LO	HI	LO
SENS. 1	95° F, 35° C	32° F, 0° C		
SENS. 2	95° F, 35° C	32° F, 0° C		
SENS. 3	95° F, 35° C	32° F, 0° C		
SENS. 4	95° F, 35° C	32° F, 0° C		

CURRENT TRANSDUCERS

	RATING	WINDOW SIZE	WHERE LOCATED
CURR. TRANS 1			
	RATING	WINDOW SIZE	WHERE LOCATED
CURR. TRANS 2			
	RATING	WINDOW SIZE	WHERE LOCATED
CURR. TRANS 3			
	RATING	WINDOW SIZE	WHERE LOCATED
CURR. TRANS 4			

THRESH.	DEFAULTS		ACTUAL	
	OVER CURRENT			
TRANS 1	600 AMPS			
TRANS 2	600 AMPS			
TRANS 3	600 AMPS			
TRANS 4	600 AMPS			

THRESHOLDS

ENB Y/N	THRESHOLD	VALUE	ENB Y/N	THRESHOLD	VALUE	ENB Y/N	THRESHOLD	VALUE
	CH 1	HI LOW		CH 9	HI LOW		CH 17	HI LOW
	CH 2	HI LOW		CH 10	HI LOW		CH 18	HI LOW
	CH 3	HI LOW		CH 11	HI LOW		CH 19	HI LOW
	CH 4	HI LOW		CH 12	HI LOW		CH 20	HI LOW
	CH 5	HI LOW		CH 13	HI LOW		CH 21	HI LOW
	CH 6	HI LOW		CH 14	HI LOW		CH 22	HI LOW
	CH 7	HI LOW		CH 15	HI LOW		CH 23	HI LOW
	CH 8	HI LOW		CH 16	HI LOW		CH 24	HI LOW

ENTER DEFAULT FROM MANUAL OR CUSTOMER THRESHOLD UNDER "VALUE"  
 ENTER FULL SCALE VALUE FOR EACH MONITORED SCALE SHUNT BY "RATING"  
 NOTE: THE PSMC I DOES NOT PROVIDE A LOW THRESHOLD FOR SHUNTS.

NOTES: