PEL-2000A Series

Programmable D.C. Electronic Load

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/LAN (Optional)

GW INSTEK
Simply Reliable

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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 100µs 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 25µs 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 LAN as well as 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.

PANEL INTRODUCTION

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A. MODULARIZED STRUCTURE/PROGRAM & INTERFACE

Modularized Structure

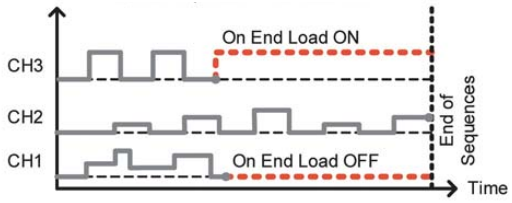
PEL-2004A is a 4-slot mainframe with a master control unit made to hold 4 load modules, and PEL-2002A is a 2-slot mainframe with a master control unit made to hold 2 load modules. The modularized structure of the PEL-2000A Series allows any combination of mainframe and load module (PEL-2020A, PEL-2030A, PEL-2040A, PEL-2041A) to be integrated into a custom-tailored system.

Multiple loads within the same mainframe can be connected in parallel to perform both static and dynamic tests. This flexibility makes the PEL-2000A Series a very cost-effective instrument for testing a broad range of power supply outputs.

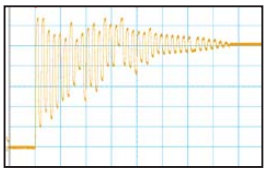
Program & Interface

The PEL-2000A Series supports a total of 12 different programs and 10 sequences to each program. With a total of up to 120 different configurations. For external control and system configuration, the PEL-Series has USB and RS-232 interfaces as standard and GPIB as an option. The LabView driver and Data Logging PC software are supported for all the interfaces available. Each channel has an analog control/monitoring connector to externally turn a load on/off and to externally monitor load input current and voltage.

B. AUTOMATICALLY SEQUENCE FUNCTION



Sequence - On End Load

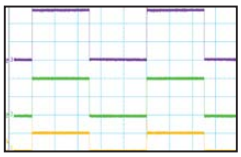


The figure above shows the current waveform of a simulation using the sequence function.

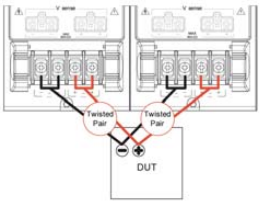
The Sequence function allows each channel to change its load sink according to a predefined sequence at a rate of up to 100µs per step. Each sequence is able to run concurrently, under the control of one clock. This is one of the most powerful features of the PEL-2000A Series as it is able to realistically 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 25µs per step. This is often used as the standard test procedure to verify the response of a power supply to quick load changes.

The picture above is an example of a sequence used as a load profile for a single output switching power supply. A load profile is programmed to simulate the current drawn of a power supply load.
By using a current probe to acquire a current waveform, PEL-2000A is able to evaluate the performance of a power supply based on the load sequence that is programmed. An oscilloscope is then used to display the result.

C. PARALLEL DYNAMIC LOADING



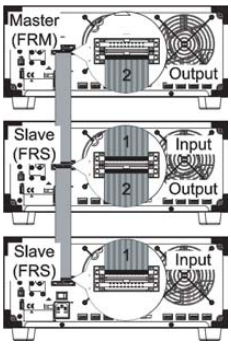
Dynamic Test



Wire Connection

All the load channels in a PEL-2000A mainframe can be connected in parallel to perform any combination of static or dynamic loading. Under Dynamic mode, the load current or load resistance pulses between two preset levels at a predefined speed of up to 25µs per step. When the channels are connected in parallel, dynamic tests are synchronously clocked. The ability to perform parallel dynamic loading gives you the flexibility to perform dynamic tests to high-power power supplies without the need for a dedicated high power electronic load.

D. FRAME LINK



The PEL-2000A Series allows multiple mainframes to be linked together with standard MIL 20-pin connectors to provide higher power load capacity. A maximum of 5 mainframes, including one master and 4 slaves, can be chained together to give a 7kW load capacity for high current and high power applications

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OCP TEST AUTOMATION FUNCTION

OCP is one of the basic protection functions for power supply products. Hence, a fully automatic test function of electronic load is designed for testing OCP function of the output terminal of power supply products.

I. BENEFITS

Provide users with high resolution OCP measurement values to verify DUT's OCP activation point. Provide users with measurement results so as to help them determine whether DUT's actual OCP activation point meets the regulations.

DUT : Power Supply

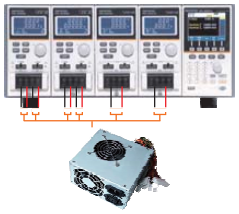
OCP Verification Specification : 3A (ideal)±0.1%
Actual Measurement : DUT1 : 3.000A
DUT2 : 2.999A
DUT3 : 3.000A

Test the value of OCP by setting load current increment from start current to stop current. OCP's activation point can be accurately measured.

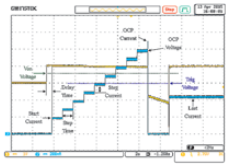
II. FEATURES OF PARAMETER SETTINGS (This mode can only be used under CC mode)

Parameters

Active Channel : Applies the setting to the load channel.
Range : High(CC Mode High) or Low(CC Mode Low)
Start Current(Start C) : Starting current value for the test.
End Current(End C) : The current value that will end the test. The value must be higher than the OCP value of the DUT you are testing.
Step Current(Step C) : Sets the step resolution of the current.
Last Current(Last C) : Sets the final current value after OCP has been tripped. This is the steady-state current draw after the OCP has been tripped.
Step Time(Step T) : Sets the execution time of each step. (50mS to 1600S)
Delay Time(Delay) : The OCP testing delay time. Sets the how long to delay starting the test after the Load On key has been pressed. (5mS ~ 160mS)
Trig Voltage(Trig V) : Sets the voltage trigger level needed see whether the power supply OCP has been triggered.



Schematic Diagram



Waveforms Corresponding to Parameters

Parameter Settings

Result: Final DUT Output Status Before Entering OCP

III. GENERAL MEASUREMENT & HIGH RESOLUTION MEASUREMENT

GENERAL MEASUREMENT (STEP_C→0.5A)

DUT: OCP specification 3A
Set test current from 0A to 4A and each current increment of 0.5A for 0.5 seconds. When DUT's voltage drops to 9V for over 0.5 seconds, it is determined as OCP status.

Parameter Settings

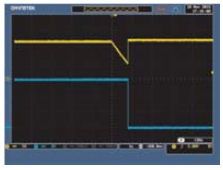
Actual Waveforms
(ch1:Voltage of DUT;ch2:Current of DUT)

Result: Final DUT Output Status Before Entering OCP

HIGH RESOLUTION MEASUREMENT (STEP_C→0.001A)

DUT: OCP specification 3A
Set test current from 2.9A to 4A and each current increment of 0.001A for 0.5 seconds. When DUT's voltage drops to 9V for over 0.5 seconds, it is determined as OCP status.

Parameter Settings



Actual Waveforms
(ch1:Voltage of DUT;ch2:Current of DUT)

Result: Final DUT Output Status Before Entering OCP

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SPECIFICATIONS

	PEL-2020A/ PEL-2020B		PEL-2030A/ PEL-2030B			PEL-2040A/ PEL-2040B		PEL-2041A/ PEL-2041B	
CHANNEL	L/R	L/R	Left	Right	Right	One channel	One channel	One channel	One channel
RANGE	Low	High	N/A	Low	High	Low	High	Low	High
POWER	100W	100W	30W	250W	250W	350W	350W	350W	350W
CURRENT	0~2A	0~20A	0~5A	0~4A	0~40A	0~7A	0~70A	0~1A	0~10A
VOLTAGE	0~80V	0~80V	0~80V	0~80V	0~80V	0~80V	0~80V	0~500V	0~500V
MIN.OPERATING VOLTAGE (DC)(Typ.)	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	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
STATIC MODE									
CONSTANT CURRENT MODE									
Operating Range	0~2A	0~20A	0~5A	0~4A	0~40A	0~7A	0~70A	0~1A	0~10A
Setting Range	0~2.04A	0~20.4A	0~5.1A	0~4.08A	0~40.8A	0~7.14A	0~71.4A	0~1.02A	0~10.2A
Resolution	0.1mA	1mA	0.125mA	0.1mA	1mA	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 + 0.1%F.S.)	±(0.1%set + 0.2%F.S.)	±(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.)
CONSTANT RESISTANCE MODE									
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)		0.025Ω~100Ω(350W/16V) 1.25Ω~5K(350W/80V)		1.25Ω~5KΩ(350W/125V) 50Ω~200K(350W/500V)	
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)		0.025Ω~100Ω(350W/16V) 1.25Ω~5K(350W/80V)		1.25Ω~5Ω(350W/125V) 50Ω~200K(350W/500V)	
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)		1mS(350W/16V) 20μS(350W/80V)		20μS(350W/125V) 0.5μS(350W/500V)	
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)		100Ω: ±(0.2%set+0.1S) 5KΩ: ±(0.1%set+0.01S)		5KΩ:±(0.2%set+0.02S) 200KΩ:±(0.1%set+0.005S)	
CONSTANT VOLTAGE+ CONSTANT CURRENT MODE									
Operating Range	1~80V					1~80V		2.5~500V	
Setting Range	0~81.6V					0~81.6V		0~510V	
Resolution	2mV					2mV		10mV	
Accuracy	±(0.05%set + 0.1%F.S.)					±(0.05%set + 0.1%F.S.)		±(0.05%set + 0.1%F.S.)	
Current Setting Range	0~20A		0~5A	0~40A		0~70A		0~10A	
Resolution	1mA		0.125mA	1mA		2mA		0.5mA	
Accuracy	±(0.1%set + 0.2%F.S)								
CONSTANT POWER MODE									
Operating Range*	1~10W	1~100W	1~30W	1~25W	1~250W	1~35W	1~350W	1~35W	1~350W
Setting Range	0~10.2W	0~102W	0~30.6W	0~25.5W	0~255W	0~35.7W	0~357W	0~35.7W	0~357W
Resolution	1mW	10mW	1mW	1mW	10mW	1mW	10mW	1mW	10mW
Accuracy	±(0.5%set + 0.5%F.S)	±(0.5%set + 0.5%F.S)	±(0.5%set + 0.5%F.S)	±(0.5%set + 0.5%F.S)	±(0.5%set + 0.5%F.S)	±(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)
DYNAMIC MODE									
T1&T2	0.025mS~10mS/Res:1μS 10mS~30S/Res:1mS		0.025mS~10mS/Res:1μS 10mS~30S/Res:1mS			0.025mS~10mS/Res:1μS 10mS~30S/Res:1mS		0.025mS~10mS/Res:1μS 10mS~30S/Res:1mS	
Accuracy	1μS/1mS ± 100ppm		1μS/1mS ± 100ppm			1μS/1mS±100ppm		1μS/1mS±100ppm	
CONSTANT CURRENT MODE									
Slew Rate (±10%set+15μS)	0.32~80mA/μS	3.2~800mA/μS	0.8~200mA/μS	0.64~160mA/μS	6.4~1600mA/μS	0.001~0.28A/μS	0.01~2.8A/μS	0.16~40mA/μS	1.6~400mA/μS
Slew Rate Resolution	0.32mA/μS	3.2mA/μS	0.8mA/μS	0.64mA/μS	6.4mA/μS	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)	±(10%+15μs)	±(10%+15μs)	±(10%+15μs)	±(10%+15μs)	±(10%+15μs)
Current Settong Range	0~2A	0~20A	0~5A	0~4A	0~40A	0~7A	0~70A	0~1A	0~10A
Current Resolution	0.1mA	1mA	0.125mA	0.1mA	1mA	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.	±0.4%F.S.	±0.4% F.S.	±0.4% F.S.	±0.4%F.S.	±0.4%F.S.
CONSTANT RESISTANCE MODE									
Slew Rate	0.32~80mA/μS	3.2~800mA/μS	0.8~200mA/μS	0.64~160mA/μS	6.4~1600mA/μS	0.001~0.28A/μS	0.01~2.8A/μS	0.16~40mA/μS	1.6~400mA/μS
Slew Rate Resolution	0.32mA/μS	3.2mA/μS	0.8mA/μS	0.64mA/μS	6.4mA/μS	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)	±(10%+15μs)	±(10%+15μs)	±(10%+15μs)	±(10%+15μs)	±(10%+15μs)
Resistance Setting Range	0.075Ω~300KΩ(100W/16V) 3.75Ω~15K(100W/80V)		0.3Ω~1.2KΩ(30W/16V) 15Ω~60K(30W/80V)	0.0375Ω~150KΩ(250W/16V) 1.875Ω~7.5K(250W/80V)		0.025Ω~100Ω(350W/16V) 1.25Ω~5K(350W/80V)		1.25Ω~5KΩ(350W/125V) 50Ω~200K(350W/500V)	
Resistance 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)		1mS(350W/16V) 20μS(350W/80V)		20μS(350W/125V) 0.5μS(350W/500V)	
Resistance Resolution Resistance Accuracy	300Ω:±(0.5%set+0.1S) 15KΩ:±(0.5%set+0.01S)		1.2KΩ:±(0.5%set+0.1S) 60KΩ:±(0.5%set+0.01S)	150Ω:±(0.5%set+0.1S) 7.5KΩ:±(0.5%set+0.01S)		100Ω:±(0.5%set + 0.1S) 5KΩ:±(0.5%set + 0.01S)		5KΩ:±(0.5%set + 0.02S) 200KΩ:±(0.5%set + 0.005S)	
MEASUREMENT									
VOLTAGE READBACK									
Range	0~16V	0~80V	0~16V,0~80V	0~16V	0~80V	0~16V	0~80V	0~125V	0~500V
Resolution	0.32mV	1.6mV	0.32mV,1.6mV	0.32mV	1.6mV	0.32mV	1.6mV	2.5mV	10mV
Accuracy	±(0.025%set + 0.025%F.S.)								
CURRENT READBACK									
Range	0~2A	0~20A	0~5A	0~4A	0~40A	0~7A	0~70A	0~1A	0~10A
Resolution	0.04mA	0.4mA	0.1mA	0.08mA	0.8mA	0.14mA	1.4mA	0.02mA	0.2mA
Accuracy	±(0.05%set + 0.05%F.S.)								
POWER READBACK									
Range	0~10W	0~100W	0~30W	0~25W	0~250W	0~35W	0~350W	0~35W	0~350W
Accuracy	±(0.1%set + 0.1%F.S.*1)								

*1 : Power F.S.=Vrange F.S. x Irange F.S.

원문: GW Instek PEL-2000A 데이터시트 · 제조사 원문 자료입니다. 사양은 제조사 사정에 따라 변경될 수 있습니다.

SPECIFICATIONS

	PEL-2020A/ PEL-2020B		PEL-2030A/ PEL-2030B			PEL-2040A/ PEL-2040B		PEL-2041A/ PEL-2041B	
PROTECTION									
OVER POWER PROTECTION									
Range	1~102W		1~30.6W	1~255W		1~357W		1~357W	
Resolution	0.5W		0.15W	1.25W		1.75W		1.75W	
Accuracy	±(2%set+0.25%F.S.)		±(2%set+0.25%F.S.)	±(2%set+0.25%F.S.)		±(2%set+0.25%F.S.)		±(2%set+0.25%F.S.)	
OVER CURRENT PROTECTION									
Range	0~20.4A		0~5.1A	0~40.8A		0~71.4A		0~10.2A	
Resolution	0.05A		0.0125A	0.1A		0.175A		0.025A	
Accuracy	±(2%set+0.25%F.S.)		±(2%set+0.25%F.S.)	±(2%set+0.25%F.S.)		±(2%set+0.25%F.S.)		±(2%set+0.25%F.S.)	
OVER VOLTAGE PROTECTION									
Range	1~81.6V		1~81.6V	1~81.6V		1~81.6V		1~510V	
Resolution	0.2V		0.2V	0.2V		0.2V		1.25V	
Accuracy	±(2%set+0.25%F.S.)		±(2%set+0.25%F.S.)	±(2%set+0.25%F.S.)		±(2%set+0.25%F.S.)		±(2%set+0.25%F.S.)	
Over Temperature Protection	≒85℃		≒85℃	≒85℃		≒85℃		≒85℃	
RATED POWER PROTECTION									
Value	110W		33W	275W		385W		385W	
Accuracy	±(2%set)		±(2%set)	±(2%set)		±(2%set)		±(2%set)	
GENERAL									
SHORT CIRCUIT									
Current(CC)	≒2.2/2A	≒22/20A	≒5.5/5A	≒4.4/4A	≒44/40A	≒7.7/7A	≒77/70A	≒1.1/1A	≒11/10A
Voltage(CV)	0V	0V	0V	0V	0V	0V	0V	0V	0V
Resistance(CR)	≒3.75Ω	≒0.075Ω	≒15Ω , ≒0.3Ω	≒1.875Ω	≒0.0375Ω	≒1.25Ω	≒0.025Ω	≒15Ω , ≒50Ω	≒1.25Ω
INPUT RESISTANCE(LOAD OFF)									
	500KΩ(Typical)								
POWER SOURCE	AC100V ~ 230V ± 10% ; 50Hz / 60Hz ± 2Hz								
WEIGHT	Approx. 3.8 kg								
DIMENSIONS & WEIGHT (PEL-2002A)	272(W) x 200(H) x 581(D) mm ; Approx. 17.1kg(full modules)								
DIMENSIONS & WEIGHT (PEL-2004A)	435(W) x 200(H) x 581(D) mm ; Approx. 28.4kg(full modules)								

Specifications subject to change without notice. EL-2000AGD1BH_2024

ORDERING INFORMATION

PEL-2020A/2020B Dual Channel Module, (0~80V, 0~20A, 100W) x 2
PEL-2030A/2030B Dual Channel Module, (1~80V, 0~5A, 30W)+(1~80V, 0~40A, 250W)
PEL-2040A/2040B Single Channel Module, (0~80V, 0~70A, 350W)
PEL-2041A/2041B 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/2020B/2030A/2030B/2040A/2040B/2041A/2041B
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 ASSESSORIES

PEL-001 GPIB Card
PEL-002 PEL-2000A Series Rack Mount Kit
PEL-003 Panel Cover
PEL-016 LAN Card
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

Global Headquarters
GOOD WILL INSTRUMENT CO., LTD.
No.7-1, Jhongsing Road, Tucheng Dist., New Taipei City 236, Taiwan
T +886-2-2268-0389 **F** +886-2-2268-0639
E-mail: marketing@goodwill.com.tw

China Subsidiary
GOOD WILL INSTRUMENT (SUZHOU) CO., LTD.
No. 521, Zhujiang Road, Snd, Suzhou Jiangsu 215011 China
T +86-512-6661-7177 **F** +86-512-6661-7277

Malaysia Subsidiary
GOOD WILL INSTRUMENT (SEA) SDN. BHD.
No. 1-3-18, Elit Avenue, Jalan Mayang Pasir 3, 11950 Bayan Baru, Penang, Malaysia
T +604-6111122 **F** +604-6115225

Europe Subsidiary
GOOD WILL INSTRUMENT EURO B.V.
De Run 5427A, 5504DG Veldhoven, THE NETHERLANDS
T +31(0)40-2557790 **F** +31(0)40-2541194

U.S.A. Subsidiary
INSTEK AMERICA CORP.
5198 Brooks Street Montclair, CA 91763, U.S.A.
T +1-909-399-3535 **F** +1-909-399-0819

Japan Subsidiary
TEXIO TECHNOLOGY CORPORATION.
7F Towa Fudosan Shin Yokohama Bldg., 2-18-13 Shin Yokohama, Kohoku-ku, Yokohama, Kanagawa, 222-0033 Japan
T +81-45-620-2305 **F** +81-45-534-7181

Korea Subsidiary
GOOD WILL INSTRUMENT KOREA CO., LTD.
Room No.503, Gyeonginro 775 (Mullae-Dong 3Ga, Ace Hightech-City B/D 1Dong), Yeongduengpo-Gu, Seoul 150093, Korea.
T +82-2-3439-2205 **F** +82-2-3439-2207

India Subsidiary
GW INSTEK INDIA LLP.
No.2707/B&C, 1st Floor UNNATHI Building, E-Block, Sahakara Nagar, Bengaluru-560 092. India
T +91-80-6811-0600 **F** +91-80-6811-0626

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