ENVIROPOWER SYSTEMS™ OPERATIONS MANUAL

VAN'S ELECTRONICS LIMITED

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The operation of ENVIROPOWER SYSTEMS**™** S as described in this manual reflects current production.

ENVIROPOWER SYSTEMS™

SYSTEMS INFORMATION

The **ENVIROPOWER SYSTEMS™** is a complete un-interruptible power supply and is comprised of a Charger unit, a nominal 48V battery, and an optional User Interface unit. These items can be mounted on a variety of backplanes and are available mounted on a backplane or mounted in an enclosure.

The equipment is a combined primary and back-up power source designed to power auxiliary equipment, for example a remote telemetry (RTU) unit or a motor operated high voltage switch. It is offered in pole and pad mounted configurations. The system uses sealed Ni-Cad batteries in a variety of Ampere hour capacities.

The ENVIROPOWER SYSTEMS™ has the following attributes:

1) MICROPROCESSOR CONTROL allows precise control of the charging process and facilitates intelligent control interrogation.

2) VERY HIGH RELIABILITY through the use of digital circuits combined with special selected analog circuits. Continuous self tests are performed by the microprocessor to check for correct operation.

3) COMPREHENSIVE ALARMS are provided for maintenance purposes and include summary status LED indicators, located on the front panel, to provide local visual status. For a remote alarm indication a form C contacts are provided. The battery condition, the charger operation and if required external sources are continuously monitored for alarms. A detailed indication can be read via one of the serial communications options.

5) EVENT LOGGING of all alarms and some actions takes place in follow order as they occur. The last 64 events can be read via any of the serial communications options for maintenance purposes.

6) LOCAL MONITORING is provided via the optional User Interface. It features a keypad and a 2 line with 20 characters display. It allows for setting and viewing all battery and charger parameters as well as viewing of the event log. The User Interface can be permanently mounted on the charger or can be used as a hand held unit.

7) SERIAL COMMUNICATIONS is an optional feature and can be used for remote viewing and setting of all parameters via SCADA or personal computer. All settings and alarms can be viewed or changed as well as initiating a conditioning or commissioning operation. The event log can also be viewed via the serial port.

8) PRINTED RECORD of the ENVIROPOWER SYSTEMS™ condition and battery condition is available with the optional use of a personal computer.

FEATURES

Provides power for charging a nominal 48V battery

Reflex charge mode is used for maximum power availability

Memory effect of the battery is minimized by special charge algorithm

Optimum performance and service life from sealed Nicad batteries.

Continuous available battery capacity measurement

Battery commissioning and conditioning capability

True battery capacity measurement during the commissioning cycle

Event logging of the last 64 events

Telemetry & SCADA compatible.

Remote Battery status and charge control capability via serial port

Remote control of external inputs and outputs (optional equipment)

Auxiliary Power for other equipment, i.e. radio, RTU, etc

Compact, efficient and environmentally friendly.

Extended temperature range withstands severe environmental conditions.

Rugged pole mount enclosure capable to withstand exposure to moisture and salt dust

Protected against surges induced by nearby lightning strikes.

Internal heating to prevent condensation.

REMOTE MONITORING AND CONTROL

All chargers may be monitored and controlled from a remote location using the optional serial interface port connected to either a personal computer or SCADA equipment. Please consult the factory for this option.

APPLICATIONS

Telecommunications-	Remote power supply
Electric power Utilities-	SCADA, RTU, switch gear, sensing equipment
Water Utilities-	SCADA, RTU, valve control, metering
Pipe Lines-	Remote sensing, SCADA, RTU, valve control
Rail Transit-	Rail switching, signalling, SCADA, yard safety, lighting
Airport-	SCADA, perimeter security, sensing ,backup lighting
Penal Systems-	Sensing, perimeter security, lighting alarm circuits
Weather Station-	Data acquisition

SOFTWARE STATUS AND UPGRADES

BC unit Version 3.07
IPM unit Version 2.00

The following changes have been incorporated:

1) Multiple units can now be installed with the RS485 serial communications port. Address selection for each individual unit has been added.

BC unit Version 3.06

The following changes have been incorporated:

1) Communications with the new IPM Interface program has been incorporated.
2) This version handles the customer supplied External Inputs and Outputs, i.e. one analog input, 8 digital outputs and 8 digital inputs. This requires also a new Controller card with hardware for these features installed. See the Order Information section in this manual.
3) This release features improvements in alarm sensing and recording. When an alarm occurs only that one will be reported while other alarms which may have been triggered by the first one are now suppressed.
4) Battery Charger Status indications have been enhanced. Battery faulty and Self test alarms results in a Charger OFF status.
5) Some code has been cleaned up, bugs cleared.
6) False Ground faults, 24V P/S alarms has been cleared, and other alarm conditions has been enhanced.
7) Quantity of battery cells limited to 40.
8) A Commissioning/Conditioning cycle is now completed when 50% charge has been reached.
9) If a new revision of software is higher then previous, charger parameters are not reset to default values. If an older revision is installed all parameters are reset to defaults.
10) PC communications is now permanently enabled.

IPM Interface Version 1.20

1) This is a new release of software replacing the DOS version. The DOS version still works with the new IPM software however some new features will not be accessible. The DOS version will not be upgraded.
2) This version includes the capability to read and set the External Inputs and Outputs.

User Interface Version 3.02

1) This release has been improved by reducing the time between the initial connection operational status. Communicating with the old SBL units has been deleted. If SBL communications is required the older revision, 2.33, of software is required.
2) New Charger features have not been included. For External Input/Output functions the new IPM Interface and/or SCADA communications is required.

ENVIROPOWER SYSTEMS™ SPECIFICATIONS

INPUT POWER

ac line power	105 to 132 Vac, 47 - 63 Hz, 350VA
battery power	45 to 65 Vdc, 150mA max, drawn from battery while ac power is not available Charger unit will continue to operate during brown-out conditions or ac failure with automatic switch over to battery power. Any charging will be suspended until ac power is fully recovered.
protection	ac line: 5A circuit breaker battery: 30A fuse in series between the batteries battery power for auxiliary power supplies internally fused

OUTPUT POWER

CHARGER:

current	Constant charging current adjustable up to 3 A
voltage	dependant on the battery, quantity of cells and charge condition. Automatically adjusted as the battery is charged.
trickle current	50 mA max dependant on battery charge. (In the event the control electronics has failed or is shut down the controller will fall back to an un-monitored trickle charge.)

48V LOAD OUTPUT:

voltage	Direct from battery, 50V nominal for a 40 cell battery
current	20A maximum. Limited by circuit breaker. Supports inrush currents associated with motor circuits. Intended only for momentary motorized breaker drive operation. Power taken from this output is not included in the battery charge status.

AUXILIARY OUTPUTS:

1) voltage	+13.5V ±10%
current	8A max. for 10 seconds, 4A continuous* (8A max current limited)
2) voltage	+50V ±4%, (dependant on option installed)
current	2A max. current limited*
or	voltage
+5V, ±3%, (dependant on option installed)	
current	5A max. current limited*
3) voltage	-12V, ±10% (dependant on option installed)
current	100mA max

*Note: The total Auxiliary Power Supply output is limited to 110W!

BATTERIES

type	nickel cadmium cells, for full information see manufacturers specifications.
quantity of cells	40 cells divided in 2 packs
capacity	up to 10Ahr
charging mode	constant current with special algorithm (modified reflex)
charging current	dependant on the type of cells. See battery manufacturer's suggestions.
temperature range	operating range -40˚C to 80˚C
temperature sensor	each battery pack has a build-in temperature sensor

EXTERNAL INPUTS

inputs	2, digital
voltage range	0 - +5V
current sinking	5mA typically
purpose	remote conditioning commands or external alarm inputs, user programmable

OPTIONAL INPUTS AND OUTPUTS

The following inputs and outputs require an optional controller card with special software for functionality. These signals also require special hardware interfacing. See manufacturer for more information.

INPUTS

type	digital inputs
quantity	8
voltage	0 - +5V
purpose	external inputs for sensing, i.e. switch closure. See manufacturer for hardware/software implications.

type	analog input
quantity	1
voltage	0 - +5V, analog, with additional circuits can be trimmed to desired voltage. See manufacturer for specifications and hardware/software implications.

OUTPUTS

type	digital outputs
quantity	8
voltage	0 - +5V
purpose	general purpose, with additional circuits can be used to interface to external hardware. See manufacturer for specifications and hardware/software implications.

SERIAL PORTS

1st UIF port	The UIF port is a dedicated port specifically for the User Interface unit and is not available for any other purpose.
2nd	Serial Communications The optional Serial Communications port has Receive and Transmit signals only. It can be configured during manufacturing according to one of the following specifications: RS232, RS422, RS485 or 20mA loop current. To be specified on the purchase order. See the manufacturer for more information.

ALARM CONTACTS

arrangement	Form C. The NO contact is closed during normal operation. Either contact can be used for alarm signalling.
current capability	2A max. ac or dc
voltage capability	250V ac or dc, maximum

CONNECTORS

power, ac, batt.	Phoenix, type 7 pin 1= line 120Vac 2= neutral 120V 3= ground 4= battery positive 5= battery negative 6= motor drive negative 7= motor drive positive
power and signal	Phoenix, type 13 pin 1= external input #1 2= common for external inputs 3= external input #2 4= battery temperature sensor #1 input 5= battery temperature sensor #1 and #2 common 6= battery temperature sensor #2 input 7= NO contact of alarm relay output 8= common of alarm relay contacts 9= NC contact or alarm relay output 10= nc (or -13.5V) aux. power supply** 11= +50V (or +5V) aux. power supply** 12= +13.5V aux. power supply 13= return for aux. power supplies ** dependant on which axillary power supply has been installed.
UIF port D type, 9 pin, female contacts	pin-out dedicated for UIF unit
Serial port	D type, 9 pin, female contacts pin-out dependant on type of communications. See serial port connections drawing in Communications section.
I/O port (optional)	Header 50 pin, male contacts, 3M type with locks.

INDICATORS

type	LED
function	green= power available, either ac, battery, or both yellow (upper)= charging yellow (lower)= discharging red= alarm condition (led continuous on) Processor resetting (led toggling)

INTERNAL HEATING

purpose	To prevent condensation with rapid warming and high humidity conditions.
set point	+5˚C, with falling temperature
temperature range	+5˚ to +9˚C, maintained until maximum differential has been reached.
differential	max. 22˚C, inside/outside
power	from ac line

ENVIRONMENTAL

TEMPERATURE	-40˚C to +50˚C (-40˚F to 120˚F) operating -40˚C to +60˚C (-40˚F to 140˚F) storage
HUMIDITY	up to 95% relative humidity without condensation. Internal heating will prevent condensation with rapid warming trends.
VENTILATION	Both the ENVIROPOWER SYSTEMS™ and the battery packs require proper ventilation which do not allow water to enter the enclosure.
EMI IMMUNITY	Radio frequency emissions from the charger are suppressed and the charger will not be affected by nearby radio transmissions.
POWER SURGES	The charger is protected against lightning induced surges. It is not guaranteed to survive a direct strike.

PHYSICAL

DIMENSIONS	Charger: 14" wide, 5.25" height, 6.5" depth Battery packs: max. 10" wide, 8.5" height, 6.75" depth, dependant on type installed. Back plate: dependant on unit chosen. See installation drawing for more detail.
WEIGHT	Charger: 6 kg (13lbs) Battery pack: maximum 12kg (28lbs), dependant on type installed
MOUNTING	Charger and battery pack by means of 4 screws on the back of the unit. Keyed holes allow for ease of removal. See the installation drawing for more detail.
CONSTRUCTION	The charger is ruggedly constructed to survive most handling hazards.

FUNCTIONAL SPECIFICATIONS

CHARGING AND DISCHARGING

The charger will maintain the battery in a full charge condition using periodic charge cycles. It uses a special charge algorithm to minimize the memory effect. The conditioning cycle will exercise the battery by first discharging then fully charging the battery using a previous calculated Ampere hour rating as a guide to complete the charge. The commissioning cycle will be used to calculate the true capacity of the battery as opposed to the rated capacity.

The number of battery cells, the rated Ampere hour and the maximum charge current can be programmed into the charger. These parameters will form the basis for the charge algorithm to maintain maximum charge of the battery.

The voltage and current are averaged during the charge and discharge cycle and will be displayed on the UIF or made available for remote monitoring.

During charging the current into the battery is averaged over the complete charge cycle, i.e. 18 seconds of charge at the maximum set rate, 1 second of discharge at 3A and 1 second idle. The discharge current is averaged over 1 second at 3A and 1 second idle. The current will diminish with battery depletion.

While charging the batteries may become warm. If this persist charging may be suspended to allow cooling.

AUXILIARY POWER SUPPLIES

Two auxiliary power supplies are made available to supply current for external devices like the communications radio, RTU and other equipment. The outputs are current limited.

A combination of total power on all output supplies is sensed to protect the equipment and abnormal conditions will shutdown these supplies.

These supplies are normally fed from the ac power line. When this fails it will automatically switch over to battery power without interruption of the outputs. When the battery voltage goes below 45V these supplies will be shutdown. The supplies are automatically restored when the ac power returns to normal.

GROUND FAULT SENSING

The Enviropower System™ is completely floating with respect to power and ground in order to provide maximum noise and high voltage dis-charge immunity. To maintain the immunity no connection is allowed from any of Enviropower System™ terminals to power or ground sources, except the Ground terminal on the Power connector. The Ground Fault detector senses any short condition to either the positive or negative side of the battery.

BATTERY CONDITION SENSING

The battery condition is continually sensed for low voltage, temperature and internal impedance. During the Commissioning cycle a minimum capacity is also sensed.

The battery low voltage is sensed as an indication of possible low actual capacity remaining. This is important during an ac power failure and is an indication of imminent power depletion.

During charging the battery internal impedance is sensed giving an indication of the battery capability to accept a charge. During discharge the battery internal impedance may result in low out put voltage. If the impedance is high a Battery faulty alarm is generated.

The battery temperature is sensed and is used during the charge cycle to obtain the maximum charge and at the same time protect the batteries.

After a Commissioning cycle has been completed the calculated capacity is compared with the rated capacity. If the calculated is lower then the set limit a Batt. Capacity alarm is generated.

UNIT HEATING

Internal heating is built into the Enviropower Systems™ to maintain a moderate temperature to prevent condensation when a sudden warm air flow occurs while the unit was at an ambient temperature of below 0 ˚ C. When enabled the unit is maintained at approximately 5 ˚C.

EQUIPMENT HOT

When the Enviropower System™ is installed in the field a possibility may arise that the unit will be in a high ambient temperature environment. If this occurs the equipment, Enviropower System™ and batteries, may be degraded. An alarm will be triggered to notify the operator of this condition.

When the equipment is hot, battery charging may be suspended as well as the power supplies for external purposes may be shut down to protect the equipment.

SERIAL COMMUNICATIONS

For complete specifications see the chapter "Serial Communication". This chapter is included when this option has been installed.

EXTERNAL INPUT / OUTPUT (optional equipment)

This option adds one analog input, 8 digital inputs and 8 digital outputs. All inputs and outputs are of the standard +5V logic level. The analog input range is 0 - +5V.
Since these signals are at TTL levels and directly connected to the controller board, these signals can not be used directly. Interfacing and surge protection are required.

Customer to supply specifications for interfacing should include:
a) analog input range
b) digital input voltage levels
c) digital output requirements, i.e. max. applied voltage, max. current required, resistive, inductive or capacitive load

Contact the factory to have interfacing added.

ALARMS

The charger will continually check its operational conditions and battery status. It will report any abnormal condition(s) with an alarm. This alarm is transmitted to the User Interface unit (UIF) or the serial port. The alarm also activates a relay and its contacts can be used by other user installed equipment. Following is a list of alarms.

Alarm conditions:	**Signalled when:**
AC FAILURE	the ac breaker has tripped or no ac power is available
DC BREAKER OPEN	the dc breaker has tripped
BATT. LOW VOLTAGE	the battery terminal voltage is below the Under Voltage set point as selected by the "Set Under Voltage Level" command. This may also be reported when the battery is faulty.
BATT. EXTREME TEMP	the temperature of the battery is either extremely hot, >60˚C or cold, <-30˚C
BATT. FAULTY	the battery has an open circuit or high internal impedance or 30A series fuse is blown. After problem has been corrected a Remote Reset is required to start normal operation.
BATT. LIFE LOW	the battery capacity, measured during a Commissioning cycle, has dropped below the minimum level and should be exchanged.
BATT. SENSOR FAULTY	the battery temperature sensor circuit has an open, one or both sensors are open. If persistent batteries and/or charger needs to be returned to manufacturer.
BATT. REG. HIGH TEMP.	the battery regulator or charging circuit is over heated, >65˚C
GROUND FAULT	either the positive or negative battery or one of the auxiliary power terminals is shorted to the chassis or ground
AUX P/S OVERLOAD	the auxiliary power supplies are overloaded. P/S will be shutdown
AUX P/S HIGH TEMP	the auxiliary power supply circuit is over heated, >65˚C. P/S will be shutdown
AUX P/S SHUTDOWN	the auxiliary power supplies have been shut down due to: a) a low battery voltage, i.e. <45V, ±1V (when ac power is not available), b) overload condition (auto reset occurs after approx. 15 sec) or c) internal power supply is over heated (auto reset occurs after temperature has cooled down).
AUX 24V P/S	an alarm condition has been sensed in the Aux. 24V motor drive power supply See the LED indicators on the 24V supply to identify what caused the alarm
EQUIPMENT HOT	the complete ENVIROPOWER SYSTEMS™is over heated, i.e. inside the enclosure, charger, battery (and other equipment) are hot, >60˚C
SELF TEST	one of the following conditions has been sensed: 1) the charging circuit has malfunctioned 2) the discharging circuit has malfunctioned 3) the initial power on tests has failed 4) microprocessor sensed an error After the problem has been corrected a Remote Reset is required to resume normal operation. If persistent charger needs to be send to manufacturer.
UNIT HEATER	a unit heater failure has been detected.

ALARM RELAY OUTPUT AND INDICATORS

ALARM RELAY OUTPUT	A relay with form C contacts is provided as a summary alarm for any of the above mentioned alarm conditions. It will cause the relay to de-energize indicating an alarm and can be used to connect to user supplied equipment.
ALARM INDICATION	Any of the above alarms will cause the Alarm LED to be continuous lit. When there is a problem with the execution of the program the Watch Dog Timer will cause resetting of the processor. In this case the Alarm LED will toggle until the processor runs correctly.

EVENT LOGGING

Events are logged in a rotating buffer for a maximum of 64 events. The last event which occurred will be presented first when read. Scrolling backwards will show all events in sequence.
No time stamp is attached to the event. Reading the alarm as they occur will indicate the time of occurrence.
In case of multiple occurrences of the same last event no further events are logged but a message is recorded to indicate multiple events have occurred.

Events can be a command, an alarm or a condition. Following is the list of events that will be recorded:

AC Failure
AC Power Restored
Aux. Power Supply High Temperature
Aux. Power Supply Overload
Aux. Power Supply Shutdown
Aux. 24 V Power Supply Alarm
Battery Regulator High Temperature
Battery Faulty
Battery Low Voltage
Battery Extreme temperature
Battery Sensor Faulty
Battery Life
Battery Parameters Changed
Charger Powered-Up
Commissioning Started
Conditioning Started
Commissioning or Conditioning Cancelled
Commissioning or Conditioning Completed
Commissioning Interrupted
Conditioning Completed
Conditioning Interrupted
DC Breaker Open
Default Settings
Equipment Hot
Events Start
Event Marker
Ground Fault
Multiple Last Event
New Firmware Revision
Remote Reset
Self Test Alarm
Unit Heater Alarm

IPM INTERFACE PROGRAM

FUNCTIONAL DESCRIPTION

The IPM INTERFACE PROGRAM is a software program installed on a personal computer running Windows 95 Windows 98 or Windows NT that allows communications between the IPM Charger unit and the PC. (IPM = Intelligent Power Management.)

The personal or laptop computer can be used as an IPM Interface to control and read all status of the ENVIROPOWER SYSTEMS™. Changes to the parameters and features are easily made while all status information is displayed on a single screen. The event log can also be viewed.

This program monitors the External analog and digital inputs. It allows changes to be made to the External digital outputs.

A utility is included to dump all information into a ASCII file which can be printed using any standard printer. This file is identified automatically by the Location ID set in the charger, namely SID_nnnnn.DAT (nnnnn=Site ID number). Ensure that each system has a unique location ID assigned.

The Enviropower stystems™must have the software option installed in order to make use of this program. See the manufacturer for details.

See also the Readme file on the diskette for the latest information which may not be included in this manual.

OPERATIONS INSTRUCTIONS

1) Connect the Enviropower Systems™ using a special cable (3 conductor only) to your personal computer. Either Com-1, Com-2, Com-3 or Com-4 can be used.

Note: **Make sure the PC cable is connected to the serial port connector and NOT the UIF connector. Damage to the PC may result**.

2) Disable the UIF if present by disconnecting or placing it in the Standby mode with <C> and <0>. The UIF may already be in the Standby mode if it has been inactive for some time.

3) Start the IPM Interface program by clicking on the icon. The program follows the usual Windows methods of human interface.

4) A message in the upper left corner will displayed “Trying to establish communications”. Wait until communications has been established which is shown by a full screen with data. The PC software configures the selected serial communication port automatically for data format and baud rate. If no communications occur select the Configuration button and select the applicable Com port.

5) The screen is divided in six major blocks of information excluding the title block,

    a) The upper left area shows the Features enabled. Clicking on the Features bar will change the screen to display the External I/O readings. Clicking on the External I/O bar will change the screen back to display the features.
    b) The middle left area shows the parameter Settings of the charger.
    c) The lower left area shows the actual Measurements and Status of the charger.
    d) The upper right area shows the events that have occurred, last event on top.
    e) The lower right area shows the alarms that are present.
    f) The lower portion of the screen showing the functions to be selected.

6) Functions can now be made by clicking the Selection buttons on the screen.

7) To write the screen information select the 'Write LogFile' button in the selection area. To read a file that has been generated earlier select the Configuration button and select 'Load Site Report" and select the report with the proper ID and time stamp name.

Notes:
1) The communications can be interrupted when the UIF becomes active.
2) When communications are broken all data will be removed from the screen.
3) The IPM Interface file is in ASCII text format with spaces (no Tab's). When printing select a fixed rather than a proportional font.

EXAMPLE OF AN "IPM Interface" REPORT

The following page shows a typical printout of an IPM Interface generated report.

When a report has been appended more pages of previous status will be printed.

The Charger ID number is a hexadecimal value string of all the pertinent information.

ENVIROPOWER SYSTEMS™ - IPM Interface REPORT

Site ID:	1234	File:	SID1234.DAT
Date:	12/23/95	PC Interface:	2.30
Time:	19:55:44	Charger Ver.	2.31

SETTINGS

Number of Cells:	40	Unit Heater:	ENABLED
Rated Capacity:	4.00 Ahr	Low Batt. Alarm:	ENABLED
Current Limit:	1.10 A	Low Batt. Level:	47 V
Ground Fault:	ENABLED	Batt. Cap. Alarm:	ENABLED
External Input:	ALARM	Batt. Cap. Level:	32 %
External Alarm:	ENABLED		

STATUS

Mode:	NORMAL STATE	Charged:	97.50 %
Voltage:	51.10 V	Capacity:	3.90 Ahr
Current:	0.03 A	Calc. Capacity:	4.00 Ahr

ALARMS

No Active Alarms

EVENTS

01: GROUND FAULT	33:
02: BATT LOW VOLTAGE	34:
03: EVENT MARKER	35:
04: GROUND FAULT	36:
05: AC POWER RESTORED	37:
06: MULTIPLE LAST EVENT	38:
07: GROUND FAULT	39:
08: AC FAILURE	40:
09: CHARGER POWERED-UP	41:
10: SELF TEST ALARM	42:
11: GROUND FAULT	43:
12: AUX P/S SHUTDOWN	44:
13: AC FAILURE	45:
14: EVENTS START	46:
15:	47:
16:	48:
17:	49:
18:	50:
19:	51:
20:	52:
21:	53:
22:	54:
23:	55:
24:	56:
25:	57:
26:	58:
27:	59:
28:	60:
29:	61:
30:	62:
31:	63:
32:	64:

Charger ID: A020F7C1C58E155D4B17590C8FA1EC1AC0FF23C0DA2398FE87A23B7A41172EF22B5C13761C1

USER INTERFACE UNIT

DESCRIPTION

The portable User Interface Unit (UIF) features a keypad, 2 line x 20 character alphanumeric display, an LED indicator and an audible alarm. The UIF is used to set up the various application specific parameters and to read the status of the battery and charger.

An LED indicator and an audible alarm are provided to indicate a summary alarm while with the aid of the LCD display the actual alarm cause can be read.

The interface can be permanently installed for continuous monitoring. This unit can also be connected to the charger via a standard serial cable to provide temporary local monitoring and control.

SPECIFICATIONS

Keyboard	16 push buttons, 10 numeric, 4 alphabetic and 2 special 0-9= numbers R= read function I= initiate function S= set function C= clears audible alarm if alarm present, otherwise contrast function for LCD display - and += for selecting various parameter option. See installation section.
Display	LCD with 2 lines each having up to 20 characters. (No backlighting.)
Audible alarm	piezo sounder to indicate alarm condition
Power	Supplied by charger unit
Connector	D type, 9 pin male
Signal type	dedicated for connection to the Charger only. A standard 9 pin to 9 pin cable may be used for hand held operation.
Mounting	2 thumb screws for permanent mounting on the charger unit
PHYSICAL DIMENSIONS	8.25" wide, 4" height and 1" depth
OPTIONAL CASE	A specially designed rugged case to hold the User Interface and its connecting cable is available for hand held purposes. This case is recommended for all field applications. See the manufacturer for more information.
OTHER SUPPORT	The UIF unit can support the chargers made by Saft Batteries Limited (SBL) however it requires special software and is limited to the SBL 300 specifications and features. Consult factory for special order information. When the special software has been installed and to operate with a SBL 300 unit press and hold the "-" key while connecting the UIF unit. The UIF will show the SBL messages and allows you to enter and read charger and battery status. See the SBL manual for the operational instructions.

FUNCTIONAL DESCRIPTION

GENERAL

During normal operation the battery voltage and current is shown on the LCD display. When viewing other parameters the display will return to display the battery voltage and current after a predetermined time has expired after the last keystroke. When there is no keyboard activity for approx. 6 minutes the UIF will enter the Standby mode.

Communications between the UIF and the Enviropower Controller have priority over the serial port communications. Connecting a UIF or any activity on the keyboard of the UIF will suspend serial communications. During the Standby mode the serial communications is again released.

With the LCD display all conditions, the event log, settings and feature status can be read. Via the keypad new values can be entered and features can be enabled or disabled. Menus guide the operator for further input.

With the aid of the UIF the user may also initiate a commissioning or conditioning cycle, cancel commiss./condition., cause a System Reset and place an event marker in the event log.

The charger keeps an event log of the last 64 events that have occurred. The UIF can display these events showing the last event first and can scroll backwards to view previous events.

ALARM INDICATION

A visible and audible alarm is given to indicate an alarm condition. The alarm indication will remain on as long as the alarm condition exists. The audible alarm however can be silenced via the keypad.

DISPLAY

The LCD contrast can be adjusted as required via the keypad. This adjustment is valid as long as the UIF is connected. When the UIF is connected to the charger the LCD display defaults to an average level of contrast. The contrast of the LCD display may vary with temperature and can be re- adjusted up or down as required for proper viewing. This setting will remain as long as the UIF is connected to the charger.

STANDBY MODE

With no activity at the UIF for approximately 6 minutes the UIF will enter the Standby mode. It can also immediately be put in the Standby mode by pressing the <C> followed by <0> key.

Pressing the <R> key will take the UIF immediately out of the Standby mode and ready for further requests.

In the Standby mode there is no communications with the Enviropower Systems™. If an alarm occurs the Alarm LED indicator and audible alarm will be activated but the UIF will remain in the Standby mode.

When switching back to the active mode communications with the Enviropower Controller will be re-established. Due to the asynchronous communication and different protocols between the UIF and the serial port switching back may result in transmission error messages until full communications has been re-established.

OPERATIONAL INSTRUCTIONS

1) After connecting the UIF to the Charger press:
   - <R> to read status or to return from Standby mode
   - <I> to initiate or cancel Commissioning or Conditioning, to force a Reset or place an event marker
   - <S> to set parameters,
   - <C> to cancel an input, audible alarm or adjust contrast

2) Follow the menus to select or enter parameters as required.
   <+> selects next menu item, <-> toggles the selection or numeric keys enter values.

3) See ENVIROPOWER SYSTEMS™ Operational Instructions for further detail.

4) Select <C> to turn the audible alarm off or if no alarm present pressing <C> followed by <-> or <+> changes the LCD contrast. The newly selected contrast level is not maintained when powering down (disconnecting) the UIF.

5) When in Set or Initiate mode pressing <R> or <C> will cause the UIF to leave that mode and return to the Read mode without making any changes.

MENU FOR USER INTERFACE

R = Read	0	Batt. voltage &current	V and A
	1	Actual battery capacity	Ahr and % Charged
	2	Calculated maximum capacity	Ahr
	3	Settings:	
		Number of cells	number of cells
		Rated capacity	in Ahr
		Current limit	in A
		Ground fault	Enabled/Disabled
		External input	Conditioning / Alarm
		External alarm	Enabled/Disabled
		Unit heater	Enabled/Disabled
		Low battery alarm	Enabled/Disabled
		Low battery level	in V, i.e. 46V
		Battery capacity	Enabled/Disabled
		Battery capacity level	level in % from rated capacity
		Site ID number	4 digits (numerical)
	4	Alarm status	use <+> to scroll
	5	Mode status	Normal/Commis/Condit.
	6	S/W versions, Charger and UIF	type and number
	7	Event log	use <+> to scroll
			1=most recent event of the last 64 events

I = Initiate	0	Initiate Commissioning
	1	Initiate Conditioning
	2	Cancel Commissioning/Conditioning
	3	Remote Reset
	4	place an event marker in the event log

S = Set	0	**Set features**:	**Use <-> to toggle**:
		Ground fault	set Enable or Disable
		External input	select Conditioning or Alarm
		External alarm	set Enable or Disable (only if Ext. input=Alarm)
		Unit heater alarm	set Enable or Disable
		Low Batt voltage alarm	set Enable or Disable
		Batt. Capacity alarm	set Enable or Disable
	1	**Set specifications**	
		Number of cells	40 (can not be changed)
		Rated capacity	in Ahr
		Current limit (charging)	in A
		Low Batt voltage level	in V
		Batt. Capacity low level	in % of rated capacity
		Site ID number	up to 4 digits
	2	Set battery capacity equal to 100% charged	
	3	Set battery capacity equal to 0% charged	

C = Cancel, Contrast or Standby mode

a) Cancel audible alarm if alarm present, or cancel an input and return to the Read mode.
b) If no alarm is present key combinations C followed by <-> or <+> change LCD contrast.
C <+>, C <+> or C <->, C<-> to change LCD contrast up or down
c) <C> followed by <0>, places the UIF in the Standby Mode.

24V MOTOR DRIVE POWER SUPPLY

FUNCTIONAL DESCRIPTION

The 24V Motor Drive power supply is intended for intermittent operation of the drive mechanism to open or close the power breaker/switches. This unit is optional equipment.

Note: Do NOT connect any other loads to the 24V output terminals.

An electronic step down circuit is used to regulate the output to the desired 24V level. Control power is normally obtained from the +13.5V auxiliary power supply of the charger. When this power is not available the control circuit will continue to operate by drawing a small amount of current directly from the battery, i.e. 48V. Motor drive current is always taken directly from the battery supply.

Various parameters are continuously checked for abnormal conditions and alarms are triggered when they exist. LED indicators are used to show which alarm is triggered while a summary alarm signal is sent to the charger for further re-direction to the UIF and/or serial port.

There are no user selectable features for the power supply.
The charger must be programmed to accept the summary alarm via Aux #1 input. See the Enviropower Systems™ charger for more information.

SPECIFICATIONS

INPUT POWER

voltage, control	13.5V dc from charger auxiliary power supply
current, control	100mA max
voltage, drive	48V dc from battery via the charger battery output terminals
current, drive	20A max., limited by charger circuit breaker

OUTPUT POWER

voltage	24Vdc ±1.2V
current	20A max. Limited by the circuit breaker on the charger. Intended for momentary motorised breaker drive operation. Supports inrush currents associated with motor circuits.

ALARMS

LED INDICATORS:	Cause of alarm:
Under Voltage	Output voltage is less than 21V
Over Voltage	Output voltage is more than 29V
Over Current	Output current is more than 23A. This will cutoff the output for approx. 5 sec.
High Temperature	Temperature of the electronics is more than 70˚C
Flashing power LED	+13.5V not available or internal power supply failure. Control power taken from the 48V battery.

ALARM OUTPUT:

Summary alarm	opto-coupler isolated for Charger Ext. Input. Opto coupler output is shorted when conditions are normal, open for an alarm.

PHYSICAL DIMENSIONS

Size	7.75" wide, 1.5" height, 5.5" depth
MOUNTING	4 screws #10

INSTALLATION

1) Place the Power Supply one the back plate and secure with four #10 screws.

2) Wire the connector to the Charger connectors as per list:

1 = +13.5V power input	to Charger Aux/Signal term.	#12
2 = 13VRTN power return	" " "	#13
3 = Alarm signal	" " "	#1
4 = +48V input from battery	to Charger Power conn.	#7
5 = -48V input from battery	" " "	#6
6 = -24V output to switchgear motor	to Switchgear	
7 = +24V output to switchgear motor	to Switchgear	

Wires to terminal 1-3 can be #22 AWG while terminals 4-7 should be wired with a gauge suitable for the motor load current, for example #16 AWG.

3) On the Charger set the Ext. Input to an Alarm input and enable Ext. Alarms.
See ENVIROPOWER SYSTEMS™ Operational Instruction.

EXCHANGE OF 24V MOTOR DRIVE P/S

Exchange of a 24V Motor Drive P/S can be done by removing the power plug without removing any wires. Exchange the unit and reconnect power plug. It is not required to power down for this operation.

SYSTEMS ORDER INFORMATION

To order an Enviropower Systems™ with a specific configuration the systems part number needs to be build up according to the next information table.

To order individual items see the Recommended Spares list, Maintenance section.

Systems Part number:

Example: E 04 A B A 0 U E

1st digit	Enviropower Systems™ ID:	E, it identifies the Enviropower Systems™	
2-3rd digit	Battery capacity:	00 = no batteries	
		02 = 2.5 Ahr	--
		04 = 4 Ahr	A 2015
		07 = 7 Ahr	A 2016
		10 = 10 Ahr	A 2017
4th digit	Back plate configuration:	0 = no back plate	
		A = pole mount #1	V 2014
		B = pad mount	V 2009
		C = pole mount #2	V 2075
		D = custom	--
5th digit	Auxiliary P/S:	A = +5V, +13.5V, -13.5V	A 2019
		B = +48V, +13.5V	A 2054
		C = don't care	--
6th digit	Serial Communication:	0 = none	--
		A = RS232	A 2022 A
		B = RS422	A 2022 B
		C = RS485	A 2022 C
		D = 20 mA loop	A 2022 D
7th digit	Auxiliary equipment:	0 = none	--
		A = 24V Motor drive P/S	V 2101
8th digit	User Interface	0 = none	
		I = UIF installed on IPM	VELEPI1
		U = User Interface	VELEPI1
9th digit	External I/O capability	0 = not installed	
		E = Ext I/O installed	

ENVIROPOWER SYSTEMS™ INSTALLATION

PHYSICAL DESCRIPTION

The charger's electronics are housed in a rugged aluminum case. It is mounted using 4 Phillips #10 screws, 2 on either side. Keyed holes allow for easy mounting by inserting screws before the charger is mounted to the backplate. The rear plate of the charger holds the power discharge resistors which will be hot during discharging. Because of this no restrictions should be placed immediately above and below the charger allowing free air flow for maximum cooling.

The battery packs are mounted on either side of the battery mounting bracket. It has been designed to give maximum support for the battery packs. The battery pack assembly is mounted by means of three keyed holes and one round hole. Please note that the battery pack is quite heavy.

The Enviropower Systems™ consists of a charger, a battery pack and a fuse assembly. These are mounted on a backplate when shipped from the factory. This backplate comes in different configurations for specific installations. Customized mounting can be provided.

The charger has 2 multi-pin connectors, one for power, the other for signals and auxiliary power supplies. All interconnections between the charger, batteries and any optional equipment have already been completed and tested. Only user connections have to be added.

POLE MOUNT #1

This configuration is intended to accommodate the Enviropower Systems™ equipment only.

The Enviropower Systems™ is mounted in a Fibreglass Reinforced Plastic (FRP) enclosure with approximate outside dimensions of 19.5"H x 17.5"W x 9.75"D.

The enclosure has holes on either side and two in the bottom to allow for ventilation. These holes have special covers to keep water out and should not be removed. The enclosure should be mounted upright.

The enclosure has four 0.312" mounting holes and may be mounted via these onto a user furnished surface. See pole mounting diagram for dimensions and hole locations. Alternately a mounting bracket may be used to mount the enclosure to the pole.

An optional bracket designed for screw or strap mounting to a pole is available. See manufacturer for further detail.

Cable entry holes may be drilled at any convenient location. When making holes consider the placement and the fixings to prevent water from entering the enclosure.

POLE MOUNT #2

This configuration is intended to accommodate the Enviropower Systems™ equipment as well as other equipment, i.e radio, RTU, etc.

The Enviropower Systems™ is mounted in a Fibreglass Reinforced Plastic (FRP) enclosure with approximate outside dimensions of 33"H x 26"W x 12"D.

The enclosure has holes on either side and two in the bottom to allow for ventilation. These holes have special covers to keep water out and should not be removed. The enclosure should be mounted upright.

The enclosure has four 0.312" mounting holes and may be mounted via these onto a user furnished surface. See pole mounting diagram for dimensions and hole locations. Alternatively a mounting bracket may be used to mount the enclosure to the pole.

An optional bracket designed for screw or strap mounting to a pole is available. See manufacturer for further detail.

Cable entry holes may be drilled at any convenient location. When making holes consider the placement and the fixings to prevent water entering into the enclosure.

PAD MOUNTING :

The Enviropower Systems™ is mounted on a backplate, which can be mounted on any vertical surface. Holes conveniently located in the four corners of this backplate allow for easy mounting. See pad mounting diagram for dimensions and hole locations.

CUSTOM MOUNTING:

For custom or site specific arrangements consult factory.

UNPACKING

The charger and batteries are normally supplied assembled on a backplate or inside an enclosure. Packing material will have been inserted into the enclosure to secure the component parts during transport. These should be removed prior to final mounting of the assembly.

Remove all packing material and inspect for any hidden damage. Damage occurred during shipment must be reported to the carrier.

NOTE: The unit is shipped with the power connector removed from the charger. Do not insert this into the charger until the unit is completely wired and ready to be powered up.

INSTALLATION

1) Make sure that all screws of various sub assemblies of the Enviropower Systems™ are have not been loosened during shipping and are tight

2) Make hole(s) in the enclosure for cable entry as required.

3) Place the Enviropower system on the mounting surface and using proper screws, #10 or larger, fix the back plate to the mounting surface or the enclosure to the pole mounting bracket.

Note: For proper battery operation ensure that ventilation is provided for the Enviropower Systems™ without allowing water to enter the enclosure.

ELECTRICAL CONNECTIONS

After the Enviropower Power System is properly mounted the electrical connections can be made. All connections are via pluggable terminal blocks, one for power and one for signals and auxiliary power supplies.

****

WARNING: When connecting battery wires make sure that the battery fuse has been removed and no short occurs.
If a short occurs the battery is capable of delivering extremely high currents and can weld leads solidly together. This may result in extreme heat, fire and possibly explosion of the batteries!

****

1) Push the ac power circuit breaker to the open position, i.e. white band visible.
2) Disconnect the power plug connector if not already done.
3) Connect all wires as per list and diagram using suitable wire and connecting practices.

POWER, BATTERY AND MOTOR DRIVE CONNECTOR

1= line 120Vac

2= neutral 120Vac

3= ground, power

4= battery, positive. (already connected)

5= battery, negative. (already connected)

6= motor drive, negative

7= motor drive, positive

SIGNAL AND AUXILIARY POWER SUPPLIES CONNECTOR

1= external input #1

2= common for external inputs

3= external input #2

4= battery temperature sensor #1 input (already connected)

5= batt. temp. sensor #1 and #2 common (already connected)

6= battery temperature sensor #2 input (already connected)

7= NO contact of alarm relay output

8= COMMON contact of alarm relay

9= NC contact or alarm relay output

10= no connection (or -13.5V) aux. power supply**

11= +48V (or +5V) aux. power supply**

12= +13.5V aux. power supply

13= return of aux. power supplies

GROUND LUG (backplate) connect ground cable from a proper ground surface

4) After all connections have been made plug in the power connector. The Charger will power up from the battery if there is enough power in it. The power LED will be lit while the charge and discharge LED indicators will toggle. The Alarm LED indicator will also be lit due to lack of ac power.

5) Push the ac power circuit breaker in. The red alarm indicator will go off. The charge and discharge indicators will now toggle in a different sequence, the charge will be on more than the discharge. The toggling will stop after a certain amount of time or when communications is established with a User Interface unit, remote PC or SCADA.

6) The battery and operating parameters must now be set followed by a battery commissioning cycle. See Operational Instructions for further detail.

NOTES: a) **Do NOT connect any loads to the battery or motor drive terminals.** The 48V output terminals should only be connected to the switchgear motor. Any electronics requiring 48Vdc needs to be connected to the Aux. 48Vdc Power supply.

b) Ensure proper ground is connected to the ground terminal (#3 of the power connector) as well as the ground lug on the backplate.

c) Terminal #1 and #3 of the signal connector have dual functions. These can be used for Conditioning on and off commands or can be used for External alarm inputs as used in case a 24V Motor Drive unit has been installed. See wiring diagram for pertinent information. Ensure that the Charger features will be or have been selected accordingly.

d) ** Dependant on power supplies installed.

ENVIROPOWER SYSTEMS™ OPERATION INSTRUCTIONS

THEORY OF OPERATION

BATTERIES AND CHARGING

The charger operates with sealed nickel cadmium batteries that are charged using an advanced microprocessor "algorithm" where the charging current and voltage levels are continuously adjusted to provide optimum charging. It takes into account the known battery characteristics, battery temperature and a measurement of the charge flowing into or out of the battery.

A special algorithm is used to achieve a greater charge acceptance and consequently maximum available battery capacity at all time. This together with the Conditioning capability of the charger counters the "memory effect" prevalent in nickel cadmium batteries.

When installing the Enviropower Systems™ the battery parameters in the charger must matched the actual battery used. This is done by entering the battery parameters into the Charger followed by a Commissioning cycle. The quantity of cells, the rated capacity and the maximum charging current to be used must be entered. These parameters are used by the charger to maintain the battery at their maximum available capacity.

Caution: When changing only the charger or the battery it is imperative that the correct battery and charge parameters are entered which then must be followed by a Commissioning cycle. See COMMISSIONING below for further information.

The batteries used in the Enviropower Systems™ are “sealed” Nickel Cadmium. Although they are labelled sealed they all have pressure valves to allow gas, produced when charging, to escape if pressure build up occurs. In addition, if the battery sees severe duty such as extremely cold or hot temperatures, large amounts of gas can be produced and vented to the atmosphere. This requires that proper ventilation must be provided.

SUPPLY DURATION

The length of time during which the supply can provide power is not an easy established criteria. The battery when new can deliver power dependant on the battery rating. Normally this is established with a constant current rate of 0.1 x the rating of the battery at normal room temperature. With a higher load current this duration will be reduced by as much as 40%. With higher or lower battery temperatures the duration can be further reduced. A cold battery can lose as much as 60% of its power capability. Each installation should be carefully calculated according to the requirements and battery capacities should be selected accordingly.

****

Warning: **When the battery has been nearly depleted there may not be enough power left to operate the power switch properly or the power switch may be left in an intermediate state. If this occurs a potentially dangerous situation may exist. When ac power is restored the battery can not be re-charged due to the high current drawn by the switch which is higher than the current supplied to charge the battery. This may render the power switch in-operable**.

****

In this condition opening the 20A dc breaker will allow the battery to be recharged. Manual operation of the switch will prevent sudden operation of the switch when closing this circuit breaker after the battery has been fully charged.

The Enviropower Systems™ supply will shed the auxiliary power supplies when the battery reaches a terminal voltage approximately 45 V. After this only the Enviropower battery charger will draw current from the battery. It will

do so for more than eight hours. It will continue to log alarm conditions as they occur. These can be read later when ac power is re-established and local or remote readings are taken.

The length of time, from power failure till load shedding occurs, is purely dependant on the load current taken by the auxiliary equipment. Calculations should be made to obtain a degree of confidence that this time is as per requirement taking into account the reduction of battery power available due to cold or hot temperatures. This will indicate what ampere-hour rating for the battery packs is required.

See the battery manufacturers data sheets for more information concerning discharge curves under normal temperature and available capacity within temperature range.

CHARGER MODES

During the operation of the charger various states are indicated on the IPM Interface or User Interface unit.

1) Normal State. Most of the time it will operate in this mode periodically charging the battery to maintain maximum charge.

2) Commissioning State. This mode indicates the Commissioning mode.

3) Conditioning State. This mode indicates the Conditioning mode.

4) Off State. Due to a fault condition which affects the ability to charge the batteries the charger can go into this mode. The charger may or may not automatically return to the Normal mode depending on the type of failure. For example when an ac failure is corrected the charger will return to the normal mode. But with a faulty battery or self test alarm it will result in a permanent off state.

5) Charging Suspended. This mode indicates that a condition exist that requires a temporary suspension of charging. For example if the batteries, the battery charger or equipment are hot during a charging period.

COMMISSIONING OF THE BATTERIES

New batteries usually have a larger capacity then the rated capacity by as much as 20-30%. Conversely older batteries may have less than their rated capacity, however they may still give satisfactory results if they are maintained at their maximum level. In order to always have the maximum power available, a Commissioning cycle is required periodically.
Also when new equipment, either a battery pack or charger or both is installed a Commissioning cycle is required to match their parameters.

During the commissioning cycle the battery is first completely discharged then fully re-charged using the Rated Capacity as a guide. Then the battery is discharged again while the discharge capacity is being measured. This measurement gives the Calculated Capacity. It is stored in non-volatile memory and is used to continuously maintain maximum battery capacity. The Commissioning mode is finished while the battery is still depleted. The battery is again fully charged in the Normal mode. When the complete commissioning cycle is finished the battery is at its maximum available capacity.

Please note that the commissioning cycle can take up to 30 hours and should not be terminated before the cycle is completed. If terminated early the old calculated capacity is maintained but the battery may not be fully charged to its capacity resulting in a loss of available power. When early termination has occurred it is suggested to re-start a commissioning cycle at the earliest convenient time.
Early termination occurs if an ac power failure has occurred or a command via the UIF or serial communications.

During the discharging periods the battery is depleted to less than 1.1V per cell. Because of this the commissioning should be done during a time when it is least likely that the battery may be required to deliver power.

It must be kept in mind that the battery must be commissioned during a period of normal temperature, i.e. approx. 10-30˚C. When the battery is charged in either extreme of the temperature range, it is not capable of accepting a full charge and an erroneous capacity may result!

A Commissioning cycle can be initiated locally with the User Interface or may be initiated remotely via the serial port from a remote location, via SCADA or a PC. The external inputs of the charger can not be used to start a commissioning cycle.

CONDITIONING OF THE BATTERIES

Nickel cadmium batteries provide superior performance, however they do need to be exercised to maintain the optimum charge condition. After a long period of inactivity a conditioning cycle should be initiated to restore the full capacity of the battery.

During the conditioning cycle the battery is first completely discharged then fully re-charged using the Calculated Capacity as a guide. The Conditioning mode is finished when the discharge has taken place. The battery is now charged in the Normal mode where the battery capacity will reach the Calculated capacity. When the complete conditioning cycle is finished the battery is back to its maximum available capacity.

During the discharging period the battery is depleted to the point of 1.1V per cell. Because of this the conditioning should be done during a time when it is least likely that the battery may be required to deliver power.

It must be kept in mind that the battery must be conditioned during a period of normal temperature, i.e. approx. 10 - 30˚C. When the battery is charged in either extreme of the temperature range, it is not capable of accepting a full charge and an erroneous capacity may be the result!

Please note that the conditioning cycle can take up to 15 hours and should not be terminated before the cycle is completed. If terminated early the battery may not be fully charged to its optimum capacity resulting in a loss of available power. When early termination has occurred it is suggested to re-start a conditioning cycle at the earliest convenient time.
Early termination will occur if a power failure has occurred or a command via the UIF or serial communications has been given

A Conditioning cycle can be initiated locally with the User Interface or may be initiated remotely via the serial port from a remote location, via SCADA or a PC.
The Conditioning cycle can also be initiated with the External inputs on the Charger. These External inputs on the Charger must have been programmed as remote conditioning inputs and not as external alarms inputs.

GENERAL OPERATING INFORMATION

BATTERY SELECTION AND PARAMETERS

Different battery capacities are available and depending on your application select one of the following. Each battery has the following recommended maximum charge current for optimum performance in the Enviropower Systems™.

Rated capacity,	2.5	4.0	7.0	10.0	Ahr
Charging current**,	0.8	1.1	1.8	1.0	A

The above currents are used as the maximum currents during the charging portion of a complete charge cycle. The current shown on the UIF or PC display is the current averaged over the entire charge cycle which includes the discharge and idle portions and is always lower than the maximum charging current.

**** Note:** Always check with the battery manufacturer for their recommended maximum charge rates. Van's Electronics Limited can not be held liable for battery failure if higher than recommended current's are used.
The above suggested maximum charging currents are the maximum values recommended for the present batteries as per manufacturer.
Please not the maximum charge current for the 10.0 Ahr battery.

DEFAULT SETTINGS

Following are the default values for the various functions. These values may have been altered when the Enviropower system has been assembled.

Cell quantity	40
Rated capacity	4 Ahr
Calculated Capacity	4 Ahr
Current limit	1.1 A
Batt Low voltage level	47 V
Batt. Capacity level	50%
Percent charged (batt)	100%
Site ID location	0000 (set to serial number of charger when shipped)
Ground fault	disabled
External input	alarm input
External alarm	disabled
Unit heater	disabled
Batt. Low volt. alarm	disabled
Batt. Cap. Low	disabled

SETTING OF PARAMETERS

After completion of the installation or after an exchange of the Charger and/or Battery packs setting the new parameters is required to obtain proper operation of the Enviropower Systems™. Improper settings can result in reduced power availability or overheating of the battery.

The settings of all parameters and features are stored in non-volatile memory and will be maintained when power has been removed for an indefinite time. Because of this it is always necessary to verify the settings and parameters with a new installation or when changes to the system has occurred.

Caution: When changing only the charger or the battery it is imperative that the correct battery and charge parameters are entered which then must be followed by a Commissioning cycle. See COMMISSIONING below for further information.

PARAMETER SETTING INSTRUCTIONS

The instructions given below are for the use of an UIF unit. The same can be done with a PC running the **IPM Interface program**. The IPM Interface program is a Windows program and the process for setting the features and parameters is the same as the usual Windows methods. See section “IPM Interface Program” in this manual for more information.

1) Connect the User Interface unit to the charger using a 9-9 pin cable (or a PC running the IPM Interface program). The audible alarm may be heard briefly.

2) Wait until the Voltage and Current readings are displayed.

3) Select the Set features by pressing <S> followed by <0>.

4) Set the features as required by using the <-> key to toggle the option and using the <+> key to go to the next selection.

Ground fault	set Enable or Disable
External input	select Conditioning or Ext. Alarm
Ext. alarm	set Enable or Disable (only if Ext. input=alarm was selected)
Unit heater	set Enable or Disable
Low Batt. volt. Alarm	set Enable or Disable
Batt. Cap. low alarm	set Enable or Disable

5) Finish the selection by pressing "S" again. This will store all feature selections.

6) Set the battery parameters for the installed battery by selecting the Set specifications via <S> and <1> keys.

7) Enter the specific values by using the number keys.

Number of cells	total quantity of cells in the battery packs
Rated capacity	in Ahr
Current limit (charging)	in A, maximum current while charging
Low Batt. voltage level	in V
Batt. Cap. low level	in % of rated capacity
Site ID number	up to 4 digits

8) Finish the selection by pressing <S> again. This will store all values.

Verification of the settings can be done by selecting <R> followed by a <3> and scroll through all parameters and features.

COMMISSIONING THE ENVIROPOWER SYSTEM

Since battery cycling requires average temperatures and commissioning results in substantial heat generation, it is recommended to do this when the outside temperature is within the 10-30 ˚C range. If the outside temperature is outside this range it is recommended to do the Commissioning indoors. Commissioning restores the battery to full charge and matches the charger to the battery. The complete commissioning cycle can take up to 30 hours, depending on battery size.

Commissioning may be initiated from the User Interface or remotely via the serial port.

COMMISSIONING INSTRUCTIONS

The commissioning cycle is a three part procedure:

a) verifying/setting of the features desired,
b) verifying/setting the battery parameters and
c) starting and completing a battery commissioning cycle.

1) Connect the User Interface unit to the charger using a 9-9 pin cable. The audible alarm will be heard momentarily.

2) Wait until the Voltage and Current readings are displayed.

3) Start the Commissioning cycle by selecting <I> followed by <0>

4) This completes the commissioning of the new installation. The battery commissioning cycle will continue for a time depending on the present charge and the Ahr rating of the battery.

5) The installation will be fully operational after the commissioning cycle and the normal charge period is completed.

NOTES: a) At the end of the Commissioning cycle the battery has been recharged to 50% of the Calculated value. At this point the charger switches back into the Normal charge mode and continues to charge until the battery is fully charged.
If the Commissioning is cancelled due to certain alarms a Low Battery Voltage alarm may be generated.

b) During the commissioning cycle, there will be two periods of about 4 hours (depending on battery size) during which the battery charge is seriously depleted. Because of this the Commissioning should be done only when no demands on the battery are expected.

c) With a completely "dead" battery it may be advantageous to start a conditioning cycle before the commissioning cycle otherwise the commissioning cycle can be run twice. This will bring the battery to its optimum charge condition.

COMMISSIONING TERMINATION

An ac power failure, battery faulty or self test alarm will terminate the commissioning cycle pre-maturely leaving the battery in a unknown condition. When this has occurred and immediately after the cause has been corrected a new commissioning cycle should be started at the earliest convenient time.

Commissioning can be terminated with the UIF or remotely via the serial port. This is not recommended since it may cause the battery never to reach a full charge or to be overcharged. This is because it will take the rated or the last calculated capacity as a charge measure rather than the actual calculated capacity. A new commissioning cycle should be started to correct this condition at the earliest convenience time.

CONDITIONING THE BATTERY

When a sealed Ni-Cad battery is left fully charged for several months, it will undergo internal changes which may result in lost capacity. Although our special charge algorithm minimizes this effect it can not completely nullify it. This effect is most pronounced when the battery is exposed to high temperatures. These are exactly the conditions experienced during summer operation. Conditioning restores the battery to full capacity. The complete conditioning cycle can take up to 18 hours (depending on battery size).

Since battery charging requires average temperatures and conditioning results in substantial heat generation, it is recommended to do this when the outside temperature is within the 10-30 ˚C range. If the outside temperature is outside this range it is recommended to do this in the evening, starting in the early evening, or indoors.

Conditioning may be initiated from the User Interface or remotely via the serial port.

CONDITIONING INSTRUCTIONS

1) Connect the User Interface unit to the charger using a 9-9 pin cable.

2) Wait until the Voltage and Current readings are displayed.

3) Start the Conditioning cycle by selecting <I> followed by <1>

4) The battery conditioning cycle will continue for a time depending on the present charge and the calculated Ahr rating of the battery.

5) The installation will be fully operational after the conditioning cycle and the normal charge period is completed.

NOTES: a) During the conditioning cycle, there will be a period of about 4 hours (depending on the battery size) during which the battery charge is seriously depleted. Conditioning should therefore NOT be initiated when the danger of a power failure is high, i.e. approaching storms or freezing rain.

b) At the end of the Conditioning cycle the battery has been recharged to 50% of the Calculated value. At this point the charger switches back into the Normal charge mode and continue to charge until the battery is fully charged.
If the Conditioning is cancelled due to certain alarms a Low Battery Voltage alarm may be generated.

CONDITIONING TERMINATION

An ac power failure or self test alarm will cause a termination of the conditioning cycle. If this has occurred and immediately after the cause has been corrected a new conditioning cycle should be started at the earliest convenient time to ensure a fully exercised battery.

Conditioning can be terminated with the UIF or remotely via the serial port. This is not recommended since the benefit of a conditioning cycle will not have been achieved.

SETTING THE BATTERY TO 0% OR 100% CHARGED

Setting the battery to 0% or 100% percent charged condition is a feature setting that allows quick settings for the battery. This setting needs to be carefully evaluated since it can have a detrimental effect on the battery. For example if the battery is not fully charged setting it to 100% results in reduced power availability. If a fully or nearly fully charged battery is set to 0% charged heavy over charging will result causing in high battery temperature alarms.

MAINTENANCE, TROUBLESHOOTING AND REPAIR

ROUTINE MAINTENANCE

The charger does not require routine maintenance. The battery however requires periodic conditioning. It is recommended that this occurs twice per year while once a year a commissioning cycle should be performed to update the actual battery capacity. See the ENVIROPOWER SYSTEMS™ OPERATION chapter for further information.

FIELD TESTS

Field tests are limited to reading the battery and charger status with the UIF unit. All settings, condition status, alarms and events can be read.

If the serial port option is installed a portable personal computer can read the complete status and write it to a file which can be printed later. The file is identified by the chargers location ID number. To make good use of this feature ensure that each charger has a unique location ID programmed. This is done via the Set commands. The unit is shipped with the serial number programmed as the site location ID.

TROUBLE SHOOTING

The charger carries out regular tests to verify proper operations. If an error condition is sensed an alarm is generated. This will cause the alarm LED indicator to be lit and the alarm relay to drop out. The form 'C' contacts change which can be used for user installed equipment to generate a warning. A Battery Faulty or Self Test alarm will cause the charger to enter the inactive Off State. The only way to restart the charger is by a Remote Reset command. This can be done via the UIF unit or via the serial port with an IPM Interface or SCADA.

If any other alarm has occurred the cause should be investigated and corrected. Following is a list of possible fault conditions to aid in trouble shooting. Note that not all conditions can be anticipated.

For alarm trip levels see Functional Specifications and also the individual settings for each specific functions.

ALARM CONDITION	POSSIBLE FAULT CONDITION AND SOLUTIONS
UIF display is blank	Faulty cable, UIF unit or charger. Replace faulty unit.
UIF persistently shows: "Trying to establish communications."	Faulty cable, UIF unit or charger. Replace faulty unit.
AC Failure alarm	Ensure ac breaker is closed. Check ac source at terminals #1 and #2 of the power connector. Check wiring and correct. Faulty charger unit, replace.
DC breaker open alarm	Ensure breaker is closed. Check dc source at terminals #4 and #5 (battery) and #6 and #7 motor drive supply. Faulty charger, replace.
Low Batt. voltage alarm	Battery voltage below the Under voltage trip level due to discharge condition, faulty battery or charger not charging due to other alarm condition. Wiring faulty, check and correct. Check battery and replace.

Batt. extreme temperature alarm	Battery temperature is either hot or cold. Wait until temperature is corrected. Charging is suspended until temperature is moderated. Check if current is coming from the charger causing over charge, if so replace charger.
Batt. faulty alarm	The battery is faulty having too high an internal impedance, open cell or battery fuse is open. This will result in a high battery voltage during charging (yellow charge LED on) and a low battery voltage when dis-charging (yellow dis-charge LED on). Check with DMM. Check wiring and battery series fuse. Replace battery, fuse or wiring. Requires a Remote Reset to start normal operation.
Batt. sensor faulty alarm	Temperature sensor in battery pack open or open wiring. Check wiring and/or replace battery packs.
Batt. regulator high temp alarm	The battery charging circuit overheated. High temperature in the enclosure, wait until cooled down. Circuit fault, replace Battery Regulator board.
Batt. capacity alarm	The actual (calculated during a commissioning cycle) battery capacity is too low for proper operation. Replace both battery packs.
Aux. power supply overload alarm	Total power of auxiliary power supplies overloaded. Check auxiliary equipment and replace. Power supplies will be shutdown for approx 10-15 sec. at which time it will re-set unless condition persist.
Aux. power supply high temperature alarm	The auxiliary power supply is overheated. Auxiliary power supplies are shutdown until circuit has cooled down.
Aux. power supply shut down alarm	The aux. power supplies have been shutdown due to low battery voltage (ac power not available), overload condition or high temperature. Wait until ac power has been restored, remove overload condition or wait until equipment has cooled down.
Aux. 24V power supply alarm	The auxiliary power supply has an alarm, check 24V power supply LED indicators for source of alarm. Wiring between 24V supply and charger open, check and correct. Faulty 24V supply, replace.
Equipment hot alarm	Enclosure temperature too high. Before this alarm is generated one or more other high temperature alarms would have been sensed. Cool down enclosure.
Self test alarm	This indicates an error in the charger. Replace charger unit. **Note:** This alarm may also be triggered when removing the Power connector. The event log will show Self test alarm followed by a Power up event. This is normal.
Ground fault alarm	Either positive or negative of the battery wiring shorted to chassis or ground. Also one of the auxiliary power supplies terminals is shorted to chassis or ground. Check wiring and correct. Auxiliary equipment has a short to ground. Check and correct. Note: The negative terminal of the battery normally measures approx. -8V to chassis or ground. The positive terminal approx. +38V to ground. Disable the ground fault checking feature if not possible to correct.
Unit heater alarm	The internal unit heater is working incorrectly. Replace charger.
No output from one or more aux. power supplies	With any aux. power supply alarms this condition is normal. Otherwise replace aux. power supply board.

REPAIR

Recommended field repair is by replacement of the charger and/or battery packs. If battery packs are to be replaced, it is necessary to replace both packs at the same time. The two new packs must have been matched to each other in order to give the maximum power.

When replacing a charger or the battery packs remember to commission the installation by verifying and/or setting all features and battery parameters followed by invoking a Commissioning cycle. This is important in order to match the battery with the new charger. See the Operational Instruction section.

Recommended charger repair is by module replacement. Determine the cause of failure and replace the appropriate card.

NOTE: Spare modules are stocked at our service depot in Newmarket, Ontario.

REPAIR PROCEDURES

Repair of the charger requires removing the charger from service and replacing a faulty board module only. Isolating a fault on a board level requires specialized test equipment and so can only be performed at the manufacturers facility.

Tools Required:
- User Interface unit and connecting cable
- Hand held multimeter
- Screwdrivers, 1/8" and 1/4" slot, #2 Phillips, at least 6 inches long
  red Robertson (square point), at least 6 inches long

REMOVAL OF THE CHARGER

Removal of the Charger of an Enviropower Systems™ requires the following :

1) Push the ac power circuit breaker to the open position
2) Disconnect the 7 pin power plug from the charger
3) Remove the 13 pin Aux/Signal plug from the charger
4) Loosen the 4 mounting screws holding the backplate

REPLACING A BOARD IN THE CHARGER

1) Remove 4 screws at the front bottom and 4 screws on the top back of the unit holding the cover with the #2 Phillips screw driver.

2) Carefully move cover forward approx. 6". Note polarity of the flat ribbon cable and disconnect it from the controller card. Leave other end connected to the serial board.

3) Move cover by rotating it on its side and place to the left side allowing access to all screws holding the board assemblies.

4) Remove left three screws if replacing the Battery Regulator board, the right three screws if replacing the Aux. Power Supply board or left five screws if replacing the Controller board. When pulling out the screws remove the stand-offs carefully. Do not allow these to drop down into the charger.

5) Remove the board assembly in question by pulling it vertically out of the charger chassis and place it in an anti-static bag.

Note: Electronic board assemblies are sensitive to static. Do not leave boards open and un-protected on the workbench. Place them as soon as possible in the anti-static bags. Also while holding the board firmly, making as much as possible contact with the tracks on the boards, touch with the other hand the chassis before placing boards in the chassis.

6) Take the new board assembly out of the anti-static bag and place it in the chassis by carefully lowering and aligning the edge connectors with the edge connectors on the motherboard (bottom). Push down until fully seated.

7) Replace screws and stand-offs as original. Do not over tighten the screws!

8) Move the cover in front of the unit and re-connect the flat ribbon cable to the controller board.

9) Place cover over the chassis aligning it with the connectors. Make sure no wires are being pinched anywhere inside and put the 8 screws back tightening them well.

REPLACEMENT OF THE CHARGER

1) Mount charger again on to the backplate and tighten the 4 mounting screws.

2) First put the Aux/Signal cable into the receptacle of the charger, secondly insert the Power connector back on the charger. This will power up the charger if sufficient power is available from the battery. Lastly switch on the ac power by closing the ac circuit breaker.

3) Check all parameter settings before leaving the site.

4) Only if the controller card has been replaced is it necessary to place the charger into operation by doing a full commissioning of the ENVIROPOWER SYSTEMS™. If the charger is placed in another location with different battery packs the charger must also go through a full commissioning cycle regardless of which board has been replaced.

REPLACEMENT OF THE BATTERY PACKS

Replacement is required when a battery has failed or does not hold a charge properly. Follow the procedure as outlined.

****

WARNING: When connecting battery wires make sure that no short occurs. If a short occurs the battery is capable of delivering extremely high currents and can weld leads solidly together. This may result in extreme heat, fire and possibly explosion of the batteries!

****

1) Remove ac power by pushing the ac circuit breaker open and remove the Power plug of the Charger.
2) Remove the 30A fuse on the battery pack assembly.
3) Disconnect the wires of the battery positive and negative leads (heavy leads).
4) Disconnect the wires of the battery temperature sensors (thin leads).
5) Loosen the four screws that fasten the battery pack bracket and remove the battery assembly. Remember this assembly is quite heavy!
6) Place new battery pack assembly on the screws and tighten the screws securely.
7) Connect all wires, battery and sensor leads. Observe polarity of the battery leads. The sensor leads are not polarity sensitive.
8) Ensure all leads are connected properly then replace the 30A battery fuse.
9) Re-connect the Power plug of the Charger. This should bring the Charger to live if sufficient power is in the battery.
10) Apply the ac power by pushing in the circuit breaker.
11) If a different capacity battery pack is installed select <S> and <1> on the UIF to set the new capacity and charging current level. If the same capacity is installed you may want to verify the battery settings.
12) **After completing the installation and setting/verification of the parameters invoke a Commissioning cycle.** See the Operational Instruction section for details.

SYSTEMS STORAGE

When a system has been taken out of service ensure that the 7 pin power connector has been disconnected from the charger. It is best to leave the batteries disconnected and allow the batteries to self discharge. There is no harm in leaving the batteries in a discharged state for a period of time. When the system is installed again it requires two or more, depending on the length of discharge state, commissioning cycles to restore the batteries to their normal conditions.

If a system is to be used as a standby unit the system should normally be connected to the ac power. This will keep the batteries fully charged and ready for installation. It is not required to have a load connected to any of the power outputs.

RECOMMENDED SPARES

Description		VEL #	Qnt 10	Qnt 25 (Qnt up to number of systems)
Complete Enviropower Systems™		see the Order Information section in this manual		
Enviropower Controller unit only		see the Order Information section in this manual		
Battery assembly,	2.5Ahr	A -----	1	2
48V, compl. with	4.0Ahr	A 2015	1	2
mounting bracket	7.0Ahr	A 2016	1	2
	10.0Ahr	A 2017	1	2
Fuse, battery	30A	BAF30	5	10
Fuse holder (batt.)		HPG	2	2
Fuse, p/s board	5A	GMA-5A	5	10
Fuse, batt.reg.brd	5A	GMA-5A	5	10
Conn., power		PC4/7ST	1	2
Conn., aux/signal		MSTB13S	1	2
Board, mother		A 2018	1	2
Board, batt.reg.		A 2020	1	2
Board, p/s,	+5/+13V/-13V	A 2019	1	2
Board, p/s,	+48/13V	A 2054	1	2
Board, controller		A 2021	1	2
Board, controller with External I/O		A 2021 IO	2	2
Board, ser.com.,	basic	A 2022	1	2
Board, ser.com.,	RS232	A 2022 A	1	2
Board, ser.com.,	RS422	A 2022 B	1	2
Board, ser.com.,	RS485	A 2022 C	1	2
Board, ser.com.,	20mA loop	A 2022 D	1	2
Ribbon cable	for Ser.com. board	A 2066	1	1
Circuit breaker	ac power, 5A	CB4505A	1	2
Circuit breaker	dc power, 20A	CB4520A	1	2
Cable for EPSIPM Interface, 3 cond DB		D3MF6FT	1	2
UIF (no cable)		VELUIF	1	2
Cable for UIF	9-9 pin DB	D9MF6FT	1	2
Tote box for UIF		A 2057	1	2
24V Motor drive P/S		V 2101	1	2
Conn., power		PC4/7ST	1	1
FRP Enclosure #1, 20"x18"x10"		VEL PMB1	1	1
FRP Enclosure #2, 33"x26"x12"		VEL PMB2	1	1
Pole/box mounting bracket for #1		V-BRK1A	1	1
Pole/box mounting bracket for #2		V-BRK2A	1	1
IPM CD-ROM with the following three items:		V ????	1	-
IPM Operational Manual		V 2103	1	-
IPM Interface Program (Windows)		IPMIF	1	-
PCIF Program (DOS)		PCUIF	1	-

SERIAL COMMUNICATIONS

GENERAL OVERVIEW

The Battery Charger can have a serial hardware-independent protocol installed. There are two options (software programs) which can be used to communicate with the charger. One is communications with a Personal Computer the other via SCADA. For the personal computer there is a special software program that allows for complete control of the ENVIROPOWER SYSTEMS™ IPM via a serial port. The protocol for SCADA is a subset of the industry standard Modicon MODBUS protocol.

The physical connection can be made via a variety of standard hardware configurations which should be selected when ordering the ENVIROPOWER SYSTEMS™ UNIT.
These configurations can be either RS232, RS422, RS485, or 20mA current loop. The current loop can be sourcing or sinking current.

The communication line drivers are electrically isolated from the Battery Charger circuitry.

The serial communications will be temporary suspended while the User Interface unit connected to the charger is active. Communications will be re-established when the User Interface is inactive either because it was disconnected, in-active for approximately 6 minutes or placed in the inactive with the <C> and <0> command.

When switching from one communications channel to another an error message may occur due to the interruption of the asynchronous communications and the change from one protocol to another. After a short period full communications will be re-established.

DATA FORMAT AND BAUD RATE

The implemented data format is 8 N 1 (8 Data bits, No parity and 1 Stop bit).
Baud rate is fixed at 1200 baud.
The same format is used for both PC and SCADA communications.

MULTIPLE CONTROLLER INSTALLATION (applicable with Controller s/w 3.0.7 and up)

ONLY with RS485 hardware can multiple controllers be installed on a common bus. In this case each Controller must have a unique address. This address must be changed for all Controllers on the RS485 bus in a multiple Controller installation and could be set **between 2 and 255.**

The default address of the Controllers is ‘1'. The address ‘1' is used as a broadcast mode and any Controller connected will return data as requested.
The default address is left for single controller installations and is also used by the UIF.
It can also be used by the IPM program if only one Controller is connected. This situation is **required** if the address for the Controller must be changed.

When the IPM program sends requests with address ‘1' and there are multiple Controllers communication collision will occur and the IPM program will indicate an “Error in communications”.

PHYSICAL CONNECTIONS

The Serial Communication Equipment can be connected to the Battery Charger via a male DB9 connector. Following is the pinout (signal names with respect to the Charger):

Pin on DB9	Charger Signal Name
2	TXD+
3	RXD+
4	GND
5	GND
6	LPSRC
7	TXD-
8	RXD-

NOTES: **1) A special cable is required to prevent possible damage to your equipment due to the fact that different voltages for the various hardware protocols are available at the connector.**

2) Only those pins which are required for your particular purpose should be wired

3) Damage to the PC may result if you do not ensure that the PC cable is connected to the serial port connector and NOT the UIF connector. .

The following table shows all possible configuration combinations (signal names with respect to the Communication Equipment):

Pin Number	RS232	RS485	RS422	20mA Loop Ext. Source	20 mA Loop Int. Source
2	RXD		RXD+	RXD+	RXD-
3	TXD	+ (pos)	TXD+	TXD+	
4					TXD-
5	GND	GND	GND	GND	GND
6					RXD+
7			RXD-	RXD-	
8		- (neg)	TXD-	TXD-	TXD+

The internal source for the 20mA loop is approx. 15 V allowing for short loop length only. If an external source is used with nominal 24 V standard loop length can be expected.

SCADA COMMUNICATION

The Communication protocol installed In the Battery Charger is a single master / single slave. The Battery Charger unit is always a slave and cannot be programmed as a master.

Both monitoring and control are possible with installed Communication Protocol using simple read and write commands. The actual list of data that can be accessed is outlined in the "Supported Features" section.

DATA PACKET FORMAT

A complete request / response sequence consists of two separate data frames.

Master Request Transmission consists of:

Slave Address	- 1 byte
Function Code	- 1 byte
Data	- variable size, depending on Function Code
CRC	- 2 bytes.

Slave Response Transmission consists of:

Slave Address	- 1 byte
Function Code	- 1 byte
Data	- variable size, depending on Function Code
CRC	- 2 bytes.

The two Function Codes are supported by the battery charger protocol. One for reading charger's data, and another for performing a particular function. See the following tables for details:

A) **Function 03** - Read Registers

		Bytes	Example (hex)	Comment
Request	Slave Address	1	01	charger address
	Function Code	1	03	read registers
	Data Starting Address	2	00 08	start from number of cells
	Number of Registers	2	00 03	get 3 registers
	CRC	2	84 09	two bytes CRC code (LSB first)

		Bytes	Example (hex)	Comment
Response	Slave Address	1	01	charger address
	Function Code	1	03	read registers
	Data Byte Count	1	06	3 registers - 6 bytes
	Data #1	2	00 28	40 battery cells
	Data #2	2	01 90	rated capacity 4.00 Ahr
	Data #3	2	00 C8	current limit 2.00 A
	CRC	2	C0 C3	two bytes CRC code (LSB first)

B) **Function 05** - Execute Operation

		Bytes	Example (hex)	Comment
Request	Slave Address	1	01	charger address
	Function Code	1	05	execute operation
	Operation Code	2	00 01	start conditioning
	Code Value	2	FF 00	mandatory
	CRC	2	DD FA	two bytes CRC code (LSB first)

		Bytes	Example (hex)	Comment
Response	Slave Address	1	01	charger address
	Function Code	1	05	execute operation
	Operation Code	2	00 01	start conditioning
	Code Value	2	FF 00	mandatory
	CRC	2	DD FA	two bytes CRC code (LSB first)

C) **Function 06** - Execute Write operation to Digital Outputs (byte wise)

		Bytes	Example (hex)	Comment
Request	Slave Address	1	01	charger address
	Function Code	1	6	execute operation
	Address	2	00 28	mandatory
	Byte Value	2	00 nn	nn is byte value
	CRC	2	DD FA	two bytes CRC code (LSB first)

		Bytes	Example (hex)	Comment
Response	Slave Address	1	01	charger address
	Function Code	1	6	execute operation
	Address	2	00 28	mandatory
	Byte Value	2	00 nn	nn is byte value
	CRC	2	DD FA	two bytes CRC code (LSB first)

ERROR CHECKING

Error checking algorithm is an industry standard CRC-16 (16 bit cyclic redundancy check) applied on every communication packet. It uses 16-bit characteristic polynomial 0xA001. Contrary to the other information, CRC bytes are being sent starting with the LSB byte.

TIMING

Data packet synchronisation is maintained by timing constraints. The receiving device must measure the time between the reception of characters. If the "3.5 x character time" elapses without a new character, the communication link is considered free for next packet sending/receiving.

SUPPORTED FEATURES

The following items can be accessed on a battery charger (see chapters 7 and 8 for details):

a) Charger Settings,
b) Charger Commands,
c) Actual Measured Values (battery voltage and current)
d) Functional Status of Battery,
e) Alarm Status,
f) Status of charging process,
g) Revision of Charger firmware,
h) Aux. Power Supply Status,
i) Last 64 events stored,
j) Setting of the external 8 digital outputs (optional equipment),
k) Reading back the external 8 digital output settings,
l) Reading of the external 8 digital inputs (optional equipment) ,
m) Reading of the external analog input (optional equipment).

All values are 16-bit signed integers with associated scaling factors or bit mapped masks.

MAP OF ACCESSIBLE DATA

Function Code 03 is used to read a group of registers from a slave unit. The maximum number of registers that can be read in one transmission is 125. Registers are 16 bits (2 bytes) long, with the high order byte transmitted first. The following table shows all accessible data with assumed scaling factors.

Table 7.1 - **Map of Available Registers**

Decimal Address	Value Range or Format	Scaling Factor	Name / Comment
8	0 to 100	1	Number of Battery Cells - Read Only
9	0 to 10000	100	Rated Capacity, 0 - 100.00 Ahr - Read Only
10	0 to 10000	100	Current Limit, 0 - 100.00 A - Read Only
16	0 to 10000	100	Battery Voltage, 0 - 100.00 V
17	-10000 to 10000	100	Battery Current, -100.00 to 100.00 A
18	0 to 10000	100	Capacity Ahr, 0 - 100.00 Ahr
19	0 to 10000	100	Percent Charged, 0 - 100.00 %
20	0 to 10000	100	Calculated Capacity, 0 - 100.00 Ahr
21	0 to 5000	1	External analog input in mV's. (Optional equipment installed)
28	bit mapped	N/A	b0-b7, digital outputs
32	Bit mapped	N/A	If 0 - No alarms, else Bit 0 - AC Failure Bit 1 - Self Test Alarm Bit 2 - Battery Regulator High Temperature Bit 3 - Battery Faulty Bit 4 - Battery Low Voltage Bit 5 - Battery Extreme Temperature Bit 6 - Battery Sensor Faulty Bit 7 - Ground Fault Bit 8 - Unit Heater Alarm Bit 9 - Battery Capacity Alarm Bit A - DC Breaker Open Bit B - Equipment Hot Bit C - Aux. Power Supply High Temperature Bit D - Aux. Power Supply Overload Bit E - Aux. Power Supply Shutdown Bit F - Aux. 24 V Power Supply Alarm

33	0 to 5	1	0 - Off State 1 - Normal State 2 - Commissioning State 3 - Conditioning State 4 - Charging Suspended 5 - Commissioning or Conditioning Interrupted
34	Bit mapped	N/A	Bit 0 - Ground Fault Enabled Bit 1 - External Alarm Enabled Bit 2 - Charger Heater Enabled Bit 3 - External Input used for Conditioning Bit 4 - Under voltage Alarm Enabled Bit 5 - Battery Capacity Alarm Enabled
35	0 to 100	1	Under voltage Alarm Level (0 - 100 V)
36	25 to 75	1	Battery Capacity Alarm level (25 to 75%)
37	Bit mapped	N/A	Alarms (future)
40	0 to 65535	100	Charger firmware revision (Example: 212 corresponds to revision 2.12)
41	0 to 9999	1	User Defined ID Number (default value 0)
49	0 to 64	1	Number of recorded events
50	51 to 114	1	Address of the most recent event (not valid if recorder is empty)
51	See Note 1	1	Event (See Note 2, below the table)
52	See Note 1	1	Event
...			
113	See Note 1	1	Event
114	See Note 1	1	Event

Note 1: Events are coded using numbers from one to the total number of different events.

0 AC Failure
1 Self Test Alarm
2 Battery Regulator High Temperature
3 Battery Faulty
4 Battery Low Voltage
5 Battery Extreme Temperature
6 Battery Sensor Faulty
7 Ground Fault
8 Unit Heater Alarm
9 Battery Capacity Alarm
10 DC Breaker Open
11 Equipment Hot
12 Aux. Power Supply High Temperature

13 Aux. Power Supply Overload
14 Aux. Power Supply Shutdown
15 Aux. 24 V Power Supply Alarm
16 Commissioning Started
17 Conditioning Started
18 Commissioning or Conditioning Cancelled
19 Commissioning Completed
20 Commissioning Interrupted
21 Conditioning Completed
22 Conditioning Interrupted
23 Default Settings
24 Charger Powered-Up
25 Event Records Cleared
26 AC Power Restored
27 Multiple Last Event
28 Remote Reset
29 Insert Event Marker

Note 2: Beginning of the rotating buffer for events, which is 64 registers long. The new event is normally stored on an incremented address, except for one that comes after the event recorded on last address.

IMPLEMENTED COMMANDS

This is a list of commands that can be performed via the serial port. Function Code 05 is used with the following Operation Codes (see Chapter 3 for details on format):

Operation Code	Function
0	Start Commissioning
1	Start Conditioning
2	Cancel Commissioning or Conditioning
3	Remote Reset
4	Insert event marker

Note 3: After a "Remote Reset" command, the charger will not send a response message. This is due to the nature of requested command. Communications will be halted until the Charger is fully running again.

INSTALLATION DRAWINGS

Following are drawings to aid installation:

1) Typical wiring of the Enviropower Systems™ using remote contacts for Comm./Cond. inputs.
2) Typical wiring of the Enviropower Systems™ including the 24V power supply.
3) Back plate dimensions used for pad mounting.
4) Mounting dimensions for the Enviropower Systems™ enclosure #1.
5) Back plate dimensions for large pad mount, type #2
6) Mounting dimensions for the Enviropower Systems™ enclosure #2.
7) External wiring for SBL charger replacement. (Special request.)