

Tripplite Communication Protocol 2012

History

Legend:

1. Items in black are supported.
2. Items in blue are supported but are user defined, these are Tripplite specific.
3. Items in red are not supported.

Report Descriptor Skeleton

UPS application collection
 PowerSummary physical collection
 AC input collection
 End AC input collection
 PresentStatus logical collection
 End PresentStatus logical collection
 End PowerSummary physical collection
 BatterySystem physical collection
 Battery physical collection
 PresentStatus logical collection
 End PresentStatus logical collection
 End battery physical collection
 End BatterySystem physical collection
 Flow physical collection
 End flow physical collection
 PowerConverter physical collection
 PresentStatus logical collection
 End PresentStatus logical collection
 End PowerConverter physical collection
 OutletSystem physical collection
 Outlet physical collection
 PresentStatus logical collection
 End PresentStatus logical collection
 End outlet physical collection
 Outlet physical collection
 PresentStatus logical collection
 End PresentStatus logical collection
 End outlet physical collection
 End OutletSystem physical collection
 Vender defined collection
 End vender defined collection
End UPS applicaion collection

This document describes the report descriptor protocol. This protocol applies to 2 types of communication ports: The USB and the RS232.

1. Tripp Lite USB Report Descriptor Protocol

This protocol attended to describe the protocol layer between UPS USB Report Descriptor and Application Software. Instead of the formal way creating an UPS Report Descriptor, the point of view of Power Device structure will be used to create a Report Descriptor of USB based UPS.

A UPS Report Descriptor include six items, that is "Power Configuration Controls", "Power Controls", "Power Generic Status", "Power Device Identification", "Power Measures" and "Battery System", Each Item share with one corresponds Report ID, and each Report ID field is pre-defined (Order, Byte #, Unit in each Report ID).

2. TrippLite Protocol (Tripp Lite Serial Report Descriptor Protocol)

The purpose of this protocol is used to transfer the Report Descriptor from USB to serial communication so that the UPS can build in 2 communication ports(USB & RS232) with less efforts. The benefits of this protocol do not only reduce the developing time but also save the limited RAM.

The PC end communicates with the UPS continually that means it won't wait 1 second for each frame any more.

RS232 Configuration:

Baud: 2400

Data: 8 bits

Parity: None

Start Bit: 1

Message Format(Binary):

Header	Type	Length	Report ID	Data	Check Sum
1 byte	1 byte	1byte	1 byte	64 bytes max	1 byte

2.1 Header

The header will be a '~' character., 0x7E in hex.

2.2 Type

0x01 - Command rejected (UPS → Computer)

0x02 - Command accepted (UPS → Computer)

0x03 - Polling command (Computer → UPS)

0x04 - Set command (Computer → UPS)

0x05 - Data returned (UPS → Computer)

2.3 Length

The length is the number of bytes from “Report ID” to “Data” items.

2.4 Report ID

To identify which item the software inquires.

2.5 Data

2.5.1 Polling Commands:

The frames look like...

PC->UPS(Inquire Input Voltage)

Header	Type	Length	Report ID	Data	Check Sum
0x7E	0x03	0x02	0x18	0x00	0x9B

UPS->PC(return 120V)

Header	Type	Length	Report ID	Data		Check Sum
0x7E	0x05	0x03	0x18	Lo	Hi	0x52
				0xB0	0x04	

2.5.2 Set Commands:

The frames look like...

PC->UPS(Set Shutdown Time 60 seconds)

Header	Type	Length	Report ID	Data		Check Sum
0x7E	0x04	0x03	0x15	Lo	Hi	0xD6
				0x3C	0x00	

UPS->PC

Header	Type	Length	Report ID	Data		Check Sum
0x7E	0x02	0x03	0x15	Lo	Hi	0xD4
				0x3C	0x00	

2.6 Check Sum

Sum the bytes from “Header” to “Data”. Overflow ignored.

3. Tripplite Communication Protocol

Power Summary Collection						
Report ID #	Usage (usage page : usage ID)	Byte #	Unit	Type	R/W	Supported ?
40	➤ iProduct (0x84:0xfe)	1		Feature	R	Y
41	➤ iSerialNumber (0x84:0xff)	1		Feature	R	Y
43	➤ iManufacture (0x84:0xfd)	1		Feature	R	Y
48	➤ ConfigVoltage(Input Line) (0x84:0x40)	1	1V	Feature	R	Y
49	➤ Voltage(Input Line) (0x84:0x30)	2	0.1V	Feature	R	Y
17	➤ AudibleAlarmControl (0x84:0x5a)	1		Feature	R/W	Y

- For items with i prefix, these are string indexes for USB. For RS232 communications, the string is reported directly instead of the string index.
- iProduct: Index of a string descriptor describing product.
- iSerialNumber: Index of a string descriptor describing the device's serial number. This field is used to report firmware part number also e.g. for fw-2263 revision A, you get "FW-2263 A". Also see report id 194.
- iManufacture: Index of a string descriptor describing manufacture.
- ConfigVoltage: Nominal value of the input line voltage.
- Voltage: Value of the input line voltage.
- AudibleAlarmControl: 1: Disable, 2: Enable, 3: Temporary Mute (not supported)

Report ID #	Usage (usage page : usage ID)	Byte #	Unit	Type	R/W	Supported?
50	➤ PresentStatus (0x84:0x02) Bit field (bit0->bit7) 0 ShutdownImminent (0x84:0x69) 1 ACPresent (0x85:0xd0) 2 Charging (0x85:0x44) 3 Discharging (0x85:0x45) 4 NeedReplacement (0x85:0x4b) 5 BelowRemainingCapacityLimit (0x85:0x42) 6 FullyCharged (0x85:0x46) 7 FullyDischarged (0x85:0x47)	1		Feature & Input	R	Y Y Y Y Y Y Y Y
42	➤ iDeviceChemistry (0x85:0x89)	1		Feature	R	Y
98	➤ iOEMInformation (0x85:0x8f)	1		Feature	R	N
51	➤ CapacityMode (0x85:0x2c)	1		Feature	R	Y
52	➤ RemainingCapacity (0x85:0x66)	1		Feature & Input	R	Y
58	➤ RemainingCapacityLimit (0x85:0x29)	1		Feature	R	N
55	➤ FullChargeCapacity (0x85:0x67)	1		Feature	R	Y
54	➤ DesignCapacity (0x85:0x83)	1		Feature	R	Y
56	➤ WarningCapacityLimit (0x85:0x8c)	1		Feature	R	N
59	➤ CapacityGranularity1 (0x85:0x8d)	1		Feature	R	N
57	➤ CapacityGranularity2 (0x85:0x8e)	1		Feature	R	N
44	➤ Rechargeable (0x85:0x8b)	1		Feature	R	N
53	➤ RunTimeToEmpty (0x85:0x68)	2	Sec	Feature & Input	R	Y

- ShutdownImminent: This should report a 1 when the unit is reporting Low Battery. (See documentation on LVC and LBW)
- ACPresent: Set this if AC input is VALID.
- BelowRemainingCapacityLimit is handled the same as ShutdownImminent. (regardless of its standard HID definition of less than RemainingCapacityLimit)
- FullyCharged: Set this if RemainingCapacity is 100.

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- Charging: Set this whenever the charger is running. (even if the unit is in float mode)
- Discharging: Set this whenever the unit is in invert mode and not charging.
- FullyDischarged: This is always read as 0.
- NeedReplacement: This is set if the unit had failed a Selftest due to a low battery indication.
- iDeviceChemistry: Index of a string descriptor containing the battery's chemistry.
- iOEMInformation: Index of a string descriptor defining OEM specific information for the battery.
- CapacityMode: 0 = maH, 1 = mWH, 2 = %, 3 = Boolean support only(OK, failed). Normally, the UPS returns value 2, the percentage capacity mode.
- RemainingCapacity: The predicted remaining capacity.
- RemainingCapacityLimit: Whenever the battery's remaining capacity falls below the value in the Remaining Capacity Alarm register, the battery periodically issues a Remaining Capacity alarm.
- FullChargeCapacity: The predicted pack capacity when it is fully charged = 100.
- DesignCapacity: The theoretical capacity of a new pack = 100.
- WarningCapacityLimit: Report this value as 30 and do not use it.
- CapacityGranularity1: Battery capacity granularity between low and warning. Should be 1%
- CapacityGranularity2: Battery capacity granularity between warning and full. Should be 1%
- Rechargeable: Rechargeable Battery(1) / Not Rechargeable Battery(0).
- RunTimeToEmpty: The predicted remaining battery life at the present rate of discharge.

BatterySystem Collection						
Report ID #	Usage (usage page : usage ID)	Byte #	Unit	Type	R/W	Supported?
4	➤ ConfigVoltage(Battery) (0x84:0x40)	2	1V	Feature	R	Y
32	➤ Voltage(Battery) (0x84:0x30)	2	0.1V	Feature	R	Y
35	➤ Battery PresentStatus (0x84:0x02) Bit field (bit0 -> bit7): 0 Charging (0x85:0x44) 1 Discharging (0x85:0x45) 2 NeedReplacement (0x85:0x4B) 3 Reserved 4 Reserved 5 Reserved 6 Reserved 7 Reserved	1		Feature	R	Y Y Y
33	➤ RemainingCapacity (0x85:0x66)	1	%	Feature	R	N
16	➤ Test (0x84:0x58)	1		Feature	R/W	Y
26	➤ Temperature (0x84:0x36)	2	K	Feature	R	N

- ConfigVoltage: Nominal value of the battery voltage.
- Voltage: Actual value of the battery voltage.
- RemainingCapacity: The predicted remaining capacity.
- Test: Write value: Test request value
0: No test (Not supported)
1: Quick test
2: Deep test (Not supported)
3: Abort test (Not supported)
Read value: Test result value
0: No test initiated
1: Done and Passed
2: Done and Warning (Not supported)
3: Done and Error
4: Aborted (Not supported)
5: In progress

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- Temperature: The actual value of the temperature.

AC Flow Collection						
Report ID #	Usage (usage page : usage ID)	Byte #	Unit	Type	R/W	Supported ?
1	➤ ConfigVoltage(Input Line) (0x84:0x40)	1	V	Feature	R	Y
2	➤ ConfigFrequency (0x84:0x42)	1	Hz	Feature	R	Y
5	➤ ConfigPercentLoad (0x84:0x45)	1	%	Feature	R	N
3	➤ ConfigApparentPower (0x84:0x43)	2	VA	Feature	R	Y
85	➤ SiteWiringFault (0xffff:0x93)	1		Feature	R	N

- ConfigVoltage: Nominal value of the AC input voltage.
- ConfigFrequency: Nominal value of the frequency.
- ConfigPercentLoad: Nominal value of the percentage load that could be used without critical overload.
- ConfigApparentPower: Maximum VA capacity of the unit.
- SiteWiringFault: Wiring OK (0) / Wiring Fault (1)

PowerConverter Collection						
Report ID #	Usage (usage page : usage ID)	Byte #	Unit	Type	R/W	Supported ?
24	➤ (Input) Voltage (0x84:0x30)	2	0.1V	Feature	R	Y
25	➤ (Input) Frequency (0x84:0x32)	2	0.1Hz	Feature	R	Y
27	➤ (Output) Voltage (0x84:0x30)	2	0.1V	Feature	R	Y
28	➤ (Output) Frequency (0x84:0x32)	2	0.1Hz	Feature	R	N
71	➤ (Output) ActivePower (0x84:0x34)	2	SEE NOTE	Feature	R	Y
6	➤ LowVoltageTransfer (0x84:0x53)	2	V	Feature	R	N
9	➤ HighVoltageTransfer (0x84:0x54)	2	V	Feature	R	N
34	➤ Power PresentStatus (0x84:0x02) Bit field (bit0 -> bit15) 0 VoltageOutOfRange (0x84:0x63) 1 Buck (0x84:0x6F) 2 Boost (0x84:0x6E) 3 Undefined 4 Overload (0x84:0x65) 5 UPS Off (0x84:0x6D) 6 OverTemperature (0x84:0x67) 7 InternalFailure (0x84:0x62) 8 Undefined 9 Reserved 10 Undefined 11 Undefined 12 Undefined 13 Undefined 14 AwaitingPower (0x84:0x72) 15 Undefined	2		Feature	R	Y Y Y Y Y N N Y

- ActivePower1: The units of this ID are in Watts. Note however that there is a null value defined as 0xFFFF. If the unit reports 0xFFFF, this is an indication that watts are not supported for the model, so the variable should not be displayed.

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- LowVoltageTransfer: The minimum line voltage allowed before the UPS system transfers to battery backup.
- HighvoltageTransfer: The maximum line voltage allowed before the UPS system transfers to battery backup.
- VoltageOutOfRange is the opposite of ACPresent.
- Buck: This is for units with omni tap functionality. If the unit is reducing the AC input voltage set this bit.
- Boost: This is for units with omni tap functionality. If the unit is increasing the AC input voltage set this bit.
- Overload: Set this bit if the unit is currently overloaded (load > 110%), ~~or if it had shutdown due to an overload.~~
- UPS Off: This usage is unused. It is also ambiguous as the Smart family identifies it as UPSOff, while previous OmniSmart protocols identified it as UPSON. The HID Usage table spec identifies this usage as "Used" which basically is intended to indicate that a given Power Converter is utilized in a UPS power system. This usage is not used by any known software, and the values reported are irrelevant, but kept for historical sake.
- AwaitingPower: Always read as 0.
- **OverTemperature and InternalFailure usages are reported by the report descriptors, but the unit does not support these features and always reports 0 for their value.**

OutletSystem Collection						
Report ID #	Usage (usage page : usage ID)	Byte #	Unit	Type	R/W	Supported ?
160	➤ ShutdownRequested (0x84:68)	1		Feature	R/W	N
21	➤ DelayBeforeShutdown (0x84:0x57)	2	Sec	Feature	R/W	Y
182	➤ AutoRestartAfterSDCmd (0xffff:C7)	1		Feature	R/W	Y
22	➤ DelayBeforeStartup (0xffff:0x56)	2	Min	Feature	R/W	N
23	➤ DelayBeforeReboot (0x84:0x55)	2	Sec	Feature	R/W	Y
97	➤ DelayBeforeStartup (0x84:0x56)	2	Sec	Feature	R/W	N
30	➤ PercentLoad (0x84:0x35)	1	SEE NOTE	Feature	R	Y
65	➤ PowerOnDelay (0xffff:0x81)	1	Sec	Feature	R/W	N
81	➤ OutputSource (0xffff:0x91)	1		Feature	R	Y
84	➤ ActivePower (0x84:0x34)	2	W	Feature	R	N
83	➤ WatchdogAlarm (0xffff:0x93)	1		Feature	R/W	N
86	➤ EmergencyPowerOff (0xffff:0x94)	1		Feature	R/W	N
103	➤ SwitchOutletMap (0xffff:0x95) b7 b6 b5 b4 b3 b2 b1 b0	1		Feature	R	N
104	➤ SwitchOutletState (0xffff:0x96) b7 b6 b5 b4 b3 b2 b1 b0	1		Feature	R	N
105	➤ SwitchOutletControlMap (0xffff:0x98) b7 b6 b5 b4 b3 b2 b1 b0	1		Feature	R/W	N
106	➤ SwitchOnControl (0xffff:0x99)	1		Feature	W	N
107	➤ SwitchOffControl (0xffff:0x9A)	1		Feature	W	N

- ShutdownRequested: If the byte is set to 1, then the unit will shut down after 10 seconds. Setting the byte to 0 will cancel the shutdown. (Unit will not auto-start for valid line after shutdown)
- DelayBeforeShutdown: Writing this value shuts down either the output after the indicated number of seconds, or sooner if the batteries become depleted.
Setting this object to 0 causes the shutdown to occur immediately. Setting this object to -1 aborts the countdown.

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When read, "Delay Before Shutdown" will return the number of seconds remaining until shutdown, or -1 if no shutdown countdown is in effect. After the shutdown, depending on the state `AutoRestartAfterSDCmd`, the unit will auto-start if line becomes valid again. Note: If this command is sent to the unit while it was in line mode, the unit will not auto-restart, because line is already valid. It will take a blackout, and then valid line being reapplied before the unit will auto-restart. (Of course the user always has the option of pressing the button to turn the unit back on).

- `AutoRestartAfterSDCmd`: If this is set to 1, after a `DelayBeforeShutdown` command, the unit will Auto-Restart to line mode, if it becomes valid again. If this is not set, the unit will not automatically restart if valid line is seen. Note that the `AlwaysOn` and `AlwaysOFF` settings override this function.
- `DelayBeforeStartup`: A program should use either the Report ID 22 or the Report ID 97 to set the value of "Delay Before Startup". Writing this value starts the output after the indicated number of seconds in "Delay before Startup".
Sending this command with -1 aborts the countdown. If the countdown expires during a utility failure, the startup shall not occur until the utility power is restored.
- `DelayBeforeReboot`: Writing this value immediately shuts down the output for a period equal to the indicated number of seconds in `DelayBewforeReboot`. When read, `DelayBeforeReboot` returns the number of seconds remaining in the countdown, or -1 if no countdown is in progress.
- `PercentLoad`: The units for this ID are %. If this reports 0xFF then it implies that the load Percentage information is temporarily not valid and the software should display N/A. Note that the unit MAY support Percentage Load in other modes.
- `PowerOnDelay`: Delay the UPS startup after power restores. The power quality may not stable when power restores, this feature let the UPS wait a period of time to startup the system.
- `OutputSource`: 0 = Normal(0) / Battery (1) / Bypass (2) / Reducing (3) / Boosting (4) / Manual Bypass (5) / [None \(6\)](#).
- `ActivePower`: The actual value of the power wattage.
- `EmergencyPowerOff`: Disable(0) / Enable(1)
- `SwitchOutletMap`: Bitmap indicating presence of outlets, receptacles, or other distribution mechanism. The outlets are numbered 0..15 from LSB to MSB, a 1 indicates a controllable outlet is present in the corresponding location. If this object is 0, UPS has no switchable outlets.
- `SwitchOutletState`: Indicates current states of switchable outlets. A 1 indicates a controllable outlet is on in the corresponding location.
- `SwitchOutletControlMap`: Bitmap of new outlet states for `outletsOn`, `outletsOff`.
- `SwitchOnControl`: Control the Switch (output Receptacle) On sequence
Write value: 0: Stop sequence 1: Start sequence
Read value: 0: None 1: Started 2: In Progress 3: Completed
- `SwitchOffControl`: Control the Switch (output Receptacle) Off sequence
Write value: 0: Stop sequence 1: Start sequence
Read value: 0: None 1: Started 2: In Progress 3: Complete

Miscellaneous Collection						
Report ID #	Usage (usage page : usage ID)	Byte #	Unit	Type	R/W	Supported ?
13	➤ iModelString (0xffff:0x75)	1		Feature	R	N
14	➤ iModelStringOffset (0xffff:0x76)	1		Feature	R	N
15	➤ UpsType (0xffff:0x7c)	1		Feature	R	N
108	➤ CommProtocol (0xffff:7d)	2	BCD	Feature	R	Y

- iModelString: Index of a string descriptor describing model names string.
- iModelStringOffset: Offset of the UPS model name in the model names string.
- UPSType:

Low 4 bits	Result
	0: On-Line
	1: Off-Line
	2: Line-Interactive
	3: Simple On-Line
	4: Simple Off-Line
	5: Simple Line-Interactive
High 4 bits	Result
	Indicates the firmware version
- **CommProtocol**: numeric value indicating the communication protocol of the unit.
 This protocol number is 0x2012

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