SENTRY RS232 COMMUNICATION PROTOCOL

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General

The communication with Sentry HPS/RPS use RS232serial line connection with:

- only 3 wires TX , RX and GND;
- 8bits;
- No parity;
- Baud rate=9600 , selectable down to 1200 on the ups.

There are two ways to communicate; TEXT mode and BINARY mode.

Holding on “0” the ECHO function. As set in factory, the Sentry responds only after receiving a command char transmitted form computer.

If the ECHO is set on “1” when customizing some operating values, the Sentry transmits chars without receiving any command char from the computer..
With ECHO=1, each time that that the alarm condition changes, the Sentry transmits the “TEXT MESSAGE 9” without receiving any command.

TEXT MODE communication

The TEXT MODE communication is opened when computer transmits a sequence of two ASCII characters.
The first must be ‘9’ the second must be ‘0’ and in must be into the time interval of 0.5 – 2sec. after the first.
The second char is ‘0’ only id the customizing value “INDENT” is equal to ‘0’, as default, otherwise it must be equal to the new value of IDENT.
The IDENT value can be set from 0 to 7 to obtain the communication with 8 different machines connected to the same RE232 serial line.

After opening TEXT MODE communication the compute can send the ASCII chars form ‘1’ to ‘9’ to have back the “TEXT MESSAGES 9” and also to execute a command on the machine in the

same of pushing the buttons panel numbered form 1 to 8.
Sending the char'9', after the opening sequence, it is possible to obtain back the "TEXT MESSAGE 9" without execute any command on the machine, sending the ASCII char ':' it is possible to receive the "TEXT MESSAGE :".
The communication is CLOSED when sending any char different form '1' to '9' or ':' and form three special (BINARY CHSR) for receiving the BINARY MESSAGE.

BINARY MODE communication
The BINARY MESSAGE is obtained each time the computer transmits only one char with value 192 or 204 or 224 decimal if the IDENT is 0, otherwise the char value is =(192 or 204 or 224 decimal) + the IDENT value,.

The char 192 selects the BINARY MESSAGE relative to all operating se values an the values of measures referred to the PRESENT EVENT RECORD.

The char 224 selects the BINARY MESSAGE relative to all operating se values an the values of measures referred to the PREVIOUS EVENT RECORD respect to current event record.

The char 204 selects the BINARY MESSAGE relative to all operating se values an the values of measures referred to the PREVIOUS EVENT RECORD holding the event record pointer to the position reached when sending the char 224.

TEXT MODE ups transmitted message

The "TEXT MESSAGE 9" is composed by 118 ASCII chars as written below numbered form0 to 117.
0 = 13 decimal, carriage return char;
1 = 10 decimal, line feed return char;
2 = ASCII char = first char show on UPPER row on LCD display on panel;
…
42 = ASCII char =40th char shown on UPPER row on LCD display on panel;
43 = 13 decimal, carriage return char;
44 = 10 decimal line feed return char;
45 =ASCII char = first char shown on LOWER row on LCD display on panel;
…
83 = ASCII char = 40th char shown on LOWER row on LCD display on panel;
84 = ASCII char = space
85 = ASCII char = first char of alarm code 'a=0000-0000';
94 = ASCII char = last char of alarm code 'a=0000-0000';
96 = ASCII char = first char of data/time 'yyyy-mm-dd/hh:mm:ss';
115 = ASCII char = last char of data/time 'yyyy-mm-dd/hh:mm:ss';
116 = 13 decimal, carriage return char;

117 = 10 decimal, line feed return char.

The “TEXT MESSAGE : “is composed by 87 ASCII char as written below numbered form 0 to 86.

0 = equal to “TEXT MESSAGE 9”;

…

83 = equal to “TEXT MESSAGE 9”;

84 = led IN. and led OUT. Status on inactive panel (binary value);

led IN. on=10 hex, led IN. flashing =30 hex;

led OUT. on = 40 hex, led OUT. flashing = C0 hex;

85 = led and buzzer status on machine panel(binary value);

led BY. on = 01 hex, led BY. flashing = 03 hex;

led BAT. on = 04 hex, led BAT. Flashing = 0C hex;

BUZZER on = 10 hex, BUZZER short sound =30 hex;

86 = same value of selected language on machine panel(binary value).

BINARY MODE ups transmitted message

The “BINARY MESSAGE” is composed by 103 binary values as written below numbered form 0 to 102.

0 = echo of char transmitted by computer = 192 decimal + IDENT value;

1 = number of message chars, always=103;

2 = LSB of word “model value”,

3 = MSB of word form “mode value:,

model value is = kVA * 10.(for single phase output machine)

model value is = 3000 + (kVA * 10),(for three phase output machine);

the ups set for parallel operation have model value + 2,

the ups in version HPS have the previous model value + 1,

4 = LSB of word for software version number,

5 = MSB of word for software version number,

6= LSB of word for minutes of battery autonomy, (valid only in battery op.);

7 = MSB of word for minutes of battery autonomy,(valid only in battery op.);

8 = byte for percentage of battery charge value [%];

9 = LSB of word “panel menu code”;

10 = MSB of word “panel menu code”;

11 = byte equal the number of the present event record into history memory,

or equal to the number of event record that is being transmitted

when the previous event record is requested.

12 = byte for the SECONDS value (bed code) of the event record time;

13 = byte for the MINUTES value (bed code) of the event record time;

14 = byte for the HOURS value (bed code) of the event record time;

15 = byte for the DAY value (bed code) of the event record time;

16 = byte for the MONTHS value (bed code) of the event record time;
17 = byte for the YEARS value (bed code) of the event record time;
18 = byte for the ALARM internal code, 0=normal operation;
19 = LSB of word for “s=….” code, (Look to the translation table of memorized internal codes);
20 = MSB of word for “s=….” code, (Look to the translation table of memorized internal codes)
21 = LSB of word for “c=….”code, (Look to the translation table of memorized internal codes)
22 = MSB of word for “c=….”code, (Look to the translation table of memorized internal codes)
23 = LSB of word for “b=….”code, (Look to the translation table of memorized internal codes)
24 = MSB of word for “b=….”code, (Look to the translation table of memorized internal codes)
25 = LSB of word for first part of “r=….-..”code, (Look to the translation table)
26 = SMB of word for first part of “r=….-..”code, (Look to the translation table)
27 = byte of second part of “r=….-..”code, (Look to the translation table)
28 = LSB of word for first part of “i=….-..”code, (Look to the translation table)
29 = MSB of word for first part of “i=….-..”code, (Look to the translation table)
30 = byte for second part of “i=….-..”code, (Look to the translation table);
31 = LSB of word for first part of “a….-..”code, (Look to the translation table)
32 = MSB of word for first part of “a….-..”code, (Look to the translation table);
33 = LSB of word for second part of “a….-..”code, (Look to the translation table);
34 = MSB of word for second part of “a….-..:code, (Look to the translation table);
35 = byte for percentage of input voltage value[%] phase 1 “IN”;
36 = byte for percentage of input voltage value[%] phase 2 “IN”;
37 = byte for percentage of input voltage value[%] phase 3 “IN”;
38 = byte for percentage of input current value[%] phase 1 “IN”;
39 = byte for percentage of input current value[%] phase 2 “IN”;
40 = byte for percentage of input current value[%] phase 3 “IN”;
41= LSB of word for frequency [Hz] of input voltage “IN”;
42 = MSB of word for frequency [Hz] of input voltage “IN”;
43 = MSB of word for battery voltage value [Volt];
44 = LSB of word for battery voltage value [Volt];
45 = MSB of word for absolute value of battery current [A];
46 = LSB of word for absolute value of battery current [A];
the battery current is multiplied by 10 if is charging current with sign value=0;
47 = byte for battery sign value, 1=discharging, 0=charging;
48 = byte for system temperature value (degree CENTIGRADE);
49 = byte for rectifier power module temperature value (degree CENTIGRADE);
50 = byte for inverter power module temperature value (degree CENTIGRADE);
51 = LSB of word for bypass line input voltage value [V] “BY”, phase 1;
52 = MSB of word for bypass line input voltage value [V] “BY”, phase 1;
53 = LSB of word for bypass line input voltage value [V] “BY”, phase 2;
54 = MSB of word for bypass line input voltage value [V] “BY”, phase 2;
55 = LSB of word for bypass line input voltage value [V] “BY”, phase 3;
56 = MSB of word for bypass line input voltage value [V] “BY”, phase 3;

57 = LSB of word for bypass line input voltage FREQENCY value [Hz] “BY”;
58 = MSB of word for bypass line input voltage FREQENCY value [Hz] “BY”;
59 = byte for output voltage value [V] phase 1 “OUT”;
60 = byte for output voltage value [V] phase 2 “OUT”;
61 = byte for output voltage value [V] phase 3 “OUT”;
62 = byte for percentage of output RMS current [%Arms], phase 1 “OUT”;
63 = byte for percentage of output RMS current [%Arms], phase 2 “OUT”;
64 = byte for percentage of output RMS current [%Arms], phase 3 “OUT”;
65 = byte for percentage of output peak current [%Apk], phase 1 “OUT”;
66 = byte for percentage of output peak current [%Apk], phase 2 “OUT”;
67 = byte for percentage of output peak current [%Apk], phase 3 “OUT”;
68 = LSB of word for output voltage FREQENCY value [Hz] “OUT”;
69 = MSB of word for output voltage FREQENCY value [Hz] “OUT”;
70 = byte for inverter output voltage [v], phase to neural value, set into control logic;
71 = LSB of word for battery circuit voltage value [V] “BATT”;
72 = MSB of word for battery circuit voltage value [V] “BATT”;
73 = byte for set system nominal output voltage [v], phase to neural;
74 = LSB of word for set battery capacity value [Ah];
75 = MSB of word for set battery capacity value [Ah];
76 = byte for set battery type value, bits 0, 1, 2,3, 4;
from version 10154, also add bit 6 =1 =ECHO function ON,
bit 7 =1 =system operating frequency 60Hz.
77 = byte for set minutes of prealarm value;
78 = byte for set percentage value of output power for AUTO-OFF;
79 = byte for set percentage value of bypass line voltage range;
80 = byte for set percentage value of bypass line voltage frequency range;
81 = LSB of word for “options o=”code, (Look forward for translation table);
82 = MSB of word for “other options” , (Look forward for translation table);
(before version 10154 ,bit 6=1=ECHO function ON,
bit 7=1=system opcrating frequency 60Hz)
83 = LSB of word for elapsed HOURS operating on inverter;
84 = MSB of word for elapsed HOURS operating on inverter;
85 = LSB of word for elapsed HOURS operating on battery;
86 = MSB of word for elapsed HOURS operating on battery;
87 = LSB of word for number of times of operation on battery (BLACK-OUT);
88 = MSB of word for number of times of operation on battery (BLACK-OUT);
89 = LSB of word for number of times of operation on battery has been fully discharged;
90 = MSB of word for number of times of operation on battery has been fully discharged;
91 = ASCII char for thousands of YEARS of date of first machine activation;
92 = ASCII char for hundred of YEARS of date of first machine activation;
93 = ASCII char for tenth of YEARS of date of first machine activation;
94 = ASCII char for unit of YEARS of date of first machine activation;

95= byte for set Time_off value;
96 = ASCII char for tenth of MONTHS of date of first machine activation;
97 = ASCII char for unit of MONTHS of date of first machine activation;
98 = byte for set Time_on value;
99 = ASCII char for tenth of DAYS of date of first machine activation;
100 = ASCII char for unit of DAYS of date of first machine activation;
101 = LSB of word for checksum value of transmitted bytes form 0 to 99;
102 = MSB of word for checksum value of transmitted bytes form 0 to 99;

Translation table of memorized internal codes gives all information on status of opration.

char 19 = LSB of word for “s=….”code.
- bit 0 on = “Power supply error on system card”
- bit 1 on = “Temporary Error on system power supply card”
- bit 2 on = “Synchro error on system card”
- bit 3 on = “Output frequency measure error on system card”
- bit 4 on = “system OVERTEMPERTURE”
- bit 5 on = “Initialization error on system card”
- bit 6 on = “Remotes system SHUT-OFF, active”
- bit 7 on = “Active aux input on system card”

char 20 = MSB of word for “s=….”code.
- bit 0 on = “System power sypply Permanent fault”(no present on version>10152)
- bit 1 on = “RS232 DSR signal present”
- bit 2 on = “Configuration card not present on system card”
- bit 3 on = “Jumper 2 not present on system card”
- bit 4 on = “Low voltage form battery or rectifier”
- bit 5 on = “Prealarm Low voltage form battery or rectifier”
- bit 6 on = “Battery contactor opened”
- bit 7 on = “Permanent fault on battery contactor”

char 21 = LSB of word for “c=….”code.
- bit 0 on = “High output peak current, line 1”
- bit 1 on = “High output peak current, line 2”
- bit 2 on = “High output peak current, line 3”
- bit 3 on = “Output OVERLOAD, line 1”
- bit 4 on = “Output OVERLOAD, line 2”
- bit 5 on = “Output OVERLOAD, line 3”
- bit 6 on = “Permanent output OVERLOAD”
- bit 7 on = “Internal of load insulation loss”, (no present on version>10152)

char 22 = MSB of word for “c=….”code.
- bit 0 on = “ ”
- bit 1 on = “SWOUT OFF, Output breaker OFF”
- bit 2 on = “Output aver voltage fail, line 3”

bit 3 on = “Output instant voltage fail, line 1”
bit 4 on = “Output instant voltage fail, line 2”
bit 5 on = “Output instant voltage fail, line 3”
bit 6 on = “Output aver voltage fail, line 1”
bit 7 on = “Output aver voltage fail, line 2”

char 23 = LSB of word for “b=….”code.
bit 0 on = “Remote bypass command (inverter-off),active”
bit 1 on = “Failure on SCR of bypass line”
bit 2 on = “Input bypass line 1 voltage error”
bit 3 on = “Input bypass line 2 voltage error”
bit 4 on = “Input bypass line 3 voltage error”
bit 5 on = “Input bypass line frequency error”
bit 6 on = “Input bypass line phases sequence error”
bit 7 on = “SWMB on, manual bypass breaker closed”

char 24 = MSB of word for “b=….”code.
bit 0 on = “Failure on inverter output contactor”
bit 1 on = “Inverter output contactor open”
bit 2 on = “Bypass line contactor closed”
bit 3 on = “Failure on bypass line contactor”
bit 4 on = “Permanent fault on bypass SCR”
bit 5 on = “Bypass switching inhibited”
bit 6 on = “Failure on inverter output contactor”
bit 7 on = “command to switch on bypass, active”

char 25 = LSB of word for first part of “r=….-..”code.
bit 0 on = “High voltage on input line 1”
bit 1 on = “High voltage on input line 2”
bit 2 on = “High voltage on input line 3”
bit 3 on = “Low voltage on input line 1”
bit 4 on = “Low voltage on input line 2”
bit 5 on = “Low voltage on input line 3”
bit 6 on= “Input current not present on line 1”
bit 7 on= “Input current not present on line 2”

char 26= MSB of word for first part of “r=…_..” code
bit 0 on= “Input current not present on line 3”
bit 1 on= “Output power limiting on rectifier”
bit 2 on= “Regulation error on rectifier”
bit 3 on= “Input line frequency error”
bit 4 on= “Rectifier error on TEMPERATURE”
bit 5 on= “Rectifier HIGHT output voltage”
bit 6 on= “Rectifier power supply error”
bit 7 on= “Rectifier inhibited”

char 27=byte for second part of “r=…_..” code

bit 0 on= “Rectifier Failure on one branch” (not present on version >10152)

bit 1 on= “Control parallel card power failure”

bit 2 on= “Parallel ups connection cable failure or SWMB closed”

bit 3 on= “”

bit 4 on= “Rectifier Permanent failure” (nor present on version >10152)

bit 5 on= “Rectifier-DRV1-signal”

bit 6 on= “Rectifier-DRV2-signal”

bit 7 on= “Rectifier-DRV3-signal”

char 28=LSB of word for first part of “i=…_..” code

bit 0 on= “Cables error on inverter driver card” (not present on version >10152)

bit 1 on= “Inverter STOP from driver card 3”

bit 2 on= “Inverter STOP from driver card 2”

bit 3 on= “Inverter over current”

bit 4 on= “Cables error into inverter”

bit 5 on= “Inverter power supply error”

bit 6 on= “inverter-HFDRV R-signal” (parallel synchro fail)

bit 7 on= “inverter-HFDRV S-signal” (parallel ups master)

char 29=MSB of word for first part of “i=…_..” code

bit 0 on= “Inverter Failure”

bit 1 on= “Inverter synchro not present”

bit 2 on= “Inverter Reset failure”

bit 3 on= “Inverter driver card power supply error”

bit 4 on= “Inverter high output voltage”

bit 5 on= “Inverter high input dc. voltage”

bit 6 on= “Inverter over temperature on module 1”

bit 7 on= “Inverter over temperature on module 2”

char 30=byte for second part of “i=…_..” code

bit 0 on= “Inverter over temperature on module 3”

bit 1 on= “Inverter STOP from driver card 1”

bit 2 on=“inverter-HFDRV T-signal” (parallel serial data fail)

bit 3 on= “Inverter inhibited”

bit 4 on= “Inverter LOW output voltage”

bit 5 on= “Inverter LOW input dc voltage”

bit 6 on= “Inverter manual reset”

bit 7 on= “Inverter permanent failure” (version >10152)

“Inverter cables error on inverter driver card” (version <10152)

char 31=LSB of word for first part of “a=…_..” code

bit 0 on= “DISRURBANCES ON BYPASS LINE” (inverter nor synchronized to bypass line)

bit 1 on= “MANUAL BYPASS ,SWMB ON” (or parallel ups link cable fault)

bit 2 on=“BYPASS LINE VOLT FAIL or SWBY,FSCR OFF”

bit 3 on= “MAIN LINE VOLTAGE FAIL or SWIN OFF”

bit 4 on= “PREALARM LOW BATTERY VOLTAGE”

bit 5 on= “LOW INPUT VOLTAGE or OUTPUT OVERLOAD[W]”

bit 6 on= “LOW BATTERY CHARGE or CLOSE SWMB”

bit 7 on= “OUTPUT OVERLOAD”

char 32=MSB of word for first part of “a=…_..” code

bit 0 on = “TEMPORARY BYPASS, WAIT”

bit 1 on = “BYPASS FOR OUTPUT VA < AUTO-OFF VALUE”

bit 2 on = “FAULT 1: configuration card no present”

bit 3 on = “FAULT 2: inverter lockup”

bit 4 on = “FAULT 3: output contactors”

bit 5 on = “FAULT 4: rectifier lockup”

bit 6 on = “FAULT 5: SCR of bypass line”

bit 7 on = “FAULT 6: power supply card lockup”

char 33=LSB of word for second part of “a=…_..” code

bit 0 on = “FAULT 7: system power supply”

bit 1 on = “FAULT 8 : one section of rectifier”

bit 2 on = “FAULT 9: battery contactor”

bit 3 on = “FAULT 10: inverter communication”

bit 4 on = “BYPASS FOR OUTPUT OVERLOAD”

bit 5 on = “BYPASS COMMAND ACTIVE”

bit 6 on = “REMOTE BYPASS COMMAND ACTIVE”

bit 7 on = “ ”

char 34=MSB of word for second part of “a=…_..” code

bit 0 on = “OVERTEMPERATURE or FAN FAILURE”

bit 1 on = “INPUT VOLTAGE SEQUENCE NOT OK”,(on bypass line)

bit 2 on = “OUTPUT OFF, CLOSE SWOUT OR SWMB”

bit 3 on = “SYSTEM OFF COMMAND ACTIVE”

bit 4 on = “REMOTE SYSTEM OFF COMMAND”

bit 5 on = “MEMORY CHANGED”

bit 6 on = “FAULT 11: output voltage fail”

bit 7 on = “Auto-off timer active”

char 81=LSB of word for “options” “o=…” code

bit 0 on = “Key command 47263 masked on display”

bit 1 on = “Battery test disabled”,

bit 2 on = “Output voltage error alarm delayed”

bit 3 on = “SCR fail from bypass to SWBY coil”

bit 4 on = “Disable bypass line”

bit 5 on = “Time OFF active”
bit 6 on = “Auto OFF active”
bit 7 on = not used

char 82=MSB of word for “options2” code
bit 0 on = “standby-on operation”
bit 1 on = “Lock to bypass line for testing”,
bit 2 on = “Standby-off operation”
bit 3 on = “Back-feed test active”
bit 4 on = “battery parallel operation”
bit 5 on =
bit 6 on =
bit 7 on =

Easiest way to monitoring ups status

The Sentry status of operation and alarms is fully given by the transmitted byte from n.30 =char 30 to n.35=char 34.

The most important byte is:
Received byte n.32:
(char 31=LSB of word for first part of “a=…_..”code)
bit 0 on=val.1= “DISRURBANCES ON BYPASS LINE”
bit 1 on= val.2= “MANUAL BYPASS ,SWMB ON”
bit 2 on= val.3= “BYPASS LINE VOLT FAIL or SWBY,FSCR OFF”
bit 3 on= val.4= “MAIN LINE VOLTAGE FAIL or SWIN OFF”
bit 4 on= val.8= “PREALARM,LOW BATTERY VOLTAGE ”
bit 5 on= val.16= “LOW INPUT VOLTAGE or OUTPUT OVERLOAD[W]”
bit 6 on= val.32= “LOW BATTERY CHARGE or CLOSE SWB”
bit 7 on= val.64= “OUTPUT OVERLOAD”

.The AC-FAIL status is indicated by bit 3 on=val.8= “MAIN LINE VOLTAGE FAIL or SWIN OFF”
.The LOW-BATTERY status is indicated by bit 4 on=val.16=“PREALARM,LOW BATTERY VOLTAGE ”
.The BYPASS-line-FAIL status is indicated by bit 2 on=val.4=“BYPASS LINE VOLT FAIL or SWBY,FSCR OFF”

How to get UPS shut-down

After started “UPS shut-down” procedure the UPS will switch-off the inverter and it will trip-out the SWBY breaker.After executed the ups shut-off the restoring is possible only manually operating on machine input “SWBY” breaker, because it was tripped.

In case of UPS configured for parallel operation and also for model 100kVA and over, the “UPS

shut-down" will switch-off the load without tripping the SWBY breaker, therefore it will be able to restart receiving the ASCII char '8'

In these last cases, if the software version is less than 10154 and over it is possible to restart the ups also with another special 5 chars command sequence, look to "5 chars commands sequence"

If the ups software version is less than 10154 it is possible to get the "ups shut-down" only sending a sequence of ASCII characters that simulates the command on machine panel.

Before sending the "UPS shut-down" sequence the communication must be already the TEXT MODE or BINARY MODE.
The ups shut-down sequence requires to send the ASCII chars 9 0 3 7 4 7 2 6 3 that must be sent with an time interval of 0.6-1.8 seconds between them. Remember that when sending the chars of the "ups shut-down" sequence the UPS responds with the 118 bytes TEXT MODE communication,
After sending the "UPS shut-down" sequence it is possible to check that the ups has correctly received the command, checking that the received byte n.35(char 34)of "binary message" looking to bit 4 on=val.16= "REMOTE SYSTEM OFF COMMAND"

The UPS shut down is executed after 600 sec. the ups-shut-down sequence is received.
The delay cannot be changed, but before the end of the 600 seconds the command can be stopped sending the ASCII char '8'

5 chars commands sequence

If the ups software version is 10154 and over, the following commands sequence is recognized.
The sequence format has 5 chars :
Char 1=176 decimal-identity value, the default is 176, because the default identity value is 0.
Char 2=command code value:

1=the following value are the seconds of delay to execute UPS shut-down

2= the following value are the minutes of delay to restart the UPS after executed UPS shut-down

3=command to execute switching to bypass

4=command to execute battery test

5=command to reset all previous command and to return at normal operation

6=command to execute UPS shut-down after the specified second before with command 1 and to automatically restart after minutes specified with command 2

Char 3=LSB of value in case of command 1 and 2, zero incase of other commands
Char 4= MSB of value incase of command 1 and 2, zero in case of other commands
Char 5=Sum of previous chars=1+2+3+4
NOTE: The ability to restart is only available on UPS configured for parallel operation, or for model 100kVA and over, because the "UPS shut-down" will switch-off the load tripping the SWBY breaker.