

American Power Conversion UPS-Link Communications Protocol Specification

1.0 Scope

This document describes the UPS-Link Communications Protocol developed by American Power Conversion. The control language is used with all APC products that support "smart" signaling via a computer interface port. "Standard" UPS signaling, based on simple level transitions or contact closures provided by APC UPSs, is not covered in this specification. For information on standard signaling, see the user's manual for your UPS.

2.0 General

The UPS-Link Communications Protocol is an ASCII-based control language that makes possible a full RS-232 communications path between any APC product that supports "smart" signaling and a host computer terminal. The control language is made up of commands and alert messages specific to APC UPSs and to UPS accessories such as the Measure-UPS. The groups for UPSs include UPS Control Commands, UPS Status Inquiry Commands, UPS Power Inquiry Commands, UPS Customizing Commands, and UPS Alert Messages. Groups specific to the Measure-UPS include Measure-UPS Inquiry Commands, Measure-UPS Customizing Commands and Measure-UPS Alert Messages.

Use **only** the commands documented in this UPS-Link Protocol Specification. Any other commands are for APC internal use only and can produce unintended results.

2.1 Terminal Requirements and Settings

To use the UPS-Link Communications Protocol, your terminal must be set as follows:

- Terminal Type: **ANSI**
- Baud Rate: **2400 bits/second**
- Bits Per Character: **8**
- Stop Bits: **1**
- Parity: **none**
- Handshaking, flow control: **none**

Note: The pin-out of the computer interface port on APC UPS products and accessories is non-standard. **Use only APC-supplied or APC-authorized UPS monitoring cables.**

3.0 Control Language - UPS Command Groups

All American Power Conversion UPSs that support "smart" signaling via a computer interface port also support "standard" signaling. "Smart" signaling is defined by full RS-232 communications capabilities. "Standard" signaling is defined by simple level transitions or contact closures. The UPS is defaulted to the standard signaling mode until it receives a command from the terminal to switch to the smart signaling mode.

In order to use the UPS-Link language to communicate with an APC UPS, the ASCII character uppercase "Y" must be sent to the UPS when the UPS is turned on. The UPS will respond with the characters "SM". Once put into the smart signaling mode, the UPS's standard signaling outputs are disabled. However, no signaling functionality is lost as the smart signaling duplicates all standard signaling information such as Line Fail and Low Battery.

The ASCII character "?" is sent as an alert message by the UPS whenever it is turned on. This is to signal that the UPS was possibly cycled off, then back on or that a problem has occurred. For more information on the "?" alert message, see Section 3.5.

All commands are effective whether the UPS is operating on-line, in bypass (where applicable) or on-battery unless otherwise noted.

Commands sent to a UPS must be in the case (upper or lower) indicated in each command description.

All responses from a UPS, initiated by a command, are followed by a CR/LF (carriage return, line feed) sequence.

Asynchronous Alert Messages generated by a UPS are not followed by a CR/LF sequence.

The UPS responds with the number of characters indicated in the following command descriptions without suppression of leading zeros. Alphabetic characters (letters) returned by the UPS, either as a word, abbreviation or part of a hexadecimal coded message will be uppercase letters except for messages returned in response to the "c" (UPS ID command), "n" (UPS Serial Number), "m" (UPS Manufacture Date) and "x" (Date of last battery replacement) commands, which may be in either letter case.

Backspace and escape terminal keys have no UPS-Link meaning and are unsupported.

In the following command descriptions, the character "*d*" in italics represents a single variable character as in "*ddd.d*". For example, in response to the "C" command, the UPS returns its internal ambient temperature (Celsius) in the format *ddd.d* (such as 029.4).

This document contains detailed descriptions of the UPS-Link commands and alert messages.

In this document, the terms "newer Smart-UPS models" and "3G" refer to the third generation Smart-UPS Models 450, 700, 1000, 1400, 2200 and 3000 and their derivatives such as RM and XL. Note that **UPS models are subject to change without notice.** Use the model numbers listed here as a guide only.

3.1 UPS Control Commands

"Y" Set UPS to Smart Mode

In order to use the UPS-Link control language to communicate with the UPS, the ASCII character uppercase "Y" must be sent to the UPS when the UPS is turned on. The UPS will respond with the characters "SM". Once put into the smart signaling mode, the UPS's standard signaling outputs are disabled. However, no signaling functionality is lost as UPS-Link duplicates all standard signaling information such as Line Fail and Low Battery.

"A" Test Lights and Beeper

Sending the ASCII character uppercase "A" causes the UPS to illuminate all front panel indicator LEDs (where applicable) and sound the beeper for 2 seconds. The UPS responds to this command by sending the characters "OK".

"K" Turn Off after Delay

Sending an ASCII character sequence **uppercase "K" uppercase "K"**, with a greater than 1.5 second delay between characters, causes the UPS to turn off based on the Shutdown Delay (the "p" command in section 3.4, "UPS Customizing Commands"). The KK character sequence, with the greater than 1.5 second delay between the K characters, is shown in this document as "**K(>1.5 sec)K**." If the delay between characters is less than 1.5 seconds, or if another command is sent to the UPS between the "K" characters, the UPS will not recognize the "K" command. When processing a command that conflicts with the Turn Off after Delay function, the UPS returns the message "NA" immediately after the "K (>1.5 sec)K" command is sent. Older UPSs return an "*" (asterisk) to the terminal to signal that it is about to turn off. Newer models respond with a "OK" to indicate that the UPS received the command. No other commands will be processed following the "*" or "OK" response. If turned off while operating on-battery, the UPS does not restart when the utility is restored.

This command is not supported on the Smart-UPS 250, 400, and 370ci. The Matrix-UPS's battery charger is disabled when shut off. Do not operate the Matrix-UPS in this mode for extended periods because the batteries may become discharged.

"S" Shut Down UPS on Battery

Sending the ASCII character uppercase "S" to the UPS while operating on-battery causes the UPS to shut down following a shutdown delay programmed by the Shutdown Delay command (the "p" command documented in Section 3.4, "UPS Customizing Commands"). The UPS's output returns when the utility power is restored. If the utility power is restored within the UPS shutdown delay interval, the UPS still shuts down at the end of the interval (and then immediately restarts). The UPS responds to this command with the characters "OK". The commands "**K(>1.5 sec)K**", "U", "W", "**Z(>1.5 sec) Z**", "@ddd" and "-" will not be processed following the "OK" response. If these commands are sent, the UPS returns the characters "NA". During the time the UPS's output is unpowered, the UPS's internal electronics remain in a "sleep" mode as indicated by the marquee sequence of the UPS LEDs or message given on the UPS's display.

The UPS responds to this command only when running on battery, and the UPS stays on battery after the command is sent.

The automatic turn on feature on APC models Smart-UPS 400 and UPS 370ci must be disabled via the option switch in order for the command to take effect.

"U" Simulate Power Failure

Sending the ASCII character uppercase "U" forces the UPS to switch briefly to battery operation. The UPS responds to this command by sending the characters "OK". When processing a command that conflicts with the simulated power failure function, the UPS returns the message "NA" immediately after the "U" command is sent.

"W" Battery Test

Sending the ASCII character uppercase "W" causes the UPS to run its battery test procedure. The test lasts about 8 seconds. The result of the battery test is saved for five minutes for retrieval via the "X" UPS Status Inquiry Command. Automatic battery testing can be scheduled using the "E" command, documented in Section 3.4, "UPS Customizing Commands." When processing a command that conflicts with the battery test function, the UPS returns the message "NA" immediately after the "W" command is sent.

The Matrix-UPS and newer Smart-UPS responds to this command with the characters "OK".

"Z" Turn Off UPS

Sending an ASCII character sequence **uppercase "Z" uppercase "Z"**, with a greater than 1.5 second delay between characters, causes the UPS to turn off immediately. The ZZ character sequence, with the greater than 1.5 second delay between the Z characters, is shown in this document as "**Z(>1.5 sec)Z**." If the delay between characters is less than 1.5 seconds, or if another command is sent to the UPS between the "Z" characters, the UPS does not recognize the "Z" command. When processing a command that conflicts with the turn off function, the UPS returns the message "NA" **immediately after the Z(>1.5 sec)Z** command is sent. Older Smart-UPSs return an "*" (asterisk) to the terminal to signal that it is about to turn off.

This command is not supported on APC models Smart-UPS 250, 400 and UPS 370ci. The Matrix-UPS's battery charger is disabled when shut off. Do not operate the Matrix-UPS in this mode for extended periods because the batteries may become discharged.

"@ddd" Shut Down with Delayed Wake Up

Sending the ASCII characters "**@ddd**" causes the UPS to turn off based on the Shutdown Delay (the "p" command, documented in Section 3.4, "UPS Customizing Commands"), then restore power to the load after "**ddd**" tenths of an hour have expired. After "**ddd**" tenths of an hour have expired, the UPS waits an additional delay interval specified by the UPS Turn On Delay (the "r" command, documented in Section 3.4, "UPS Customizing Commands").

For example, if "@126" is sent to the UPS, the UPS turns off following a 20 second delay (the default value of the "p" command) and restarts after 12.6 hours. The UPS ignores invalid characters such as alphabetic characters (letters) sent after the "@", and the command must be retried. When processing a command that conflicts with the Shut Down with Delayed Wake Up command, the UPS returns the message "NA" immediately after the "@ddd" command is sent.

Older UPSs return an "*" (asterisk) to the terminal to signal that they are about to turn off. Matrix-UPSs and newer Smart-UPSs return an "OK" to acknowledge receipt of the command. No other commands will be processed following the "*" or "OK" response. During the time the UPS's output is unpowered, the UPS's internal electronics remain in a "sleep" mode as indicated by the marquee sequence or message given on the UPS's display. A delay in addition to that programmed with the "@ddd" command is provided via the "r" command, documented in Section 3.4.

Note that the "automatic turn on" feature on APC models Smart-UPS 400 and UPS 370ci must be disabled via the option switch in order for the command to take effect.

"DEL" Abort Shutdown

Sending the ASCII character equivalent to the "DEL" key (delete) immediately causes the UPS to abort the following shutdown commands: "@ddd" (Shut Down with Delayed Wake Up), "S" (Shut Down UPS on Battery) or "K(>1.5 sec)K" (Turn Off after Delay). However, the "K" command, "K(>1.5 sec)K", can be aborted only during the delay; once the UPS is shut off, the "DEL" command responds "NO" to the "K" command and does not turn back on. When the UPS aborts a shutdown command, the UPS turns back on regardless of whether line voltage is good or not. If a newer Smart-UPS is in "sleep" mode due to the "@ddd" command, "DEL" brings it out of sleep mode. The response from the UPS to the "DEL" command is "OK".

The "DEL" command is valid for APC Matrix-UPS models and newer Smart-UPS models. Other APC UPS models do not respond to the command.

"D" Run Time Calibration

Sending the ASCII character uppercase "D" immediately causes the UPS to start a run time calibration until less than 25% of full battery capacity is reached. The APC model Matrix-UPS operates on-battery until less than 35% of full battery capacity is reached. This command calibrates the returned run time value. The test begins only if battery capacity is 100%. If battery capacity is less than 100%, the UPS returns the characters "NO". The UPS responds to the "D" command with the characters "OK". The commands "K(>1.5 sec)K", "U", "W", "Z(>1.5 sec)Z", "@ddd" and the "-" will not be processed following the "OK" response. If these commands are sent, the UPS returns the characters "NA". You can abort the run time calibration by sending the "D" command a second time. The "D" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"^" UPS to Bypass

Sending the ASCII character "^" while the UPS is operating on-line causes the UPS to respond with the characters "BYP" and transfer to bypass mode. Sending the "^" character while the UPS is operating in bypass mode causes the UPS to respond with the characters "INV" and revert to normal on-line operation (note that the UPS may first briefly operate on-battery). The UPS returns the characters "ERR" when the UPS is unable to transfer to or from bypass operation due to low line voltage or UPS fault conditions.

UPS responses are as follows:

- BYP - The UPS is attempting to transfer from normal inverter to bypass mode.
- INV - The UPS is attempting to transfer from bypass mode to normal inverter mode.
- ERR - The UPS is unable to switch to or from bypass.

The Bypass command is valid only for APC UPS models that incorporate the bypass function, such as the Matrix-UPS. Other APC UPS models do not respond to the command.

"CtrlN" Turn UPS On

Sending the key sequence "Ctrl" and ASCII character "N" or "n", followed by a greater than 1.5 second delay, followed by another Ctrl N or Ctrl n is equivalent to momentarily pushing the front ON button of the UPS. The format of the command in this document is shown as Ctrl N(>1.5 sec)Ctrl N. If line voltage is not present, the UPS responds as if a user pushed the front "on" button with no line voltage present. The Ctrl N command is valid only on newer Smart-UPS models.

"R" Return to Simple Mode

Sending the ASCII character "R" forces the UPS out of Smart mode. The response is always "BYE" (assuming the UPS is in Smart Mode when the "R" is sent). To get back into Smart mode, you must send a "Y". The R command is valid on 3G (third generation) Smart-UPS models. It is also valid on Smart-UPS v/s and Back-UPS Pro models, except for early models that do not have the necessary firmware version. The R command is not valid on Matrix-UPS.

3.2 UPS Status Inquiry Commands

"X" Battery Test Result

Sending the ASCII character uppercase "X" causes the UPS to respond with the results of the last battery test performed. The results are saved for only 5 minutes. The messages returned include: "OK" indicating a good battery, "BT" indicating a battery that has failed the test due to insufficient capacity, "NG" indicating an invalid test due to overload, and "NO" indicating that no test results are available (i.e. the "W" Battery Test command was sent more than 5 minutes prior to the "X" command).

">" Number of Battery Packs

Sending the ASCII character ">" causes the UPS to respond with a three-digit number directly representing the number of external battery packs connected to the UPS.

This command is valid only for APC UPS models designed to operate with SmartCell battery packs, such as the Matrix-UPS. Only these UPSs can automatically sense the number of battery packs connected. Other APC UPS models do not respond to the command.

See the ">" (Battery Pack Configuration) command in Section 3.4, "UPS Customizing Commands," for information on manually entering the number of battery packs for UPSs, such as 3G (third generation) Smart-UPS XL models, that support external battery packs but do not have the capacity to automatically sense the number.

"<" Number of Bad Battery Packs

Sending the ASCII character "<" causes the UPS to respond with a three-digit number directly representing the number of bad battery packs connected to the UPS.

This command is valid only for APC UPS models designed to operate with APC SmartCell battery packs, such as the Matrix-UPS. Other APC UPS models do not respond to the command.

"G" Transfer Cause

Sending the ASCII character uppercase "G" causes the UPS to respond with the reason for the most recent transfer to on-battery operation. The UPS returns one of the following ASCII characters:

- "R" for transfer due to unacceptable utility voltage rate of change.
- "H" for transfer due to detection of high utility voltage.
- "L" for transfer due to detection of low utility voltage.
- "T" for transfer due to detection of a line voltage notch or spike.
- "O" if no transfers have occurred yet.

"S" for transfer in response to a UPS-Link Control Command (e.g. the Simulate Power Failure command, "U") or activation of the UPS's Test control (where applicable).

If the UPS has not transferred to on-battery operation since being turned on, the UPS responds with the ASCII character "O".

"V" Firmware Version

Sending the ASCII character uppercase "V" causes the UPS to respond with a three character alphanumeric representation of the UPS's firmware version. In the returned message, the first character represents the UPS's base model type, the second character represents the UPS's firmware version letter (which, for third generation Smart-UPS models is always W), and the third character represents the UPS's utility voltage version. Decode the UPS base model type and utility voltage version characters according to the following tables. Other UPS model type characters may be included in the future. The "V" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

APC UPS Models (including derivatives such as RM, XL, etc.)	1 st Character
Smart-UPS 250	2
Smart-UPS 400, UPS 370ci	4
Smart-UPS 600	6
Smart-UPS 900	7
Smart-UPS 1250	8
Smart-UPS 2000	9
Matrix-UPS 3000	0
Matrix-UPS 5000	5
Smart-UPS 450	F
Smart-UPS 700	G
Smart-UPS 1000	I
Smart-UPS 1400	K
Smart-UPS 2200	M
Smart-UPS 3000	O

Utility Voltage Version	3 rd Character
100 Vac	A
120 Vac	D
208 Vac	M
220/230/240 Vac	I
Matrix-UPS configured for 208 Vac input	M
Matrix-UPS configured for 240 Vac input	I
Matrix-UPS configured for 200 Vac input/output	J

"g" UPS Nominal Battery Voltage Rating

Sending the ASCII character lowercase "g" causes the UPS to respond with a three-digit number representing the UPS's nominal battery voltage rating. This is not the UPS's actual battery voltage, which is reported by the "B" command, documented in Section 3.3, "UPS Power Inquiry Commands". For example, the UPS returns "024" (or no response on early version UPSs) for a 24 Volt battery system, "018" for a 18 Volt battery system, and "048" for a 48 Volt battery system.

"f" Battery Capacity

Sending the ASCII character lowercase "f" causes the UPS to respond with "ddd.d" characters directly representing the UPS's remaining battery capacity as a percent of the fully charged condition. The "f" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"9" Acceptable Line Quality

Sending the ASCII character "9" causes the UPS to respond with either the characters "FF", denoting acceptable utility line quality, or "00", denoting unacceptable utility line quality. No attempt is made here to better qualify the meaning of the returned messages.

"Q" UPS Status

Sending the ASCII character uppercase "Q" causes the UPS to respond with a two-digit hexadecimal coded message that can be deciphered to find the operational status of the UPS, as shown in the following table. Bits 7 through 2 reflect the state of the UPS. For example, when the Smart-UPS is performing a self-test, the state of Bit 3 also changes. Decode the two hexadecimal characters to get two four-bit binary words. The second alphanumeric character represents bits 0 through 3; the first alphanumeric character represents bits 4 through 7.

Bit	Representative UPS Operational Status
7	1 = Reserved for Future Use
6	1 = low battery condition
5	1 = overloaded output condition
4	1 = on-battery mode of operation
3	1 = on-line mode of operation
2	1 = SmartBoost mode of operation (where applicable)
1	1 = SmartTrim mode of operation (where applicable)
0	1 = run time calibration running

The Smart-UPS v/s and Back-UPS Pro do not report bit 0. Older Smart-UPS models (second generation) do not report bit 1, since they do not support SmartTrim.

"~" State Register

Sending the ASCII character "~" causes the UPS to respond with a two-digit hexadecimal coded message that can be deciphered to find the operational status of the UPS as shown in the following table. Decode the two hexadecimal characters to get two four-bit binary words. The second alphanumeric character represents bits 0 through 3; the first alphanumeric character represents bits 4 through 7.

Bit	Representative UPS Operational Status
7	1 = UPS ready to power load upon user command or return of normal line voltage
6	1 = UPS ready to power load upon user command
5	1 = UPS in bypass mode as a result of manual bypass control
4	1 = UPS is returning from bypass mode
3	1 = UPS in bypass mode as a result of UPS-Link or key command
2	1 = UPS going to bypass mode as a result of UPS-Link or key command
1	1 = UPS in bypass mode due to internal fault (indicated through TRIP or TRIP 1 register)
0	1 = UPS in wake up mode (startup test lasting less than 2 seconds)

This command is fully valid only for the APC Matrix-UPS. The 3G Smart-UPS models, the Smart-UPS v/s, and the Back-UPS Pro report only bits 6 and 7. Other APC UPS models do not respond to the command.

"'" Trip1 Register

Sending the ASCII character "'" (apostrophe) causes the UPS to respond with a two-digit hexadecimal coded message that can be deciphered to find the status of the UPS's "Trip1 register," mainly fault conditions, as shown in the following table. Decode the two hexadecimal characters to get two four-bit binary words. The second alphanumeric character represents bits 0 through 3; the first alphanumeric character represents bits 4 through 7. State change of any of these bits is asynchronously communicated by the UPS with the UPS Alert Messages Abnormal Condition ("?") or Return From Abnormal Condition ("=").

Bit	Representative UPS Trip1 Register Status
7	1 = Bad output voltage
6	1 = UPS fault - SmartBoost or SmartTrim relay fault
5	1 = UPS fault - The UPS was commanded to come out of bypass when no batteries were attached. UPS is in bypass
4	1 = UPS fault - DC imbalance; UPS is in bypass
3	1 = UPS fault - output voltage select failure; UPS is in bypass
2	1 = UPS fault - bypass supply failure
1	1 = UPS fault - Isolation Unit fan failure
0	1 = UPS fault - Electronics Unit fan failure; UPS is in bypass

Some APC UPS models support a subset, returning zeros for bits that are invalid. The APC Matrix-UPS reports all bits except 7 and 6. 3G Smart-UPS models report only bits 6 and 4. Smart-UPS v/s and Back-UPS Pro models report only bits 7, 6, and 4.

Some other models do not respond to the command at all.

"8" Trip Register

Sending the ASCII character "8" causes the UPS to respond with a two-digit hexadecimal coded message that can be deciphered to find the status of the UPS's "trip register" as shown in the following table. Decode the two hexadecimal characters to get two four-bit binary words. The second alphanumeric character represents bits 0 through 3; the first alphanumeric character represents bits 4 through 7. State change of bits 1, 2, 5, 6, or 7 is asynchronously communicated by the UPS with the UPS Alert Messages Abnormal Condition ("?") or Return From Abnormal Condition ("=").

Bit	Representative UPS Trip Register Status
7	1 = UPS fault - internal temperature has exceeded nominal limits
6	1 = UPS fault - bypass relay (where applicable) malfunction
5	1 = UPS fault - battery charger failure
4	1 = UPS in shut down mode via "S" command
3	1 = UPS in "sleep" mode via "@ddd" command
2	1 = UPS fault - main relay malfunction; UPS turned off
1	1 = UPS unable to transfer to on-battery operation due to overload
0	1 = UPS's output unpowered due to low battery shut down

Bits 6 and 7 are valid only for the Matrix-UPS. Bit 5 is valid only for the Matrix-UPS, newer (i.e. third generation) Smart-UPS, Smart-UPS v/s, and Back-UPS Pro models. UPS models for which a bit is invalid return zeros (0) for that bit.

"7" DIP Switch Position (where applicable)

Sending the ASCII character "7" causes the UPS to respond with a two-digit hexadecimal coded message that can be deciphered to find the position of the UPS's "DIP" option switches as shown in the following table. Decode the two hexadecimal characters to get two four-bit binary words. The second alphanumeric character represents bits 0 through 3; the first alphanumeric character represents bits 4 through 7. All UPS Customizing Commands, except "E", "c", "x", "e", "p" and "r" (all documented in Section 3.4) are reset to default values whenever any individual DIP option switch is moved from the ON position, except DIP switch #4 on the Smart-UPS 250, 370ci, and 400, which may be in any position.

Bit	Option Switch	Option Selected When Bit = 1
7-4		reserved for future use
3	1	1 = UPS desensitized and input voltage range widened
2	2	1 = output/transfer voltage range set to 115 or 240 Vac from 120 or 230 Vac (depending on output voltage version)
1	3	1 = audible utility failure alarm delayed 30 seconds
0	4	1 = low battery alarm interval extended from 2 to 5 minutes; and automatic startup disabled in the Smart-UPS 370ci and 400 models

APC UPS models that do not incorporate DIP option switches return the value "00" following the "7" command.

"n" UPS Serial Number

Sending the ASCII character lowercase "n" causes the UPS to respond with a string of at least 8 characters directly representing the UPS's serial number as set at the factory. You cannot change this value with the Edit or Reset UPS EEPROM Variables command. Newer Smart-UPS models have 12-character serial numbers.

"m" UPS Manufacture Date

Sending the ASCII character lowercase "m" causes the UPS to respond with eight characters (numeric and slant) directly representing the UPS's date of manufacture in the format "dd/mm/yy" (day, month, year). You cannot change this value with the Edit or Reset UPS EEPROM Variables command. The "m" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"j" Run Time Remaining

Sending the ASCII character lowercase "j" caused the UPS to respond with "ddd:" characters directly representing the UPS's estimated remaining run time in minutes. You can query the UPS when it is operating in the on-line, bypass, or on-battery modes of operation. The UPS's remaining run time reply is based on available battery capacity and output load. The UPS may return the value ">>>:" when it cannot determine the run time remaining. The "j" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"y" Copyright

Sending the ASCII character lowercase "y" causes the UPS to respond with the ASCII characters "(C) APCC". Programs written using UPS-Link should use this command to identify and validate the UPS as a genuine APC product. The UPS responds to this command if its firmware letter (second character of the firmware version) is later than the letter "O". See the Firmware Version command "V" in Section 3.2, "UPS Status Inquiry Commands" for information on determining the firmware version.

"b" Version in Decimal

Sending the ASCII character lowercase "b" causes the UPS to respond with the ASCII character string "xxx.xxx.x", with the first two elements of the character string being of variable length.

The UPS first sends back the SKU (stock keeping unit) field of variable length in decimal notation. For APC, there is one master list of SKUs that continues to grow as new products are introduced. A period (.) marks the end of the first field. The second field is a variable length decimal number indicating the firmware revision. A period (.) marks the end of the second field. The third field is one of the following country codes:

I = 220/230/240 Vac
D = 115/120 Vac
A = 100 Vac
M = 208 Vac
J = 200 Vac

Examples:

11.12.D
1.4.A
102.56.J

The "b" command is not available on the Matrix-UPS and older Smart-UPS models.

"CtrlA" UPS Model

Sending the ASCII character "CtrlA" causes the UPS to respond with a less than 32 ASCII character string consisting of the UPS model name (the words on the front of the UPS itself). This command's purpose is to display a meaningful string for models with similar firmware revision numbers (i.e. Smart-UPS 2000 v/s, Smart-UPS 2000 XL, etc.).

3.3 UPS Power Inquiry Commands

"/" Load Current

Sending the ASCII character "/" (slant) causes the UPS to respond with "dd.dd" characters directly representing the true rms load current drawn from UPS. The typical accuracy of this measurement is $\pm 7.5\%$ of the load rating of UPS.

This command is valid only for the APC Matrix-UPS. Other APC UPS models do not respond to the command.

"\" Apparent Load Power

Sending the ASCII character "\" (reverse slant) causes the UPS to respond with "*ddd.dd*" characters directly representing the UPS's output load as a percentage of the full rated load in Volt-Amps. The typical accuracy of this measurement is $\pm 5\%$ of the maximum of 105%.

This command is valid only for the APC Matrix-UPS. Other APC UPS models do not respond to the command.

"B" Battery Voltage

Sending the ASCII character uppercase "B" causes the UPS to respond with "*dd.dd*" characters directly representing the UPS's present battery voltage. The typical accuracy of this measurement is $\pm 5\%$ of the maximum value of 24 Vdc, 34 Vdc or 68 Vdc (depending upon the UPS's nominal battery voltage). See the UPS Nominal Battery Voltage Rating command, "g", in Section 3.2, "UPS Status Inquiry Commands." The "B" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"C" UPS Internal Temperature

Sending the ASCII character uppercase "C" causes the UPS to respond with "*ddd.d*" characters directly representing the UPS's present internal operating temperature in degrees Celsius. The typical accuracy of this measurement is $\pm 5\%$ of the full scale value of 100°C. The "C" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"F" UPS & Utility Operating Frequency

Sending the ASCII character uppercase "F" causes the UPS to respond with "*dd.dd*" characters directly representing the UPS's present internal operating frequency. When operating on-line, the UPS's internal operating frequency is synchronized to the line within variations within 3 Hz of the nominal 50 or 60 Hz. The typical accuracy of this measurement is $\pm 1\%$ of the full scale value of 63 Hz. The "F" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"L" Line Voltage

Sending the ASCII character uppercase "L" causes the UPS to respond with "*ddd.d*" characters directly representing the UPS's present input voltage. The typical accuracy of this measurement is $\pm 4\%$ of the maximum value of 142 Vac for 100 Vac and 120 Vac version UPSs. The typical accuracy of this measurement is $\pm 4\%$ of the maximum value of 285 Vac for 208 Vac and 220/230/240 Vac version UPSs. The "L" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"M" Maximum Line Voltage

Sending the ASCII character uppercase "M" causes the UPS to respond with "*ddd.d*" characters directly representing the UPS's maximum input voltage as determined during the interval between command messages. For example, if "M" is sent to the UPS every 24 hours, the UPS returns characters indicating the maximum voltage over the last 24 hours. The "M" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"N" Minimum Line Voltage

Sending the ASCII character uppercase "N" causes the UPS to respond with "*ddd.d*" characters directly representing the UPS's minimum input voltage as determined during the interval between command messages. For example, if "N" is sent to the UPS every 24 hours, the UPS returns characters indicating the minimum voltage over the last 24 hours. The "N" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"O" Output Voltage

Sending the ASCII character uppercase "O" causes the UPS to respond with "*ddd.d*" characters directly representing the UPS's output voltage. The typical accuracy of this measurement is $\pm 4\%$ of the maximum value of 142 Vac for 100 Vac and 120 Vac version UPSs. The typical accuracy of this measurement is $\pm 4\%$ of the maximum value of 285 Vac for 208 Vac and 220/230/240 Vac version UPSs. The "O" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"P" Load Power

Sending the ASCII character uppercase "P" causes the UPS to respond with "*ddd.d*" characters directly representing the UPS's output load as a percentage of full rated load in Watts. The typical accuracy of this measurement is $\pm 3\%$ of the maximum of 105%. The "P" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

3.4 UPS Customizing Commands

The UPS Customizing Commands provide an alternative to using UPS manual option switches or panel controls to alter UPS operations to suit specific applications. These commands enable you to alter UPS operations remotely, providing function choices beyond those available with the option switches.

Note: APC may change specific value responses to any of the UPS Customizing Commands without notice. However, you should be able to understand the meaning of a new response value from the form of other, unchanged values specified here.

Special Notes for APC UPS Models with Option Switches

APC UPS models with option switches allow local or remote selection of function choices that affect the UPS's functioning in the following areas:

- sensitivity to line voltage amplitude and distortion
- transfer voltage and output voltage (22/230/240 Vac versions only)
- audible utility failure alarm indication
- low battery warning interval times (or the disabling of automatic turn-on in the Smart-UPS 370ci and 400 models)

A change made to the setting of any individual option switch takes effect immediately. In most cases, an option switch is set to the OFF position at the factory. These "factory" settings correspond to UPS operation that is best suited to most applications.

You can use UPS Customizing Commands at any time to determine function choice settings, the UPS serial number, etc. However, you **cannot** use the "Edit" UPS Customizing Command to remotely **change**

a function choice value when any one of the option is set to the **OFF** position (except DIP switch #4 on the 250/370ci/400, which may be in any position). To use the Edit command, first set all option switches to the **ON** position (except DIP switch #4 on the Smart-UPS 250, 370ci, and 400 models, which may be in any position). The Edit command overrides all function choices defined by the option switches. However, you can use the Edit command with UPS Customizing Commands to perform the same functions available with the option switches.

When any one option switch is reset to the OFF position (except DIP switch #4 on the Smart-UPS 250, 370ci, and 400, which may be in any position), you can no longer use the Edit UPS Customizing Command to alter UPS operation. UPS functions listed in the following table return to the settings that correspond to the option switch positions. Function settings that do not conflict with option switch functionality do not change.

Customizing Functions Returned To Option Switch Functionality	Customizing Command
Highest permissible output voltage	u
Lowest permissible output voltage	l
Output voltage	o
Utility failure sensitivity	s
Low battery warning interval	q
Audible alarm	k

"Ctrl Z" Read All Configurable EEPROM Parameters

Sending the ASCII character "**Ctrl Z**" causes the UPS to respond with a multiple-character string "**ddddddd...**" representing the format and all possible selection choices returned for each of the applicable UPS Customizing Commands. Applicable UPS Customizing Commands include those that allow user selection of any one of a list of predefined values. When a new UPS or new Customizing Command choices are introduced to the system, this command enables you to update easily application software written using UPS-Link.

Example:

```
#uD43132135138129uM43230234239224uA43110112114108uI43253264271280ID43103100097106IM4
3177172168182IA43090092081085II43196188208204e44200155090oI43230240220225oD13115oJ13100o
M13208s441HMLLq44202050710p443020180300600k4410TLNr443000060180300E443336168ON OFF
```

The format, as shown in the preceding sample UPS response, is as follows:

1. The "#" character appears only as the first character in the entire multi-item response.
2. The first character in each response item represents the UPS Customizing Command that is the subject of that response item. In the preceding example, the UPS Customizing Command, "u", Lower Transfer Voltage, is shown in the response item for the first command.
3. Following the Customizing Command character, is the compatibility character. The following table shows all possible compatibility characters and their meaning. In the last item of the entire multi-item character string shown in the preceding example, the compatibility character is "4" because the Battery Test ("E" command) value responses are not utility voltage version-specific.

Compatibility Character	Meaning of Character
A	Version-specific to 100 Vac UPSs
D	Version-specific to 120 Vac UPSs
I	Version-specific to 220/230/240 Vac UPSs *
M	Version-specific to 208 Vac UPSs *
4	Not version-specific

* Or UPSs configured to operate at this nominal input voltage.

4. Following the compatibility character is an integer directly representing the number of function choices possible with the UPS Customizing Command. In the last item of the entire multi-item character string example, the number of Battery Test command choices is "4".
5. Following the number of choices character is an integer directly representing the number of characters per function choice. In the last item of the entire multi-item character string example, the number of characters per function choice is "3".
6. The remaining characters in the item string are the function choice values. The values are given in an unbroken string (including spaces, where applicable). In the last item of the entire multi-item character string example, the function choice values returned for the Battery Test command are "336" , "168", "ON ", and "OFF".

This command is valid only for the APC Matrix-UPS and newer Smart-UPS models. Other APC UPS models do not respond to the command.

"z" Reset UPS EEPROM Variables

Sending the ASCII character lowercase "z" causes the UPS to clear all programming changes made by the user with the UPS Customizing Commands except commands "c" and "x". The UPS is forced to restore the default function settings as described in the following command descriptions. The UPS returns the message "**CLEAR**" in response to this command. The "z" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"-" Edit

Sending the ASCII character "-" (minus sign) after an applicable UPS Customizing Command causes the UPS to select the next operational setting in the order shown in the table in the command description for that command. When you send the "-" is sent following the command "c" or "x", you can then enter ASCII characters directly. The UPS returns the message "**OK**" when the Edit command is sent following a UPS Customizing Command. This command is disallowed by APC UPS models having option switches when any one of the option switches is in the **OFF** position (except DIP switch #4 on the Smart-UPS 250, 370ci, and 400 models, which may be in any position). When an **OFF** DIP switch causes the command to be disallowed, the UPS returns the message "**NO**" in response to the Edit command. UPS models for which this command is invalid respond "**NA**" after the "-" has been received. The "-" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"Ctrl V" Output Voltage Selection

Sending the ASCII character "**Ctrl V**" causes the UPS to return one alphabetic character representing the UPS's output voltage reporting selection as shown in the following table. When you use the Edit command immediately following this command, the UPS selects the next setting in the order shown in the table. The UPS defaults to the setting shown in the shaded portion of the table when you use the Reset UPS EEPROM Variables command. APC UPS models having the capability to accept optional power distribution plates that change the nominal output voltage of the UPS from 208 Vac to 240 Vac, or vice versa, require that the user set the nominal voltage reported. Automatic selection of the reported output voltage is based upon the input voltage wiring tap selected, 208 or 240 Vac.

Returned Message	Nominal output voltage reported
A	Automatic selection according to input tap selected
M	208 Vac
I	240 Vac

This command is valid only for the APC Matrix-UPS. Newer Smart-UPS models return "NA" after you press the Enter key. Other APC UPS models do not respond to the command.

"Ctrl L" Front Panel Language Selection

Sending the ASCII character sequence "**Ctrl L**" causes the UPS to return one alphabetic or numeric character representing the UPS's display language selection (where applicable) as shown in the following table. When the Edit command is sent immediately following this command, the UPS selects the next setting in the order shown in the table. The UPS defaults to the setting shown in the shaded portion of the table when the Reset UPS EEPROM Variables command is used.

Returned Message	Language Setting
E	English
F	French
G	German
S	Spanish
1	To be defined
2	To be defined
3	To be defined
4	To be defined

This command is valid only for the APC Matrix-UPS. Other APC UPS models will not respond to the command.

"E" Automatic Battery Test

You can customize the UPS to run the automatic battery test immediately upon startup, upon startup and every 7 days thereafter, upon startup and every 14 days thereafter, or never. Sending the ASCII character uppercase "**E**" causes the UPS to respond with three characters (all numeric, all alphabetic, or two alphabetic with one trailing space) representing the current automatic battery test setting as shown in the following table. When the Edit command is sent immediately following this command, the UPS selects the next setting in the order shown in the table. The UPS defaults to the Battery Test setting shown in the shaded portion of the table when the Reset UPS EEPROM Variables command is used. The Automatic Battery Test setting does not affect the function of the UPS's Test push-button (where applicable) and the Battery Test command "**W**".

Returned Message	Battery Test Setting
336	Battery test every 336 hours (14 days)
168	Battery test every 168 hours (7 days)
ON *	Battery test upon startup
OFF	No automatic battery test

* There is a single space character following the N character in the "ON " response.

The "E" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"c" UPS ID

Sending the ASCII character lowercase "c" causes the UPS to respond with a previously entered eight-character string representing the UPS's model name. (The response is initially factory-set to eight spaces.) When you use the Edit command directly following this command, you can then enter a new eight-character message. After you enter all eight characters, the UPS responds with the message "OK". You cannot use the "-" (hyphen or minus sign) character as part of the new message. You cannot change this message with the Reset UPS EEPROM Variables command.

You must enter an eight-character string. Use spaces if necessary.

The "c" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"x" Battery Replacement Date

Sending the ASCII character lowercase "x" causes the UPS to respond with eight characters (numeric and slant) in the format "dd/mm/yy" (day, month, year), directly representing the date the UPS's battery was last replaced. When you use the Edit command directly following this command, you can then enter a new eight-character message. After all characters are entered, the UPS responds with the message "OK". You cannot change this message with the Reset UPS EEPROM Variables command.

The "x" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"u" Upper Transfer Voltage

You can customize over a wide range the UPS's upper transfer voltage threshold that triggers the UPS to change from on-line to on-battery operation. Sending the ASCII character lowercase "u" causes the UPS to respond with three numeric characters directly representing the UPS's current upper transfer voltage. When you use the Edit command directly following the "u" command, the UPS selects the next voltage in the order shown in the table. The UPS defaults to the Upper Transfer Voltage setting shown in the shaded portion of the table when you use the Reset UPS EEPROM Variables command.

Upper Transfer Voltage Settings						
100 Vac UPS	120 Vac UPS	208 Vac UPS	220/230/240 Vac UPS	Matrix-UPS		
				Configured for 200 Vac	Configured for 208 Vac	Configured for 240 Vac
110 Vac	132 Vac	229 Vac	253 Vac	230 Vac	240 Vac	276 Vac
112 Vac	135 Vac	234 Vac	264 Vac	232 Vac	244 Vac	264 Vac
114 Vac	138 Vac	239 Vac	271 Vac	234 Vac	248 Vac	253 Vac
108 Vac	129 Vac	224 Vac	280 Vac	236 Vac	252 Vac	282 Vac

The "u" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"l" Lower Transfer Voltage

You can customize over a wide range the UPS's upper transfer voltage threshold that triggers the UPS to transfer from on-line to on-battery operation. Sending the ASCII character lowercase "l" causes the UPS to respond with three numeric characters directly representing the UPS's current on-line to SmartBoost operation transfer voltage, i.e. the lowest on-line output voltage permitted by the UPS. When you use the Edit command directly following the "l" command, the UPS selects the next voltage

in the order shown in the table. The UPS defaults to the Lower Transfer Voltage setting shown in the shaded portion of the table when you use the Reset UPS EEPROM Variables command.

Lower Transfer Voltage Setting			
100 Vac Version	120 Vac Version	208 Vac Version	220/230/240 Vac Version
90 Vac	103 Vac	177 Vac	196 Vac
92 Vac	100 Vac	172 Vac	188 Vac
81 Vac	97 Vac	168 Vac	208 Vac
85 Vac	106 Vac	182 Vac	204 Vac

This command is not valid for the APC Matrix-UPS. The Matrix-UPS returns the message "NO" when sent the "l" command.

This command is also not valid for the Smart-UPS v/s or the Back-UPS Pro.

"e" Minimum Battery Capacity to Restart

You can customize the UPS to do one of the following when normal utility voltage returns after an extended outage:

- restart at 0% or more of full battery capacity
- remain shut down (output is deenergized) until battery capacity has returned to at least the percentage of full capacity specified from among three model-specific settings (see tables below).

Sending the ASCII character lowercase "e" causes the UPS to respond with two numeric characters directly representing the UPS's current Minimum Battery Capacity to Restart setting. When you use the Edit command directly following the "e" command, the UPS selects the next setting in the order shown in the table below that pertains to that UPS model. The Minimum Battery Capacity To Restart setting also affects the UPS when it has been shut down via the Shut Down UPS on Battery command. It is possible for the user to select Minimum Battery Capacity To Restart settings that are incompatible with Low Battery Warning ("q" command) and Shutdown Delay ("p" command) settings. The UPS defaults to the Minimum Battery Capacity to Restart setting shown in the shaded portion of the table when you use the Reset UPS EEPROM Variables command.

The following table shows the returned messages for newer Smart-UPS models.

Returned Message	Minimum Battery Capacity To Restart Setting
0	Restarts at 0% battery capacity
15	Restarts at 15% battery capacity
50	Restarts at 50% battery capacity
90	Restarts at 90% battery capacity

The following table, shows the returned messages for all models except newer Smart-UPS models.

Returned Message	Minimum Battery Capacity To Restart Setting
0	Restarts at 0% battery capacity
10	Restarts at 10% battery capacity
25	Restarts at 25% battery capacity
90	Restarts at 90% battery capacity

The "e" command is not valid for the APC Matrix-UPS. The Matrix-UPS returns the message "NO" when sent the "e" command.

The "e" command is also not available on the Smart-UPS v/s or the Back-UPS Pro.

"o" Output Voltage

You can customize over a wide range the 220/230/240 Vac version UPS's on-battery output voltage to adapt the UPS for use with loads that were designed with strict input voltage limits. You can customize a Matrix-UPS configured for operation from 240 Vac. Sending the ASCII character lowercase "o" causes the UPS to respond with three numeric characters directly representing the UPS's current on-battery output voltage setting.

100 Vac, 120 Vac, and 208 Vac version UPSs respond to the "o" command with the characters "100", "115" and "208", respectively. You cannot change these values.

On 220 Vac, 230 Vac, and 240 Vac version UPSs, when you use the Edit command directly following the "o" command, the UPS selects the next output voltage in the order shown in the table. The UPS defaults to the Output Voltage setting shown in the shaded portion of the table when you use the Reset UPS EEPROM Variables command.

Returned Message	On-Battery Nominal Output Voltage Setting
225	225 Vac
230	230 Vac
240	240 Vac
220	220 Vac

The "o" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"s" Utility Failure Sensitivity

You can customize the UPS's sensitivity to rapid changes in utility voltage (e.g. blackouts, spikes or notches) or abnormal changes in utility frequency to allow use of the UPS in "noisy" electrical environments or with fuel powered generators where the UPS may otherwise frequently transfer to on-battery operation. Sending the ASCII character lowercase "s" causes the UPS to respond with one alphabetic character representing the UPS's current utility failure sensitivity setting as shown in the following two tables, the first table for Matrix-UPS and the second for Smart-UPS. The "H" or high setting provides the best protection from all utility voltage vagaries. Select the "M" or medium setting where rapid low amplitude line voltage fluctuations commonly occur as the result of motor load switching in air conditioners, elevators, etc. Select the "L" or low setting when the UPS is operated in a "noisy" electrical environment or from an inexpensive fuel-powered generator. Select the "A" or auto-adjust setting (available on Matrix-UPS only) if you want the UPS to automatically adjust its sensitivity setting to the line voltage fluctuations it is experiencing. When you use the Edit command directly following the "s" command, the UPS selects the next setting in the order shown in the table. The UPS defaults to the Utility Failure Sensitivity setting shown in the shaded portion of the table when you use the Reset UPS EEPROM Variables command.

The following table shows, for Matrix-UPS models, the returned messages and the meanings of the corresponding sensitivity settings.

Returned Message	Utility Failure Sensitivity Setting
H	Highest sensitivity to utility voltage fluctuations
M	Medium sensitivity to utility voltage fluctuations
L	Lowest sensitivity to utility voltage fluctuations
A	Auto-adjust sensitivity to utility voltage fluctuations

The following table shows, for Smart-UPS models, the returned messages and the meanings of the corresponding sensitivity settings. Because the Auto-adjust sensitivity setting is not supported on Smart-UPS, the Lowest sensitivity setting is repeated to provide a sequence of four values to use with the Edit command.

Returned Message	Utility Failure Sensitivity Setting
H	Highest sensitivity to utility voltage fluctuations
M	Medium sensitivity to utility voltage fluctuations
L	Lowest sensitivity to utility voltage fluctuations
L	Lowest sensitivity to utility voltage fluctuations

The "s" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"q" Low Battery Warning

You can customize over a wide range the interval between the activation of the UPS's low battery alarm warnings (audible, visual and signaled) and the shutdown of the UPS. Sending the ASCII character "q" causes the UPS to respond with two numeric characters directly representing the low battery alarm warning interval in minutes. When you use the Edit command directly following the "q" command, the UPS selects the next interval in the order shown in the table. The UPS defaults to the Low Battery Warning interval setting shown in the shaded portion of the table when you use the Reset UPS EEPROM Variables command. It is possible for the user to select a Low Battery Warning interval that is incompatible with Minimum Battery Capacity To Restart ("e" command) and Shutdown Delay ("p" command) settings.

Returned Message	Low Battery Warning Interval Setting
02	2 minutes
05	5 minutes
07	7 minutes
10	10 minutes

The "q" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"k" Audible Alarm

You can customize the Operation of the UPS's audible alarm to delay or disable its activation in response to utility failure or low battery conditions. Sending the ASCII character lowercase "k" causes the UPS to respond with one alphabetic character representing the UPS's current audible alarm setting as shown in the following table. When you use the Edit command directly following the "k" command, the UPS selects the next setting in the order shown in the table. The UPS defaults to the Audible Alarm setting shown in the shaded portion of the table when you use the Reset UPS EEPROM Variables command.

Returned Message	Audible Alarm Setting
0	Audible alarm is sounded immediately upon failure of utility and for low battery condition
T	Alarm is not sounded until utility failure has lasted for more than 30 seconds. Low battery warning operates normally.
L	Alarm is sounded for low battery conditions only.
N	Audible alarm is disabled under all conditions.

The "k" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"p" Shutdown Delay

You can customize over a wide range the interval between sending the "S", "K(>1.5 sec)K" or "@ddd" commands and shutdown of the UPS. Sending the ASCII character lowercase "p" causes the UPS to

respond with three numeric characters directly representing the UPS's current Shutdown Delay setting in seconds. When you use the Edit command directly following this command, the UPS selects the next delay in the order shown in the table. The UPS defaults to the Shutdown Delay interval setting shown in the shaded portion of the table when you use the Reset UPS EEPROM Variables command. It is possible for the user to select a Shutdown Delay interval that is incompatible with the Minimum Battery Capacity to Restart ("e" command) and Low Battery Warning ("q" command) settings.

Returned Message	UPS Shutdown Delay Interval Setting
020	20 seconds
180	180 seconds
300	300 seconds
600	600 seconds

The "p" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"r" Turn On Delay

You can customize the UPS so that it will turn on only after a set delay following a shut down period initiated by the "S" or "@ddd" commands. The delay is useful for coordinating turn-on following an extended power outage. Sending the ASCII characters lowercase "r" causes the UPS to respond with three numeric characters directly representing the UPS's current Turn On Delay setting in seconds. When you use the Edit command directly following this command, the UPS selects the next delay in the order shown in the table. The UPS defaults to the Turn On Delay interval setting shown in the shaded portion of the table when you use the Reset UPS EEPROM Variables command.

Returned Message	UPS Turn On Delay Interval Setting
000	0 seconds
060	60 seconds
180	180 seconds
300	300 seconds

The "r" command is not available on the Smart-UPS v/s or the Back-UPS Pro.

"w" Run Time Conservation

You can customize A Matrix-UPS to shut down (output is deenergized) automatically following a delay interval after the low battery warning has been issued. Only the Matrix-UPS responds to this command. Using this feature conserves some amount of run time when the low battery warning interval is set to a period longer in duration than the selected run time conservation interval. For example, if the low battery warning interval is set to 5 minutes, setting the Run Time Conservation interval to 2 minutes conserves 3 minutes of run time. This command enables you to conserve some "minimum" amount of run time in the event of successive outages.

Sending the ASCII character lowercase "w" causes the UPS to respond with two alphabetic or numeric characters representing the UPS's current run time conservation interval setting following low battery warning as shown in the following table. When you use the Edit command directly following the "w" command, the UPS selects the next setting in the order shown in the table. It is possible for the user to select Run Time Conservation settings that are incompatible with Low Battery Shutdown Warning settings. The UPS defaults to the setting shown in the shaded portion of the table when you use the Reset UPS EEPROM Variables command.

Returned Message	Run Time Conservation Interval Setting
NO	Function disabled

02	2 minutes
05	5 minutes
08	8 minutes

">" Battery Pack Configuration

Currently, only the Matrix-UPS is able to automatically detect the number of external battery packs connected. For the XL models of 3G (third generation) Smart-UPS, which use external battery packs but cannot automatically detect the number connected, the ">" command enables you to configure the number of external battery packs manually.

The number of external battery packs is factory-set to 0. Sending the ASCII character "+" or "-" (the Edit command) immediately following the ">" command, increments or decrements the number of battery packs by 1 and returns the new setting. To continue changing the value, repeatedly send the ">" command followed by a "+" or "-".

UPS models for which this command is invalid respond "NA" after the "+" or "-" is received.

See Section 3.2, "UPS Status Inquiry Commands," for a description of the read-only ">" command, Number of Battery Packs, that you use to query Matrix-UPSs for the current number of external battery packs configured.

3.5 UPS Alert Messages

This section describes UPS responses that are sent asynchronously in response to a UPS state or condition. See the Index of Responses for an index of these and other UPS responses.

"!" Line Fail

The ASCII character "!" is asynchronously sent from the UPS whenever the UPS transfers to on-battery operation. This message does not interrupt any commands currently being processed (i.e. the **K** (>1.5 sec)**K** Turn Off After Delay command sequence). The message is sent every 30 seconds during an extended utility failure until low battery conditions occur. Occasionally, more than one "!" message is sent during the first 30 seconds of on-battery operation.

"\$" Return from Line Fail

The ASCII character "\$" is asynchronously sent from the UPS when the UPS has transferred back from on-battery operation. This message is sent only if the "!" Line Fail message was sent first. This message does not interrupt any commands currently being processed.

"%" Low Battery

The ASCII character "%" is asynchronously sent from the UPS to signal low battery conditions. This message does not interrupt any commands currently being processed. The "%" message is not available on the Smart-UPS v/s or the Back-UPS Pro.

"+" Return from Low Battery

The ASCII character "+" is asynchronously sent from the UPS when the UPS has recharged the battery to a sufficient capacity. This message is sent only if the "%" Low Battery message was sent first. The Return from Low Battery message does not interrupt any commands currently being processed. The "+" message is not available on the Smart-UPS v/s or the Back-UPS Pro.

"?" Abnormal Condition

The ASCII character "?" is asynchronously sent from the UPS whenever the UPS has entered an abnormal state such as Shutdown Due to Overload, Shutdown Due to Low Battery Capacity, and PC Reboot. This message is also automatically sent within 10 minutes of turn-on. The Abnormal Condition message does not interrupt any commands currently being processed.

"=" Return from Abnormal Condition

The ASCII character "=" is asynchronously sent from the UPS when the UPS has recovered from an abnormal condition. This message is sent only if the "?" Abnormal Condition message was sent first. The UPS does not send an "=" after the "?" sent at turn-on. The Return from Abnormal Condition message does not interrupt any commands currently being processed. The "=" message is not available on the Smart-UPS v/s or the Back-UPS Pro.

"*" UPS About to Turn Load Off

The ASCII character "*" is asynchronously sent from the UPS when the UPS has been commanded to turn itself or the load off. No other command will be processed once this message has been sent.

This asynchronous response is not supported for newer Smart-UPS models, the Smart-UPS v/s, or the Back-UPS Pro.

"&" Check Alarm Register for Fault

The ASCII character "&" is asynchronously sent from the Measure-UPS to signal that ambient temperature or humidity is outside the limits set by the low and high temperature and humidity thresholds. The Alarm message is also asynchronously sent from the Measure-UPS to signal that one of the contact closure inputs has changed from the selected "normal" state, i.e. either "Normally Open" or "Normally Closed".

The Measure-UPS sends an alarm every two minutes whenever an alarm condition exists. It discontinues the alarm when all alarm conditions are reset. The Alarm message is sent only for alarm states that have been enabled via the Alarm Enable command (the "I" command, documented in Section 4.2, "Measure-UPS Customizing Commands." In the case of multiple alarms, the Measure-UPS sends the alarm message once for every alarm condition detected. The Check Alarm Register for Fault message does not interrupt any commands currently being processed.

You can determine the cause of the Alarm message by using the Alarm Status command (the "J" command, documented in Section 4.1, "Measure UPS Inquiry Commands").

The "&" message is not available on the Smart-UPS v/s or the Back-UPS Pro.

"|" EEPROM Variable Change

The ASCII character "|" (vertical line) is asynchronously sent from the UPS if any UPS EEPROM is changed via the UPS Customizing Commands. This message does not interrupt any commands currently being processed. The "|" is supported only on newer Smart-UPS models and the Matrix-UPS.

4.0 Control Language - Measure-UPS Command Groups

The Measure-UPS processes commands whenever it is powered on.

The Measure-UPS "passes through" to its output port all commands specified in the UPS Command Groups. The Measure-UPS intercepts (does not "pass through" to its output port) all commands specified in the Measure-UPS Command Groups.

A command sent to the Measure-UPS must be in the case (upper or lower) indicated in its command description.

All responses from the Measure-UPS initiated by a command are followed by a CR/LF (carriage return line feed) sequence.

Asynchronous Alert Messages generated by Measure-UPS are not followed by a CR/LF sequence.

Backspace and escape terminal keys have no UPS-Link meaning and are not supported by the Measure-UPS.

The Measure-UPS responds with the number of characters indicated in the following command descriptions without suppression of leading zeros. Alphabetic characters (letters) returned by the UPS, either as a word, abbreviation, or part of a hexadecimal-coded message will be uppercase.

Undocumented commands exist and the use of such commands may lead to undesired results. Use only the commands defined by this document.

In the following command descriptions, each "*d*" character represents a single variable character as in "*ddd.d*".

To use these commands, you must have a Measure-UPS connected to a Smart-UPS or Matrix-UPS. These commands are not supported for the Smart-UPS v/s.

4.1 Measure-UPS Inquiry Commands

"t" Ambient Temperature

Sending the ASCII character lowercase "t" causes the UPS to respond with "dd.dd" characters directly representing the local ambient temperature in degrees Celsius. The typical accuracy of this measurement is $\pm 2\%$ of full scale over the range of values from 0°C to 65°C (32°F to 149° F).

"h" Humidity

Sending the ASCII character lowercase "h" causes the UPS to respond with "ddd.d" characters directly representing the local ambient relative humidity in percent. The typical accuracy of this measurement is $\pm 5\%$ of full scale over the range of values from 10% to 90% RH (relative humidity). This accuracy is valid for a non-condensing ambient temperature only. The response time, constant to within 5% RH of the final value, is less than 5 minutes. Temperature dependency of this measurement is $\pm 5\%$ RH over ambient temperatures from 15° to 35°C.

"v" Firmware Version

Sending the ASCII character lowercase "v" causes the Measure-UPS to respond with a three-digit alphanumeric representation of the unit's ROM (read only memory) firmware version. In the returned message, the first character is the Measure-UPS's model type (always "4" for a Measure-UPS), the second character represents the Measure-UPS's firmware version letter ("A", "B", etc.), and the third character is always a lowercase "x".

"i" DIP Switch & External Contact Status

Sending the ASCII character lowercase "i" causes the Measure-UPS to respond with a two-digit hexadecimal coded message that can be deciphered to find the status of the DIP switch and external contacts as shown in the following table. Decode the two hexadecimal characters to obtain two four-bit binary words. The second alphanumeric character represents bits 0 through 3; the first alphanumeric character represents bits 4 through 7.

Bit	Representative DIP Switch & External Contact Status
7	Contact input channel #4 (0 = open, 1 = closed)
6	Contact input channel #3 (0 = open, 1 = closed)
5	Contact input channel #2 (0 = open, 1 = closed)
4	Contact input channel #1 (0 = open, 1 = closed)
3	DIP switch #4 (0 = Normally Open, 1 = Normally Closed)
2	DIP switch #3 (0 = Normally Open, 1 = Normally Closed)
1	DIP switch #2 (0 = Normally Open, 1 = Normally Closed)
0	DIP switch #1 (0 = Normally Open, 1 = Normally Closed)

"J" Alarm Status

Sending the ASCII character uppercase "J" causes the Measure-UPS to respond with a two-digit hexadecimal coded message that can be deciphered to find the status of the alarms as shown in the following table. Decode the two hexadecimal characters to obtain two four-bit binary words. The

second alphanumeric character represents bits 0 through 3, the first alphanumeric character represents bits 4 through 7. When an Alarm Status bit is set to 1, it will not change to 0 again until the alarm state changes back to normal and the Alarm Status is queried.

Bit	Alarm Status
7	1= User-set upper temperature limit exceeded. See “ [” command.
6	1= Temperature is below user-set lower temperature limit. See “]” command.
5	1= User-set upper relative humidity limit exceeded. See “ {” command.
4	1= Humidity is below user-set lower relative humidity limit. See “ }” command.
3	1= Contact input channel #4 alarm state. Contact closure #4 disagrees with Dip Switch #4.
2	1= Contact input channel #3 alarm state. Contact closure #3 disagrees with Dip Switch #3.
1	1= Contact input channel #2 alarm state. Contact closure #2 disagrees with Dip Switch #2.
0	1= Contact input channel #1 alarm state. Contact closure #1 disagrees with Dip Switch #1.

4.2 Measure-UPS Customizing Commands

You can customize the Measure-UPS to send an asynchronous Alarm message in response to being outside a range of temperature and/or relative humidity limits. The Alarm message may also be disabled for individual contact closure inputs and temperature and humidity limit alarm conditions.

"-" Edit

Sending the ASCII character "-" (minus) following the command "[", "]", "{" or "}" causes the Measure-UPS to select the next parameter or operational setting in the order shown in the table in the command description. When you use the Edit command "-" immediately following the "I" command, you can then directly enter ASCII characters. The Measure-UPS returns the message "OK" when you send the Edit command following a Measure-UPS Customizing Command.

Caution: Since the use of the Edit command is shared by APC UPSs, it is possible for an UPS-Link user to inadvertently customize the UPS by sending the Edit command twice (i.e. key stroke bounce) after you send a UPS Customizing Command directly before a Measure-UPS Customizing Command.

"[" Upper Temperature Alarm Limit

The Measure-UPS sends an asynchronous Alarm message when the measured local ambient temperature is above a pre-set value selectable from among four choices. Sending the ASCII character "[" causes the Measure-UPS to respond with "*dd.dd*" characters directly representing the UPS's current upper temperature alarm limit in degrees Celsius. When you use the Edit command "-" directly following this command, the Measure-UPS selects the next temperature limit in the order shown in the following table. The Measure-UPS is factory-set to the limit shown in the shaded portion of the table.

Returned Message	Upper Temperature Alarm Limit Setting (rounded to the nearest degree)
32.13	32° C (90° F)
45.90	46° C (115° F)
54.06	54° C (129° F)
23.97	23° C (75° F)

"]" Lower Temperature Alarm Limit

The Measure-UPS sends an asynchronous Alarm message when the measured local ambient temperature is below a pre-set value selectable from among four choices. Sending the ASCII character "]" causes the Measure-UPS to respond with "*dd.dd*" characters directly representing the UPS's current lower temperature alarm limit in degrees Celsius. When you use the Edit command "-" directly following this command, the Measure-UPS selects the next temperature limit in the order shown in the following table. The Measure-UPS is factory-set to the limit shown in the shaded portion of the table.

Returned Message	Lower Temperature Alarm Limit Setting (rounded to the nearest degree)
04.08	4° C (39° F)
09.94	10° C (50° F)
14.02	14° C (57° F)
18.10	18° C (65° F)

"{" Upper Relative Humidity Alarm Limit

The Measure-UPS sends an asynchronous Alarm message when the measured local ambient relative humidity is above a pre-set value selectable from among four choices. Sending the ASCII character "{" causes the Measure-UPS to respond with "ddd.d" characters directly representing the UPS's current upper relative humidity alarm limit in percent. When you use the Edit command "-" directly following this command, the Measure-UPS selects the next humidity limit in the order shown in the following table. The Measure-UPS is factory-set to the limit shown in the shaded portion of the table.

Returned Message	Upper Relative Humidity Alarm Limit Setting
070.0	70% RH
080.0	80% RH
084.5	84.5% RH
090.1	90.1% RH

"}" Lower Relative Humidity Alarm Limit

The Measure-UPS sends an asynchronous Alarm message when the measured local ambient relative humidity is below a pre-set value selectable from among four choices. Sending the ASCII character "}" causes the Measure-UPS to respond with "ddd.d" characters directly representing the UPS's current lower relative humidity alarm limit in percent. When you use the Edit command "-" directly following this command, the Measure-UPS selects the next humidity limit in the order shown in the following table. The Measure-UPS is factory-set to the limit shown in the shaded portion of the table.

Returned Message	Lower Relative Humidity Alarm Limit Setting
010.0	10% RH
020.1	20.1% RH
030.2	30.2% RH
040.3	40.3% RH

"I" Alarm Enable

You can disable the asynchronous Alarm message for any of the temperature and relative humidity conditions that are outside the range of the pre-set limits or for any contact closure input state changes. Sending the ASCII character "I" causes the Measure-UPS to respond with a two-digit hexadecimal coded message that can be deciphered to find the status of the Measure-UPS's alarm enable state as shown in the following table. Decode the two hexadecimal characters to obtain two four-bit binary words. The second alphanumeric character represents bits 0 through 3; the first alphanumeric character represents bits 4 through 7. When you use the Edit command "-" directly following this command, you can then enter a new two-digit coded message. The Measure-UPS ignores invalid hexadecimal coded messages, and you must retry the Alarm Enable command. The UPS responds with the message "OK" when you enter a valid Alarm Enable code.

Bit	Alarm Enable Settings (1= enabled)
7	Send Alarm message when temperature exceeds upper temperature limit
6	Send Alarm message when temperature is below lower temperature limit
5	Send Alarm message when humidity exceeds upper relative humidity limit
4	Send Alarm message when humidity is below lower relative humidity limit
3	Send Alarm message when Contact input channel #4 has changed to abnormal state
2	Send Alarm message when Contact input channel #3 has changed to abnormal state
1	Send Alarm message when Contact input channel #2 has changed to abnormal state
0	Send Alarm message when Contact input channel #1 has changed to abnormal state

4.3 Measure-UPS Alert Messages

"&" Measure-UPS Alarm

The ASCII character "&" is asynchronously sent from the Measure-UPS to signal that the ambient temperature or relative humidity is outside the ranges set as the upper and lower temperature and humidity limits, or to signal that one of the contact closure inputs has changed from the selected "normal" state. The message is sent every two minutes whenever an alarm condition exists and is discontinued when all alarm conditions are reset. The Alarm message is sent only for alarm states that have been enabled via the Alarm Enable command. In the case of multiple alarms, the Measure-UPS sends the alarm message once for every alarm condition detected. You can determine the cause of an Alarm message by using the Alarm Status command (the "J" command, documented in Section 4.1, "Measure UPS Inquiry Commands"). This message does not interrupt any commands currently being processed.

5.0 Index of Responses

The following "Index of Responses" lists responses or alert messages your UPS or Measure-UPS accessory can send.

The following categories of responses are not included in this index:

- Hexadecimal coded messages, such as those returned by the "Q", "~", "8", and "7" commands
- Variable responses that do not have a fixed set of possible values
- Responses to commands that have a large number of possible responses in their response set, often specific to different models, such as the "V" (Firmware Version) command and the "u" (Upper Transfer Voltage) command.

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