COMMUNICATION PROTOCOL

SLC TWIN/3 PRO2

8...20 kVA III/I

salicru

Table of contents

1. HYPERTERMINAL CONFIGURATION

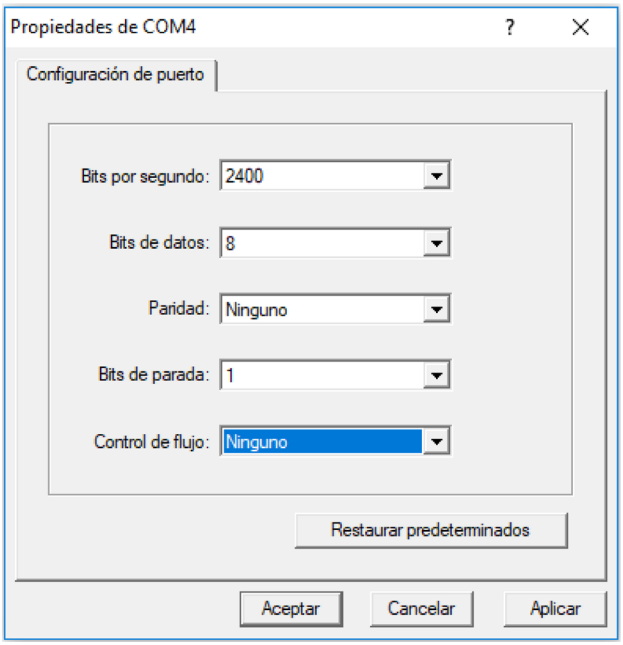


Fig. 1.

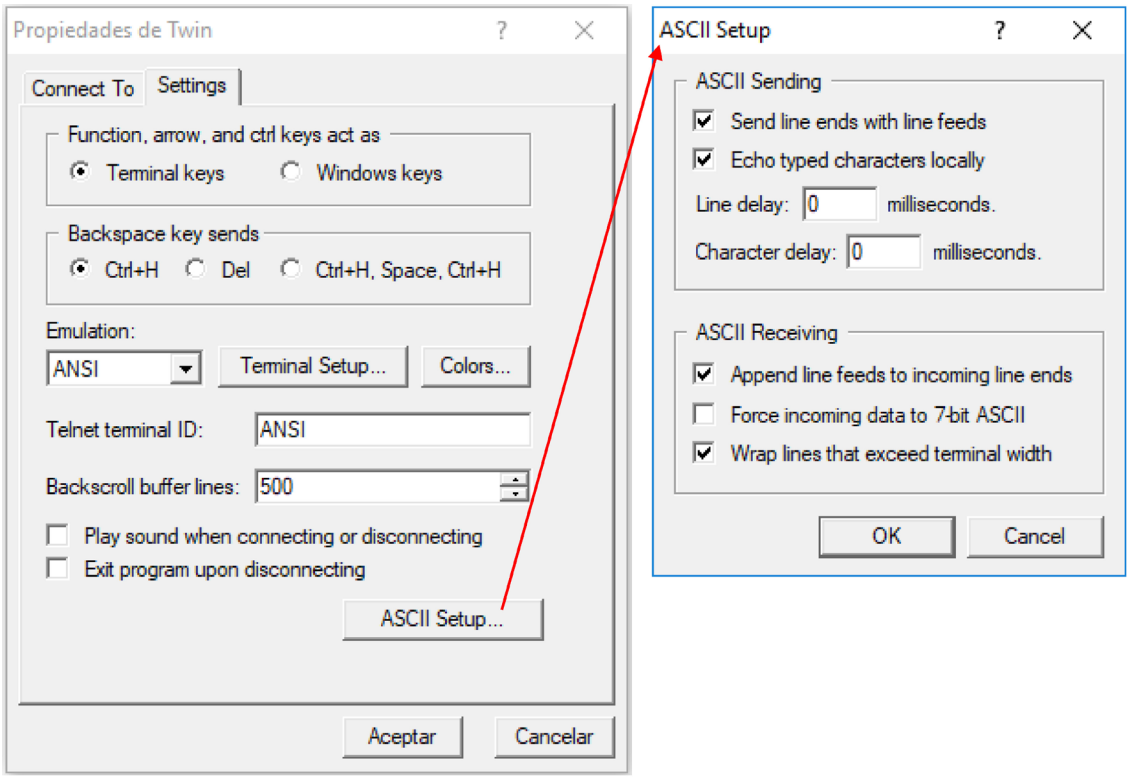


Fig. 2.

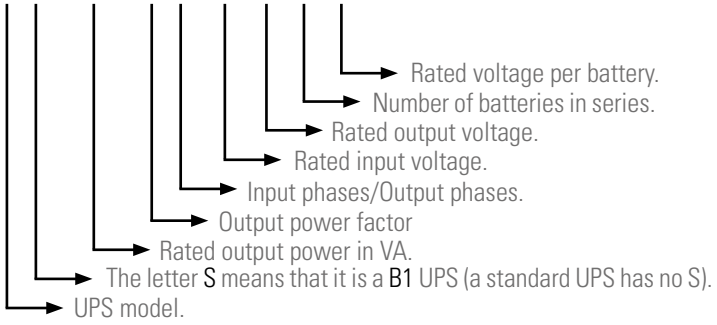
2. QUERY COMMANDS

ITEM	COMMAND	DESCRIPTION
1	**QPI**	PROTOCOL ID
2	**QMD**	MODEL AND RATED PARAMETERS
3	**QRI**	RATED OUTPUT AND BATTERY VALUES
4	**QMOD**	CURRENT OPERATING MODE OF THE UPS
5	**QGS**	MEASUREMENTS AND CURRENT OPERATING STATUS
6	**QBV**	BATTERY VOLTAGE MEASUREMENTS AND PARAMETERS
7	**Q3PV**	VOLTAGE MEASUREMENTS OF THE THREE INPUT PHASES
8	**QLDL**	OUTPUT POWER MEASUREMENT, MAXIMUM AND MINIMUM
9	**QVB**	BATTERY VOLTAGE MEASUREMENT CALIBRATION PARAMETER
10	**QV**	RATED OUTPUT VOLTAGE SETTING
11	**QVC**	OUTPUT VOLTAGE FINE ADJUSTMENT PARAMETER
12	**QBYV**	BYPASS VOLTAGE RANGE
13	**QBYF**	BYPASS FREQUENCY RANGE
14	**QHE**	ECO MODE VOLTAGE RANGE
15	**QBUS**	RATED DC BUS VOLTAGE SETTING
16	**QBUSP**	POSITIVE DC BUS VOLTAGE FINE ADJUSTMENT PARAMETER
17	**QBUSN**	NEGATIVE DC BUS VOLTAGE FINE ADJUSTMENT PARAMETER
18	**QTPR**	PFC AND INVERTER TEMPERATURE MEASUREMENTS
19	**QFLAG**	CONTROL BITS CONFIGURATION STATUS
20	**QFS**	UPS STATUS WHEN A FAULT OCCURS
21	**QWS**	ALERT BITS STATUS
22	**QVFW**	FIRMWARE VERSION OF THE DSP CONTROL BOARD
23	**QVFW2**	FIRMWARE VERSION OF THE MCU COMMUNICATIONS BOARD
24	**QPAR**	UNIT'S ADDRESS IN THE PARALLEL SYSTEM
25	**Q5**	FIRMWARE CREATION DATE
26	**QBDR**	RS-232 PORT COMMUNICATION SPEED
27	**QSK<n>**	SECONDARY OUTPUT STATUS
28	**QSKT<n>**	THE SECONDARY OUTPUT'S SHUTDOWN TIME SETTING
29	**QNL**	NEUTRAL LOSS SETTING

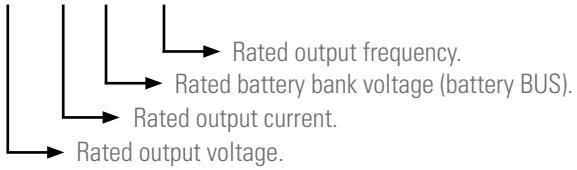
Tab. 1.

1. **QPI**: Protocol ID.
   PC: QPI<cr>
   UPS: (PI<NN><cr>
   Where N is an integer, between 0 and 9.

2. **QMD**: UPS model.
   PC: QMD<cr>
   UPS: (##########3G08KS ##08000 90 3/1 230 230 20 12.0



3. **QRI**: Information about some rated values.
PC: QRI<cr>
UPS: (230.0 043 240.0 50.0



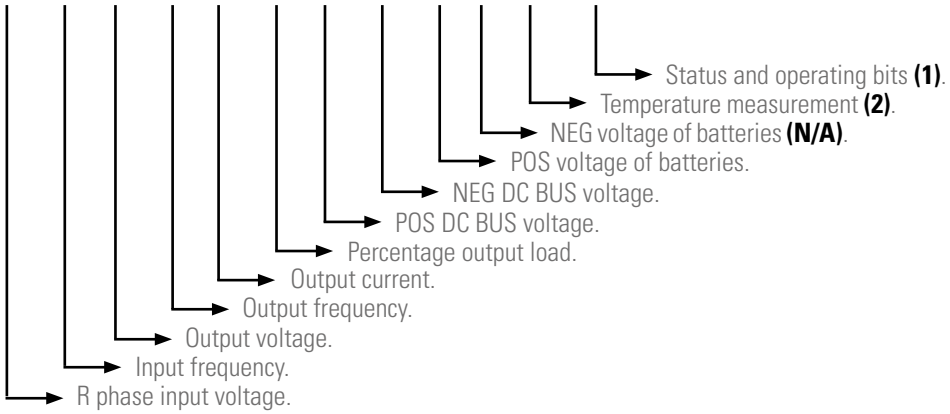
4. **QMOD**: Current operating mode of the UPS.
PC: QMOD<cr>
UPS: (M<cr>

With "M" being the current operating mode of the UPS, according to the following coding:

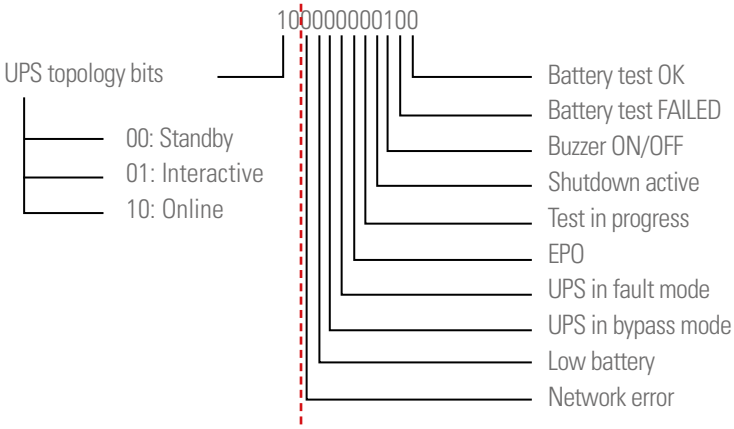
OPERATING MODE	"M" CODE
On mode	**P**
Standby mode	**S**
Bypass mode	**Y**
Online mode	**L**
Battery mode	**B**
Battery test mode	**T**
Fault mode	**F**
ECO mode	**E**
Frequency converter mode	**C**
Off mode	**D**

5. **QGS**: Measurements and current operating status of the UPS
PC: QGS<cr>
UPS: (224.4 49.9 228.9 49.9 011.3 064 360.5 361.9 273.9 ---.- 028.0 100000000100<cr>

224.1 50.0 223.8 50.0 001.0 002 369.8 369.6 266.0---.- 023.6 100010000000



(1) Description of the status and operating bits.



(2) Temperature measurement
The measurement that appears on the screen (when using the QGS command) is the maximum temperature value obtained from the 4 sensors installed on the power board.

6. **QBV**: Battery voltage measurements and parameters.
PC: QBV<cr>
UPS: (265.2 20 01 072 00534<cr>
   - Runtime **(min.)**.
   - Battery charge level **(%)**.
   - Number of groups of batteries (strings in parallel).
   - Number of batteries connected in series **(string)**.
   - Battery voltage measurement.

7. **Q3PV**: Input voltage measurements.
PC: Q3PV<cr>
UPS: (223.4 218.2 218.2 382.4 377.9 382.4<cr>
   - TR voltage.
   - ST voltage.
   - RS voltage.
   - T-N voltage.
   - S-N voltage.
   - R-N voltage.

8. **QLDL**: Maximum and minimum power measurements, expressed as a percentage.
PC: QLDL<cr>
UPS: (043 038<cr>
   - Minimum power measurement recorded at an instant expressed in %.
   - Maximum power measurement recorded at an instant expressed in %.

9. **QVB**: Charger battery/output voltage measurement calibration parameter.
PC: QVB<cr>
UPS: (VBS-40<cr>
   - Current calibration parameter value. This is entered using the VB±<nn> command (detailed below).

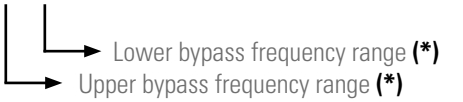
10. **QV**: Rated output voltage setting.
PC: QV<cr>
UPS: (V230<cr>
   - Current value of the output voltage setting.

11. **QVC**: Output voltage fine adjustment parameter.
PC:QVC<cr>
UPS: (V+14<cr>
   - Current value of the parameter setting. This is entered using the V±<nn> command (detailed below).
   - Output voltage measurement.

12. **QBYV**: Voltage range for static bypass availability.
PC: QBYV<cr>
UPS: (276 184<cr>
   - Lower bypass voltage range **(*)**
   - Upper bypass voltage range **(*)**

(*) Outside this voltage range, there will be no switching to static bypass, under any circumstances.

13. **QBYF**: Frequency range for static bypass availability.
    PC: QBYF<cr>
    UPS: (54.0 46.0<cr>



    (*) Outside this frequency range, there will be no switching to static bypass, under any circumstances.

14. **QHE**: Voltage range for operating in ECO mode.
    PC: QHE<cr>
    UPS: (241 219<cr>

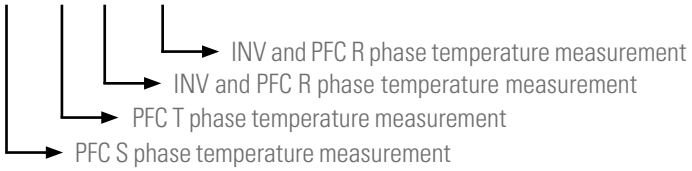
    (*) Outside this voltage range, the load is powered via the inverter.

15. **QBUS**: Rated DC BUS voltage setting.
    PC: QBUS<cr>
    UPS: (BUS370<cr>

16. **QBUSP**: Positive DC BUS voltage fine adjustment parameter.
    PC: QBUSP<cr>
    UPS: (BUSP+55<cr>

17. **QBUSN**: Negative DC BUS voltage fine adjustment parameter.
    PC: QBUSN<cr>
    UPS: (BUSN+10<cr>

18. **QTPR**: Temperature measurement of the PFCs of the RST and inverter phases.
    PC: QTPR<cr>
    UPS: (025.2 023.4 025.1 022.7<cr>



19. **QFLAG**: Status of the control bits/flags.
    PC: QFLAG<cr>
    UPS: (**E**pbrosdtjiy**D**avef<cr>

BIT	DESCRIPTION
a	Enable/disable the audible alarm (buzzer)
b	Enable/disable the audible alarm (buzzer) in battery mode
d	Enable/disable battery disconnected alarm
e	Enable/disable operation in ECO mode
f	Enable/disable FBD function of static bypass (*)
i	Enable/disable the inverter's short clean function
j	Enable/disable scheduled shutdown of secondary output in battery mode
o	Enable/disable switch to static bypass on shutdown
p	Enable/disable the audible alarm (buzzer) in bypass mode
r	Enable/disable the AUTO REBOOT function
s	Enable/disable the battery deep discharge protection
t	Enable/disable the low battery protection (if this is disabled, if there is an anomaly the battery can be discharged to 6 Vdc)
v	Enable/disable frequency converter mode
y	Enable/disable the incorrect phase rotation alarm

Tab. 2.

(*) When the FBD function is enabled, static bypass is completely disabled, regardless of any event occurring in the UPS. It is as if the unit has no bypass function.

20. QFS: State of the UPS when a fault occurs
PC: QFS<cr>
UPS: QFS (03 219.6 50.0 000.0 00.0 005 010.6 112.4 115.5 039.6 037.0 00000100<cr>

(03 219.6 50.0 000.0 00.0 005 010.6 112.4 115.5 039.6 037.0 00000100

- Information bits **(*)**
- Temperature before the fault
- Battery voltage before the fault
- NEG DC BUS voltage before the fault
- POS DC BUS voltage before the fault
- Output current before the fault
- Output load percentage before the fault
- Inverter output frequency before the fault
- Inverter output voltage before the fault
- Input frequency before the fault
- Input voltage before the fault
- Type of fault **(see Tab. 2)**

(*) Information bits.

00000100

- Reserved **(always 0)**
- Reserved **(always 0)**
- Output relay on
- Input relay on
- Reserved **(always 0)**
- Inverter on
- PFC on
- DC/DC converter on

1: is on.
0: is off.

FAULT	FAULT	CODE	DESCRIPTION OF THE FAULT
Fault in the DC BUS	DC BUS soft start error	01	The DC BUS voltage did not reach the set value after 30 seconds.
	High DC BUS voltage	02	The +BUS or -BUS remains at 450 Vdc for 50 ms. The +BUS or -BUS remains at 400 Vdc for 1.5 s.
	Low DC BUS voltage	03	The +BUS or -BUS remains below 230 Vdc for 200 ms.
	DC BUS voltage imbalance	04	When the difference between the absolute values of the +BUS and the -BUS is 40 Vdc for 2 minutes.
	DC BUS overload	06	If the BUS value falls to 32 V during a period and this occurs for more than two periods, the fault signal will be displayed.
Fault in the inverter	Inverter soft start fault	11	The inverter cannot reach the set voltage in 30 seconds.
	High voltage	12	The output voltage remains at 276 Vac for 128 ms.
	Low voltage	13	The output voltage remains at 140 Vac for 128 ms.
	Short-circuited output	14	The voltage remains at 50 Vac and the current remains at 20 A for 3 periods.
	Negative power fault	1A	The output power is above -800 W.
Fault in the electrical connection	Fault in battery SCR	21	The battery voltage is above 310 Vdc.
	Inverter relay short-circuited	24	After starting the DC BUS with the inverter's PWM OFF, 50 V are detected at the output.
	Battery fuse open	29	Fuse or battery circuit, open.
Fault in the parallel system	Loss of parallel communication	31	Parallel communication between some UPSs was interrupted.
	Output power distribution fault	36	The difference in current between the UPSs is 5 A.
Other	Overheating	41	Overheating of the PFC or INV.
	Overload	43	Output overload.
	Fault in the model	46	The UPS model is not configured correctly.

Tab. 3.

If the fault that occurs is not on Tab. 3, refer to the general fault code table.

21. **QWS**: Warning alarm query
PC: QWS<cr>
UPS: (0000000000000000000000000000000000000000000000000000000000000000 1000000<cr>

Description of the bits according to table 3

0000000000000000000000000000000000000000000000000000000001000000

Bit 0 Bit 63

BIT	WARNING CODE	WARNING	NOTE
Bit 0	01	Battery open	Batteries disconnected .
Bit 1	02	Loss of neutral	Loss of input neutral.
Bit 3	04	Phase error	Incorrect input phase rotation.
Bit 6	07	Battery overload	Overvoltage in the batteries.
Bit 7	08	Low battery	Low battery voltage
Bit 8	09	Overload	Overload at the UPS output.
Bit 9	0A	Fan clogged	Fan fault.
Bit 10	0B	EPO activated	The EPO has been activated.
Bit 12	0D	Overheating	The UPS is overheating.
Bit 13	0E	Charger fault	Charger fault .
Bit 15	10	L1 input fuse	L1 input fuse blown.
Bit 32	21	Different input connection	The input line connection in a parallel system is different.
Bit 33	22	Different bypass connection	The bypass line connection in a parallel system is different.
Bit 50	33	UPS locked in bypass mode due to overload	UPS locked in bypass mode after 3 consecutive overloads in 30 minutes.
Bit 51	34	RST input current imbalance	Imbalance caused by the PFC circuits.
Bit 52	35	Damaged battery fuse	The battery fuse in the plate is damaged.
Bit 53	36	Unbalanced inverter current	Inverter's internal current is unbalanced.
Bit 57	3A	Maintenance bypass switch cover open	Maintenance bypass switch cover open.
Bit 58	3B	Automatic phase detection fault.	Automatic phase detection fault.
Bit 59	3C	Unbalanced input.	RST input voltage unbalanced.
Bit 60	3D	Bypass unstable	Instability in the bypass voltage/frequency.

Tab. 4.

When the Bits are set to 1, it means that the warning has been activated and when they are set to 0, the warning is not present. For the above example, Bit 57 is active, meaning that the cover of the maintenance bypass switch is open.

22. **QVFW**: Firmware version query for the DSP control board.
    PC: QVFW<cr>
    UPS: (VERFW:00134.28<cr>
    - 28: Version
    - 00134: Serial number of the Firmware.

23. **QVFW2**: Firmware version query for the MCU communications board.
    PC: QVFW2<cr>
    UPS: (VERFW2:01903.05<cr>
    - 05: Version
    - 01903: Serial number of the Firmware.

24. **QPAR**: Address of the UPS in the parallel system.
    PC: QPAR<cr>
    UPS: (01<cr>
    - Address 01.

25. **Q5**: Firmware creation date.
    PC: Q5<cr>
    UPS: (20130809-A<cr>

26. **QBDR**: RS-232 port communication speed.
    PC: QBDR<cr>
    UPS: (24<cr>

    → Speed of 2400 Bits per second.

27. **QSK<n>**: Secondary output status.
    Where the n value can only be 1 or 2, depending on how many secondary outputs the UPS has. It normally includes a secondary output.

    PC: QSK1<cr>
    UPS: (1<cr>

    → If the answer is "1", this means that the secondary output is ON, if the answer is "0", it means that the secondary output is OFF.

28. **QSKT<n>**: Time setting expressed in minutes, for the secondary output, when the UPS is in battery discharge mode.
    Where the n value can only be 1 or 2, depending on how many secondary outputs the UPS has. It normally includes a secondary output.

    PC: QSKT1<cr>
    UPS: (030<cr>

    → When the UPS is in battery discharge mode, the secondary output will change to OFF after 30 minutes.

29. **QNL**: Neutral loss alarm setting.
    PC: QNL<cr>
    UPS: (NL<nnn><cr>

    Where nnn can be ATO, CHE or DIS, which each have the following meanings:

    ATO: Neutral loss detection alarm and clearing of alarm when the neutral connection is restored.

    CHE: Neutral loss detection alarm and alarm remains when the neutral connection is restored.

    DIS: Neutral loss detection alarm disabled.

3. CONTROL COMMANDS

CONTROL COMMANDS		
ITEM	**COMMAND**	**DESCRIPTION**
1	T	10-SECOND BATTERY TEST
2	TL	BATTERY TEST UNTIL BATTERY LOW
3	T<n>	SCHEDULED BATTERY TEST (n=minutes)
4	CT	CANCELS THE BATTERY TEST
5	S<n>	SCHEDULED INVERTER SHUTDOWN
6	S<n>R<m>	SCHEDULED INVERTER POWER ON/SHUTDOWN
7	CS	CANCELS THE SHUTDOWN COMMANDS
8	SON	TURNS THE INVERTER ON
9	SOFF	TURNS THE INVERTER OFF
10	BZOFF	DEACTIVATES THE BUZZER
11	BZON	ACTIVATES THE BUZZER
12	SKON<n>	SECONDARY OUTPUT POWER ON
13	SKOFF<n>	SECONDARY OUTPUT SHUTDOWN

Tab. 5.

1. **T**: Start of a 10-second battery test.
   PC: T<cr>
   UPS: (ACK<cr>

   1) If a low battery is detected during the test, the UPS will immediately return to the mains power.
   2) The command will only be executed when the UPS is in online mode and the voltage of each battery is no lower than 13 V.

2. **TL**: Battery test until battery voltage is low.
   PC: TL<cr>
   UPS: (ACK<cr>

   With this command, the UPS will discharge the batteries until battery voltage is low, after which the UPS will go back to being powered by the mains. Low battery voltage means approximately 11.4 Vdc per battery.
   If a battery in a poor condition is detected during the test, the test will be stopped and the UPS will go back to being powered by the mains.

3. **T<n>**: Battery test for a scheduled time.
   Where **n** represents the scheduled time, expressed in minutes, with the permitted range being as follows: .2, .3, .4……..01, 02, 03……..99. Note that for times below 1 minute, the count is not very precise.

   PC: T.5<cr>
   UPS: (ACK<cr>
   In this example, the UPS will perform a battery test for 0.5 minutes, i.e. 30 seconds.
   If a battery in a poor condition is detected during the test, the test will be stopped and the UPS will go back to being powered by the mains.

4. **CT**: Cancel battery test.
   PC: CT<cr>
   UPS: (ACK

   When this command is entered, the UPS immediately cancels the test and returns to the state it was in before starting the test.

5. **S<n>**: Output shutdown (zero at the output) for a scheduled time.
   This command allows the inverter to be shut down after the scheduled number of minutes.
   Where n represents the scheduled time, expressed in minutes, with the permitted range being as follows: 0.2, 0.3, 0.4……..01, 02, 03……10.

   PC: S01<cr>
   UPS: (ACK<cr>

   In the example, the inverter will be shut down after one minute and whether or not the switch occurs will depend on how the bypass is configured and the input voltage value.

6. **S<n>R<m>**: Power on/shutdown of the output (zero at the output) for a scheduled time.
   This command allows the inverter to be turned on and shut down after the scheduled number of minutes for shutting it down and turning it on.
   Where n represents the scheduled shutdown time, expressed in minutes, with the permitted range being as follows: 0.2, 0.3, 0.4……..01, 02, 03……99, and m represents the scheduled power on time expressed in minutes, with the permitted range being as follows: 0001 to 9999.

   PC: S.5R0002<cr>
   UPS: (ACK<cr>

   In the example, the inverter will be shut down after 30 seconds and turned back on after 2 minutes.

   If the UPS's inverter is waiting for the OFF state, with the "CS" command it is possible to cancel the shutdown.

   If there UPS's inverter is waiting for power to be turned on, 10 seconds after the shutdown, with the "CS" command it is possible to cancel the power on operation (if the mains power is present).

7. **CS**: Cancels the commands that turn the UPS output on and off.
   PC: CS<cr>
   UPS: (ACK<cr>

   With this command it is possible to cancel the actions performed with the S<n> command.

8. **SON:** Switch on the inverter.
   When the UPS is in bypass or standby mode, with this command it is possible to switch on the inverter.

   PC: SON<cr>
   UPS: (ACK<cr>

9. **SOFF**: Switch off the inverter.
   With this command it is possible to switch off the inverter. If the UPS has mains power, it will stay in bypass mode, otherwise it will be completely shut down.

   PC: SOFF<cr>
   UPS: (ACK<cr>

10. **BZOFF**: Deactivate the audible alarm **(buzzer)**.
    You can confirm that the buzzer has been deactivated with this command by the following icon being displayed on the LCD screen:

    PC: BZOFF<cr>
    UPS: (ACK<cr>

11. **BZON**: Activate the audible alarm **(buzzer)**.
    You can confirm that the buzzer has been activated with this command by the following icon disappearing from the LCD screen:

    PC: BZON<cr>
    UPS: (ACK<cr>

12. **SKON<n>:** On executing this command, the secondary output will be turned on (UPS output voltage).

This command will apply to the secondary output that appears on the UPS's chassis as “OUTPUT 2”. However, when using the command, the n value that will have to be entered is 1, as shown in the following example.

PC: SKON1<cr>
UPS: (ACK<cr>

13. **SKOFF<n>**: On executing this command, the secondary output will be turned off **(zero volts)**.

This command will apply to the secondary output that appears on the UPS's chassis as “OUTPUT 2”. However, when using the command, the n value that will have to be entered is 1, as shown in the following example.

PC: SKOFF1<cr>
UPS: (ACK<cr>

4. CALIBRATION, SETTING AND PARAMETER COMMANDS

CALIBRATION, SETTING AND PARAMETER COMMANDS		
CALIBRATION		
ITEM	**COMMAND**	**DESCRIPTION**
1	VB±<nn>	BATTERY VOLTAGE CALIBRATION
2	VLINE±<nn>	FINE CALIBRATION OF R PHASE INPUT VOLTAGE
3	VLINEB±<nn>	FINE CALIBRATION OF S PHASE INPUT VOLTAGE
4	VLINEC±<nn>	FINE CALIBRATION OF T PHASE INPUT VOLTAGE
5	VBYP±<nn>	FINE CALIBRATION OF R PHASE BYPASS VOLTAGE
SETTINGS		
ITEM	**COMMAND**	**DESCRIPTION**
1	VC±<nn>	VOLTAGE SETTING OF THE BATTERY CHARGER
2	V<nnn>	RATED OUTPUT VOLTAGE SETTING
3	V±<nn>	FINE ADJUSTMENT OF THE OUTPUT VOLTAGE
4	RESET<cr>	DEFAULT OUTPUT VOLTAGE SETTING (230 VAC)
5	F50<cr>	OUTPUT VOLTAGE SETTING AT 50 Hz
6	F60<cr>	OUTPUT VOLTAGE SETTING AT 60 Hz
7	BUS<nnn>	RATED DC BUS VOLTAGE SETTING
8	BUSP±<nn>	POSITIVE VOLTAGE SETTING OF THE DC BUS
9	BUSN±<nn>	NEGATIVE VOLTAGE SETTING OF THE DC BUS
PARAMETERS		
ITEM	**COMMAND**	**DESCRIPTION**
1	BATCAP<nnn>	SETTING THE BATTERY CAPACITY
2	BATGN<nn>	SETTING THE NUMBER OF BATTERY STRINGS
3	BATCOEF<nn>	BACKUP TIME CALIBRATION FACTOR
4	BATS<n>	HIDE 'NO BATTERY' ALARM
5	PLV<p>	SETTING OF MINIMUM BYPASS VOLTAGE
6	PHV<q>	SETTING OF MAXIMUM BYPASS VOLTAGE
7	PSF<m>	SETTING OF MINIMUM BYPASS FREQUENCY
8	PGF<n>	SETTING OF MAXIMUM BYPASS FREQUENCY
9	HEH<nnn>	SETTING OF MAXIMUM VOLTAGE IN ECO MODE
10	HEL<nnn>	SETTING OF MINIMUM VOLTAGE IN ECO MODE
11	HEFH<n>	SETTING OF MAXIMUM FREQUENCY IN ECO MODE
12	HEFL<n>	SETTING OF MINIMUM FREQUENCY IN ECO MODE
13	PE<X>/PD<X>	SETTING OF OPERATING CONTROL BITS
14	PEPO<n>	SETTING OF THE EPO'S LOGICAL STATUS
15	PF	SETS ALL DEFAULT SETTINGS
16	QL<nnn>	NEUTRAL LOSS ALARM SETTING
17	PSK<n><m>	TIME SETTING FOR THE SECONDARY OUTPUT

Tab. 6.

4.1. CALIBRATION

1. **VB±<nn>**: Charger battery/output voltage measurement calibration.
   The **nn** parameter is an integer between 00 and 99 that represents the voltage value that you want to add to/deduct from the current value to perform calibration. The UPS interprets this value in tenths of volts, so if you enter nn=22, you will be adding 2.2 V.

   ⚠ To carry out this calibration correctly, you need to turn on the UPS's inverter without any load at the output **(off-load)** and put the unit in battery discharge mode. Then, view the LCD screen to get the battery voltage measurement from the UPS, or enter the QBV command to obtain a more precise measurement.

   Note that it is very important for the **nn** values that you want to add to/deduct from the current battery voltage measurement have nn=±00 as a reference or starting point and they also take into account the current calibration parameter (the current nn), which can be viewed using the QVB<cr> command.

   Therefore, there are two ways to effectively achieve the desired calibration:

   a. Set **nn** to zero using the command:

   PC: VB+00<cr>
   UPS: (ACK<cr>

   Then read the new voltage measurement on the screen or by using the QBV command and simply deduct/add the nn value in volts (remember that this is expressed in tenths of volts) to achieve the desired calibration.

   Example:
   Voltage measured with tester = 255.4 Vdc
   Voltage in UPS according to QBV = 263 Vdc

   - ❒ Enter the command:
     PC: VB+00<cr>
     UPS: (ACK<cr>
     So the battery bank's new voltage reading fell to 256.9 Vdc, according to the measurement obtained from the QBV command.
     Therefore, 1.5 Vdc should be deducted and, as nn is expressed in tenths of volts, nn= –15.
   - ❒ Finally:
     PC: VB-15<cr>
     UPS: (ACK<cr>
     Check the calibration with the QBV command.

   b. The second way is to use the following equation:

   $$nn = [QVB + (MEASUREMENT_{DESIRED} - MEASUREMENT_{ACTUAL}) \times 10]$$

   Example:
   Desired measurement (measured by the tester): 256.2 Vdc
   Actual measurement (measured by the UPS): 250.9 Vdc
   PC: QVB<cr>
   UPS: (VBS-65<cr>
   Therefore QVB=-65

   $$nn = [-65 + (256{,}2 - 250{,}9) \times 10] = -12$$

   - ❒ Finally, the command will be:
     PC: VB-12<cr>
     UPS: (ACK<cr>
     Check the calibration with the QBV command.

Example:
Desired measurement (measured by the tester): 256.3 Vdc
Actual measurement (measured by the UPS): 261.7 Vdc
PC: QVB<cr>
UPS: (VBS+40<cr>
Therefore QVB = + 40

$$nn = [40 + (256.3 - 261.7) \times 10] = -14$$

❒ Finally, the command will be:
PC: VB-14<cr>
UPS: (ACK<cr>

2. **VLINE±<nn>**: Calibration of the R phase input voltage (with respect to neutral).
The **nn** parameter is an integer between 00 and 99 that represents the voltage value that you want to add to/deduct from the current value to perform calibration. The UPS interprets this value in tenths of volts, so if you enter nn=35, you will be adding 3.5 V.

Once again, the **nn** values that you want to add to/deduct from the current input voltage measurement have nn = ± 00 as a reference or starting point and they also take into account the current calibration parameter (the current nn), but in this case it cannot be viewed using any command.

So the most practical thing to do is to calibrate the central voltage point with nn = + 00, as in the following example.

To perform this calibration correctly, it is advisable to put the unit in online mode. Then, view the LCD screen to get the input voltage measurement from the UPS, or enter the QGS command to obtain a more precise measurement.

Example:
Voltage measured with tester = 223 Vdc
Voltage on the UPS screen = 227 Vac
❒ Enter the command:
PC: VLINE+00<cr>
UPS: (ACK<cr>
So the new input voltage measurement has decreased to 221 Vac.
Therefore, 2 Vac should be added and, as nn is expressed in tenths of volts, nn=+ 20.
❒ Finally:
PC: VLINE+20<cr>
UPS: (ACK<cr>

3. **VLINEB±<nn>:** Calibration of the S phase input voltage (with respect to neutral).
The process is identical to calibrating the R phase.

4. **VLINEC±<nn>**: Calibration of the T phase input voltage (with respect to neutral).
The process is identical to calibrating the R phase.

5. **VBYP±<nn>**: Calibration of the bypass voltage measurement.
The **nn** parameter is an integer between 00 and 99 that represents the voltage value that you want to add to/deduct from the current measurement value to perform the calibration. The UPS interprets this value in tenths of volts, so if you enter nn=17 you will be adding 1.7 V.

Once again, the **nn** values that you want to add to/deduct from the current bypass voltage measurement have nn = ± 00 as a reference or starting point and they also take into account the current calibration parameter (the current **nn**), but in this case it cannot be viewed using any command.

So the most practical thing to do is to calibrate the central voltage point with nn=+00, as in the following example.


To perform this calibration correctly, it is necessary to put the unit in bypass mode. Then, view the LCD screen to get the bypass voltage measurement from the UPS, more specifically under the output measurement, or enter the QGS command to obtain a more precise measurement.

Example:
Voltage measured with tester = 223 Vdc
Voltage on the UPS screen = 217 Vac

- ❒ Enter the command:
  PC: VBYP+00<cr>
  UPS: (ACK<cr>
  So the bypass's new voltage value has increased to 222 Vac.
  Therefore, 1 Vac should be added and, as nn is expressed in tenths of volts, nn=+10.
- ❒ Finally:
  PC: VBYP+10<cr>
  UPS: (ACK<cr>

4.2. SETTINGS

1. **VC<±nn>**: Output voltage setting of the battery charger.
   This command allows you to set the output voltage of the battery charger to obtain the desired float value.

   The nn parameter is an integer between 00 and 70 that represents the voltage value that you want to add to/deduct from the current value to set the voltage. The UPS interprets this value in tenths of volts, so if you enter nn=36, you will be adding 3.6 volts.

   Note that it is very important for the nn values that you want to add to/deduct from the current charger voltage have nn=±00 as a reference or starting point and they also take into account the current set value, but in this case it cannot be viewed using any command.

   So the most practical thing to do is to calibrate the central voltage point with nn=+00, as in the following example.

   Example:
   Set nn to zero using the command:
   PC: VC+00<cr>
   UPS: (ACK<cr>
   Then read the new voltage measurement on the tester and simply deduct/add the nn value in volts (remember that this is expressed in tenths of volts) to achieve the desired voltage.

   Example:
   Desired voltage: 275 Vdc
   Initial voltage: 265.5 Vdc
   - ❒ Enter the command:
     PC: CHGV+00<cr>
     UPS: (ACK<cr>
     So the charger's new voltage value has increased to 272.6 Vdc.
     Therefore, 2.4 Vdc should be added and, as nn is expressed in tenths of volts, nn=+24.
   - ❒ Finally:
     PC: CHGV+24<cr>
     UPS: (ACK<cr>

2. **V<nnn>**: Rated output voltage setting (the inverter's voltage).
   Where nnn is an integer that represents the set rated voltage and it can only be one of the following values:

   - ❒ 208 Vac RMS
   - ❒ 220 Vac RMS
   - ❒ 230 Vac RMS
   - ❒ 240 Vac RMS

   It must be set in bypass or standby mode, i.e. with the inverter off.

   The voltage is set to 230 Vac by default. If you want to change it to 220 Vac, you must enter the following command:
   PC: V220<cr>
   UPS: (ACK<cr>

3. **V±<nn>**: Fine adjustment of the output voltage (the inverter's voltage)
   After setting the rated voltage, this command allows you to finely adjust any minimal difference that may exist, or change the voltage to a desired value that is different to other possible rated voltages.

It must be set with the inverter running.

The **nn** parameter is an integer between 00 and 99 that represents the voltage value that you want to add to/deduct from the current value to set the voltage. The UPS interprets this value in tenths of volts, so if you enter nn=28 you will be adding 2.8 V.

As when setting the charger's voltage, the nn values that you want to add to/deduct from the inverter's current voltage have nn = ±00 as a reference or starting point and they also take into account the current set value, which can be viewed using the QVC<cr> command.

Therefore, there are two ways to effectively set the desired voltage:

a. Set nn to zero using the command:
PC: V+00<cr>
UPS: (ACK<cr>

Then read the new output voltage measurement on the tester and simply deduct/add the nn value in volts (remember that this is expressed in tenths of volts) to achieve the desired voltage.

Example:
Desired voltage = 227 Vac
Initial voltage = 233 Vac
– Enter the command:
PC: V+00<cr>
UPS: (ACK<cr>
According to the measurement displayed by the tester, the inverter's new voltage has fallen to 229 Vac.
Therefore, 2 Vdc should be deducted and, as nn is expressed in tenths of volts, nn=-20.
– Finally:
PC: V-20<cr>
UPS: (ACK<cr>

b. The second way is to use the following equation:

$$nn = [QCHGCUR + (CURRENT_{DESIRED} - CURRENT_{ACTUAL}) \times 10]$$

Example:
Desired voltage = 231 Vac
Initial voltage = 225 Vac
– Enter the command:
PC: QVC<cr>
UPS: (V-50<cr>
Therefore, the QVC value=-50

$$nn = [-50 + \mathbf{(231 - 225)} \times 10] = 10$$

– Finally:
PC: V+10<cr>
UPS: (ACK<cr>

4. **RESET<cr>**: Default rated output voltage setting (the inverter's voltage).
With this command you set the default rated output voltage, which is 230 Vac RMS.
It must be set in bypass or standby mode, i.e. with the inverter off.

PC: RESET<cr>
UPS: (ACK<cr>5.

5. **F50**: Output frequency setting a 50 Hz.
This setting is applicable if the frequency of the mains power is 50 Hz, or the UPS is in frequency converter mode. It must be set while the UPS is in bypass or standby mode, i.e. with the inverter off.

PC: F50<cr>
UPS: (ACK<cr>

6. **F60**: Output frequency setting a 60 Hz.
   This setting is applicable if the frequency of the mains power is 60 Hz, or the UPS is in frequency converter mode. It must be set while the UPS is in bypass or standby mode, i.e. with the inverter off.
   PC: F60<cr>
   UPS: (ACK<cr>

7. **BUS<nnn>**: Rated DC BUS voltage setting.
   Where **nnn** is an integer that represents the set rated voltage and it can only be one of the following values:
   - ❒ 360 Vdc
   - ❒ 370 Vdc
   - ❒ 380 Vdc

8. **BUSP±<nn>**: Positive voltage setting of the DC BUS.
   The **nn** parameter is an integer between 00 and 99 that represents the voltage value that you want to add to/deduct from the current value to set the voltage. The UPS interprets this value in tenths of volts, so if you enter **nn** = 28 you will be adding 2.8 V.

   Once again, the **nn** values that you want to add to/deduct from the DC BUS's current voltage have nn=±00 as a reference or starting point and they also take into account the current set value.

   So the most practical thing to do is to calibrate the central voltage point with **nn** = + 00.

   Example:
   Set the **nn** parameter to zero with the UPS at 50% load.
   PC: BUSP+00<cr>
   UPS: (ACK<cr>

   Then use the tester to measure the voltage of the +DC BUS and add/deduct the necessary voltage to obtain +360 Vdc with the **UPS at 50% load**.

   For example, if the previous measurement was + 355 Vdc, the command will be:
   PC: BUSP+50<cr>
   UPS: (ACK<cr>

9. **BUSN±<nn>**: Negative voltage setting of the DC BUS.
   The **nn** parameter is an integer between 00 and 99 that represents the voltage value that you want to add to/deduct from the current value to set the voltage. The UPS interprets this value in tenths of volts, so if you enter nn=28 you will be adding 2.8 V.

   Once again, the nn values that you want to add to/deduct from the DC BUS's current voltage have nn = ± 00 as a reference or starting point and they also take into account the current set value.
   So the most practical thing to do is to calibrate the central voltage point with nn = + 00.

   Example:
   Set the nn parameter to zero with the UPS at 50% load.
   PC: BUSN+00<cr>
   UPS: (ACK<cr>

   Then use the tester to measure the voltage of the -DC BUS and add/deduct the necessary voltage to obtain -360 Vdc with the **UPS at 50% load**.
   For example, if the previous measurement was -362 Vdc, the command will be:
   PC: BUSN-20<cr>
   UPS: (ACK<cr>

4.3. PARAMETERS

1. **BATCAP<nnn>**: Setting the capacity of each battery string.
   The **nnn** parameter is an integer that expresses the Ah of each string of batteries, which may be: 7, 9, 12, 17, 26, 40, 65 and 100 Ah. Note that with this parameter you set the Ah of each string, not the total Ah, i.e. if the UPS has 2 parallel strings that are each 9 Ah, it would be a mistake to enter nnn=018. You should enter nnn=009 and, with another command that will be explained below, you will tell the UPS that it has 2 strings connected in parallel.

   Example: if the UPS uses 7 Ah batteries, it will be configured as follows:

   PC: BATCAP007<cr>
   UPS: (ACK<cr>

Then, you can use the QBV command to check the runtime (which is expressed in minutes) with the current UPS output load:

PC: QBV<cr>
UPS: (275.0 20 01 100 00770<cr>

However, if that 7 Ah string is replaced by one that is 9 Ah, proceed as follows:

PC: BATCAP009<cr>
UPS: (ACK<cr>

Now, if you check the runtime with the same load as above, you will get the following result:

PC: QBV<cr>
UPS: (274.8 20 01 100 00109<cr>

2. **BATGTN<nn>**: Setting the number of battery strings in parallel.
The nnn parameter is an integer that expresses the number of battery strings connected in parallel, ranging from 0 to 99. Do not confuse this with the number of packs or external battery cabinets.

   For example, if it is a TWIN/3 PRO2 B1 which has two external battery cabinets connected, one with 40 batteries and the other with 60 batteries, the total number of strings will be 5, so it should be set as follows:

   PC: BATGN03<cr>
   UPS: (ACK<cr>

   Then enter QBV to check the change:

   PC: QBV<cr>
   UPS: (275.2 20 05 100 00460<cr>

3. **BATCOEF<nn>**: Correction coefficient to calibrate the runtime.
The **nn** parameter is an integer that multiplies the runtime calculated by the UPS, expressed in tenths, ranging from 5 to 20. This parameter is very useful for calibrating the runtime shown by the UPS on the screen, after calculating the theoretical runtime and then performing the respective discharge test.

   As the factor is expressed in tenths, entering 5 means that the runtime calculated by the UPS will be multiplied by 0.5. If you enter 20, the time will be multiplied by 2.

   After correctly setting the Ah of the banks and the number of strings, it is advisable to enter nn=10, to place the runtime value at a central starting point. So, if it has to be increased, use values greater than 1 and, if it has to be decreased, use values lower than 1.

   Example:
   If when you calculate and test the runtime for a given load the result is 60 minutes, but the runtime indicated by the UPS does not match this, proceed as follows.
   - ❒ Enter the initial calibration value in nn=10 as a starting point:
     PC: BATCOEF10<cr>
     UPS: (ACK<cr>
   - ❒ Check the runtime calculated by the UPS.
     PC: QBV<cr>
     PC: (275.2 20 01 100 00047<cr>
   - ❒ As the runtime indicated by the UPS is still not 60 minutes, the value to correct it will be: nn=60/47=12.7. To be conservative, it was calibrated with nn=12.
     PC: BATCOEF12<cr>
     UPS: (ACK<cr>
     PC: QBV<cr>
     UPS: (275.1 20 01 100 00057<cr>

4. **BATS<n>**: Disabling the 'battery bank disconnected' alarm.
Where **n** can be two values, 0 or 1. If n=1 the alarm is disabled and if n=0 the alarm is disabled and will detect when the battery bank is open.

   This function is very useful for cases where the UPS is not used for backup power, but to stabilise or convert the frequency.

   Bear in mind that if the battery bank is open, the battery charger will be switched off.

   Example: to disable:
   PC: BATS1<cr>
   UPS: (ACK<cr>

5. **PLV<p>**: Setting the minimum operating bypass voltage.
   Where the **p** parameter is an integer that represents the minimum permitted operating bypass voltage of the UPS, ranging from 110 to 209.

   For example, if it is set to p=200, this corresponds to a voltage of 200 volts, meaning that below this voltage there will be no switching to bypass, whatever happens.

   Example:
   PC: PLV200<cr>
   UPS: (ACK<cr>

   Note that the voltage hysteresis is +10 volts, so for this example, the bypass will be disabled if the voltage drops to 200 volts and it will be enabled again if the voltage increases to 210 volts.

6. **PHV<q>**: Setting the maximum operating bypass voltage.
   Where the **q** parameter is an integer that represents the maximum permitted operating bypass voltage of the UPS, ranging from 231 to 276.

   For example, if it is set to q=250, this corresponds to a voltage of 250 volts, meaning that above this voltage there will be no switching to bypass, whatever happens.

   Example:
   PC: PHV250<cr>
   UPS: (ACK<cr>

   Note that the voltage hysteresis is -10 volts, so for this example, bypass will be disabled if the voltage increases to 250 volts and it will be enabled again if the voltage decreases to 240 volts.

7. **PSF<m>**: Setting the minimum operating bypass frequency.
   Where the **m** parameter is a decimal number that represents the minimum permitted operating bypass frequency of the UPS, ranging from 46.0 to 49.0 for a system with a 50 Hz output. For systems with a 60 Hz output, it will be between 56.0 and 59.0.

   For example, if it is set to m=47.5, this corresponds to a frequency of 47.5 Hz, meaning that below this frequency there will be no switching to bypass, whatever happens.

   PC: PSF47.5<cr>
   UPS: (ACK<cr>

   In this case the hysteresis is +0.5 Hz.

8. **PGF<n>**: Setting the maximum operating bypass frequency.
   Where the **n** parameter is a decimal number that represents the maximum permitted operating bypass frequency of the UPS, ranging from 51.0 to 54.0 for a system with a 50 Hz output. For systems with a 60 Hz output, it will be between 61.0 and 64.0.

   For example, if it is set to n=53.0, this corresponds to a frequency of 53 Hz, meaning that above this frequency there will be no switching to bypass, whatever happens.

   PC: PSF53.0<cr>
   UPS: (ACK<cr>

   In this case the hysteresis is -0.5 Hz.

9. **HEH<nnn>**: Setting the maximum voltage for operating in ECO mode.
   Where the **nnn** parameter is an integer that represents the maximum operating voltage for ECO mode, ranging from +3% to +10% of the rated output voltage set for the UPS. The default factory value is +10%.

   For example, if it is set to nnn=240, this corresponds to a voltage of 240 volts, meaning that above this voltage the load will be powered via the inverter.

   Example:

   PC: HEH240<cr>
   UPS: (ACK<cr>

   Hysteresis is -2.5% of the rated output voltage.

10. **HEL<nnn>**: Setting the minimum voltage for operating in ECO mode.
    Where the nnn parameter is an integer that represents the minimum operating voltage for ECO mode, ranging from -3% to -10% of the rated output voltage set for the UPS. The default factory value is -5%.

    For example, if it is set to nnn=210, this corresponds to a voltage of 210 volts, meaning that below this voltage the load will be powered via the inverter.

Example:
PC: HEL210<cr>
UPS: (ACK<cr>

Hysteresis is +2.5% of the rated output voltage.

11. **HEFH<n>**: Setting the maximum frequency for operating in ECO mode.
Where the **n** parameter is a decimal number that represents the maximum permitted operating frequency for ECO mode, ranging from 52 to 54 for a system with a 50 Hz output. For systems with a 60 Hz output, it will be between 62 and 64.

Example:

PC: HEFH52<cr>
UPS: (ACK<cr>

In this case the hysteresis is -0.5 Hz.

12. **HEFL<n>**: Setting the minimum frequency for operating in ECO mode.
Where the n parameter is a decimal number that represents the minimum permitted operating frequency for ECO mode, ranging from 46 to 48 for a system with a 50 Hz output. For systems with a 60 Hz output, it will be between 56 and 58.

Example:

PC: HEFL47<cr>
UPS: (ACK<cr>

In this case the hysteresis is +0.5 Hz.

13. **PE<X>/PD<X>**: Setting of control bits/flags.
This command allows you to enable and disable the functions that appear on table 3. Note that almost all of these functions can also be enabled and disabled on the control panel. Bear in mind that the "J" bit only applies to USPs that have more than one output.

With the PE command ("E" from enable) you enable the desired function and with the PD command ("D" from disable), the function is disabled.

BIT	DESCRIPTION
A	Enable/disable the audible alarm (buzzer)
B	Enable/disable the audible alarm (buzzer) in battery mode
E	Enable/disable operation in ECO mode
F	Enable/disable FBD function of static bypass (*)
I	Enable/disable the inverter's short clean function
J	Enable/disable scheduled shutdown of output 1 in battery mode
O	Enable/disable switch to static bypass on shutdown
P	Enable/disable the audible alarm (buzzer) in bypass mode
V	Enable/disable frequency converter mode
M	Enable/disable the hot standby function

Tab. 7.

(*) When the FBD function is enabled, static bypass is completely disabled, regardless of any event occurring in the UPS. It is as if the unit has no bypass function.

Note that the letter that is entered to perform the desired function must be in upper case, otherwise the UPS will indicate a command error.

Example: Enable the ECO mode function.

PC: PEE<cr>
UPS: (ACK<cr>

14. **PEPO<n>**: Configuring the operation logic of EPO.
Where n defines the operation logic of the EPO function (emergency power off function), whose values may be 0, 1, 2, 3 and 4.

Therefore, depending on what n value has been entered for the command, a different logical operating condition will be obtained, as detailed below:

If n=0: EPO will be activated when the EPO connector is open (without the jumper).

If n=1: EPO will be activated when the EPO connector is closed (with the jumper).

Example:
Configuring the EPO so that it is activated when the connector is closed.

PC: PEPO1<cr>
UPS: (ACK<cr>

15. **PE**: Set all default parameters.

    Example:
    PC: PE<cr>
    UPS: (ACK

16. **QL<nnn>**: Neutral loss alarm setting.
    Where **nnn** can be ATO, CHE or DIS, which each have the following meanings:

    ATO: Neutral loss detection alarm and clearing of alarm when the neutral connection is restored.

    CHE: Neutral loss detection alarm and alarm remains when the neutral connection is restored.

    DIS: Neutral loss detection alarm disabled.

    PSK<n><m>: Setting the secondary output's shutdown time, when the UPS is in battery discharge mode.

    Where n represents the number of the secondary output, which in this case is 1, and m represents the shutdown time expressed in minutes, which ranges from 000 to 999.

    Bear in mind that in order to use this function, you have to enable the **J** control bit.

    Example: to shut down the secondary output **(1)**, after 10 minutes of battery discharging.

    PC: PEJ<cr>
    UPS: (ACK<cr>

    PC: PSK1010<cr>
    UPS: (ACK<cr>

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