[APPLICATION NOTE #181]

Smart-UPS™ Communications

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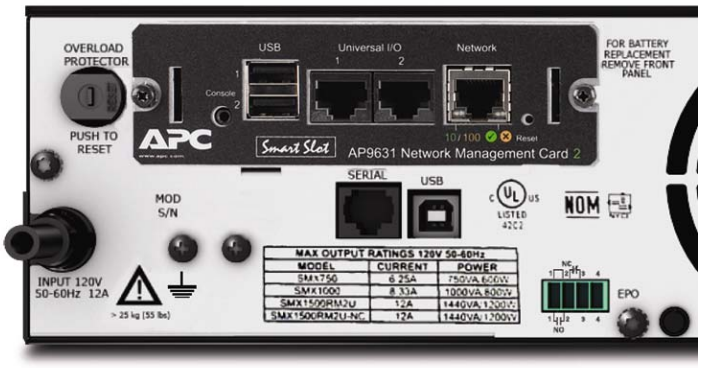
PROJECT AT A GLANCE

Project Type

Manage the behavior of the Smart-UPS with one of the smart interfaces. Communicate with the UPS to monitor, configure and control its operation, or to integrate shutdown sequences with external equipment, including servers.

Applicable Products

All APC Smart-UPS with an RJ-45 (serial) connector, including: SMT, SMC, SMX, and SURTD.



Smart-UPS Communications

Connecting and communicating with your APC Smart-UPS allows you to get the most value out of the UPS and you entire system. With multiple options available, chose the one that best fits your application.

Management and configuration of the UPS can be achieved using APC's software products, such as Power Chute Business Edition, APC's network accessories via Ethernet, or through custom written applications. Connecting your computer to the UPS is essential.

This document outlines the various options available in the Smart-UPS products to connect to your server or equipment.

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1 Introduction

There are several different methods available to communicate with APC Smart-UPS™.

The following Smart-UPS product families are covered in this document:

		Serial RJ-45	USB -Type B	Pre-installed UPS Network Management Card 2	SmartSlot
Smart-UPS	SMC	X	X		
	SMT	X	X		X
	SMX	X	X		X
	SMX*NC	X	X	X	
Smart-UPS Online	SURTD under 5kVA	X(1)			X
	SURTD 5kVA and higher	X(1)		X	

(1) SURTD offers different functionality through this interface

Table 1- Applicable Products

UPS communication options can be divided into 2 categories: those available as a standard feature, and those that require an additional accessory. For the purposes of this document, communication options that are available in the standard product as delivered to the user are classified as STANDARD, while ones that require an accessory are classified as OPTIONAL.

UPS communications occur on one of several physical media:

- USB
- Serial communications
- Electrical signals communications
- Ethernet

The document is divided into sections related to each physical layer and the options for using these layers.

2 Communication Options

Interface		Cables & Connections	Communication Types	Software options
USB		USB 2.0 Type A to Type B	Smart Communications	PowerChute Business Edition
				Native OS Management
				Custom[1] using USB Power Summary
				Custom[1] using Modbus[2]
Serial RJ-45		AP940-0625[3] or AP940-1525[3]	Smart Communications	PowerChute Business Edition
				Custom[1] using Modbus [2]
		940-0128[3]	Simple Signaling	PowerChute Business Edition
				Custom
		Custom	Simple Signaling	Custom
AP9613	Dry Contact I/O Card	Custom	I/O Signals	Custom
AP9620	Legacy Communications Card	USB 2.0 Type A to Type B or DB-9 serial cable (supplied with comm. card)	Smart communications	PowerChute Business Edition ver ≤8.0
				Custom[1]
AP9630	UPS Network Management Card 2	Ethernet	Smart communications	Web page
				Custom[1] SNMP
AP9631	UPS Network Management Card 2 with Environmental Monitoring	Ethernet	Smart communications	Web page
				Custom[1] SNMP
AP9810	Dry Contact I/O Accessory for AP9631	Custom	I/O	-

Table 2- Smart-UPS Communication Options

[1]Open source application available for this option (e.g. APCUPSD)
[2]Modbus communications supported in some models. See AN #176 for details
[3]Contact APC Tech Support for availability.

3 USB Communications

3.1 Standard Features

Only available on products with USB ports: SMT, SMC, and SMX product families. (Note: Not available on SURTD)

3.1.1 PowerChute Business Edition

Using a standard USB cable, connect the UPS to a computer running the software PowerChute Business Edition - which ships with every UPS rated below 5kVA. PowerChute gives the user the ability to configure and monitor the UPS and to allow the UPS to safely shut down the computer when there is a power outage.

3.1.2 Native Operating System Safe Shutdown

The UPS implements industry standard data elements, ensuring compatibility with the operating system of the computer. The host operating system will be capable of instructing the computer to shut down when the UPS deems it necessary. Compatibility with Windows and MAC is provided by the operating system, and Linux native shutdown is commonly provided via APCUPSD, an open source application. All of these are tested for compatibility with our UPS for shutdown functionality.

3.1.3 Custom Programming Interface

The following table indicates a partial list of data points that are available via the USB communications interface that is included in all Smart-UPS units. For a complete list of data items and interface options, see App Note #178 (USB HID Implementation in Smart-UPS).

Signal	UPS Output	Description
Firmware Version	Output	Firmware version of the UPS
SKU Name	Output	SKU number of the UPS
Serial Number	Output	Serial Number of the UPS
Manufacture Date	Output	Manufacturer date of the UPS
Alarm Mute	Input	Commands the beeper to enable or disable
Run Time Remaining	Output	The amount of run time that the unit has remaining when on battery
Battery Voltage	Output	The battery voltage
State of Charge	Output	The state of charge of the battery system (100% = fully charged)
Shutdown Imminent	Output	Indicates that the UPS will turn off its output
Battery Replacement	Output	Indicates that the battery needs replacement
On Battery	Output	Indicates that the unit is operating on battery
Battery Present	Output	Indicates that the battery is present
Overload	Output	Indicates that the unit is in an overload condition
Temperature	Output	Indicates the temperature of the unit
Shutdown UPS	Input	Commands the UPS to turn its output off (can be done with delay)
Transfer Sensitivity	Input	Configures the sensitivity of the UPS to input power.

Table 3- Partial List of Data Available via USB

3.2 Optional Accessories

Accessory	Description
AP9620	Legacy Communications Card

Table 4- Accessories for USB communication

3.2.1 Legacy Communications Card (AP9620)

This SmartSlot™ card may be used to provide the historical USB interface that existed on previous versions of products. This is useful for customers who have already written software to communicate with older products and want compatibility with the new product. This card emulates the serial communications that was supported on previous versions of the product through DB-9 connectors.

Note: USB functionality is not supported on SURTD family.

4 Simple Signal Communications

4.1 Standard Features

All Smart-UPS covered by this document contain a similar communications interface.

This interface offers one connector, an RJ-45 serial connector.

The RJ-45 serial connector provides the following physical port on the back of the UPS.

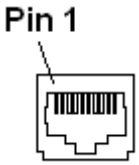

Figure 1 – Electrical Signal Communication Interface

This interface is designed to connect to a computer's serial port, therefore one should consider the power available to be driven through an NPN transistor and have a pull down voltage of 0.5V (min) with a maximum of 20mA.

Table 4 describes the signals available on this interface. Below are the definitions to the various input and output types used.

4.1.1 Output Type 1 Characteristics

This output will have a voltage of 5V when active, and voltage of -5V when inactive. It is intended to be connected to an RS-232 device, and can drive a non-inductive impedance of ≥ 3KOhm. There is a tolerance of the voltage of ±10%.

4.1.2 Output Type 2 Characteristics

This is an Open Collector output, and will sink current when active. It should be connected to a supply voltage between 2.4V and 25V with appropriate non-inductive impedance to limit the current to <5mA. The open collector output voltage may be as high as 1.2V when sinking current up to 5mA.

4.1.3 Input Type 1 Characteristics

The input circuit is designed to be active when a voltage of between 2.4V and 25V is applied. The signal is inactive when the input is < 0.6V or left unconnected. This pin is intended to interface with RS-232 drivers. Resistance to ground is approximately 3KOhms. The maximum voltage that can be applied to this pin is +/-25V.

4.1.4 Input Type 2 Characteristics

The input circuit is designed to be active when a voltage of between 4.8V and 25V is applied. The signal is inactive when the input is < 0.6V or left unconnected. This pin is intended to interface with RS-232 drivers. Resistance to ground is approximately 100KOhms. The maximum voltage that can be applied to this pin is +/-25V.

Pin	Signal	Direction	Description
1	+24V	Output	Switched 24 Volt DC output, jumper required to enable *Not supported by SURTD*
2	Power Fail	Output Type 1	Positive voltage indicates an AC Power Failure. RS-232 level output.
3	Shutdown Imminent	Output Type 2	Stops sinking current when the output of the UPS is scheduled to turn off.
4	Chassis Ground	Output	Used for drain wire termination in shielded cables.
5	+24V Enable	Input	Used to enable the +24V output at pin 1. Short pin 5 to pin 7 to enable Pin 1 +24V output. *Not supported by SURTD*
7	Signal GND	Output	Signal ground for all inputs and outputs
8	Inverter Shutdown	Input Type 1	Application of positive voltage for >= 5 seconds starts a delayed shut down of the UPS during a power failure. RS-232 level input.
9	UPS Turn Off	Input Type 2	Application of positive voltage for >= 0.25 seconds turns off the UPS immediately. *Not supported by SURTD*
10	UPS Turn On	Input Type 2	Application of positive voltage for >= 0.25 seconds when AC power is OK starts a (delayed) turns on of the UPS. *Not supported by SURTD*

Table 5- Simple Signals Available on RJ Interface

4.2 Optional Accessories

Accessory	Description
AP940-0128	Simple Signal Cable – RJ-45 to DB-9 Serial port (6ft or 15ft in length)
AP9613	Relay I/O
AP98275	Kit including RJ-45 converter to Legacy DB-9 connector
AP9620	Legacy Communications Card
AP9631	UPS Network Management Card 2 with Environmental Monitoring
AP9810	Dry Contact I/O Accessory for AP9631

Table 6- Accessories for Electrical Signal Communications

4.2.1 Simple Signal Cable (AP940-0128)

This cable is designed to interface a Smart-UPS to a computer's serial port. It provides 3 signals to the serial port, Power Failure, Shutdown Imminent, and the Shutdown Command pin.

4.2.2 Relay I/O Card (AP9613)

This SmartSlot™ card is designed to provide isolated dry contacts for user

interface to equipment. This is typically used in applications which do not have a computer connected.

4.2.3 UPS Signaling Cable for IBM iSeries or AS/400 (AP98275)

Although this cable package indicates that it is for the AS/400 computer systems it contains several cables. One of these cables (940-3000A) is a converter from the RJ-45 to the legacy DB-9 connector. This solution replicates the interface that was on the SUA product family however it does not implement pin 6 (On Battery normally closed), or the Remote Off functionality.

4.2.4 Legacy Communications Card (AP9620)

This SmartSlot™ card may be used to provide the historical Serial interface that existed on previous versions of products. This is useful for customers who have already written software to communicate with older products and want compatibility with the new product.

4.2.5 UPS Network Management Card 2 with Environmental Monitoring (AP9631) with Dry Contact I/O Accessory (AP9810)

This solution provides an input and output contacts which can be configured with the web interface that is provided with the SmartSlot™ card.

5 Serial Communications

5.1 Standard Features

All Smart-UPS covered by this document contain a serial communications interface that can be used by the customer. The cables 940-0625 or 940-1525 can be used to interface with a standard DB-9 connector on a computer.

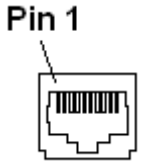

Figure 2 – Serial Communication Interface

Pin	Signal	Direction	Description
1			
2	UPS TX	Output	RS-232 output from the UPS
3			
4	Chassis Ground	Output	Used for drain wire termination in shielded cables.
5			
7	Signal GND	Output	Signal ground for all inputs and outputs
8	UPS RX	Input	RS-232 input to the UPS
9			
10			

Table 7- Signals Available on Electrical Interface

5.1.1 Power Chute Business Edition

The serial cable provided with the UPS can be connected to a computer's serial port to allow communication. The software Power Chute Business Edition can be used to provide safe shut down of the computer, as well as give the user the ability to configure and monitor the UPS.

5.2 Optional Accessories

Accessory	Description
AP9620	Legacy Communications Card
AP9630	UPS Network Management Card 2
AP9631	UPS Network Management Card 2 with Environmental Monitoring

Table 8- Accessories for USB Communication

5.2.1 Legacy Communications Card (AP9620)

This SmartSlot™ card may be used to provide the USB interface that existed on previous products. This is useful for customers who have already written software to communicate to this specification.

Note: AP9620 is not compatible with SURTD family.

5.2.2 UPS Network Management Card 2 (AP9630) or UPS Network Management Card 2 with Environmental Monitoring (AP9631)

This solution provides a serial programming interface which can be used to communicate to both the network interface and the UPS parameters.