

# Programmable D.C. Electronic Load



**PEL-2004A**



**PEL-2002A**



## FEATURES

- \* Sequence Function to do High Speed Load Simulations
- \* Flexible Configuration with Mainframes and Plug-in Modules
- \* Multiple Independent Load Inputs up to 8 Channels in a Mainframe
- \* Parallel Connection of Inputs for Higher Load Capacity
- \* Program Mode to Create Work Routines for Repetitive Tests
- \* OPP/OCP/OVP/OTP/RVP/UVP Protections
- \* External Channel Control/Monitoring via Analog Control Connector
- \* Multiple-Interface USB Device/Host, RS-232C, and GPIB (Optional)

The PEL-2004A and PEL-2002A are multiple channel, programmable DC electronic loads with a modularized structure. The PEL-2000A Series is designed to meet the continuing shift toward high speed operation in today's semiconductor market. As the power supply units, DC-DC converters, and batteries that drive semiconductor circuits need to follow this shift, power supply design, quality inspection and characteristic certification using high-speed performance loads have become necessary. The PEL-2000A Series includes two types of mainframes and 4 types of load modules to accommodate users' requirements in a flexible manner. Any load module combination can be used with a mainframe to tailor a test system based on the number of channels, and the maximum load power, voltage and current of each channel. Multiple loads can be connected in parallel to provide a higher-power load to test higher power supply outputs. This flexibility significantly reduces the investment needed for future projects that have differed power requirements. PEL-2004A is a 4-slot mainframe with a master control unit to hold 4 load modules, while PEL-2002A is a 2-slot mainframe with master control unit to hold 2 load modules. When PEL-2004A is configured with 4 load modules rated at 350W each, the PEL-2000A series is able to sink up to 1.4kVA of power. For higher load capacities, mainframes can be linked together in parallel with standard MIL 20-pin connectors. A maximum of 5 mainframes, including one master and 4 slaves can be chained together to create a total load capacity of 7kW for high current and high power applications. Using 4 dual channel load modules, PEL-2004A is able to test 8 power supply outputs simultaneously. The Sequence function allows each channel to change its load sink according to a predefined sequence at a rate of up to 100 s per step. Each sequence is able to run concurrently, under the control of one clock. This is one of the most powerful features of the PEL-2000A Series as it is able to realistically simulate a multi-output power supply load. Under Dynamic mode, the load current or load resistance pulses between two preset levels at a pre-defined speed up to 25 s per step. This is often used as the standard test procedure to verify the response of a power supply to quick load changes. Most remarkably, multiple load channels can be connected in parallel to run Dynamic tests synchronously under a single clock. This Parallel Dynamic functionality gives the flexibility to perform dynamic tests for a high-power power supply without the need of another high-power load. The PEL-2000A Series includes a number of protection modes: Over Current Protection (OCP), Over Voltage Protection (OVP), Over Power Protection (OPP), Reverse Voltage Protection (RVP), and Under Voltage Protection (UVP). The protection modes are useful to protect both the load modules and the DUT(s). A buzzer can be set for when a protection setting has been tripped. When a protection mode has been tripped, the load unit will display an alarm and stop sinking current/voltage. When a load unit is operating in CR or CV mode, the unit may need Over Current Protection to prevent excessive current being sunk. Over Current Protection stops the load from sinking more current than its recommended limit and prevents the load from burn-out damage. Over Voltage Protection is used to limit the amount of voltage sunk. If the OVP trips, the PEL-Series load will stop sinking voltage. Over Power Protection is used when the input power exceeds the specifications of the load. When OPP is tripped, the power will cease to be sunk. Reverse Voltage Protection prevents reverse voltage damage to the PEL-2000A Series up to the specified rating. When Reverse Voltage Protection has been tripped, an alarm tone will sound until the reverse voltage is removed. Under Voltage Protection will turn off the load when the voltage drops below a set limit. The Go/NoGo function is available to monitor test results all the time. When a test result goes beyond a preset limit range, a "No Go" indication will be shown on the display and a "No Go" signal can be sent out through the D-SUB interface for external device control. This Go/NoGo function is available for CC mode, CV mode and CR mode. Under "Program" mode, 12 programs each containing 10 panel-setup memories, can be edited to create work routines for repetitive tests. After a program has been executed, the results of all test steps, along with the Go/NoGo judgments, will be shown on the screen. For external control and system configuration, the PEL series has USB and RS232 interfaces as standard and GPIB as an option. The LabView driver and Data Logging PC software are both supported for all the available interfaces. Each channel has an analog control/monitoring connector on the rear panel to externally turn a load on/off and to externally monitor load input current and voltage.

## SPECIFICATIONS

	PEL-2020A		PEL-2030A		
<b>CHANNEL POWER</b>	L/R 100W	L/R 100W	Left 30W	Right 250W	Right 250W
<b>RANGE</b>	Low	High	N/A	Low	High
<b>CURRENT</b>	0-2A	0-20A	0-5A	0-4A	0-40A
<b>VOLTAGE</b>	0-80V	0-80V	0-80V	0-80V	0-80V
<b>MIN.OPERATING VOLTAGE (DC)(Typ.)</b>	0.4V at 2A 0.2V at 1A	0.8V at 20A 0.4V at 10A	0.8V at 5A 0.4V at 2.5A	0.4V at 4A 0.2V at 2A	0.8V at 40A 0.4V at 20A
<b>STATIC MODE</b>					
<b>CONSTANT CURRENT MODE</b>					
Operating Range	0-2A	0-20A	0-5A	0-4A	0-40A
Setting Range	0-2.04A	0-20.4A	0-5.1A	0-4.08A	0-40.8A
Resolution	0.1mA	1mA	0.125mA	0.1mA	1mA
Accuracy	±(0.1%set + 0.1%F.S.)	±(0.1%set + 0.2%F.S.)	±(0.1%set + 0.1%F.S.)	±(0.1%set + 0.1%F.S.)	±(0.1%set + 0.2%F.S.)
<b>CONSTANT RESISTANCE MODE</b>					
Operating Range	0.075Ω-300Ω(100W/16V) 3.75Ω-15K(100W/80V)		0.3Ω-1.2KΩ(30W/16V) 15Ω-60K(30W/80V)	0.0375Ω-150Ω(250W/16V) 1.875Ω-7.5K(250W/80V)	
Setting Range	0.075Ω-300Ω(100W/16V) 3.75Ω-15K(100W/80V)		0.3Ω-1.2KΩ(30W/16V) 15Ω-60K(30W/80V)	0.0375Ω-150Ω(250W/16V) 1.875Ω-7.5K(250W/80V)	
Resolution	0.333mS(100W/16V) 6.667μS(100W/80V)		83.333μS(30W/16V) 1.666μS(30W/80V)	0.666mS(250W/16V) 13.333μS(250W/80V)	
Accuracy (with ≥ 2.5V at input)	300Ω: ±(0.2%set+0.1S) 15KΩ: ±(0.1%set+0.01S)		1.2KΩ±(0.2%set+0.1S) 60KΩ±(0.1%set+0.01S)	150Ω:±(0.2%set+0.1S) 7.5KΩ±(0.1%set+0.01S)	
<b>CONSTANT VOLTAGE+ CONSTANT CURRENT MODE</b>					
Operating Range	1-80V				
Setting Range	0-81.6V				
Resolution	2mV				
Accuracy	±(0.05%set + 0.1%F.S.)				
Current Setting Range	0-20A		0-5A	0-40A	
Resolution	1mA		0.125mA	1mA	
Accuracy	±(0.1%set + 0.2%F.S.)				



<b>CONSTANT POWER MODE</b> Operating Range* Setting Range Resolution Accuracy	1-10W 0-10.2W 1mW $\pm(0.5\% \text{set} + 0.5\% \text{F.S.})$	1-100W 0-102W 10mW $\pm(0.5\% \text{set} + 0.5\% \text{F.S.})$	1-30W 0-30.6W 1mW $\pm(0.5\% \text{set} + 0.5\% \text{F.S.})$	1-25W 0-25.5W 1mW $\pm(0.5\% \text{set} + 0.5\% \text{F.S.})$	1-250W 0-255W 10mW $\pm(0.5\% \text{set} + 0.5\% \text{F.S.})$
<b>DYNAMIC MODE</b>					
<b>T1&amp;T2</b> Accuracy	0.025mS-10mS/Res:1 $\mu$ S 10mS-30S/Res:1mS 1 $\mu$ S/1mS $\pm$ 100ppm			0.025mS-10mS/Res:1 $\mu$ S 10mS-30S/Res:1mS 1 $\mu$ S/1mS $\pm$ 100ppm	
<b>CONSTANT CURRENT MODE</b> Slew Rate ( $\pm 10\% \text{set} + 15\mu\text{S}$ ) Slew Rate Resolution Slew Rate Accuracy of Setting Current Setting Range Current Resolution Current Accuracy	0.32-80mA/ $\mu$ S 0.32mA/ $\mu$ S $\pm(10\% + 15\mu\text{S})$ 0-2A 0.1mA $\pm 0.4\% \text{ F.S.}$	3.2-800mA/ $\mu$ S 3.2mA/ $\mu$ S $\pm(10\% + 15\mu\text{S})$ 0-20A 1mA $\pm 0.4\% \text{ F.S.}$	0.8-200mA/ $\mu$ S 0.8mA/ $\mu$ S $\pm(10\% + 15\mu\text{S})$ 0-5A 0.125mA $\pm 0.4\% \text{ F.S.}$	0.64-160mA/ $\mu$ S 0.64mA/ $\mu$ S $\pm(10\% + 15\mu\text{S})$ 0-4A 0.1mA $\pm 0.4\% \text{ F.S.}$	6.4-1600mA/ $\mu$ S 6.4mA/ $\mu$ S $\pm(10\% + 15\mu\text{S})$ 0-40A 1mA $\pm 0.4\% \text{ F.S.}$
<b>CONSTANT RESISTANCE MODE</b> Slew Rate Slew Rate Resolution Slew Rate Accuracy of setting	0.32-80mA/ $\mu$ S 0.32mA/ $\mu$ S $\pm(10\% + 15\mu\text{S})$	3.2-800mA/ $\mu$ S 3.2mA/ $\mu$ S $\pm(10\% + 15\mu\text{S})$	0.8-200mA/ $\mu$ S 0.8mA/ $\mu$ S $\pm(10\% + 15\mu\text{S})$	0.64-160mA/ $\mu$ S 0.64mA/ $\mu$ S $\pm(10\% + 15\mu\text{S})$	6.4-1600mA/ $\mu$ S 6.4mA/ $\mu$ S $\pm(10\% + 15\mu\text{S})$
Resistance Setting Range	0.075 $\Omega$ -300K $\Omega$ (100W/16V) 3.75 $\Omega$ -15K(100W/80V)		0.3 $\Omega$ -1.2K $\Omega$ (30W/16V) 15 $\Omega$ -60K(30W/80V)	0.0375 $\Omega$ -150K $\Omega$ (250W/16V) 1.875 $\Omega$ -7.5K(250W/80V)	
Resistance Resolution	0.333mS(100W/16V) 6.667 $\mu$ S(100W/80V)		83.333 $\mu$ S(30W/16V) 1.666 $\mu$ S(30W/80V)	0.666mS(250W/16V) 13.333 $\mu$ S(250W/80V)	
Resistance Resolution	300 $\Omega$ : $\pm(0.5\% \text{set} + 0.1\text{S})$ 15K $\Omega$ : $\pm(0.5\% \text{set} + 0.01\text{S})$		1.2K $\Omega$ : $\pm(0.5\% \text{set} + 0.1\text{S})$ 60K $\Omega$ : $\pm(0.5\% \text{set} + 0.01\text{S})$	150 $\Omega$ : $\pm(0.5\% \text{set} + 0.1\text{S})$ 7.5K $\Omega$ : $\pm(0.5\% \text{set} + 0.01\text{S})$	
Resistance Accuracy					
<b>MEASUREMENT</b>					
<b>VOLTAGE READBACK</b> Range Resolution Accuracy	0-16V 0.32mV $\pm(0.025\% \text{set} + 0.025\% \text{F.S.})$	0-80V 1.6mV	0-16V, 0-80V 0.32mV, 1.6mV	0-16V 0.32mV	0-80V 1.6mV
<b>CURRENT READBACK</b> Range Resolution Accuracy	0-2A 0.04mA $\pm(0.05\% \text{set} + 0.05\% \text{F.S.})$	0-20A 0.4mA	0-5A 0.1mA	0-4A 0.08mA	0-40A 0.8mA
<b>POWER READBACK</b> Range Accuracy	0-10W $\pm(0.1\% \text{set} + 0.1\% \text{F.S.}^{*1})$	0-100W	0-30W	0-25W	0-250W
	*1 : Power F.S.=Vrange F.S. x Irange F.S.				
<b>PROTECTION</b>					
<b>OVER POWER PROTECTION</b> Range Resolution Accuracy	1-102W 0.5W $\pm(2\% \text{set} + 0.25\% \text{F.S.})$		1-30.6W 0.15W $\pm(2\% \text{set} + 0.25\% \text{F.S.})$	1-255W 1.25W $\pm(2\% \text{set} + 0.25\% \text{F.S.})$	
<b>OVER CURRENT PROTECTION</b> Range Resolution Accuracy	0-20.4A 0.05A $\pm(2\% \text{set} + 0.25\% \text{F.S.})$		0-5.1A 0.0125A $\pm(2\% \text{set} + 0.25\% \text{F.S.})$	0-40.8A 0.1A $\pm(2\% \text{set} + 0.25\% \text{F.S.})$	
<b>OVER VOLTAGE PROTECTION</b> Range Resolution Accuracy	1-81.6V 0.2V $\pm(2\% \text{set} + 0.25\% \text{F.S.})$		1-81.6V 0.2V $\pm(2\% \text{set} + 0.25\% \text{F.S.})$	1-81.6V 0.2V $\pm(2\% \text{set} + 0.25\% \text{F.S.})$	
Over Temperature Protection	$\approx 85^{\circ}\text{C}$		$\approx 85^{\circ}\text{C}$	$\approx 85^{\circ}\text{C}$	
<b>RATED POWER PROTECTION</b> Value Accuracy	110W $\pm(2\% \text{set})$		33W $\pm(2\% \text{set})$	275W $\pm(2\% \text{set})$	
<b>GENERAL</b>					
<b>SHORT CIRCUIT</b> Current(CC) Voltage(CV) Resistance(CR)	$\approx 2.2/2\text{A}$ 0V $\approx 3.75\Omega$	$\approx 22/20\text{A}$ 0V $\approx 0.075\Omega$	$\approx 5.5/5\text{A}$ 0V $\approx 15\Omega, \approx 0.3\Omega$	$\approx 4.4/4\text{A}$ 0V $\approx 1.875\Omega$	$\approx 44/40\text{A}$ 0V $\approx 0.0375\Omega$
<b>INPUT RESISTANCE(LOAD OFF)</b>	500K $\Omega$ (Typical)				
<b>POWER SOURCE</b>	AC100V ~ 230V $\pm 10\%$ ; 50Hz / 60Hz $\pm 2\text{Hz}$				
<b>WEIGHT</b>	Approx. 3.8 kg				
<b>DIMENSIONS &amp; WEIGHT (PEL-2002A)</b>	272(W) x 200(H) x 581(D) mm ; Approx. 17.1kg(full modules)				
<b>DIMENSIONS &amp; WEIGHT (PEL-2004A)</b>	435(W) x 200(H) x 581(D) mm ; Approx. 28.4kg(full modules)				

PEL-001 GPIB Card



PEL-002 Rack Mount Kit



PEL-003 Panel Cover



# Programmable D.C. Electronic Load

PEL-2004A Rear Panel



PEL-2002A Rear Panel



PEL-2000A Series

## SPECIFICATIONS

	PEL-2040A		PEL-2041A	
<b>CHANNEL RANGE</b>	One channel Low	One channel High	One channel Low	One channel High
<b>POWER</b>	350W	350W	350W	350W
<b>CURRENT</b>	0-7A	0-70A	0-1A	0-10A
<b>VOLTAGE</b>	0-80V	0-80V	0-500V	0-500V
<b>MIN.OPERATING VOLTAGE (DC)(Typ.)</b>	0.4V at 7A 0.2V at 3.5A	0.8V at 70A 0.4V at 35A	0.4V at 1A 0.2V at 0.5A	0.8V at 10A 0.4V at 5A
<b>STATIC MODE</b>				
<b>CONSTANT CURRENT MODE</b>				
Operating Range	0-7A	0-70A	0-1A	0-10A
Setting Range	0-7.14A	0-71.4A	0-1.02A	0-10.2A
Resolution	0.2mA	2mA	0.05mA	0.5mA
Accuracy	±(0.1%set+0.1%F.S.)	±(0.1%set+0.2%F.S.)	±(0.1%set+0.1%F.S.)	±(0.1%set+0.2%F.S.)
<b>CONSTANT RESISTANCE MODE</b>				
Operating Range	0.025Ω-100Ω(350W/16V) 1.25Ω-5K(350W/80V)		1.25Ω-5KΩ(350W/125V) 50Ω-200K(350W/500V)	
Setting Range	0.025Ω-100Ω(350W/16V) 1.25Ω-5K(350W/80V)		1.25Ω-5Ω(350W/125V) 50Ω-200K(350W/500V)	
Resolution	1mS(350W/16V) 20μS(350W/80V)		20μS(350W/125V) 0.5μS(350W/500V)	
Accuracy (with ≥ 2.5V at input)	100Ω: ±(0.2%set+0.1S) 5KΩ: ±(0.1%set+0.01S)		5KΩ: ±(0.2%set+0.02S) 200KΩ: ±(0.1%set+0.005S)	
<b>CONSTANT VOLTAGE+CONSTANT CURRENT MODE</b>				
Operating Range	1-80V		2.5-500V	
Setting Range	0-81.6V		0-510V	
Resolution	2mV		10mV	
Accuracy	±(0.05%set+0.1%F.S.)		±(0.05%set+0.1%F.S.)	
Current Setting Range	0-70A		0-10A	
Resolution	2mA		0.5mA	
Accuracy	±(0.1%set+0.2%F.S.)			
<b>CONSTANT POWER MODE</b>				
Operating Range*	1-35W	1-350W	1-35W	1-350W
Setting Range	0-35.7W	0-357W	0-35.7W	0-357W
Resolution	1mW	10mW	1mW	10mW
Accuracy	±(0.5%set+0.5%F.S.)	±(0.5%set+0.5%F.S.)	±(0.5%set+0.2%F.S.)	±(0.5%set+0.5%F.S.)
<b>DYNAMIC MODE</b>				
<b>T1&amp;T2</b>	0.025mS-10mS/Res:1μS 10mS-30S/Res:1mS 1μS/1mS±100ppm		0.025mS-10mS/Res:1μS 10mS-30S/Res:1mS 1μS/1mS±100ppm	
<b>CONSTANT CURRENT MODE</b>				
Slew Rate (±10%set+15μS)	0.001-0.28A/μS	0.01-2.8A/μS	0.16-40mA/μS	1.6-400mA/μS
Slew Rate Resolution	0.001A/μS	0.01A/μS	0.16mA/μS	1.6mA/μS
Slew Rate Accuracy of Setting	±(10%+15μs)	±(10%+15μs)	±(10%+15μs)	±(10%+15μs)
Current Setting Range	0-7A	0-70A	0-1A	0-10A
Current Resolution	0.2mA	2mA	0.05mA	0.5mA
Current Accuracy	±0.4% F.S.	±0.4% F.S.	±0.4% F.S.	±0.4% F.S.
<b>CONSTANT RESISTANCE MODE</b>				
Slew Rate	0.001-0.28A/μS	0.01-2.8A/μS	0.16-40mA/μS	1.6-400mA/μS
Slew Rate Resolution	0.001A/μS	0.01A/μS	0.16mA/μS	1.6mA/μS
Slew Rate Accuracy of setting	±(10%+15μs)	±(10%+15μs)	±(10%+15μs)	±(10%+15μs)
Resistance Setting Range	0.025Ω-100Ω(350W/16V) 1.25Ω-5K(350W/80V)		1.25Ω-5KΩ(350W/125V) 50Ω-200K(350W/500V)	
Resistance Resolution	1mS(350W/16V) 20μS(350W/80V)		20μS(350W/125V) 0.5μS(350W/500V)	
Resistance Resolution	100Ω: ±(0.5%set+0.1S) 5KΩ: ±(0.5%set+0.01S)		5KΩ: ±(0.5%set+0.02S) 200KΩ: ±(0.5%set+0.005S)	
Resistance Accuracy				



SPECIFICATIONS				
	PEL-2040A		PEL-2041A	
<b>MEASUREMENT</b>				
<b>VOLTAGE READBACK</b>				
Range	0~16V	0~80V	0~125V	0~500V
Resolution	0.32mV	1.6mV	2.5mV	10mV
Accuracy	$\pm(0.025\%set + 0.025\%F.S.)$			
<b>CURRENT READBACK</b>				
Range	0~7A	0~70A	0~1A	0~10A
Resolution	0.14mA	1.4mA	0.02mA	0.2mA
Accuracy	$\pm(0.05\%set + 0.05\%F.S.)$			
<b>POWER READBACK</b>				
Range	0~35W	0~350W	0~35W	0~350W
Accuracy	$\pm(0.1\%set + 0.1\%F.S.)$ *1 : Power F.S.=Vrange F.S. x Irange F.S.			
<b>PROTECTION</b>				
<b>OVER POWER PROTECTION</b>				
Range	1~357W		1~357W	
Resolution	1.75W		1.75W	
Accuracy	$\pm(2\%set+0.25\%F.S.)$		$\pm(2\%set+0.25\%F.S.)$	
<b>OVER CURRENT PROTECTION</b>				
Range	0~71.4A		0~10.2A	
Resolution	0.175A		0.025A	
Accuracy	$\pm(2\%set+0.25\%F.S.)$		$\pm(2\%set+0.25\%F.S.)$	
<b>OVER VOLTAGE PROTECTION</b>				
Range	1~81.6V		1~510V	
Resolution	0.2V		1.25V	
Accuracy	$\pm(2\%set+0.25\%F.S.)$		$\pm(2\%set+0.25\%F.S.)$	
Over Temperature Protection	$\approx 85^{\circ}C$		$\approx 85^{\circ}C$	
<b>RATED POWER PROTECTION</b>				
Value	385W		385W	
Accuracy	$\pm(2\%set)$		$\pm(2\%set)$	
<b>GENERAL</b>				
<b>SHORT CIRCUIT</b>				
Current(CC)	$\approx 7.7/7A$	$\approx 77/70A$	$\approx 1.1/1A$	$\approx 11/10A$
Voltage(CV)	0V	0V	0V	0V
Resistance(CR)	$\approx 1.25\Omega$	$\approx 0.025\Omega$	$\approx 15\Omega, \approx 50\Omega$	$\approx 1.25\Omega$
<b>INPUT RESISTANCE(LOAD OFF)</b>	500K $\Omega$ (Typical)			
<b>POWER SOURCE</b>	AC100V ~ 230V $\pm 10\%$ ; 50Hz / 60Hz $\pm 2$ Hz			
<b>WEIGHT</b>	Approx. 3.8 kg			
<b>DIMENSIONS &amp; WEIGHT (PEL-2002A)</b>	272(W) x 200(H) x 581 (D) mm ; Approx. 17.1kg(full modules)			
<b>DIMENSIONS &amp; WEIGHT (PEL-2004A)</b>	435(W) x 200(H) x 581 (D) mm ; Approx. 28.4kg(full modules)			

GTL-249 Frame Link Cable



GTL-120 Test Lead



GTL-121 Sense Lead



## ORDERING INFORMATION

PEL-2020A	Dual Channel Module, (0~80V, 0~20A, 100W) x 2
PEL-2030A	Dual Channel Module, (1~80V, 0~5A, 30W)+(1~80V, 0~40A, 250W)
PEL-2040A	Single Channel Module, (0~80V, 0~70A, 350W)
PEL-2041A	Single Channel Module, (0~500V, 0~10A, 350W)
PEL-2004A	4-Slot Programmable D.C. Electronic Load Mainframe
PEL-2002A	2-Slot Programmable D.C. Electronic Load Mainframe

Note : Load module cannot be used without a mainframe

### ACCESSORIES :

PEL-2002A/2004A	User Manual x1, Power Cord x1
PEL-2020A/2030A/2040A/2041A	GTL-120 Test Lead x 1, GTL-121 Sense Lead x 1

\* PEL-003 x 3 (PEL-2004A); PEL-003 x 1 (PEL-2002A)

### OPTIONAL ACCESSORIES

PEL-001	GPIB Card
PEL-002	PEL-2000A Series Rack Mount Kit
PEL-003	Panel Cover
GTL-248	GPIB Cable (2m)
GTL-249	Frame Link Cable
GTL-246	USB Cable, USB 2.0 A-B TYPE CABLE, 4P
GTL-232	RS-232C Cable, 9-pin, F-F Type, null modem, 2000mm