RIFERIMENTI ***REFERENCES***	**Progetto:** ***Project:***	**ENERGY STORAGE SYSTEM** **33kVA, 66kVA, 100kVA**	
	WBS ID :		
OGGETTO/SCOPO *SUBJECT/SCOPE*	Sunsys PCS^2 communication protocol		
Apparato / Circuito: ***Equipment/Circuit:***	**Sunsys PCS^2 (Power Conversion Storage System)** **33kVA, 66kVA, 100kVA**		
Documenti di riferimento: ***Reference documents:***			
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Document revisions

Revision	Date	Author	Evolution/Change
01 Draft.	09/04/2012	AGO	Initial revision
02 Draft	16/07/2013	ETI, AGO	Data map reviewed, state-machine diagrams updated
03 Draft	28/11/2013	ETI	Battery type parameter updated, added Standard JBus Database
04 Draft	10/01/2014	ETI, MDV	Supervisor Variables, System Warnings and System Alarms reviewed
05 Draft	17/04/2014	ETI, MDV	Supervisor Statistics Variables, System Warnings and System Alarms reviewed
06	06/05/2014	SCA	System Warnings and System Alarms reviewed (Temperature)
07	25/07/2014	MDV,ETI	Control Variables, Supervisor Variables, System Warnings and System Alarms reviewed
08	12/09/2014	SCA	Samsung battery type added
09	24/02/2015	SCA/AGO	Additional commands and variables for Samsung batteries
10	15/07/2015	MDV	Additional functional general information

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Definitions

BMS Battery Management System
EMS Energy Manager System
ESS Energy Storage System (includes PCS and Battery System)
HMI Human Machine Interface
PCS Power Conversion System
PCS² Power Conversion Storage System
SOC State of Charge
SOH State of Health

1 Foreword

The scope of this document is the definition of the communication interface for the SOCOMEC Energy Storage System, *ESS* from here on, to be implemented by an external controller.
The variables and parameters defined in ***Energy Manager Modbus registers mapping*** are intended to be sufficient to manage battery charge, discharge and their life expectation.
The variables and parameters defined in ***Monitoring Modbus registers mapping*** are intended to monitoring ESS activities.

1.1 Protocol overview and definitions

The communication protocol supported by SOCOMEC ESS is the standard *Modbus* application-layer protocol. The following versions are available:

- **Modbus RTU**, over a standard RS485 serial line;
- **Modbus/TCP**, over a standard Ethernet connection (over TCP/IP, port 502).

SOCOMEC ESS acts as a *Modbus* server device (slave).

Refer to the *Modbus* protocol specifications for the description of the frame formats and protocol details (available on www.modbus.org).

Configuration of the communication parameters

RS485 port

The serial communication parameters of the RS485 port can be configured by the user through the display of the converter. These are the default values:

Slave address 1

Baudrate 9600 kbps
No. of data bits 8
Parity None
No. of stop bits 1

Ethernet

The communication cycle time shouldn't be lower than 20 ms.
The Ethernet parameters can be accessed through the display of the converter.
Both DHCP and fixed IP addressing are supported.

NOTE: The PCS can manage only one connection on the Modbus TCP/IP dedicated port (default value: 502).

Modbus Function Codes

Only the following FC (*Function-Codes*) are supported:

Modbus FC	Descrizione
3	Read registers
6	Write Single register
16	Write Multiple registers

Registers addressing mode

A "base 0 address" format has to be used to access data.

This means that the "*Modbus Address*" field in the data mapping tables of this document shall be considered as the *Modbus* PDU address (no -1 offset has to be applied to get the PDU address).

When accessing different data tables, separate message requests have to be used, even if they have contiguous addresses. The areas in the following picture shall be considered as different data tables:

Monitoring areas

0x0360	*Date and Time*
0x0363	
0x1000	*Identifiers*
0x101B	
0x1020	*System States*
0x1023	
0xm024	*Unit States*
0xm027	
0x1030	*System Warnings*
0x1033	
0xm034	*Unit Warnings*
0xm037	
0x1040	*System Alarms*
0x1043	
0xm044	*Unit Alarms*
0xm047	
0x1050	*System Measurements*
0x106F	
0xm070	*Unit Measurements*
0xm08F	
0x1090	*System Statistics*
0x10AF	
0x10E0	*System Settings*
0x10FF	

Control and supervision

0x1100	*Control variables*
0x111F	
0x1150	*Supervision variables*
0x116F	
0x1170	*Battery parameters*
0x117F	
0x1A50	*Battery specific area*
0x1AC5	

m = 1 *Data aggregation of the Units*
m = 2 *Unit #1*
m = 3 *Unit #2*
m = 4 *Unit #3*

2 System Control Modbus registers mapping

The SOCOMEC ESS is typically managed by an external *Energy Manager System* controller (*EMS* from here on), which has the task to define the rules for the energy exchange between the storage system and the grid.
The *EMS* can control the ESS by accessing some control/supervision variables that are mapped in the following areas:

- ***Control variables*** (in read/write mode for the *EMS*), which allow the *EMS* to send commands and references to the ESS;
- ***Supervision variables*** (read-only for the *EMS*), which allow the *EMS* to monitor the global state of the ESS.

The most important batteries nominal data are available in the ***Battery parameters*** area.
Additional monitoring information of specific batteries (detail of alarms, warnings, measures) are mapped in other areas, that are beyond the scope of this document.

2.1 Control variables (OUTPUT for the *EMS*)

All variables in this area have read/write access.

Note: the symbol *PU* as unit in the table below means "Per-Unit"; the value of the quantity is its representation related to the nominal value of the same quantity, multiplied by a factor 2^N.

Modbus Address (HEX)	Variable	Unit	Description
1100	Command Word	---	**Bit 0 = Switch-On** Closes DC contactor and connects to the batteries. Switch-on sequence is completed when the "*Battery Ready*" bit in the *Status Word 1* is set to 1. If *"Sleep mode"* bit in *Status Word 1* is 1, then a *"Switch-On=0"* command is needed, before restarting again the ESS **Bit 1 = Operation-Mode Enable** Enables the operating mode selected by *Operation-Mode* variable. When an operation mode is active the *"Operation Mode Enabled"* bit in the *Status Word 1* is set to 1. If *"Operation-Mode End"* bit in *Status Word 1* is set to 1, then a *"Operation-Mode Enable = 0"* command is needed, before restarting again the operation mode. **Bit 2 = Alarm Reset** A rising edge of "*Alarm Reset*" requests the clearing of the pending alarms. Alarm conditions: - System alarm, "*Alarm state*" bit in the *Status Word 1* is set to 1; - Only some power modules are in alarm (*"Module n General Alarm"* variable [0x1032], bit 10..15 are set to 1), but the system is still operational. **Bit 3..14** = *reserved* **Bit 15 = Life / Performance Mode** [1] Selects the operation behavior of the battery system: 0 : Life-Mode, the batteries can operate in the range 5-100% SOC, to preserve life-time 1 : Performance-Mode, the batteries can operate in full range 0-100%

[1] for Samsung batteries only

Modbus Address (HEX)	Variable	Unit	Description
			SOC. **Default = all bits 0 (zero)**
1101	Operation-Mode	---	Sets the operation mode of the converter. **0 = No operation** **1 = Normal mode (**batteries are charged/discharged according to *P_setpoint* and *Q_setpoint*) **2 = Commissioning procedure** [1] **3 = Equalization procedure** [1] **5 = State-of-Health** (SOH) calculation procedure [1] **10 = System calibration procedure** [1] **Default = 0**
1102	P_setpoint	PU	Active Power reference (signed). Value of active power related to the nominal power Sn of the PCS in PU, so that 2^{14} = 16384 = 100% Sn Charge/discharge mode is selected by the sign: Positive values → DISCHARGE mode Negative values → CHARGE mode (Active sign convention) Range: [-18022…0... +18022] corresponding to [-110% ... 0% ... +110%] Sn **Default = 0** Note: overload @110% Sn can be hold for 30 minutes by the PCS Note: overload is allowed only when *"Capability"* variable [0x1168] is equal to 100% and overload timeout is not expired. The *"Capability"* is the value of available power of PCS.
1103	Q_setpoint	PU	Reactive Power reference (signed). Value of reactive power related to the nominal power Sn of the PCS in PU, so that 2^{14} = 16384 = 100% Sn Inductive/capacitive behavior is selected by the sign: Positive values → CAPACITIVE (Over-excitation) Negative values → INDUCTIVE (Under-excitation) (Passive sign convention) Range: [-16384…0... +16384] corresponding to [-100% ... 0% ... +100%] Sn **Default = 0**
1104	*Reserved*	---	---
1105	*Reserved*	---	---
1106	*Reserved*	---	---
1107	*Reserved*	---	---

[1] only for Lead-Acid batteries

Modbus Address (HEX)	Variable	Unit	Description
1108	Watchdog_monitor	---	Monitoring of the communication link between *EMS* and ESS. Updated by the master with a free-running counter (See paragraph below). **Default = 0**
1109	*Reserved*	---	---
110A	*Reserved*	---	---
110B	I_Max_Charge [1]	1/10 A	Value of maximum DC current during charge (Negative *"P_Setpoint"*): if 0 (zero) charge is not allowed (*"Battery can be charged"* bit in *Status Word 1* is clear to 0). **Default = 0**
110C	I_Max_Discharge [1]	1/10 A	Value of maximum DC current during discharge (Positive *"P_Setpoint"*): if 0 (zero) discharge is not allowed (*"Battery can be discharged"* bit in *Status Word 1* is clear to 0). **Default = 0**
110D	V_Charge [2]	1/10 V	Battery voltage reference in charge mode. If 0 (zero) then internal default reference is used, according to battery type. The actual used voltage reference can be read-out in *"Nominal_Charge_Voltage" (0x1175)* **Default = 0**
110E	V_Min_Discharge [1]	1/10 V	Value of minimum battery voltage in discharge mode, if battery voltage falls below this value then bit "*Discharge complete"* in "*Warning Word"* is set to 1 and discharge is no more allowed. **Default = 0**
110F	String Disconnection Command [3]	Bit	In a multi-string battery application (strings of batteries in parallel), this command forces strings to be disconnected from the system, by opening their DC contactors (bitwise, each bit corresponds to one string): **Bit 0 … 15 = if set to 1, disconnects 1st ... 16th string** E.g., if the first bit (LSB) is set high, the first string will be forced to disconnect from the system. **Default = 0**
1110	Connection_Strategy [3]	---	In a multi-string battery application (strings of batteries in parallel), it defines the string that will be connected first, in case of voltage unbalance between strings. **0 =** String with the highest voltage (discharge priority) **1** = String with the lowest voltage (charge priority) **11 .. 15** = String #1 .. String #5 Other values: as for value 0, string with the highest voltage Changes to this variable are effective if the PCS is switched-off. **Default = 0**
1111÷111F	*Reserved*	---	---

[1] only for Generic Battery, if remote V/I limits are configured
[2] only for Generic Battery and Samsung lithium battery
[3] only for Samsung lithium battery

Communication-link monitor

The communication link between the *EMS* (master) and ESS (slave) can be monitored by the ESS itself, in order to be able to autonomously stop operations and enter a safe state, in case of communication failure. In this case *"WatchDog Alarm Latch"* bit in *Alarm-Word* is set.
In order to enable this feature, the parameters "*External Communication Watchdog*" and "*Watchdog timeout*" must be set. This operation can be performed through the inverter display.

The external controller (*EMS)* has to cyclically update the *Watchdog_monitor* variable with an increasing number (a free-running counter), with a cycle time that must be shorter than the timeout set in parameter "*External Communication Watchdog Timeout*".

NOTE: In case a watchdog alarm occurs:
- *"Switch-On"* and *"Operation-Mode Enable"* bits of *Command Word* [0x1100: b0 & b1] are automatically cleared;
- P and Q setpoints [0x1102 & 0x1103] are forced to zero.

2.2 Supervision variables (INPUT for the *EMS*)

All variables in this area have read-only access.
The availability of some data depends on the battery type.

Modbus Address (HEX)	Variable	Unit	Description
1150	Status Word 1	Bit	Status of the inverter (bitwise): **Bit 0 = Switched-On** Image of the *"Switch-On"* command. **Bit 1 = Operation-Mode Enabled** Current operation mode (see "*Operation-Mode Display*") is enabled (after "*Operation-Mode Enable*" command). **Bit 2 = Operation-Mode End** Current operation mode (see "*Operation-Mode Display*") has autonomously ended; this bit is set after a procedure has been completed. If "*Operation-Mode"* is "*Normal Mode*" this bit is never set. **Bit 3 =** *reserved* **Bit 4 = Battery Ready** Switch-on sequence is completed, after "*Switch-On*" command; DC contactor is closed, battery system is ready and connected to the PCS. **Bit 5 = Inverter Ready** Start sequence is completed, after both "*Switch-On*" and "*Operation-Mode Enable*" commands; DC and AC contactors are closed, the PCS is connected to the grid and ready to operate ("*P_setpoint"* and "*Q_setpoint"* are active). **Bit 6 = Sleep** The system is in Sleep mode for battery saving, in case no operations are performed; DC and AC contactors are open and the PCS is disconnected from the grid. A reset of *"Switch-On"* command is needed to exit Sleep mode. **Bit 7 = Alarm state** The ESS is in Alarm state, DC and AC contactors are open and the PCS is in safe state, disconnected from the grid. An "*Alarm Reset*" command (rising edge) is needed to clear the alarm condition. **Bit 8 = Idle** The PCS is connected to the grid, with active and reactive power reference equal to zero. **Bit 9 = Charging** PCS is charging batteries. Actual active power reference is negative. **Bit 10 = Discharging** PCS is discharging batteries. Actual active power reference is positive. **Bit 11 = General Critical Alarm** Hardware Reset is needed! There are one or more active critical alarms (see "*Alarm Word*" for details). **Bit 12 = General Alarm** There are one or more active alarms (see "*Alarm Word*" for details). **Bit 13 = General Warning** There are one or more active warnings (see "*Warning Word*" for details).

Modbus Address (HEX)	Variable	Unit	Description
			Bit 14 = Battery can be charged Batteries can be charged, if 0 (zero) charge is not allowed. **Bit 15 = Battery can be discharged** Batteries can be discharged, if 0 (zero) discharge is not allowed.
1151	Status Word 2	Bit	**Bit 0 ..15** = *reserved*
1152	Alarm Word	Bit	**Bit 0 = WatchDog Alarm** WatchDog timeout has elapsed; see "*Communication-link monitor"* paragraph for more information. NOTE: In case a watchdog alarm occurs: - *"Switch On"* and *"Operation Mode Enable"* of *Command Word* [0x1100: b0 & b1] are automatically cleared; - P and Q setpoint [0x1102 & 0x1103] are forced to zero. **Bit 1 = Battery Overvoltage Alarm** Battery voltage is too high. **Bit 2 = Battery Communication Fault** Communication failure between PCS and BMS (Battery Management System). **Bit 3 = Inverter Fault** Generic PCS fault (see Monitoring alarms for more details). **Bit 4 = Battery Fault** There are one or more active Battery faults (see "*Battery specific data*" for details). **Bit 5 = Thermal protection active** Thermal protection of battery cabinet's fan activated. [1] **Bit 6 = Battery Disconnection Fault** PCS in "SWITCHED OFF" state and Battery Voltage is present. Verify DC Contactor. **Bit 7 = Battery Temperature Too High** PCS in "SWITCHED OFF". Dangerous battery temperature for safe operation. [1] **Bit 8..15** = *reserved*
1153	Warning Word	Bit	**Bit 0 = Active Power reference too low for charging** *"P_setpoint"* in "*Control Variables"* is too low to guarantee correct charging of battery. [1] Charge is not allowed. **Bit 1 = De-rating in progress** Charge/discharge power is de-rated, due to battery request **Bit 2 = Discharge complete** Battery is fully discharged, re-charge is needed. **Bit 3 = Battery Low Voltage** Battery cell voltage is critically low, the PCS is going to be switched-off because of *"Inverter discharge complete"*. [1] **Bit 4 = Battery Low Charge** Battery charge is critically low, the PCS is going to be switched-off because of *"Discharge complete"*. [1] **Bit 5 = Battery Rest Time request** Battery requires to wait Rest Time before charging/discharging.[1] During this time charge/discharge is not allowed. **Bit 6 = Battery Full Charge request** Battery requires a Full Charge before discharging. [1] Discharge is not allowed. **Bit 7 = Battery Temperature High**

[1] only for Lead-Acid batteries

Modbus Address (HEX)	Variable	Unit	Description
			Battery temperature warning. [1] **Bit 8 = System calibration procedure request** Execution of "*System calibration procedure*" is requested. [1] See "*Operation-Mode"* in *"Control Variables"* for more information to start "*System calibration procedure*". **Bit 9 = Battery equalization procedure request** Execution of "*Equalization procedure*" is requested. [1] See "*Operation-Mode"* in *"Control Variables"* for more information to start "*Equalization procedure*". **Bit 10 = Inverter Warning** Generic inverter warning (see Monitoring warning for more details). **Bit 11 = Battery Warning** Generic battery warning (see "*Battery specific data*" for details). **Bit 12 = Local Mode enabled** ESS is locally controlled through HMI. Control Variables are not evaluated. **Bit 13..15** = *reserved*
1154	Operation-Mode Display		Active Operation-Mode, see "*Operation-Mode"* in *"Control Variables"* for more information.
1155	Vac	V	Grid AC voltage (phase-to-phase)
1156	Iac	1/10 A	PCS AC current
1157	Active_Power (P)	1/10 kW	PCS Output Active Power (*signed*) Positive values → Generation (discharge mode) Negative values → Absorption (charge mode) (Active sign convention)
1158	Reactive_Power (Q)	1/10 kVAR	PCS Output Reactive Power (*signed*) Positive values → CAPACITIVE behavior (Over-excitation) Negative values → INDUCTIVE behavior (Under-excitation) (Passive sign convention)
1159	*Reserved*	---	
115A	cosPhi	10^{-3}	cos(φ) power factor
115B	Frequency	1/10 Hz	Grid frequency
115C	Vdc_battery	V	DC voltage on PCS
115D	Idc_battery	1/10 A	DC current (*signed*) Positive values → Generation (discharge mode) Negative values → Absorption (charge mode) (Active sign convention)
115E	SOC	%	Battery State-Of-Charge [2]
115F	SOH	%	Battery State-Of-Health [2]
1160	*Reserved*	---	
1161	Battery Temperature	°C	Battery temperature
1162	Time before complete discharge	min	Time before complete discharging of battery [3]

[1] only for Lead-Acid and Enersys Batteries
[2] not available for Generic battery
[3] only for Lead-Acid batteries

Modbus Address (HEX)	Variable	Unit	Description
1163	Time before complete charge	min	Time before complete charging of battery [3]
1164	Battery Cycles	---	Counter of battery cycles --- *For reference only* --- It has not to be considered for warranty purposes concerning life-time of the batteries.
1165	Connection_Strategy_Display	---	Actual value of the selected connection strategy (see "*Connection_Strategy*" at address *0x1110*)
1166	Digital Input/Output State	Bit	Status of Digital Inputs (1 = active): **Bit 0 = Digital Input 1** **Bit 1 = Digital Input 2** **Bit 2 = Digital Input 3** **Bit 3..7** = *reserved* Status of Digital Outputs (0 = NC Close, NO Open; 1 = NC Open, NO Close) **Bit 8 = Digital Output 1** **Bit 9 = Digital Output 2** **Bit 10 = Digital Output 3** **Bit 11 = Digital Output 4** **Bit 12..15** = *reserved*
1167	*Reserved*	---	
1168	Battery_String_Out_Of_Order	Bit	In a multi-string battery application (strings of batteries in parallel), a string is reported as "Out-of-Order", if it has been disconnected by opening its circuit breaker or if a protection fuse is blown in the coupling cabinet. [1] **Bit 0 … 15 = if set to 1, battery string #1 .. #16 is out of order**
1169	PCS_Capability	PU	Available power that can be currently managed by PCS, considering PCS internal power limitation. The value of capability is related to the nominal power Sn of the PCS in PU, so that 2^{14} = 16384 = 100% Sn Range: [0... +16384] corresponding to [0% ... +100%] Sn
1167÷116F	*Reserved*	---	

[1] Only for Samsung battery

2.3 Battery parameters

All variables in this area have read-only access and holds the batteries nominal data.
The availability of some data depends on the battery type.

Modbus Address (HEX)	Variable	Unit	Description
1170	Battery_Type	---	0 = Generic battery 1 = Lithium-Ion battery (Enersys) 2 = Lithium-Ion battery (Saft) 3 = Lead-Acid battery 62Ah (Enersys) 4 = Lead-Acid battery 92Ah (Enersys) 5 = Lithium-Ion battery (Samsung)
1171	Number_Of_Modules	---	Number of modules per cabinet [1]
1172	Number_Of_Cabinets	---	Number of cabinets in parallel [1]
1173	Nominal_Capacity	1/10 Ah	[1]
1174	Nominal_Energy_Capacity	1/10 kWh	[1]
1175	Nominal_Charge_Voltage	1/10 V	[1]
1176	Maximum_Charge_Voltage	1/10 V	Max. charging voltage
1177	Minimum_Discharge_Voltage	1/10 V	Min. allowed voltage in discharge mode
1178	Nominal_Charge_Current	1/10 A	Nominal charge current [1]
1179	Maximum_Charge_Current	1/10 A	Max. allowed current in charge mode
117A	Nominal_Discharge_Current	1/10 A	Nominal discharge current [1]
117B	Maximum_Discharge_Current	1/10 A	Max. allowed current in discharge mode
117C	Number_Of_Connected_Cabinet	---	Number of connected cabinets in parallel [1]
117D÷117F	*Reserved*	---	

2.4 Battery specific area

This data area contains battery data provides by BMS (detail of alarms, warnings, measures) and is mapped depending on specific battery type.
Refer to battery documentation for more information.
All variables in this area have read-only access.

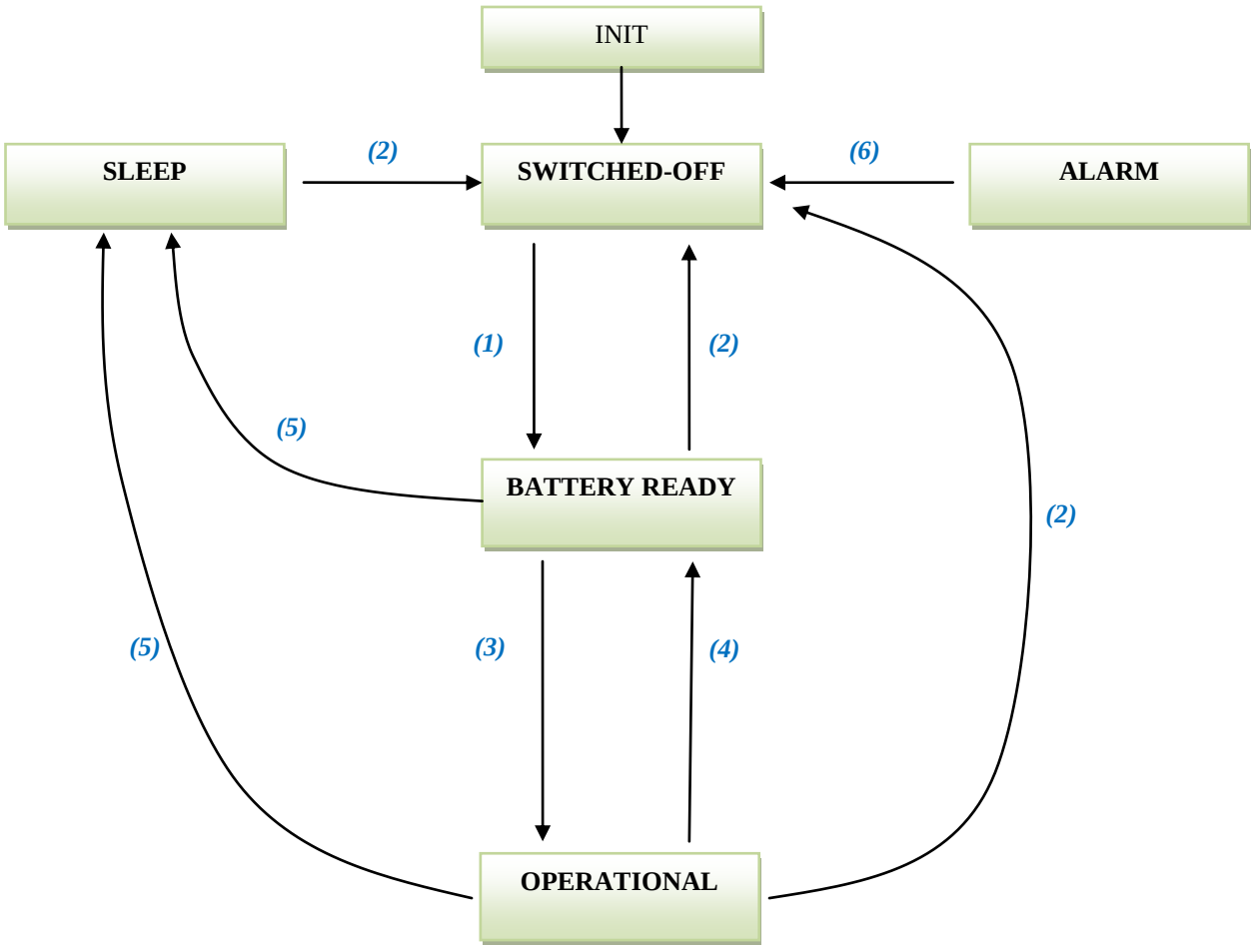
Modbus Address (HEX)	Variable	Unit	Description
1A50÷1AC5	*Battery specific data*	---	Refer to battery specific documentation

[1] not available for Generic Battery

2.5 Inverter operation modes

2.5.1 Converter state-machine

The ESS implements the following main state-machine:



With the following transition conditions:

- **(1)** *Switch-On = 1*
- **(2)** *Switch-On = 0*
- **(3)** *Operation-Mode Enable = 1*
- **(4)** *Operation-Mode Enable = 0*
- **(5)** Inactivity timeout expired (30 min)
- **(6)** *Alarm reset 0 → 1* (rising edge) with no pending alarms

At system power-up, the PCS automatically enters the **SWITCHED-OFF** state, from the **INIT** state.
After a *"Switch-On"* command, the PCS enters the **BATTERY READY** state, after successful check of the battery conditions. The DC contactor is closed and the battery is ready to operate. In this case, the *"Battery Ready"* bit in the *Status Word 1* is set to 1.
Only at first power-on of the battery system, a self-tuning/calibration process is performed by the PCS. This operation can take about 1 minute.

From the BATTERY READY state, by setting "*Operation-Mode Enable"* to 1, the PCS enters the **OPERATIONAL** state: the *"Operation-Mode Enabled"* bit in the *Status Word 1* is set to 1 (*"Operation-Mode Enable*" command has been accepted).
In the OPERATIONAL state, the functionality performed by the system is defined by the value of the "*Operation-Mode"* variable.

In case *"Operation-Mode"* is set to *"Normal Mode"*, the AC contactor is closed, the PCS is connected to the grid and ready to operate (*"Inverter Ready"* in the *Status Word 1* is set to 1); *P_setpoint* and *Q_setpoint* are now active.

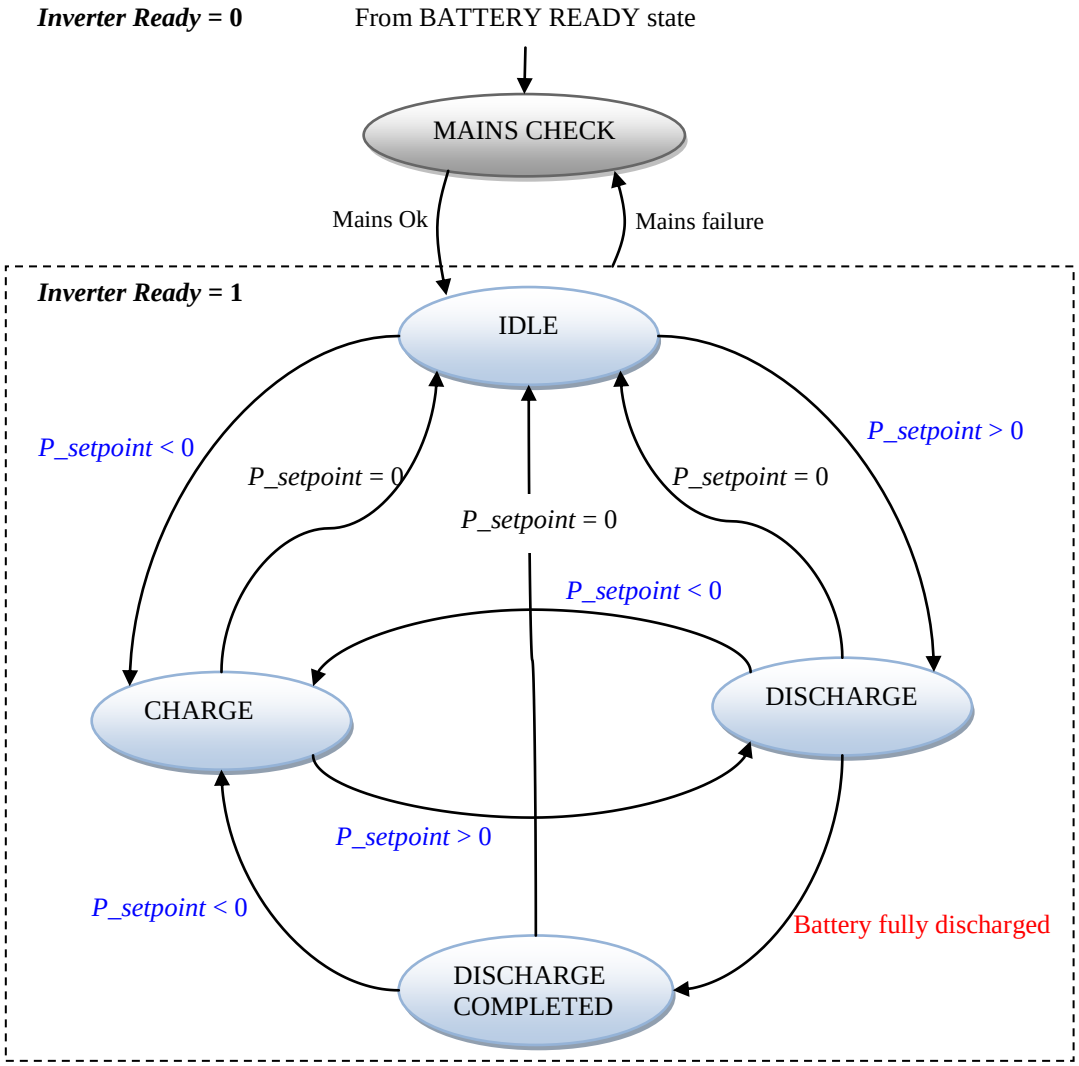
In case of alarm, the system enters the **ALARM** state from any other state: the user has to provide a rising edge of the "*Alarm Reset*" bit in the *Command*-Word (0→1 transition) to exit the ALARM state and enter the SWITCHED-OFF state; the reset command is actually executed only if no alarm conditions are still pending: in this case the alarm flags are cleared and the system can be restarted.

NOTE: If "*General Critical Alarm*" bit in *Status Word 1* is active an hardware reset is needed.
It's possible to verify if the critical alarm is concerned to the batteries ("*Battery Fault*" bit in *Alarm Word* is 1) or to the PCS ("*Inverter Fault*" bit in *Alarm Word* is 1).

In case of inactivity of the PCS for 30 minutes, the converter enters the **SLEEP** state and the *"Sleep"* bit in *Status Word 1* is set to 1. In this mode DC and AC contactors are opened and the PCS is disconnected from the grid.
This happens for example when the converter is operating in "*Normal mode*" and battery is fully discharged, but with *P_setpoint* >= 0 for a long time (*"Idle"* bit in the *Status Word 1* is 1) or after the conclusion of a system procedure (*"Operation-Mode End"* bit in the *Status Word 1* is 1).
It's necessary to reset the "Switch-On" command bit to exit the SLEEP state.

2.5.2 Normal mode

The "*Normal mode*" is the standard operating mode of the PCS when in OPERATIONAL state ("*Operation-Mode*" must be set to 1, i.e. "Normal mode"). In this mode, the active and reactive power exchanged with the grid can be dynamically controlled by the EMS, through *P_setpoint* e *Q_setpoint*.
The following state-machine can be taken as a reference for the "*Normal mode*" in the OPERATIONAL state:



When the PCS connects to the grid, it is ready to exchange power with the grid and the "*Inverter Ready*" bit in the *Status Word 1* is set to1. Bits "*Idle*", "*Charging*", "*Discharging*" in the *Status Word 1* are set accordingly, as well.
If *P_setpoint* is different from zero, the charge or discharge process is actually performed only if the corresponding bit "*Battery can be charged*" or "*Battery can be discharged*" in the *Status Word 1* is set to 1.

If the batteries are fully discharged, then the inverter stops and the "*Discharge complete*" bit in the *Warning Word* is set to 1.

In case of grid failure, the PCS stops, the AC contactor opens and the "*Inverter Ready*" bit is cleared. If the grid restores, then the system is automatically reconnected ("*Inverter Ready*" is set again).

2.5.3 Commissioning procedure (Lead-acid batteries only)

The "Commissioning procedure" is used for the commissioning of the batteries at first installation.
In this mode, active and reactive power set points (*P_setpoint* e *Q_setpoint)* are ignored and PCS autonomy set the power exchanged with the grid.
When procedure is ended "*Operation-Mode End*" in the *Status Word 1* is set to and "*Operation-Mode Enables*" in the *Status Word 1* is set to 0.

2.5.4 Equalization procedure (Lead-acid batteries only)

The "Equalization procedure" is used for periodic equalization of the batteries.
When an equalization is needed "*Battery equalization procedure request* " in the *Warning-Word* is set to 1.
In this mode, active and reactive power set points (*P_setpoint* e *Q_setpoint)* are ignored and PCS autonomy set the power exchanged with the grid.
When procedure is ended "*Operation-Mode End*" in the *Status Word 1* is set to and "*Operation-Mode Enables*" in the *Status Word 1* is set to 0.
"*Battery equalization procedure request* " in the *Warning-Word* is set to 0 if "Equalization procedure" has been correctly completed.

2.5.5 State-of-Health (SOH) calculation procedure (Lead-acid batteries only)

The "State-of-Healt procedure" is used for periodic test of state of healt of the batteries.
For correct calculation this procedure must be started when the batteries are fully charged. It consists in a fully discharge of the batteries at predefined current.
In this mode, active and reactive power set points (*P_setpoint* e *Q_setpoint)* are ignored and PCS autonomy set the power exchanged with the grid.
When procedure is ended "*Operation-Mode End*" in the *Status Word 1* is set to 1, "*Operation-Mode Enables*" in the *Status Word 1* is set to 0 and "*SOH*" in the *Supervisor variables* shows calculated value of state of health of the batteries..

2.5.6 System calibration procedure (Lead-acid batteries only)

The "System Calibration procedure" is used for periodic calibration of the PCS measuring system.
When a calibration is needed "*System calibration procedure request* " in the *Warning-Word* is set to 1.
In this mode, active and reactive power set points (*P_setpoint* e *Q_setpoint)* are ignored and PCS autonomy set the power exchanged with the grid.
When procedure is ended "*Operation-Mode End*" in the *Status Word 1* is set to and "*Operation-Mode Enables*" in the *Status Word 1* is set to 0.
"*System Calibration procedure request* " in the *Warning-Word* is set to 0 if "System Calibration procedure" has been correctly completed.

3 Monitoring Modbus registers mapping

The SOCOMEC ESS can be monitored by an external *Monitoring System*, which has the task to monitor activities of PCS and to collect statistic data.
The *Monitoring System* can monitor the ESS by accessing some monitoring variables that are mapped in the following areas (all areas are read only):

- Identifiers, that provide information about equipment type and communication protocol;
- States, that provide information about the state of the system;
- Alarms, that provide information about system alarms;
- Warnings, that provide information about system warnings;
- Measurements, that provide most important measures of PCS and batteries;
- Statistics, that provide statistics concerning to system activities;
- Settings, that provide information about machine specific settings;

The SOCOMEC PCS has a modular architecture, it can include 1, 2 or 3 power modules (33, 66, 100 kVA).
General PCS data are available by accessing the “System” areas.
Single modules data are available by accessing the “Units” areas.

3.1 Identifiers

All variables in this area have read only access.

Modbus Address (HEX)	Code	Unit	Description
1000	I000	---	SOCOMEC Equipment type identifier for Energy Storage System Hard coded value = **0x2022**
1001	I001	1/10 KVA	Equipment nominal power
1002	I002	---	Number of modules of the system
1003	I003	---	Equipment serial number
1004	I004	---	Equipment serial number
1005	I005	---	Equipment serial number
1006	I006	---	Equipment serial number
1007	I007	---	Equipment serial number
1008	I008	---	*N.M.*
1009	I009	---	*N.M.*
100A	I010	---	*N.M.*
100B	I011	---	*N.M.*
100C	I012	---	*Reserved*
100D	I013	---	*Reserved*
100E	I014	---	*Reserved*
100F	I015	---	*Reserved*
1010	I016	---	*Reserved*
1011	I017	---	*Reserved*
1012	I018	---	*Reserved*
1013	I019	---	*Reserved*
1014	I020	---	*Reserved*
1015	I021	---	*Reserved*
1016	I022	---	*Reserved*
1017	I023	---	*Reserved*
1018	I024	---	*Reserved*
1019	I025	---	*Reserved*
101A	I026	---	*Reserved*
101B	I027	---	*Reserved*

3.2 States

All variables in this area have read only access.

3.2.1 System States

Modbus Address (HEX)	Bit	Code	Description
1020	0	S000	AC Mains ok
	1	S001	System Interface Protection AC mains OK
	2	S002	System Interface Protection disabled
	3	S003	#
	4	S004	#
	5	S005	#
	6	S006	#
	7	S007	Modular Centralized System
	8	S008	#
	9	S009	Buzzer enabled
	10	S010	Reactive power compensation mode
	11	S011	#
	12	S012	AC Mains contactor open
	13	S013	#
	14	S014	System Maintenance Mode Active
	15	S015	System Remote Command disable
1021	0	S016	Module 1 Available
	1	S017	Module 2 Available
	2	S018	Module 3 Available
	3	S019	Module 4 Available
	4	S020	Module 5 Available
	5	S021	Module 6 Available
	6	S022	
	7	S023	Inverter Waiting to test DC Voltage
	8	S024	#
	9	S025	Inverter ON
	10	S026	Battery Ready
	11	S027	#
	12	S028	#
	13	S029	#
	14	S030	#
	15	S031	#
1022	0	S032	Module 1 Present
	1	S033	Module 2 Present
	2	S034	Module 3 Present
	3	S035	Module 4 Present
	4	S036	Module 5 Present
	5	S037	Module 6 Present
	6	S038	#
	7	S039	#
	8	S040	#
	9	S041	#
	10	S042	*Reserved*
	11	S043	*Reserved*
	12	S044	#
	13	S045	#
	14	S046	#
	15	S047	Modules Not Present
1023	0	S048	#

Modbus Address (HEX)	Bit	Code	Description
	1	S049	#
	2	S050	#
	3	S051	#
	4	S052	#
	5	S053	#
	6	S054	#
	7	S055	#
	8	S056	External State 1
	9	S057	External state 2
	10	S058	External State 3
	11	S059	External State 4
	12	S060	External State 5
	13	S061	External State 6
	14	S062	External State 7
	15	S063	External State 8

3.2.2 Unit States

Concentrator of all the units can be addressed using m=1, a specific module can be addressed using m = 2, 3, 4 (m = module number + 1)

Modbus Address (HEX)	Bit	Code	Description
m024	0	S064	Module available
	1	S065	Modular Centralized Inverter
	2	S066	AC Output Voltage Ok
	3	S067	Inverter ON
	4	S068	Inverter Testing DC Voltage
	5	S069	Inverter Waiting to test DC Voltage
	6	S070	#
	7	S071	DC Input Voltage Ok
	8	S072	Remote command disabled (if=1)
	9	S073	*Reserved*
	10	S074	Maintenance mode active
	11	S075	First maintenance period
	12	S076	*Reserved*
	13	S077	Stopped by Energy Saver
	14	S078	#
	15	S079	#
m025	0	S080	Reactive power compensation mode
	1	S081	#
	2	S082	#
	3	S083	#
	4	S084	#
	5	S085	#
	6	S086	#
	7	S087	#
	8	S088	#
	9	S089	#
	10	S090	#
	11	S091	#
	12	S092	#
	13	S093	#
	14	S094	#
	15	S095	#
m026	0	S096	#
	1	S097	#
	2	S098	#
	3	S099	#
	4	S100	#
	5	S101	#
	6	S102	#
	7	S103	#
	8	S104	#
	9	S105	#
	10	S106	#
	11	S107	#
	12	S108	#
	13	S109	#
	14	S110	#
	15	S111	#
m027	0	S112	#
	1	S113	#
	2	S114	#

Modbus Address (HEX)	Bit	Code	Description
	3	S115	#
	4	S116	#
	5	S117	#
	6	S118	#
	7	S119	#
	8	S120	#
	9	S121	#
	10	S122	#
	11	S123	#
	12	S124	#
	13	S125	#
	14	S126	#
	15	S127	#

3.3 Warnings

All variables in this area have read only access.

3.3.1 System Warnings

Modbus Address (HEX)	Bit	Code	Description
1030	0	W000	Warning present (OR of all warning)
	1	W001	Ambient Overtemperature
	2	W002	Ambient Undertemperature
	3	W003	System Efficiency Warning
	4	W004	Internal overtemperature
	5	W005	#
	6	W006	DC input undervoltage
	7	W007	External SPD Fault
	8	W008	Inverter temporarily stopped by latched alarm
	9	W009	System wrong configuration
	10	W010	Module 1 Warning
	11	W011	Module 2 Warning
	12	W012	Module 3 Warning
	13	W013	Module 4 Warning
	14	W014	Module 5 Warning
	15	W015	Module 6 Warning
1031	0	W016	Commissioning code not entered
	1	W017	Parallel communication fault
	2	W018	No Module present
	3	W019	New Module found
	4	W020	High impedance to ground
	5	W021	Active Power reference too low for charging batteries
	6	W022	Battery Current Derating in progress
	7	W023	Battery fully discharged
	8	W024	Battery Low Voltage
	9	W025	Battery Low Capacity
	10	W026	Battery Rest Time request
	11	W027	Battery Full Charge request
	12	W028	Battery Overtemperature
	13	W029	Calibration Procedure request
	14	W030	Equalization Procedure request
	15	W031	Local Mode Enabled
1032	0	W032	Generic Battery Warning
	1	W033	AC input voltage fault
	2	W034	AC input frequency fault
	3	W035	System AC Voltage Quality fault
	4	W036	#
	5	W037	#
	6	W038	#
	7	W039	#
	8	W040	Low Impedance to Ground
	9	W041	Insulation Sensor Fault
	10	W042	Module 1 General Alarm
	11	W043	Module 2 General Alarm
	12	W044	Module 3 General Alarm
	13	W045	Module 4 General Alarm
	14	W046	Module 5 General Alarm
	15	W047	Module 6 General Alarm
1033	0	W048	#

Modbus Address (HEX)	Bit	Code	Description
	1	W049	#
	2	W050	#
	3	W051	#
	4	W052	#
	5	W053	#
	6	W054	#
	7	W055	#
	8	W056	Ext. Warning 1
	9	W057	Ext. Warning 2
	10	W058	Ext. Warning 3
	11	W059	Ext. Warning 4
	12	W060	#
	13	W061	#
	14	W062	#
	15	W063	#

3.3.2 Unit Warnings

Concentrator of all the units can be addressed using m=1, a specific module can be addressed using m = 2, 3, 4 (m = module number +1)

Modbus Address (HEX)	Bit	Code	Description
m034	0	W064	Warning present (OR of all unit warnings)
	1	W065	Inverter Derating in progress
	2	W066	Inside over-temperature (OR of all temperature sensors)
	3	W067	#
	4	W068	DC input undervoltage
	5	W069	AC input voltage fault
	6	W070	AC input frequency fault
	7	W071	Enviromental Warning
	8	W072	#
	9	W073	Inverter temporarily stopped by latched alarm
	10	W074	#
	11	W075	#
	12	W076	#
	13	W077	#
	14	W078	#
	15	W079	#
m035	0	W080	#
	1	W081	#
	2	W082	#
	3	W083	#
	4	W084	#
	5	W085	#
	6	W086	#
	7	W087	#
	8	W088	#
	9	W089	#
	10	W090	#
	11	W091	#
	12	W092	#
	13	W093	#
	14	W094	#
	15	W095	#
m036	0	W096	#
	1	W097	#
	2	W098	#
	3	W099	#
	4	W100	#
	5	W101	#
	6	W102	#
	7	W103	#
	8	W104	#
	9	W105	#
	10	W106	#
	11	W107	#
	12	W108	#
	13	W109	#
	14	W110	#
	15	W111	#
m037	0	W112	#
	1	W113	#
	2	W114	#

Modbus Address (HEX)	Bit	Code	Description
	3	W115	#
	4	W116	#
	5	W117	#
	6	W118	#
	7	W119	#
	8	W120	#
	9	W121	#
	10	W122	#
	11	W123	#
	12	W124	#
	13	W125	#
	14	W126	#
	15	W127	#

3.4 Alarms

All variables in this area have read only access.

3.4.1 System Alarms

Modbus Address (HEX)	Bit	Code	Description	Critical Alarm
1040	0	A000	Alarm present (A001 OR A002 ... OR A063)	
	1	A001	External Shutdown Activated	*
	2	A002	I Leak Fault	
	3	A003	I Leak sensor Fault	
	4	A004	#	
	5	A005	AC side Lightning protection	
	6	A006	DC side Lightning protection	
	7	A007	Output AC Mains Contactor Fault	
	8	A008	Output Trasfo Overtemperature	
	9	A009	System AC Voltage fault	
	10	A010	System AC Frequency fault	
	11	A011	System AC Voltage Quality fault	
	12	A012	Parallel fault	
	13	A013	WatchDog elapsed	
	14	A014	System MicroP failure	
	15	A015	System wrong configuration	
1041	0	A016	Module 1 in parallel general alarm	
	1	A017	Module 2 in parallel general alarm	
	2	A018	Module 3 in parallel general alarm	
	3	A019	Module 4 in parallel general alarm	
	4	A020	Module 5 in parallel general alarm	
	5	A021	Module 6 in parallel general alarm	
	6	A022	Battery Overvoltage	
	7	A023	Battery Communication fault	
	8	A024	Generic Battery Alarm	see "*Battery specific data*" for details
	9	A025	Battery Cabinet Thermal protection fault	
	10	A026	DC Connection fault	
	11	A027	Battery Overtemperature	
	12	A028	#	
	13	A029	#	
	14	A030	#	
	15	A031	#	
1042	0	A032	#	
	1	A033	#	
	2	A034	#	
	3	A035	#	
	4	A036	#	
	5	A037	#	
	6	A038	#	
	7	A039	#	
	8	A040	#	
	9	A041	#	
	10	A042	T-Service General Alarm	
	11	A043	#	
	12	A044	Maintenance Alarm	

Modbus Address (HEX)	Bit	Code	Description	Critical Alarm
	13	A045	Interface Protection fault	
	14	A046	#	
	15	A047	Module in parallel with different configuration	
1043	0	A048	Modules Communication Fault	
	1	A049	System board I2C comm. Fault	
	2	A050	ADC boards I2C comm. Fault	
	3	A051	#	
	4	A052	Earth Fuse Fault	
	5	A053	#	
	6	A054	#	
	7	A055	#	
	8	A056	External Alarm 1	
	9	A057	External Alarm 2	
	10	A058	External Alarm 3	
	11	A059	External Alarm 4	
	12	A060	External Alarm 5	
	13	A061	External Alarm 6	
	14	A062	External Alarm 7	
	15	A063	External Alarm 8	

3.4.2 Unit Alarms

Concentrator of all the units can be addressed using m=1, a specific module can be addressed using m = 2, 3, 4 (m = module number +1)

Modbus Address (HEX)	Bit	Code	Description
m044	0	A064	Alarm present (OR of all module alarms)
	1	A065	Digital power supply fault (Vcc)
	2	A066	Microprocessor control system failure
	3	A067	Configuration data map corrupted
	4	A068	Module stopped for over-temperature
	5	A069	Fan fault
	6	A070	Maintenance alarm
	7	A071	#
	8	A072	Inverter fault
	9	A073	DC input overvoltage
	10	A074	T-Service General Alarm
	11	A075	External Shutdown Active
	12	A076	Ambient temperature too low Module
	13	A077	Ambient temperature too high
	14	A078	#
	15	A079	#
m045	0	A080	#
	1	A081	AC Mains Fault
	2	A082	#
	3	A083	#
	4	A084	#
	5	A085	#
	6	A086	#
	7	A087	#
	8	A088	#
	9	A089	#
	10	A090	#
	11	A091	#
	12	A092	#
	13	A093	#
	14	A094	#
	15	A095	#
m046	0	A096	#
	1	A097	#
	2	A098	#
	3	A099	#
	4	A100	#
	5	A101	#
	6	A102	#
	7	A103	#
	8	A104	#
	9	A105	#
	10	A106	#
	11	A107	#
	12	A108	#
	13	A109	#
	14	A110	#
	15	A111	#
m047	0	A112	#

Modbus Address (HEX)	Bit	Code	Description
	1	A113	#
	2	A114	#
	3	A115	#
	4	A116	#
	5	A117	#
	6	A118	#
	7	A119	#
	8	A120	#
	9	A121	#
	10	A122	#
	11	A123	#
	12	A124	#
	13	A125	#
	14	A126	#
	15	A127	#

3.5 Measurements

All variables in this area have read only access.

3.5.1 System Measurements

Modbus Address (HEX)	Code	Unit	Description
1050	M000	1/10 Hz	AC Mains Input Frequency
1051	M001	1/10 V	AC Mains R-S Voltage
1052	M002	1/10 V	AC Mains S-T Voltage
1053	M003	1/10 V	AC Mains T-R Voltage
1054	M004	1/10 A	Inverters Current phase R
1055	M005	1/10 A	Inverters Current phase S
1056	M006	1/10 A	Inverters Current phase T
1057	M007	1/10 kW	Inverters Active Power
1058	M008	1/10 kVAR	Inverters Reactive Power
1059	M009	1/10 kW	Inverters DC Input Power
105A	M010	1/100	AC Mains Cos phi (signed value * 100)
105B	M011	---	*N.M.*
105C	M012	---	*N.M.*
105D	M013	---	*N.M.*
105E	M014	---	*N.M.*
105F	M015	---	*N.M.*
1060	M016	kOhm	Insulation resistance kohm (option)
1061	M017	---	External Measure 1
1062	M018	---	External Measure 2
1063	M019	---	*N.M.*
1064	M020	°C	Module Board Temperature (worst case)
1065	M021	°C	External Temperature (option)
1066	M022	---	*N.M.*
1067	M023	---	*N.M.*
1068	M024	1/10 V	Battery DC Voltage
1069	M025	1/10 A	Battery DC Current
106A	M026	%	Battery State of Charge (SOC)
106B	M027	%	Battery State of Health (SOH)
106C	M028	Min	Time Before Battery Discharging
106D	M029	Min	Time Before Battery Charging
106E	M030	---	*N.M.*
106F	M031	---	*N.M.*

3.5.2 Unit Measurements

Concentrator of all the units can be addressed using m=1, a specific module can be addressed using m = 2, 3, 4 (m = module number +1)

Modbus Address (HEX)	Code	Unit	Description
m070	M032	1/10 Hz	AC Mains Input Frequency
m071	M033	1/10 V	AC Mains R-S Voltage
m072	M034	1/10 V	AC Mains S-T Voltage
m073	M035	1/10 V	AC Mains T-R Voltage
m074	M036	1/10 A	Inverter Current phase R
m075	M037	1/10 A	Inverter Current phase S
m076	M038	1/10 A	Inverter Current phase T
m077	M039	1/10 kW	Inverter Active Power
m078	M040	1/10 kVAR	Inverter Reactive Power
m079	M041	V	DC Input Voltage
m07A	M042	1/10 A	DC Input current
m07B	M043	1/10 kW	DC Input power
m07C	M044	°C	Module Board Temperature [°C]
m07D	M045	1/100	AC Mains Cos phi (signed value * 100)
m07E	M046	---	*N.M.*
m07F	M047	---	*N.M.*
m080	M048	---	*N.M.*
m081	M049	---	*N.M.*
m082	M050	---	*N.M.*
m083	M051	---	*N.M.*
m084	M052	---	*N.M.*
m085	M053	---	*N.M.*
m086	M054	---	*N.M.*
m087	M055	---	*N.M.*
m088	M056	---	*N.M.*
m089	M057	---	*N.M.*
m08A	M058	---	*N.M.*
m08B	M059	---	*N.M.*
m08C	M060	---	*N.M.*
m08D	M061	---	*N.M.*
m08E	M062	---	*N.M.*
m08F	M063	---	*N.M.*

3.6 Statistics

All variables in this area have read only access.

3.6.1 System Statistics

Modbus Address (HEX)	Code	Unit	Description
1090	L000	---	Counter: AC fault
1091	L001	1/100 s	Free Running Counter
1092	L002	Min	Partial Running Time (Today)
1093	L003	Hour	Total Running Time
1094	L004	Sec	Next DC test countdown
1095	L005	kWh	Total Energy Charged (HIGH WORD)
1096	L006	kWh	Total Energy Charged (LOW WORD)
1097	L007	---	Battery Cycles (HIGH WORD)
1098	L008	---	Battery Cycles (LOW WORD)
1099	L009	kWh	Total Energy Discharged (HIGH WORD)
109A	L010	kWh	Total Energy Discharged (LOW WORD)
109B	L011	---	*N.M.*
109C	L012	---	*N.M.*
109D	L013	---	*N.M.*
109E	L014	---	*N.M.*
109F	L015	---	*N.M.*
10A0	L016	---	*N.M.*
10A1	L017	---	*N.M.*
10A2	L018	---	*N.M.*
10A3	L019	---	*N.M.*
10A4	L020	---	*N.M.*
10A5	L021	---	*N.M.*
10A6	L022	---	*N.M.*
10A7	L023	---	*N.M.*
10A8	L024	---	*N.M.*
10A9	L025	---	*N.M.*
10AA	L026	---	*N.M.*
10AB	L027	---	*N.M.*
10AC	L028	---	*N.M.*
10AD	L029	---	*N.M.*
10AE	L030	---	*N.M.*
10AF	L031	---	*N.M.*

3.6.2 Unit Statistics

Concentrator of all the units can be addressed using m=1, a specific module can be addressed using m = 2, 3, 4 (m = module number +1)

Modbus Address (HEX)	Code	Unit	Description
m0B0	L032	---	Counter: AC fault
m0B1	L033	---	*N.M.*
m0B2	L034	Min	Partial Running Time (Today)
m0B3	L035	Hour	Total Running Time
m0B4	L036	Sec	Next DC test countdown
m0B5	L037	---	*N.M.*
m0B6	L038	---	*N.M.*
m0B7	L039	---	*N.M.*
m0B8	L040	---	*N.M.*
m0B9	L041	---	*N.M.*
m0BA	L042	---	*N.M.*
m0BB	L043	---	*N.M.*
m0BC	L044	---	*N.M.*
m0BD	L045	---	*N.M.*
m0BE	L046	---	*N.M.*
m0BF	L047	---	*N.M.*
m0C0	L048	---	*N.M.*
m0C1	L049	---	*N.M.*
m0C2	L050	---	*N.M.*
m0C3	L051	---	*N.M.*
m0C4	L052	---	*N.M.*
m0C5	L053	---	*N.M.*
m0C6	L054	---	*N.M.*
m0C7	L055	---	*N.M.*
m0C8	L056	---	*N.M.*
m0C9	L057	---	*N.M.*
m0CA	L058	---	*N.M.*
m0CB	L059	---	*N.M.*
m0CC	L060	---	*N.M.*
m0CD	L061	---	*N.M.*
m0CE	L062	---	*N.M.*
m0CF	L063	---	*N.M.*

3.7 Settings

All variables in this area have read only access.

3.7.1 System Settings

Modbus Address (HEX)	Code	Unit	Description
10E0	T000	V	AC nominal voltage (Ph/Ph)
10E1	T001	Hz	AC nominal frequency
10E2	T002	---	*N.M.*
10E3	T003	---	*N.M.*
10E4	T004	---	*N.M.*
10E5	T005	---	*N.M.*
10E6	T006	---	*N.M.*
10E7	T007	---	*N.M.*
10E8	T008	---	*N.M.*
10E9	T009	---	*N.M.*
10EA	T010	---	*N.M.*
10EB	T011	---	*N.M.*
10EC	T012	---	*N.M.*
10ED	T013	---	*N.M.*
10EE	T014	---	*N.M.*
10EF	T015	---	*N.M.*
10F0	T016	---	*N.M.*
10F1	T017	---	*N.M.*
10F2	T018	Hex	Language checksum.
10F3	T019	Hex	WebServer checksum
10F4	T020	Version *100	HMI software version
10F5	T021	Hex	HMI software checksum
10F6	T022	---	*N.M.*
10F7	T023	---	*N.M.*
10F8	T024	Version *100	Module microcontroller software version
10F9	T025	Hex	Module microcontroller software checksum
10FA	T026	Version *100	Module DSP software version
10FB	T027	Hex	Module DSP software checksum
10FC	T028	Version *100	System Board Software version
10FD	T029	Hex	System Board Software checksum
10FE	T030	Version *100	HMI loader version
10FF	T031	Hex	HMI loader checksum

3.8 Date and Time

All variables in this area have read only access.

Modbus Address (HEX)	Code	Unit	Description
0360	DT00	---	H byte: Minute [0 ÷ 59] L byte: Second [0 ÷ 59]
0361	DT01	---	H byte: Day [1 ÷ 31] L byte: Hour [0 ÷ 23]
0362	DT02	---	H byte: Month [0 ÷ 59] L byte: Day of the week [1 Monday ÷ 7 Sunday]
0363	DT03	---	*H byte: Free* L byte: Year [00 ÷ 99]