APC by Schneider Electric UPS-Link Communications Protocol Specification for APC AV Product Family

1.0   Scope

This document describes the UPS-Link Communications Protocol developed by APC by Schneider Electric (formerly American Power Conversion). The control language is used with APC AV products that support "smart" signaling via a computer interface port.

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 AV product that supports "smart" signaling and a host computer terminal. The control language is made up of commands and alert messages specific to APC AV UPSs and to UPS accessories. The groups for UPSs include UPS Control Commands, UPS Status Inquiry Commands, UPS Power Inquiry Commands, and 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**
- Minimum Time Between Transmissions: **see Appendix I**

> **Note:** The pin-out of the computer interface port on APC AV products and accessories is an industry standard straight-through RS –232 DB9 port. Use only industry standard straight through RS-232 cable.

3.0   Control Language - UPS Command Groups

In order to use the UPS-Link language to communicate with an APC AV 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**".

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 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. **Appendix I** lists these commands and messages, provides brief command and message descriptions, summarizes responses from various UPS models, indicates transmit delay times, and indicates the UPS models and types for which each command is valid.

Note: The response time for the UPS commands may vary between 50ms to 300ms. Wait for a response to an UPS-Link command to finish prior to asking the next question.

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**". If the UPS does not receive any command within a period of 150 seconds it will timeout.

"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. The UPS will respond with a "**OK**" to indicate that the UPS received the command. No other commands will be processed following the "OK" response. If turned off while operating on-battery, the UPS does not restart when the utility is restored.

"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.

"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 UPS responds to this command by sending the characters "**OK**".

The test lasts about 16 seconds. The result of the battery test is saved for five minutes for retrieval via the "**X**" UPS Status Inquiry Command. When processing a command that conflicts with the battery test function, the UPS returns the message "**NA**" immediately after the **"W"** command is sent.

"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.

"@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.

The UPSs return an "**OK**" to acknowledge receipt of the command. No other commands will be processed following the "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.

"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 the 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**".

"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.   This command calibrates the returned run time value. The test begins only if battery capacity is 100% and total load (watts) is greater than 10% of rated power. If battery capacity is less than 100% or load is less than 10%, 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.

"Ctrl n"   Turn UPS On

Sending the ASCII character **"Ctrl n"** followed by a greater than 1.5 second delay, then followed by another "**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.

"Ctrl r" Toggle Digital Outlet Bank

Sending the ASCII character "**Ctrl r**" immediately causes the UPS to toggle the Digital Outlets – On to Off and Off to On. The UPS returns "**OK**" to acknowledge the receipt of the command. If this command is sent when the UPS is in STANDBY state (off), the UPS returns the message "**NA**" immediately after the "**Ctrl R**" is sent.

"Ctrl s" Toggle Video Outlet Bank

Sending the ASCII character "**Ctrl s**" immediately causes the UPS to toggle the Video Outlets – On to Off or Off to On. The UPS returns "**OK**" to acknowledge the receipt of the command. If this command is sent when the UPS is in STANDBY state (off), the UPS returns the message "**NA**" immediately after the "**Ctrl s**" is sent.

"Ctrl y" Toggle Analog Outlet Bank

Sending the ASCII character "**Ctrl y**" immediately causes the UPS to toggle the Analog Outlets – On to Off or Off to On. The UPS returns "**OK**" to acknowledge the receipt of the command. If this command is sent when the UPS is in STANDBY state (off), the UPS returns the message "**NA**" immediately after the "**Ctrl y**" is sent.

"Ctrl w"   Toggle High Current Outlet Bank

Sending the ASCII character "**Ctrl w**" immediately causes the UPS to toggle the High Current Outlets – On to Off or Off to On. The UPS returns "**OK**" to acknowledge the receipt of the command. If this command is sent when the UPS is in STANDBY state (off), the UPS returns the message "**NA**" immediately after the "**Ctrl w**" is sent.

"R"   Exit Smart 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**".

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 AV UPS models designed to operate with SmartCell battery packs, such as S15NET. Only these UPSs can automatically sense the number of battery packs connected.

"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".

"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 "048" for a 48 Volt battery system, "024" for a 24 Volt battery system, and "012" for a 12 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.

"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. 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 = replace battery condition
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

" ' "   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 = Inverter Fault
6 - 0	Reserved

"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	Reserved
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	Reserved
1	Reserved
0	1 = UPS's output unpowered due to low battery shut down

Reserved bits are set to zero (0).

"n"   UPS Serial Number

Sending the ASCII character lowercase "**n**" causes the UPS to respond with a string of 12 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.

"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.

"j"   Run Time Remaining

Sending the ASCII character lowercase "**j**" caused the UPS to respond with "_**dddd**_**:**" characters directly representing the UPS's estimated remaining run time in minutes. You can query the UPS when it is operating in the on-lin 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.

"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.

"a"   All Commands Available from UPS

Sending the ASCII character lowercase "**a**" causes the UPS to respond with the ASCII character string "_**x.x.x.x[,]x.x.x.x**_". This string contains UPS-link level, asynchronous characters, and UPS-Link commands in the following format:

"UPS-Link level"[period]"asynchronous characters"[period]"single-character commands"

The terms in this format have the following meanings:

- The "UPS-Link level" is the level to which the UPS has implemented the command set.

- "Asynchronous characters" are all the characters the UPS will send asynchronously.

- "Single-character commands" are all the single-character commands to which the UPS can respond.

- A period "." (shown as [period] in the format) separates fields and is not a command or asynchronous character.

Example:

2.$!*&%.ABCDEFG^?+-SktZ

"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:

750.G1.D

"Ctrl A" UPS Model

Sending the ASCII character "**Ctrl A**" 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).

"_" Outlet Status

Sending the ASCII character "_" causes the UPS to respond with a two-digit hexadecimal coded message that can be deciphered to find the Outlet Bank 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 Outlet Bank Status
7	1 = High Current Outlet Bank On
6	1 = Analog Outlet Bank On
5	1 = Video Outlet Bank On
4	1 = Digital Outlet Bank On
3-0	Reserved

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 ±7.5% of the load rating of UPS. The UPS will respond with **"NA"** if the command is not supported.

"\"   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 ±5% of the maximum of 105%. The UPS will respond with **"NA"** if the command is not supported.

"B"   Battery Voltage

Sending the ASCII character uppercase "**B**" caused the UPS to respond with "*dd.dd*" characters directly representing the UPS's present battery voltage. The typical accuracy of this measurement is ±5% of the maximum value of48 Vdc, 24 Vdc or 12 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."

"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 ±5% of the full scale value of 100°C.

"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 ±1% of the full scale value of 63 Hz.

"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 ±4% of the maximum value of 150 Vac for 100 Vac and 120 Vac version UPSs. The typical accuracy of this measurement is ±4% of the maximum value of 300 Vac for 208 Vac and 220/230/240 Vac version UPSs.

"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.

"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.

"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.

"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 ±5% of the maximum of 150%.

3.4   UPS Customizing Commands

The UPS Customizing Commands provide an alternative to using UPS panel controls to alter UPS operations to suit specific applications. These commands enable you to alter UPS operations remotely.

> **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.

"Ctrl Z" Read All Configurable EEPROM Parameters

Sending the ASCII character "**Ctrl Z**" causes the UPS to respond with a multiple-character string "***dddddddd***..." 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:

    #uD43132135138129uM43230234239224uA43110112114108uI43253264271280lD4310310009
    7106lM431771721681821A43090092081085lI43196188208204e44200155090oI4323024022022
    5oD13115oJ13100oM13208s441HMLLq44202050710p443020180300600k4410TLNr44300006
    0180300E443336168ON 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".

"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.

"-"   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. UPS models for which this command is invalid respond "**NA**" after the "-" has been received.

"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
S	Spanish

"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.

120 Vac UPS	220/230/240 Vac UPS
134 Vac	268 Vac
135 Vac	270 Vac
136 Vac	272 Vac
137 Vac	274 Vac
138 Vac	276 Vac
139 Vac	278 Vac
140 Vac	280 Vac
141 Vac	282 Vac
142 Vac	284 Vac

"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.

120 Vac Version	220/230/240 Vac Version
100 Vac	200 Vac
99 Vac	198 Vac
98 Vac	196 Vac
97 Vac	194 Vac
96 Vac	192 Vac
95 Vac	190 Vac
94 Vac	188 Vac
93 Vac	186 Vac
92 Vac	184 Vac

"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 table. 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.   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.

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

"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 Shutdown Delay ("p" command) settings.

Returned Message	Low Battery Warning Interval Setting
02	2 minutes
05	5 minutes
08	8 minutes
11	11 minutes
14	14 minutes
17	17 minutes
20	20 minutes
23	23 minutes
26	26 minutes

"k"   Audible Alarm

You can customize the Operation of the UPS's audible alarm to either on or off. 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
N	Audible alarm is disabled under all conditions except faults
T	Mute current beeping.
0	Audible alarm enabled

"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.

Returned Message	UPS Shutdown Delay Interval Setting
000	000 seconds
090	090 seconds
180	180 seconds
270	270 seconds
360	360 seconds
450	450 seconds
540	540 seconds
630	630 seconds

"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
120	120 seconds
180	180 seconds
240	240 seconds
300	300 seconds
360	360 seconds
420	420 seconds

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.

"+"   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.

"?"   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.

"#"   Replace Battery

The ASCII character "#" is asynchronously sent from the UPS if the UPS's battery test has determined that a replace battery condition exists, i.e. the battery is unable to retain an adequate charge. The message does not interrupt any commands currently being processed and is sent every five hours until a new battery test is run or the UPS is turned off. If the UPS's battery is not replaced, each successive battery test results in a replace battery condition, and the replace battery message continues to be sent. However, if the battery subsequently recharges to at least 10% of the UPS's load rating, the replace battery message ceases after the battery test is rerun.

4.0 Environmental Monitoring Command Group

There are two commands available for the Environmental Monitoring Command Group: Ambient Temperature and Humidity.

4.1　　　Environmental 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 ±2% of full scale over the range of values from 0°C to 65°C (32°F to 149°F).

"h"　　Ambient 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 ±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 ±5% RH over ambient temperatures from 15° to 35°C.

Table of Contents