

4421 Power Meter and RS-232 Interface

By David Farcus
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The 4421 RF Power Meter

Since its release in the 1980's, the 4421 Multifunction Power Meter has found its way into laboratories and semiconductor processing facilities all over the world. The 4421 Power Meter, along with a precision power sensor, is part of a RF power measurement system that has become known for being highly accurate and very reliable.

Along with the easy to use buttons located on the front panel, the 4421 RF Power Meter has an integrated RS-232 port along with a separate GPIB bus (IEEE-488). This allows the 4421 RF Power Meter to be easily incorporated into any setup that is using standard laboratory test equipment.

RS-232 Interface

The interface between the computer and the 4421 Power Meter is a purely asynchronous communication. While the 4421 Power Meter doesn't use all of the pins in the DB-25 connector on the back panel, there are several pins that are critical for it to correctly communicate to a PC.

Pin	Designation	Notes
1	Protection Ground	Chassis Ground
2	Transmit Data	
3	Receive Data	
4	Request to Send	(Output) Set true after module power up
5	Clear to Send	(Input) Set by input device. When true, it enables the module to transmit. When false, it disables transmission.
6	Data Set Ready	(Input) Set internally true by module
7	Signal Ground	Return path for data and control signals
8	Receive Signal DET	(Input) Set true by module
20	Data Terminal Ready	(Output) Set true after module power up

Table 1: RS-232 Pin Assignment in the 4421 Multifunction Power Meter

Since there has been some confusion in the past on connecting a 4421 Power Meter to a computer through the RS-232 serial port, a little explanation of the RS-232 interface may be needed.

RS-232 Basics

There are two types of equipment used in RS-232 serial communications: DCE and DTE. DCE stands

for Data Communication Equipment (a modem) and DTE stands for Data Terminal Equipment (a PC). The 4421 Power Meter and the computer cannot be connected directly together because 1) the PC has a DB-9 Serial port and the 4421 Power Meter has a DB-25 Connection and 2) both are configured to work as a DTE. To get the units to interface and work correctly, a 9-pin to 25-pin adapter is needed as well as a 25-pin NULL modem adapter.

The serial port on a computer, needed for RS-232 communications, is normally a DB-9 female connector. The RS-232 port on back of the 4421 Power Meter is a DB-25 female connector.

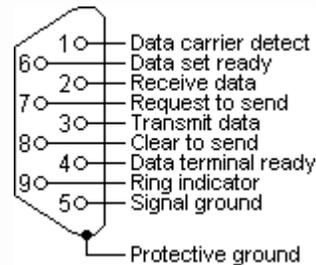


Figure 1: RS232 DB-9 pin outs

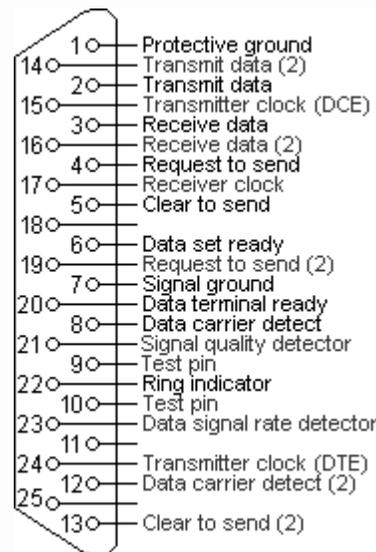


Figure 2: RS232 DB-25 pin outs

As the figures above illustrate, the Receive and Transmit Pins (Pins 2 & 3) are reversed on the DB-9 compared to the DB-25. The DB-9 to DB-25 adapter takes care of this issue.

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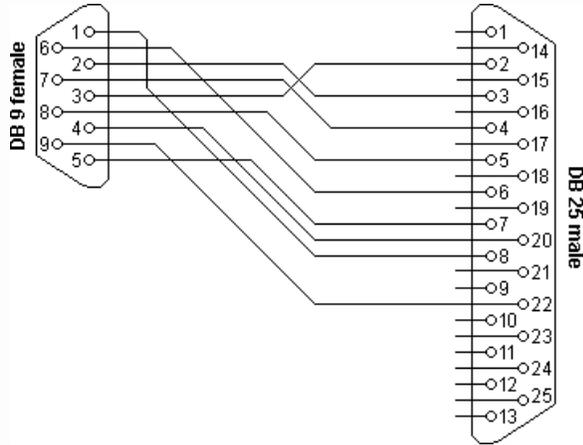


Figure 3: RS232 DB9 to DB25 converter

The NULL modem adapter allows the receive data and the transmit data lines to cross. It also loops the Request to Send line back into the Clear to Send line and the Data Carrier Detect line at both ends of the NULL modem, satisfying need for these signals by both DTEs. (This is only needed if there is Hardware Control in the communication setup)

Testing the RS-232 Port on the 4421 Multifunction Power Meter

As a quick test to see if the 4421 Power Meter is communicating correctly over the RS-232 port, follow these instructions:

1. Set the switches next to the RS-232 port match the picture below:

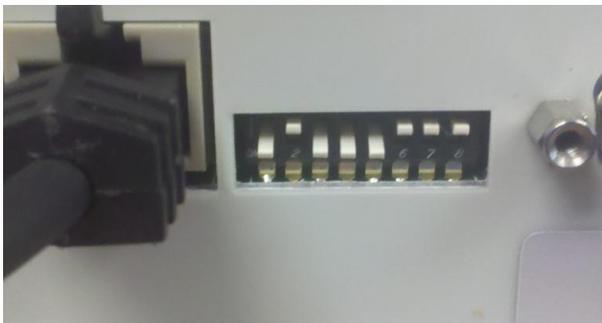


Figure 4: RS-232 Switch Settings

2. Cycle the ON/OFF switch on the back of the 4421 Power Meter. (This will make sure that the new switch settings are accepted by the unit.)
3. Attach the 4421 Power Meter to the PC through a 9-pin serial cable, 9-pin to 25-pin adapter, and NULL modem.
4. Attach the 4421 Power Meter to a precision power sensor through the 8-pin Latch-N-Lock Interface Cable.
5. Turn on the 4421 Power Meter. (Wait for the 4421 Power Meter to get to the 0.000W display)
6. Launch HyperTerminal on the PC using the following settings:
 - a. COM1
 - b. 9600 baud
 - c. No parity
 - d. 8 data bits
 - e. 1 stop bit
 - f. no flow control
7. In HyperTerminal, type "RC". Verify that "RFL" appears on the front panel display of the 4421 Power Meter and "FWD" disappears.
8. Type "FC" and verify that "FWD" appears on the display and "RFL" disappears.
9. On the front panel of the 4421 Power Meter, press the "FWD" button. In the HyperTerminal window, the message similar to "NFC 0.0000 W" should appear. (The exact numbers aren't important)

Conclusion

The 4421 Multifunction Power Meter and precision power sensor are valuable tools that can be integrated into any automated test system using RS-232 as long as you understand how the 4421 Power Meter is configured and the basic principles of the RS-232 Communication Interface. Armed with this knowledge, you will be communicating with your 4421 Power Meter as easily as pushing any of the buttons on its front panel.