SENTRY HPS / HTS

COMMUNICATION PROTOCOL

Rev. 1.00 - October 1996

The communication with Sentry.RPS uses RS232 serial line connection with:
- only 3 wires TX , RX and GND;
- 8 bits;
- no parity;
- 1 stop bit;
- 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.RPS responds only after receiving a command char transmitted from computer.

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

The TEXT MODE communication is opened when the computer transmits a sequence of two ASCII characters.
The first must be '9' the second must be '0' and in must be sent into the time interval of 0.5 - 2 sec. after the first.
The second char is '0' only if the customizing value "IDENT." 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 RS232 serial line.

After opening TEXT MODE communications the computer can send the ASCII chars from '1' to '9' to have back the "TEXT MESSAGE 9" and also to execute a command on the machine in the same of pushing the buttons panel numbered from 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 communications is CLOSED when sending any char different from '1' to '9' or ':' and from three special BINARY CHAR.

The TEXT MODE communication is also opened when the computer transmits a single special char (BINARY CHAR) for receiving the BINARY MESSAGE.

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 INDENT. value.

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

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

The char 204 selects the BINARY MESSAGE relative to all operating set values and the values of measures referred to a PAST EVENT RECORD holding the event record pointer to the position reached when sending the char 224.

DESCRIPTION OF TRANSMITTED MESSAGES.

The **"TEXT MESSAGE 9"** is composed by 118 ASCII chars as written below numbered from 0 to 117.
0 = 13 decimal, carriage return char;
1 = 10 decimal, line feed return char;
2 = ASCII char = first char shown 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 codes 'a=0000-0000';
94 = ASCII char = last char of alarm codes '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 chars as written below numbered from 0 to 86.
0 = equal to "TEXT MESSAGE 9";
...
83 = equal to "TEXT MESSAGE 9";
84 = led IN. and led OUT. status on machine panel (binary value);
led IN on = 10 hex, led IN flashing = 30 hex,
led OUT on = 40 hex, led IN flashing = C0 hex,
85 = led and buzzer status on machine panel (binary value);
led BY. = 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).

The **"BINARY MESSAGE"** is composed by 103 binary values as written below numbered from 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 for "model value",
model value is = kVA * 10, (for single phase output machine)
model value is = 3000 +(kVA * 10), (for three phase output machine);
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 for "panel menu code",
11 = byte equal the number of the present event record into history memory,

or equal to the number of the event record that is being transmitted
when the previous event record is requested;

12 = byte for the SECONDS value (bcd code) of the event record time;
13 = byte for the MINUTES value (bcd code) of the event record time;
14 = byte for the HOURS value (bcd code) of the event record time;
15 = byte for the DAY value (bcd code) of the event record time;
16 = byte for the MONTHS value (bcd code) of the event record time;
17 = byte for the YEARS value (bcd code) of the event record time;

18 = byte for the ALARM internal code, 0 = normal operation;

19 = LSB of word for "s=...." code,
20 = MSB of word for "s=...." code,
21 = LSB of word for "c=...." code,
22 = MSB of word for "c=...." code,
23 = LSB of word for "b=...." code,
24 = MSB of word for "b=...." code,
25 = LSB of word for first part of "r=....-.." code,
26 = MSB of word for first part of "r=....-.." code,
27 = byte for second part of "r=....-.." code,
28 = LSB of word for first part of "i=....-.." code,
29 = MSB of word for first part of "i=....-.." code,
30 = byte for second part of "i=....-.." code,
31 = LSB of word for first part of "a=....-...." code,
32 = MSB of word for first part of "a=....-...." code,
33 = LSB of word for second part of "a=....-...." code,
34 = MSB of word for second part of "a=....-...." code,
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 multiplyied 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 / 3 of output peak current [%Apk], phase 1 "OUT.",
66 = byte for percentage / 3 of output peak current [%Apk], phase 2 "OUT.",
67 = byte for percentage / 3 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 value [v], phase to neutral 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 value [v], phase to neutral,
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,
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 = byte for set value of modem control number, (ver. >= 20),
82 = byte for set value of ECHO function = bit 0 value, and
set value of System operating frequency: 50Hz if bit 7 =1 else 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 that the battery has been fully discharged,
90 = MSB of word for number of times that the 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 value of daily Timer OFF, value 120 = 24h (ver. >= 20)
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 value of daily Timer ON , value 120 = 24h (ver. >= 20)
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 from 0 to 100,
102 = MSB of word for checksum value of transmitted bytes from 0 to 100;

About the flag:

The Sentry status of operation and alarms is fully given by the transmitted byte from n.31 = 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= "DISTURBANCES ON BYPASS LINE",
bit 1 on = val. 2 = "MANUAL BYPASS, SWMB ON",
bit 2 on = val. 4 = "BYPASS LINE VOLT. FAIL or SWBY,FSCR OFF",
bit 3 on = val. 8 = "MAIN LINE VOLTAGE FAIL or SWIN OFF",
bit 4 on = val. 16 = "PREALARM, LOW BATTERY VOLTAGE",
bit 5 on = val. 32 = "LOW INPUT VOLTAGE or OUTPUT OVERLOAD[W]",
bit 6 on = val. 64 = "LOW BATTERY CHARGE or CLOSE SWB",
bit 7 on = val. 128 = "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",

About UPS shut-down:

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.

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". Look forward to have the value of other bits.

The ups_shut_down sequence requires to send the ASCII chars 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 the shut_down sequence operates only if before the communication was opened in the normal binary way.
Also remember that when sending the shut_down sequence the received bytes changes meanings and quantity. In that case the computer receives the “text message 9” message composed by 118 bytes.

After executed the ups shut-off the restoring is possible only manually operating on machine input "SWBY" breaker, because it was tripped.

About ups tests:
The self test cannot be started it is continuos.
The battery test seems to be ok, in any case the ups makes automatically, the battery test each 24 houres with duration of 6 sec.

The other alarms are:

Received byte n. 33:
(char 32 = MSB of word for first part of "a=....-...." code,)
bit 0 on = val. 1= "TEMPORARY BYPASS, WAIT",
bit 1 on = val. 2 = "BYPASS FOR OUTPUT VA < AUTO-OFF VALUE",
bit 2 on = val. 4 = "FAULT 1: configuration card not present",
bit 3 on = val. 8 = "FAULT 2: inverter lockup",
bit 4 on = val. 16 = "FAULT 3: output contactors",
bit 5 on = val. 32 = "FAULT 4: rectifier lockup",
bit 6 on = val. 64 = "FAULT 5: SCR of bypass line",
bit 7 on = val. 128 = "FAULT 6: power supply card lockup",

Received byte n. 34:
(char 33 = LSB of word for second part of "a=....-...." code,)
bit 0 on = val. 1= "FAULT 7: system power supply",
bit 1 on = val. 2 = "FAULT 8: one section of rectifier",
bit 2 on = val. 4 = "FAULT 9: battery contactor",
bit 3 on = val. 8 = "FAULT 10:inverter communication",
bit 4 on = val. 16 = "BYPASS FOR OUTPUT OVERLOAD",
bit 5 on = val. 32 = "BYPASS COMMAND ACTIVE",
bit 6 on = val. 64 = "REMOTE BYPASS COMMAND ACTIVE",
bit 7 on = val. 128 = "INTERNAL or LOAD INSULATION LOSS",

Received byte n. 35:
(char 34 = MSB of word for second part of "a=....-...." code,)
bit 0 on = val. 1= "OVERTEMPERATURE or FAN FAILURE",
bit 1 on = val. 2 = "INPUT VOLTAGE SEQUENCE NOT OK",
bit 2 on = val. 4 = "OUTPUT OFF, CLOSE SWOUT OR SWMB",
bit 3 on = val. 8 = "SYSTEM OFF COMMAND ACTIVE",
bit 4 on = val. 16 = "REMOTE SYSTEM OFF COMMAND",
bit 5 on = val. 32 = "MEMORY CHANGED",
bit 6 on = val. 64 = "FAULT 11: output voltage fail",
bit 7 on = val. 128 = " ",

The other status code are:

Received byte n. 20:
char 19 = LSB of word for "s=...." code,
bit 0 on = val. 1= "Power supply error on system card",
bit 1 on = val. 2 = "Error on system power supply card",
bit 2 on = val. 4 = "Synchro error on system card",
bit 3 on = val. 8 = "Frequency error on system card",
bit 4 on = val. 16 = "system OVERTEMPERATURE",
bit 5 on = val. 32 = "Initialization error on system card",
bit 6 on = val. 64 = "Remote system SHUT-OFF, active ",
bit 7 on = val. 128 = "Active aux. input on system card",

Received byte n. 21:

char 20 = MSB of word for "s=...." code,
bit 0 on = val. 1= "System power supply Permanent fault",
bit 1 on = val. 2 = "RS232 DSR signal present",
bit 2 on = val. 4 = "Key card not present",
bit 3 on = val. 8 = "Jumper 2 not present on system card",
bit 4 on = val. 16 = "Low d.c. voltage",
bit 5 on = val. 32 = "Prealarm low d.c. voltage",
bit 6 on = val. 64 = "Battery contactor opened",
bit 7 on = val. 128 = "Permanent fault on battery contactor",

Received byte n. 22:
char 21 = LSB of word for "c=...." code,
bit 0 on = val. 1= "High output peak current, line 1",
bit 1 on = val. 2 = "High output peak current, line 2",
bit 2 on = val. 4 = "High output peak current, line 3",
bit 3 on = val. 8 = "Output OVERLOAD, line 1",
bit 4 on = val. 16 = "Output OVERLOAD, line 2",
bit 5 on = val. 32 = "Output OVERLOAD, line 3",
bit 6 on = val. 64 = "Permanent output OVERLOAD",
bit 7 on = val. 128 = "Internal or load insulation loss",

Received byte n. 23:
char 22 = MSB of word for "c=...." code,
bit 0 on = val. 1= " ",
bit 1 on = val. 2 = "SWOUT OFF, Output breaker OFF",
bit 2 on = val. 4 = "Output aver. voltage fail, line 3",
bit 3 on = val. 8 = "Output instant. voltage fail, line 1",
bit 4 on = val. 16 = "Output instant. voltage fail, line 2",
bit 5 on = val. 32 = "Output instant. voltage fail, line 3",
bit 6 on = val. 64 = "Output aver. voltage fail, line 1",
bit 7 on = val. 128 = "Output aver. voltage fail, line 2",

Received byte n. 24:
char 23 = LSB of word for "b=...." code,
bit 0 on = val. 1= "Remote bypass command, active",
bit 1 on = val. 2 = "Failure on SCR of bypass line",
bit 2 on = val. 4 = "Input bypass line 1 voltage NOT correct",
bit 3 on = val. 8 = "Input bypass line 2 voltage NOT correct",
bit 4 on = val. 16 = "Input bypass line 3 voltage NOT correct",
bit 5 on = val. 32 = "Input bypass line frequency NOT correct",
bit 6 on = val. 64 = "Input bypass line phases sequence error",
bit 7 on = val. 128 = "SWMB on, manual bypass breaker closed",

Received byte n. 25:
char 24 = MSB of word for "b=...." code,
bit 0 on = val. 1= "Failure on inverter output contactor",
bit 1 on = val. 2 = "Inverter contactor open",
bit 2 on = val. 4 = "Bypass line contactor closed",
bit 3 on = val. 8 = "Failure on bypass line contactor",
bit 4 on = val. 16 = " ",
bit 5 on = val. 32 = "Bypass switching inhibited",
bit 6 on = val. 64 = "Failure on inverter output contactor",

bit 7 on = val. 128 = "Command to switch on inverter",

Received byte n. 26:
char 25 = LSB of word for first part of "r=....-.." code,
bit 0 on = val. 1= "High voltage on input line 1",
bit 1 on = val. 2 = "High voltage on input line 2",
bit 2 on = val. 4 = "High voltage on input line 3",
bit 3 on = val. 8 = "Low voltage on input line 1",
bit 4 on = val. 16 = "Low voltage on input line 2",
bit 5 on = val. 32 = "Low voltage on input line 3",
bit 6 on = val. 64 = "Input current not present on line 1",
bit 7 on = val. 128 = "Input current not present on line 2",

Received byte n. 27:
char 26 = MSB of word for first part of "r=....-.." code,
bit 0 on = val. 1= "Input current not present on line 3",
bit 1 on = val. 2 = "Output power limiting on rectifier",
bit 2 on = val. 4 = "Regulation error on rectifier",
bit 3 on = val. 8 = "Input line frequency error",
bit 4 on = val. 16 = "Rectifier OVERTEMPERATURE",
bit 5 on = val. 32 = "Rectifier HIGH output voltage",
bit 6 on = val. 64 = "Rectifier power supply error",
bit 7 on = val. 128 = "Rectifier inhibited",

Received byte n. 28:
char 27 = byte for second part of "r=....-.." code,
bit 0 on = val. 1= "Rectifier Failure on one branch",
bit 1 on = val. 2 = " ",
bit 2 on = val. 4 = " ",
bit 3 on = val. 8 = " ",
bit 4 on = val. 16 = "Rectifier Permanent Failure",
bit 5 on = val. 32 = "Rectifier - DRV1 - signal",
bit 6 on = val. 64 = "Rectifier - DRV2 - signal",
bit 7 on = val. 128 = "Rectifier - DRV3 - signal",

Received byte n. 29:
char 28 = LSB of word for first part of "i=....-.." code,
bit 0 on = val. 1= "Cables error on inverter driver card",
bit 1 on = val. 2 = "Inverter STOP from driver card 1",
bit 2 on = val. 4 = "Inverter STOP from driver card 2",
bit 3 on = val. 8 = "Inverter overcurrent",
bit 4 on = val. 16 = "Cables error into inverter",
bit 5 on = val. 32 = "Inverter power supply error",
bit 6 on = val. 64 = "inverter - HFDRV R - signal",
bit 7 on = val. 128 = "inverter - HFDRV S - signal",

Received byte n. 30:
char 29 = MSB of word for first part of "i=....-.." code,
bit 0 on = val. 1= "Inverter Failure",
bit 1 on = val. 2 = "Inverter synchro not present",
bit 2 on = val. 4 = "Inverter Reset failure",
bit 3 on = val. 8 = "Inverter driver card power supply error",
bit 4 on = val. 16 = "Inverter high output voltage",

bit 5 on = val. 32 = "Inverter high input voltage",
bit 6 on = val. 64 = "Inverter overtemperature on module 1",
bit 7 on = val. 128 = "Inverter overtemperature on module 2",

Received byte n. 32:
char 30 = byte for second part of "i=....-.." code,
bit 0 on = val. 1= "Inverter overtemperature on module 3",
bit 1 on = val. 2 = "Inverter STOP from driver card 1",
bit 2 on = val. 4 = "inverter - HFDRV T - signal",
bit 3 on = val. 8 = "Inverter inhibited",
bit 4 on = val. 16 = "Inverter LOW output voltage",
bit 5 on = val. 32 = "Inverter LOW input voltage",
bit 6 on = val. 64 = "Inverter manual reset ",
bit 7 on = val. 128 = "Inverter permanent failure ",