COMMUNICATION PROTOCOL

SLC TWIN PRO2/RT2

4...10 kVA I/I

salicru

General index

1. HYPERTERMINAL CONFIGURATION

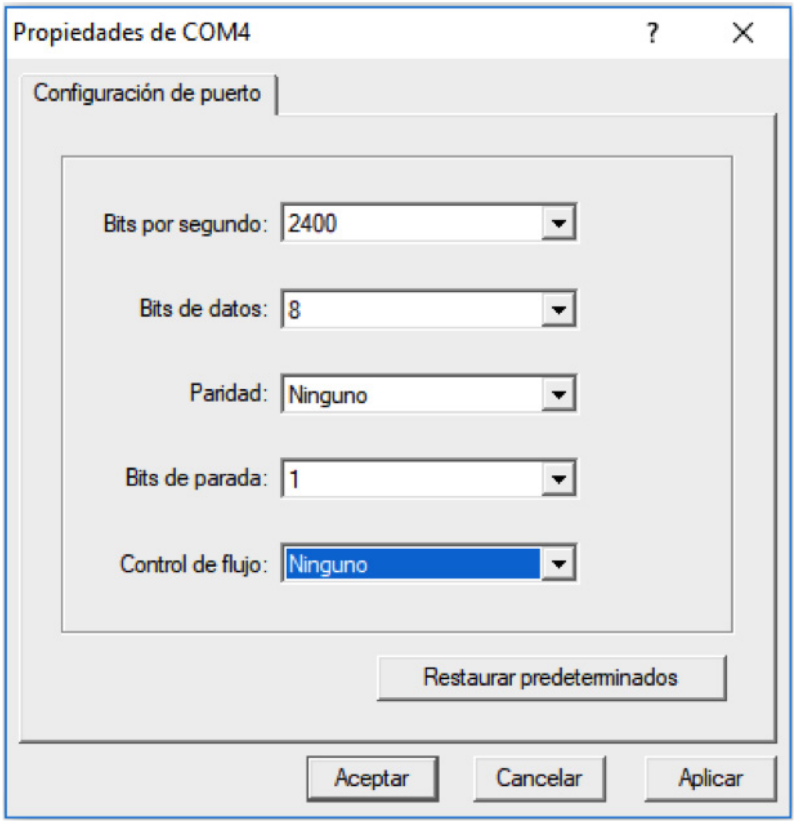

Fig. 1.

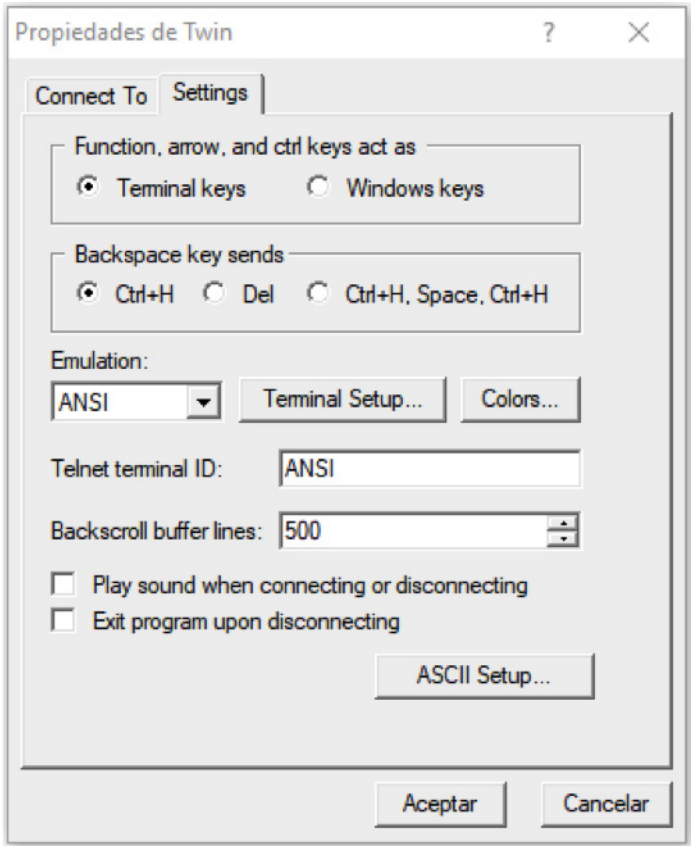

Fig. 2.

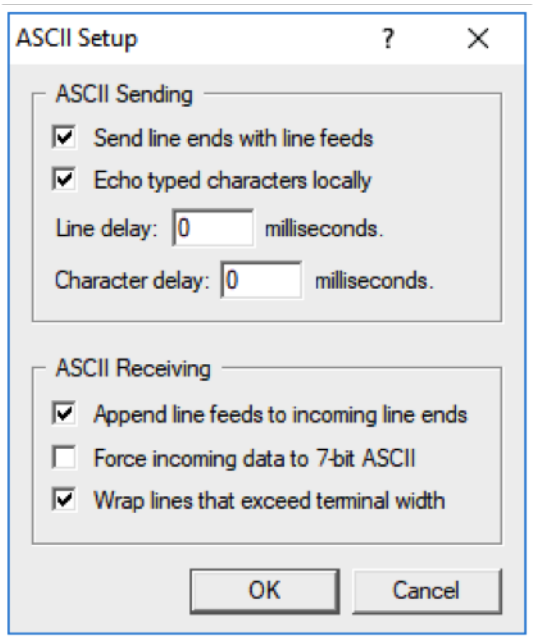

Fig. 3.

2. QUERY COMMANDS

ITEM	COMMAND	DESCRIPTION
1	**QPI**	PROTOCOL ID
2	**QID**	UPS ID
3	**QMD**	MODEL AND RATED PARAMETERS
4	**QRI**	RATED OUTPUT AND BATTERY VALUES
5	**QMOD**	CURRENT OPERATING MODE OF THE UPS
6	**QGS**	MEASUREMENTS AND CURRENT OPERATING STATUS
7	**QBV**	BATTERY VOLTAGE MEASUREMENTS AND PARAMETERS
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11	**QCHGCUR**	CHARGER CURRENT SETTING
12	**QV**	RATED OUTPUT VOLTAGE SETTING
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14	**QVC**	OUTPUT VOLTAGE FINE ADJUSTMENT PARAMETER
15	**QBYV**	BYPASS VOLTAGE RANGE
16	**QBYF**	BYPASS FREQUENCY RANGE
17	**QHE**	ECO MODE VOLTAGE RANGE
18	**QHEF**	ECO MODE FREQUENCY RANGE
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20	**QFS**	UPS STATUS WHEN A FAULT OCCURS
21	**QWS**	ALERT BITS STATUS
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23	**QVFW**	FIRMWARE VERSION OF THE DSP CONTROL BOARD
24	**QVFW2**	FIRMWARE VERSION OF THE MCU COMMUNICATIONS BOARD

Tab. 1.

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

2. **QID**: UPS ID
   PC: QID<cr>
   UPS: (ABCDEEFFGXXXXX<cr>

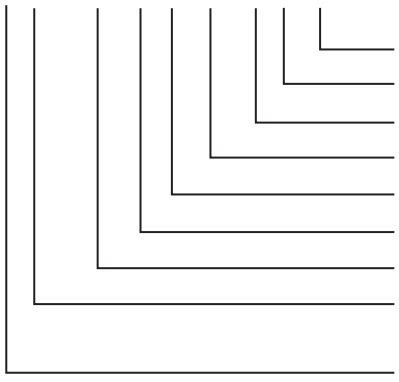
ITEM	INFO	DESCRIPTION	NOTES
1	**(**	Start byte	
2	**A**	Main production type	8: UPS, 9: not UPS
3	**B**	Sub-production type	
4	**C**	VA	
5	**D**	HV/LV	
6	**EE**	Year of manufacture	
7	**FF**	Month of manufacture	
8	**G**	Manufacturer ID	
9	**XXXXX**	Serial number	

Tab. 2.

PC: QID<cr>
UPS: (83320903100001<cr>

3. **QMD**: UPS model

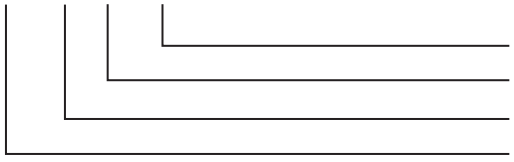
PC: QMD<cr>
UPS: (########G2-4KL ###4000 99 1/1 230 230 20 12.0



12.0	Rated voltage per battery
20	Number of batteries in series
230	Rated output voltage
230	Rated input voltage
1/1	Input phases/output phases
99	Output power factor
4000	Rated output power in VA
L	The letter L means that it is a B1 UPS (a standard UPS has no L)
4	UPS model

4. **QRI**: Information about some rated values

PC: QRI<cr>
UPS: (230.0 017 240.0 50.0



50.0	Rated output frequency
240.0	Rated voltage of the battery bank (battery BUS)
017	Rated output current
230	Rated output voltage

5. **QMOD**: Current operating mode of the UPS

PC: QMOD<cr>
UPS: (M<cr>

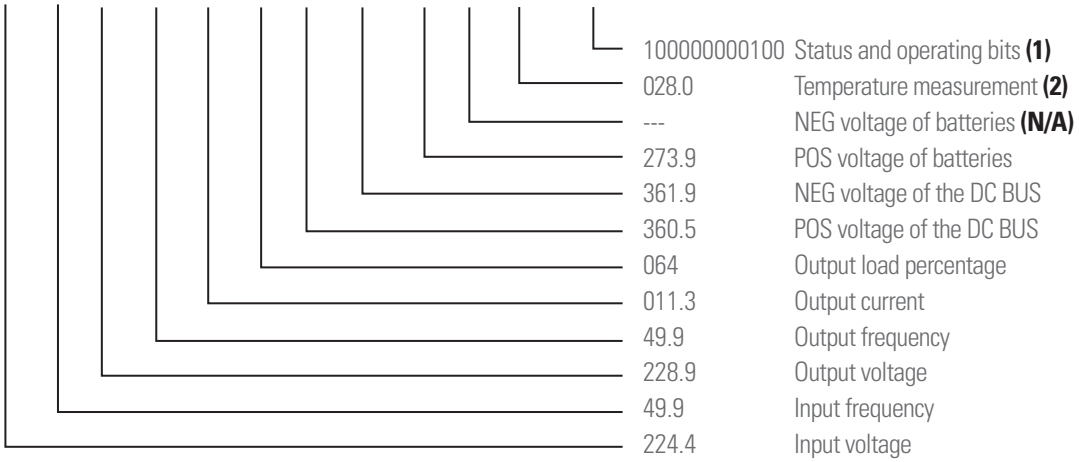
With “M” being the current operating mode of the UPS, according to the following coding:

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**

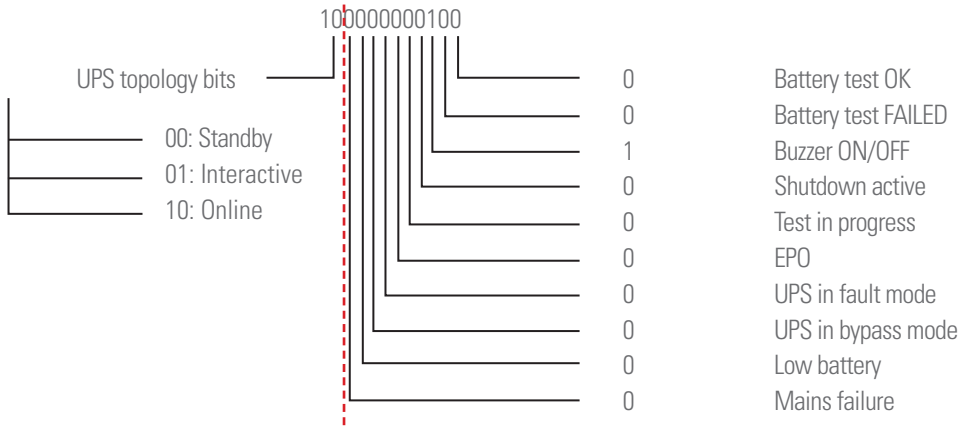
Tab. 3.

6. **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



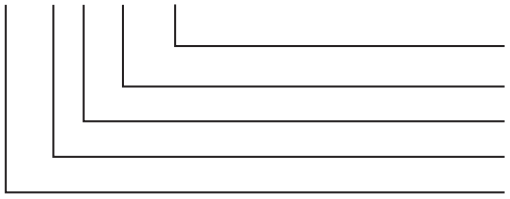
(1) Description of the status and operating bits



(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.

7. **QBV**: Battery voltage measurements and parameters

PC: QBV<cr>
UPS: (273.9 20 01 100 00032<cr>



00032	Runtime **(minutes)**
100	Battery charge level **(%)**
01	Number of groups of batteries (strings in parallel)
20	Number of batteries connected in series **(string)**
273.9	Battery voltage measurement

8. **QEBP**: Number of battery packs in parallel. Applicable to RT2 B1.

PC: QEBP<cr>
UPS: (nn<cr>

Where "nn" is the number of battery packs in parallel, ranging from 01 to 07.

9. **QVB**: Charger battery/output voltage measurement calibration parameter.

PC: QVB<cr>
PS: (VBS-40<cr>

40	Current value of the parameter setting. This is entered using the VB±<nn> command (detailed below).

10. **QCHGV**: Voltage setting parameter of the battery charger.

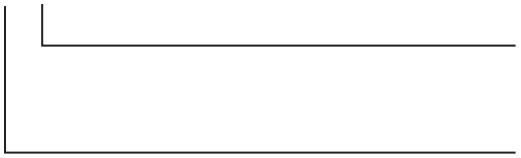
PC: QCHGV<cr>
UPS: (+18<cr>

18	Current value of the parameter setting. This is entered using the CHGV±<nn> command (detailed below).

Shows the current setting parameter value that was previously entered, setting the output voltage of the battery charger. The setting parameter is CHGV<±nn>, as shown below.

11. **QCHGCUR**: The maximum charging current value that is currently set for the battery charger.

PC: QCHGCUR<cr>
UPS: (02 -06 <cr>



06	Current value of the finely adjusted charging current parameter. This is entered using the CHGCURA±<nn> command (detailed below).
02	Current value of the charging current setting. This is entered using the CHGCUR<nn> command (detailed below).

12. **QV**: Rated output voltage setting.

PC: QV<cr>
UPS: (V230<cr>

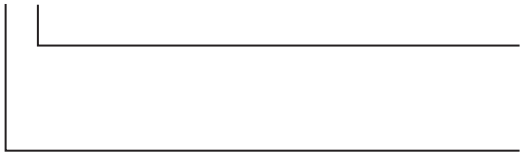
V230	Current value of the output voltage setting

13. **QVOP**: Output voltage measurement calibration parameter.

PC: QVOP<cr>
UPS: (230. +20<cr>

14. **QVC**: Output voltage fine adjustment parameter.

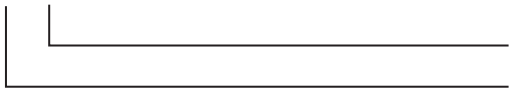
PC:QVC<cr>
UPS: (V+14<cr>



14	Current value of the parameter setting. This is entered using the V±<nn> command (detailed below).
V	Output voltage measurement.

15. **QBYV**: Voltage range for static bypass availability.

PC: QBYV<cr>
UPS: (276 184<cr>

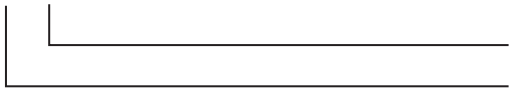


184	Lower bypass voltage range **(*)**
276	Upper bypass voltage range **(*)**

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

16. **QBYF**: Frequency range for static bypass availability.

PC: QBYF<cr>
UPS: (54.0 46.0<cr>

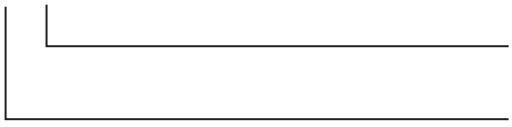


46.0	Lower bypass frequency range **(*)**
54.0	Upper bypass frequency range **(*)**

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

17. **QHE**: Voltage range for operating in ECO mode.

PC: QHE<cr>
UPS: (241 219<cr>

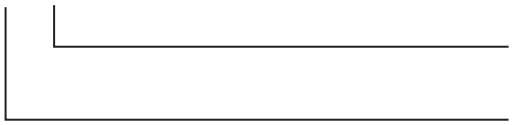


219	Lower voltage range for operating in ECO mode **(*)**
241	Upper voltage range for operating in ECO mode **(*)**

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

18. QHEF: Frequency range for operating in ECO mode.

PC: QHEF<cr>
UPS: (54.0 46.0<cr>

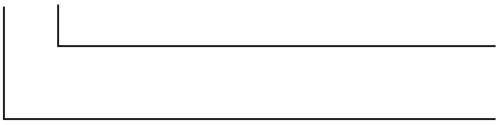


46.0	Lower frequency range for operating in ECO mode **(*)**
54.0	Upper frequency range for operating in ECO mode **(*)**

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

19. QFLAG: Status of the control bits/flags.

PC: QFLAG<cr>
UPS: (EpboajDvefi<cr>



Dvefi	Control bits disabled (upper case "D") as per table 1
Epboaj	Control bits enabled (upper case "E") as per table 1

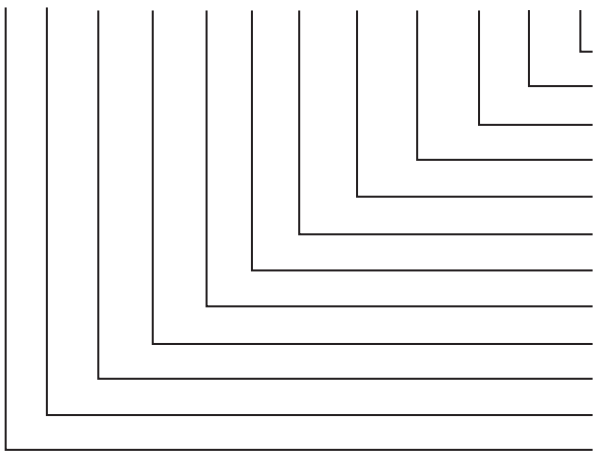
BIT	DESCRIPTION
a	Enable/disable the audible alarm (buzzer)
b	Enable/disable the audible alarm (buzzer) in battery mode
e	Enable/disable operation in ECO mode
f	Enable/disable FBD function of static bypass (*)
i	Enable/disable the inverter's short clean function
j	Enable/disable scheduled shutdown of 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

Tab. 4.

(*) 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

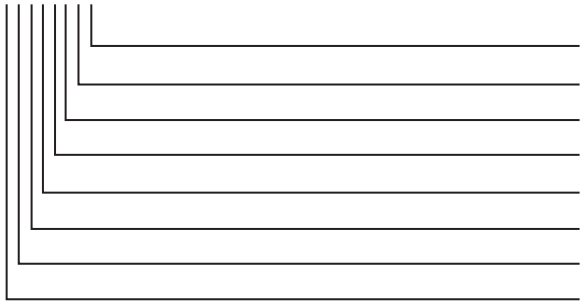
PC: QFS<cr>
UPS: QFS (03 219.6 50.0 000.0 00.0 005 010.6 112.4 115.5 039.6 037.0 00000100<cr>



00000100	Information bits **(*)**
037	Temperature before the fault
039.6	Battery voltage before the fault
115.5	NEG voltage of DC BUS before the fault
112.4	POS voltage of DC BUS before the fault
010.6	Output current before the fault
005	Output load percentage before the fault
00.0	Inverter output frequency before the fault
000.0	Inverter output voltage before the fault
50.0	Input frequency before the fault
219.6	Input voltage before the fault
03	Type of fault (see table 5)

(*) Information bits

00000100



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

1: is on
0: if 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 short-circuited	05	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.
Fault in the parallel system	Loss of parallel communication	35	Parallel communication between some UPSs was interrupted.
	Output power distribution fault	36	The difference in current between the UPSs is 5 A.
Miscellaneous	Overheating	41	Overheating of the PFC or INV.
	Communication failure with the CPU	42	The CPU cannot establish communication and the control board is not responding.
	Overload	43	Output overload.

Tab. 5.

If the fault that occurs is not on table 2, 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 6

0000000000000000000000000000000000000000000000000000000001000000

Bit 0 Bit 63

BIT	WARNING CODE	WARNING	DESCRIPTION OF THE FAULT
Bit 0	01	Battery open	Batteries disconnected
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 57	3A	Maintenance bypass switch cover open	Maintenance bypass switch cover open

Tab. 6.

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. **QEPO**: EPO logical status query

PC: QEPO<cr>
UPS: (0<cr>

0 — EPO will be activated when the EPO connector is open (without the jumper).
Without manual restart(*).

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

1 — EPO will be activated when the EPO connector is closed (with the jumper).
Without manual restart(*).

PC: QEPO<cr>
UPS: (2<cr>

2 — EPO will be activated when the EPO connector is open (without the jumper).
With manual restart (*).

PC: QEPO<cr>
UPS: (3<cr>

3 — EPO will be activated when the EPO connector is closed (with the jumper).
With manual restart (*).

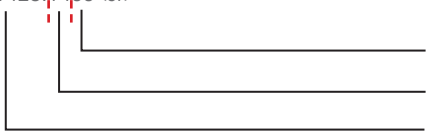
PC: QEPO<cr>
UPS: (4<cr>

4 — The EPO function is disabled.

(*) A manual restart means that the UPS must be completely switched off (unplug from the mains and wait until the control is turned off).

23. **QVFW**: Firmware version query for the DSP control board.

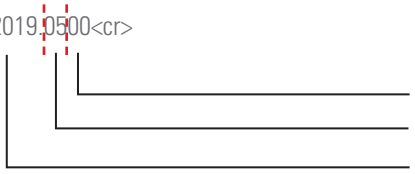
PC: QVFW<cr>
UPS: (VERFW:01428.1400<cr>



00	Extra version
14	Version
01428	Firmware serial number

24. **QVFW2**: Firmware version query for the MCU communications board.

PC: QVFW2<cr>
UPS: (VERFW2:02019.0500<cr>



00	Extra version
05	Version
02019	Firmware serial number

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>	PROGRAMMED OUTPUT SHUTDOWN (ZERO VOLT)
6	S<n>R<m>	PROGRAMMED OUTPUT SHUTDOWN/RESTORE (ZERO VOLT)
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	CHGON	TURNS ON THE CHARGER WITH THE UPS WITHOUT BATTERIES

Tab. 7.

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

If a low battery is detected during the test, the UPS will immediately return to the mains power.

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 output to be shut down (zero at the output) after the scheduled number of minutes have passed.
- 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>

6. **S<n>R<m>**: Power on/shutdown of the output (zero at the output) for a scheduled time.
- This command allows the output to be turned on and shut down (zero at the output) after the scheduled number of minutes have passed for it to be shut down and switched 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 output will be turned off after 30 seconds and turned back on after 2 minutes.
- If the UPS is waiting for the OFF state, with the "CS" command it is possible to cancel the shutdown.
- If there UPS 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> and S<n>R<m> commands.

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. **CHGON**: Turn on the battery charger.
- When this command is executed, the charger will be turned on, even if there are no batteries or they are disconnected. This

function is used to check the charger and/or set the float voltage. When the charger has been turned on, it will switched back off automatically after 5 minutes.
PC: CHGON<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 INPUT VOLTAGE
3	VOP±<nn>	OUTPUT VOLTAGE CALIBRATION
4	OC±<nn>	OUTPUT CURRENT CALIBRATION
SETTINGS		
ITEM	**COMMAND**	**DESCRIPTION**
1	CHGV±<nn>	VOLTAGE SETTING OF THE BATTERY CHARGER
2	CHGCUR<nn>	CURRENT SETTING OF THE BATTERY CHARGER
3	CHGCURA±<nn>	FINE ADJUSTMENT OF THE BATTERY CHARGER CURRENT
4	V<nnn>	RATED OUTPUT VOLTAGE SETTING
5	V±<nn>	FINE ADJUSTMENT OF THE OUTPUT VOLTAGE
6	RESET<cr>	DEFAULT OUTPUT VOLTAGE SETTING (230 VAC)
7	F50<cr>	OUTPUT VOLTAGE SETTING AT 50 Hz
8	F60<cr>	OUTPUT VOLTAGE SETTING AT 60 Hz
9	BUSP±<n>	POSITIVE VOLTAGE SETTING OF THE DC BUS
10	BUSN±<n>	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	PEBP<nn>	SETTING OF EXTERNAL BATTERY PACKS
6	PLV<p>	SETTING OF MINIMUM BYPASS VOLTAGE
7	PHV<q>	SETTING OF MAXIMUM BYPASS VOLTAGE
8	PSF<m>	SETTING OF MINIMUM BYPASS FREQUENCY
9	PGF<n>	SETTING OF MAXIMUM BYPASS FREQUENCY
10	HEH<nnn>	SETTING OF MAXIMUM VOLTAGE IN ECO MODE
11	HEL<nnn>	SETTING OF MINIMUM VOLTAGE IN ECO MODE
12	HEFH<n>	SETTING OF MAXIMUM FREQUENCY IN ECO MODE
13	HEFL<n>	SETTING OF MINIMUM FREQUENCY IN ECO MODE
14	PE<X>/PD<X>	SETTING OF OPERATING CONTROL BITS
15	PEPO<n>	SETTING OF THE EPO'S LOGICAL STATUS
16	PF	SETS ALL DEFAULT SETTINGS

Tab. 8.

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 inteprets this value in tenths of volts, so if you enter nn=22, you will be adding 2.2 volts.

> ⚠ To carry out this calibration, you need to turn on the UPS 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 to have nn=±00 as a reference or starting point and they must 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:

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

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 input 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 value to perform calibration. The UPS inteprets this value in tenths of volts, so if you enter nn=35, you will be adding 3.5 volts.
- 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 Vdc should be added and, as nn is expressed in tenths of volts, nn=+20.

❒ Finally:
PC: VLINE+20<cr>
UPS: (ACK<cr>

3. **VOP±<nn>**: Calibration of output voltage measurement.

- The nn parameter is an integer that represents the voltage that you want to add to/deduct from the current measurement to achieve the desired calibration. It ranges from 00, 01,…… to 99 and is expressed in tenths of volts.
- For example, if you enter +36, the voltage measurement will increase by 3.6 volts.
- Once again, the nn values that you want to add to/deduct from the current output 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, the UPS must be in online mode and, to be able to view the output voltage measurement provided by the unit, it is advisable to enter the QGS<cr> command, to get a more precise measurement than the one shown on the screen.

Example:

❒ Enter the following command to view the measurement taken by the UPS:
PC: QGS<cr>
UPS: (235.2 50.0 234.0 49.9 000.8 003 369.8 369.9 258.1……..<cr>
Therefore, the output voltage measured by the UPS = 234 Vac

❒ Set nn to zero using the following command:
PC: VOP+00<cr>
UPS: (ACK<cr>

❒ Enter the following command to view the new measurement reading:
PC: QGS<cr>
UPS: (234.1 49.9 227.4 50.0 000.8 003 369.7 369.8 258.9……. <cr>
So the new output voltage measurement has decreased to 227.4 Vac, as indicated by the QGS command.
Therefore, 2.6 Vdc should be added and, as nn is expressed in tenths of volts, nn=+26.

❒ Finally:
PC: VOP+26<cr>
UPS: (ACK<cr>

❒ Check the measurement with the QGS command:
PC: QGS<cr>
UPS: (233.9 49.9 230.0 49.9 000.8 003 369.8 369.9 259.8……<cr>

4. **OC±<nn>:** Calibration of output current measurement.

- The nn parameter is an integer that represents the current that you want to add to/deduct from the existing measurement to achieve the desired calibration. It ranges from 00, 01,…… to 99 and is expressed in hundredths of amperes.
- For example, if you enter +45, the current measurement will increase by 0.45 amperes.
- Once again, the nn values that you want to add to/deduct from the existing output current measurement have nn=±00 as a reference or starting point and they also take into account the existing calibration parameter (the existing nn), but in this case it cannot be viewed using any command.
- So the most practical thing to do is to calibrate the central current point with nn=+00, as in the following example.

To perform this calibration, the UPS must be in online mode, with a load connected at the output (resistive load at 50%). You must enter the QGS<cr> command to view the output current measured by the unit.

Example:
Current measured with ammeter = 9 Aac

❒ Enter the following command to view the new current measurement:
PC: QGS<cr>
UPS: (218.2 49.9 229.4 49.9 009.8 063 360.8 362.2 275.1 ---.- 050.0……
Therefore, the output current measured by the UPS = 12 Aac

❒ Enter the command:
PC: OC+00<cr>
UPS: (ACK<cr>

❒ Enter the following command to view the measurement:
PC: QGS<cr>
UPS: (216.6 50.0 228.8 50.0 009.3 052 360.4 361.9 275.1 ---.- 053.0……
So the new output current measurement has decreased to 9.3 Aac, as indicated by the QGS command.
Therefore, 0.3 Aac should be deducted and, as nn is expressed in tenths of amperes, nn=-03.

❒ Finally:
PC: OC-03<cr>
UPS: (ACK<cr>

❒ Check the measurement with the QVOP command:
PC: QGS<cr>
UPS: (216.6 50.0 228.8 50.0 009.0 052 360.4 361.9 275.1 ---.- 053.0……

4.2. SETTINGS

1. **CHGV<±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.
- This command should be used together with the CHGON command, which allows you to turn on the charger while the UPS is without batteries.
- 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=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 to have nn=±00 as a reference or starting point and they must also take into account the current set value, which can be viewed using the QCHGV<cr> command.
- Therefore, there are two ways to effectively set the desired voltage:

a. Set nn to zero using the command:
PC: CHGV+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>

Example 2:
Desired voltage: 270 Vdc
Initial voltage: 278.5 Vdc

– Enter the command:
PC: CHGV+00<cr>
UPS: (ACK<cr>
So the charger's new voltage value has decreased to 272.9 Vdc.
Therefore, 2.9 Vdc should be deducted and, as nn is expressed in tenths of volts, nn=-29.

– Finally:
PC: CHGV-29<cr>
UPS: (ACK<cr>

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

$$nn=[QCHGV+(_{DESIRED}VOLTAGE-_{ACTUAL}VOLTAGE)\times 10]$$

Example:
Desired voltage: 274 Vdc
Actual voltage: 269.8 Vdc
PC: QCHGV<cr>
UPS: (-30<cr>
Therefore QCHGV=-30

$$nn=[-30+\mathbf{(274-269.8)}\times 10]=12$$

– Finally, the command will be:
PC: CHGV+12<cr>
UPS: (ACK<cr>

Example:
Desired voltage: 272 Vdc
Actual voltage: 280.6 Vdc
PC: QCHGV<cr>
UPS: (+80<cr>
Therefore QCHGV=+80

$$nn=[80+\mathbf{(272-280.6)}\times 10]=-6$$

– Finally, the command will be:
PC: CHGV-06<cr>
UPS: (ACK<cr>

2. **CHGCUR<nn>**: Setting the maximum charging current of the battery charger.

- Where nn is an integer that represents the charging current setting, ranging from 01 to 04, 1 ampere and 4 amperes respectively.
- For example, if you want to set the charging current to 3 amperes, the command will be as follows:
PC: CHGCUR03 <cr>
UPS: (ACK<cr>

3. **CHGCURA±<nn>**: Fine adjustment of the maximum charging current of the battery charger.

- After setting the charging current with the above command, it can now be finely adjusted to a different value. For example, if the UPS has a single 9 Ah battery bank and you want to set the charging current to 20% of the capacity, you will have to use this command to set it to 1.8 A.

- The nn parameter is an integer that represents the current that you want to add to/deduct from the existing measurement to obtain the desired value. It ranges from 00, 01,…… to 09 and is expressed in tenths of amperes.
  For example, if you enter +03, the current measurement will increase by 0.3 A.
- Once again, the nn values that you want to add to/deduct from the existing charger current have nn=±00 as a reference or starting point and they also take into account the existing set value, which can be viewed using the QCHGCUR<cr> command.
  Therefore, there are two ways to effectively set the desired voltage:

  a. Set nn to zero using the command:
  PC: CHGCURA+00<cr>
  UPS: (ACK<cr>
  Then read the new current measurement with the ammeter and simply deduct/add the nn value in amperes (remember that this is expressed in tenths of amperes) to achieve the desired current.

  Example:
  Desired current: 1.8 Adc
  Initial current: 2.5 Adc
  – Enter the command:
    PC: CHGCURA+00<cr>
    UPS: (ACK<cr>
    So the charger's new current has decreased to 2 Adc.
    Therefore, 0.2 Adc should be deducted and, as nn is expressed in tenths of amperes, nn=-02.
  – Finally:
    PC: CHGCURA-02<cr>
    UPS: (ACK<cr>

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

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

  Example:
  Desired current: 1.4 Adc
  Actual current: 1.8 Adc
  PC: QCHGCUR<cr>
  UPS: (02 -02<cr>
  So the value to be taken from QCHGCUR is -02

  $$nn=[-02+\mathbf{(1.4-1.8)}\times 10]=-6$$

  – Finally, the command will be:
    PC: CHGCURA-06 <cr>
    UPS: (ACK<cr>

4. **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>

5. **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 volts.

- 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 = 233Vac
– 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:

$$nn=[QVC+(_{DESIRED}VOLTAGE-_{ACTUAL}VOLTAGE)\times 10]$$

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>

6. **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>

7. **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>

8. **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>

9. **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 volts.
- 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, 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.

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>

10. **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 volts.
- 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, 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.

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, ranging from 0 to 200. 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 00077<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 the UPS is a TWIN PRO2 with an internal battery bank and an external cabinet is added to it which contains 20 batteries in series that are in parallel with another 20 batteries in series, the total number of strings will be 3.
PC: BATGN03<cr>
UPS: (ACK<cr>
❒ Then enter QBV to check the change:
PC: QBV<cr>
UPS: (275.2 20 03 100 00276<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 tests.
- 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 less 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. **PEBP<nn>**: Setting of external battery packs.

- Where nn is the number of external battery packs installed in the UPS, ranging from 01 to 07. Applicable to RT2 B1 units.
PC: PEBP03<cr>
UPS: (ACK<cr>
- This parameter can also be entered on the panel, by going to menu 17.

6. **PLV<p>**: Setting the minimum operating voltage for bypass mode comebackto.

- Where the p parameter is an integer that represents the minimum permitted operating voltage of the UPS for bypass mode comebackto, 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 mode, whatever happens.

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

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

7. **PHV<q>**: Setting the maximum operating voltage for bypass mode comebackto.

- Where the q parameter is an integer that represents the maximum permitted operating voltage of the UPS for bypass mode comebackto, ranging from 230 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 mode, whatever happens.

  Example:
  PC: PHV250<cr>
  UPS: (ACK<cr>
- Note that the voltage hysteresis is -10 volts, so for this example, bypass mode comebackto will be disabled if the voltage increases to 250 volts and it will be enabled again if the voltage decreases to 240 volts.

8. **PSF<m>**: Setting the minimum operating frequency for bypass mode comebackto.

- Where the m parameter is a decimal number that represents the minimum permitted operating frequency of the UPS for bypass mode comebackto, 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 mode, whatever happens.
  PC: PSF47.5<cr>
  UPS: (ACK<cr>
  In this case the hysteresis is +0.5 Hz.

9. **PGF<n>**: Setting the maximum operating frequency for bypass mode comebackto.

- Where the n parameter is a decimal number that represents the maximum permitted operating frequency of the UPS for bypass mode comebackto, 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 mode, whatever happens.
  PC: PSF53.0<cr>
  UPS: (ACK<cr>
  In this case the hysteresis is -0.5 Hz.

10. **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 +5%.
  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.

11. **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.

12. **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 52.0 to 53.9 for a system with a 50 Hz output. For systems with a 60 Hz output, it will be between 62.0 and 63.9.
  Example:
  PC: HEFH52.5<cr>
  UPS: (ACK<cr>
  In this case the hysteresis is -0.5 Hz.

13. **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 46.0 to 47.9 for a system with a 50 Hz output. For systems with a 60 Hz output, it will be between 56.0 and 67.9.

Example:
PC: HEFL47.5<cr>
UPS: (ACK<cr>
In this case the hysteresis is +0.5 Hz.

14. **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. 9.

(*) 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, disable the audible alarm:
PC: PEE/PDA<cr>
UPS: (ACK<cr>

15. **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). Without manual restart **(*)**.
  - ❒ If n=1: EPO will be activated when the EPO connector is closed (with the jumper). Without manual restart **(*)**.
  - ❒ If n=2: EPO will be activated when the EPO connector is open (without the jumper). With manual restart **(*)**.
  - ❒ If n=3: EPO will be activated when the EPO connector is closed (with the jumper). With manual restart **(*)**.
  - ❒ If n=4: The EPO function is disabled.

(*) A manual restart means that the UPS must be completely switched off (unplug from the mains and wait until the control is turned off).

Example:
Configuring the EPO so that it is activated when the connector is opened, with manual restart of the UPS.
PC: PEPO2<cr>
UPS: (ACK<cr>

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

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

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