PEL-3000 Series

Programmable D.C. Electronic Load

FEATURES

- Operating Voltage (DC) : 1.5V~150V
- Operating Mode : C.C/C.V/C.R/C.P/C.C+C.V/C.R+C.V/C.P+C.V
- Parallel Connection of Inputs for Higher Capacity (Max : 9,450W)
- Support of High Slew Rate : Max 16A/μs
- Run Program Function (Go/No Go Test)
- Sequence Function for High Efficient Load Simulations
- Commands are Compatible With Kikusui PLZ-4W Model (*)
- Dynamic (Switching) Function : 0.0166Hz~20kHz
- Soft Start Function : Off/On (1~200ms, Res : 1ms)
- Adjustable OCP/OVP/OPP/UVP Setting
- Short Circuit Function
- Timer Function : Elapsed Time of Load on
- Cut Off Time (Auto Load Off Timer) : 1s to 999h 59min 59s or Off
- External Channel Control/Monitoring Via Analog Control Connector
- Setup Memories : 100 sets
- 3.5 Inch TFT LCD Display
- Multi Interface : USB 2.0 Device/Host, RS-232, GPIB (Optional)

* The sequence and program commands are different from that of kikusui PLZ-4W model.

GW INSTEK
Simply Reliable

Flexible Power Combinations, High-Speed and Versatile Load Simulations

The PEL-3000 Series, a single-channel, programmable D.C. electronic load with 0.01mA current resolution and 16A/μs current Slew Rate, is very ideal for testing server power supply and SPS (Switching Power Supply) for commercial and industrial computers. For a heavy-duty device like cloud ecosystem running 24-hour nonstop operations, a stable and high-power power supply, ranging from 350W to 1500W, is required to maintain the normal operation of server, Hub, and the equipment of data storage and internet communications. Owing to the increasing demand of data transmission and large scale data storage of telecommunications systems, the infrastructure of internet communications is in the pace of rapid expansion. This has greatly boosted the market demand of telecommunications equipment powered by power supply of 2000W and above. The flexible power combination of PEL-3000 meets the test requirements of present high-power power supply. With respect to battery testing applications such as rechargeable battery for electrical tools, battery module and automobile battery, PEL-3000 has three stand-alone models to offer including 175W, 350W, 1050W and 1050W. By connecting Booster 2100W units with master units, the maximum load capacity of the whole system can reach 9,450W. Hence, the PEL-3000 Series fulfills various power testing requirements including medium to low power or high-power power supply.

The PEL-3000 Series has seven operating modes and three operating functions. Among the seven operating modes, four of them are basic operating modes, including constant current, constant voltage, constant resistance, and constant power, and the other three are advanced operating modes including constant current + constant voltage, constant resistance + constant voltage, and constant power + constant voltage. Users must first select operating mode and then operating function based upon the test requirements. Static, Dynamic and Sequence operating functions can be applied to different testing conditions including a fixed load level, switching between two levels or switching among more than two levels. Sequence function is divided into Fast Sequence and Normal Sequence according to the test time of each step. Both Dynamic and Sequence are to assist users to simulate the genuine load change. For instance, PEL-3000 can simulate HEV current consumption to make sure that automobile battery can supply HEV with sufficient power need on the road. By so doing, manufacturers can elevate product quality and reliability.

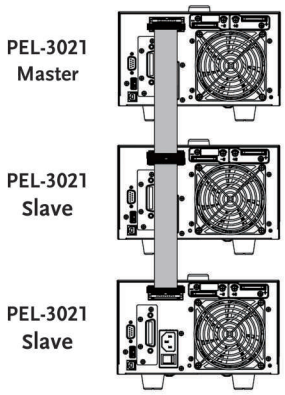
The adjustable high speed Slew Rate of 16A/μs simulates rise and fall speed of different load current so as to test the adequacy of the Response time of power supply. The Soft Start function of the PEL-3000 Series can set current rise time for the moment PEL-3000 is turned on to reduce the abnormal situation of the voltage drop of power supply under test. The adjustable Under Voltage Protection (UVP), GO/NO GO voltage input monitoring function, current monitoring function and Timer Function to control load activation time can be jointly applied to the characteristic tests of battery bleeding to avoid battery damage during bleeding operation. Based upon the functionalities described above, the PEL-3000 Series can test a vast variety of power supply ranging from the fundamental static sink current to complex dynamic load simulations so as to enhance product quality and reliability.

The PEL-3000 Series D.C Electronic Load

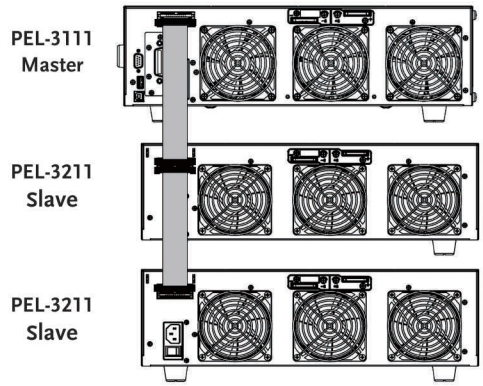
The PEL-3000 Series is a high speed, single channel and programmable D.C. electronic load and its power, functionality, parallel combination and size are listed on the following chart :

MODEL	PEL-3021	PEL-3041	PEL-3111	PEL-3211
Power	175W	350W	1,050W	2,100W Booster
Function	Full-function Single Unit	Full-function Single Unit	Full-function Single Unit	No control panel, can not be operated alone
Parallel Combination	Parallel with same model, 5 units the maximum	Parallel with same model, 5 units the maximum	Parallel with same model, 5 units the maximum Parallel with the maximum of four PEL-3211s	Parallel with PEL-3111
Size	Half Rack	Half Rack	Full Rack	Full Rack

A. OPERATING FUNCTION FOR MASTER AND SLAVE IN PARALLEL



Three PEL-3021 in Parallel

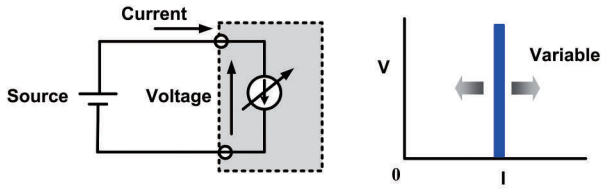


One PEL-3111 connects with two PEL-3211 in Parallel

PEL-3000 Series connects with loads via MIL 20-pin interface and connecting cables to designate a master to control other slave units in parallel. One PEL-3111 and four PEL-3211s in parallel provide the maximum power of 9,450W. Parallel arrangement allows users to flexibly select and apply different power arrangement which enhances equipment utilization efficiency to save R&D cost.

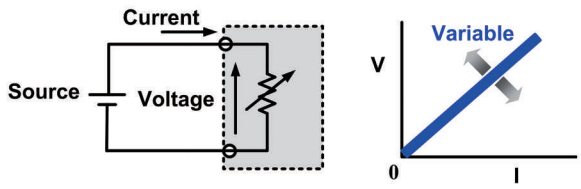
B. OPERATING MODE

The PEL-3000 series provides four fundamental operating modes and three add-on modes of CC, CR and CP separately combining with CV. Users can set different load condition under different operating modes such as setting operating range for load level, Current Slew Rate, input voltage and load current. The input voltage range has two levels - high and low. The load current operating range has three levels - high, medium and low current levels which possess different resolution to meet test requirements of different power product specifications.



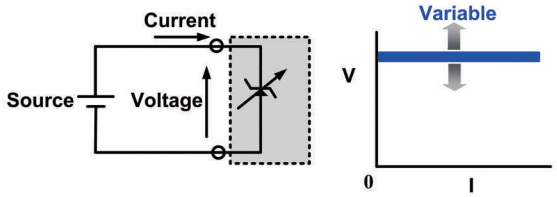
CC Mode

Under constant current mode, electronic load will sink the amount of current users has set. Different current settings via CC mode allow users to test the voltage changes of DC power supply which is called load regulation rate test.



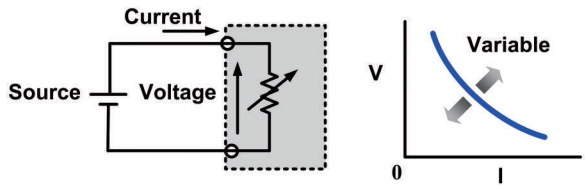
C.R Mode

Under constant resistance mode, electronic load will sink load current, which is linearly direct proportion to input voltage. This mode can be utilized in testing voltage or the activation and current limit of power supply.



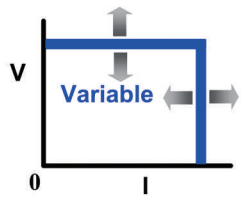
C.V Mode

Under constant voltage mode, electronic load will sink sufficient current to regulate the voltage source to the set value. This mode allows users not only to test current limit function of power supply, but also to simulate battery operation in testing battery chargers.

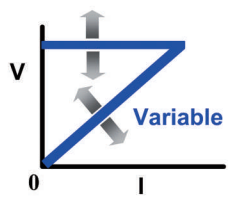


C.P Mode

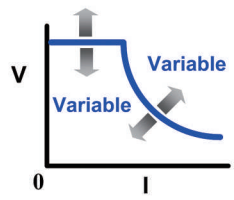
Under constant power mode, electronic load will sink load current, which is indirect proportion to input voltage to reach preset constant power requirement. Hence, the changes of input voltage will have indirect proportion effect on current sinking so as to reach constant power control.



CC+CV Mode



CR+CV Mode



CP+CV Mode

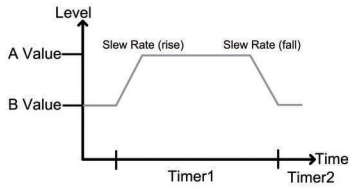
+CV mode can be selected under CC, CR or CP mode. When +CV mode function is turned on and electronic load sinks more current than the maximum current of power supply under test, electronic load will automatically switch to CV mode. It is because that the current sunk is the maximum current of power device. Therefore, power supply will switch to CC mode and PEL-3000 will switch to CV mode to limit electronic load from sinking the total current of power supply so as to prevent power supply under test from damaging. Electronic load will cease operation once the voltage of DUT is lower than the set voltage under +CV mode.

C. THREE OPERATING FUNCTIONS

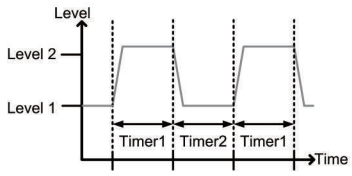
The PEL-3000 series, according to different test conditions, step or continuous changes, test speeds, and selectable modes, has three operating functions: Static, Dynamic and Sequence, which can be separately applied on a fixed load test; between two loads; or among more than two loads. Detailed descriptions of these functions are as follows:

Static function provides a fixed load to test output stability of power supply. Switching load value A to B will be manually operated. Under Dynamic function, two test conditions can be switched automatically and every set of parameter includes Level, Timer and Slew Rate. Timer can be set to the fastest of 25μs to accommodate response time of different power supply and assist testing power supply output status when load is unstable in order to enhance products' reliability and quality.

Function \ Operation	Static	Dynamic	Sequence	
			Fast	Normal
Operating Condition Selection	Single fixed condition	Selection between two conditions	Selection among more than two conditions	Selection from more than two conditions
Operating Modes	All modes	• Two conditions using same mode • CR, CC,CP modes	• Each condition must use same mode • Support CC or CR mode	• Each condition using different mode • All modes
Adjustable Condition Setting	• A/B Value • Slew Rate	• Level 1/Level 2 • Timer 1/Timer 2 • Slew Rate 1/Slew Rate 2	• Level • Timer • Slew Rate • Others...	• Level • Timer • Slew Rate • Others...
Sequence Step Combination	N/A	N/A	• 1 Sequence • 1,000 steps • 25μs/step	• 10 Sequence • 1,000 steps • 1ms/step
Other Functions	N/A	N/A	• Trigger Out function	• Trigger Out function • Ramp function

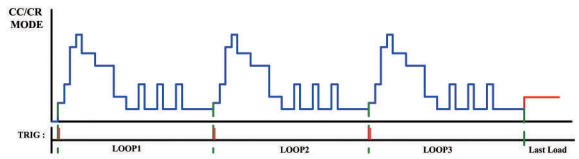


Static Mode

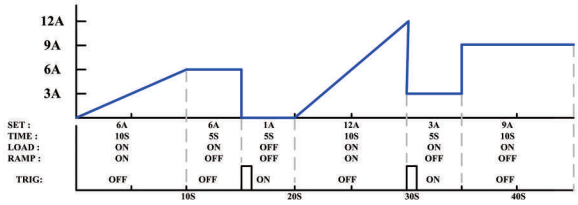


Dynamic Mode

In Sequence function, waveforms of load current edited by Fast Sequence are steps and every step can reach the fastest of 25μs to provide the high slew rate for electronic loads.



Fast Sequence Diagram



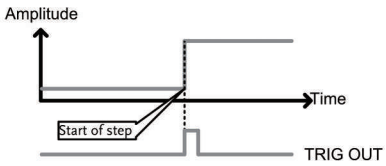
Normal Sequence Diagram

Normal Sequence provides RAMP function to users, according to their requirements, to select between slope and step method under set time to sink current.

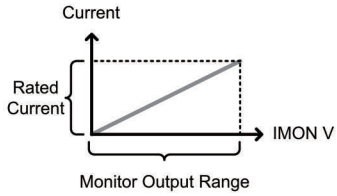
By applying a complete sequence editing function, users can control electronic load without using a computer or writing a program so as to save cost and time of R&D.

D. TRIGGER SIGNAL AND CURRENT MONITORING (IMON)

BNC connectors on the front panel



TRIG OUT = ON

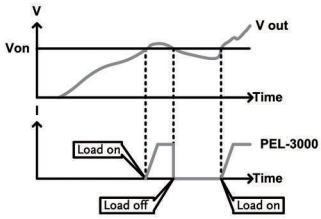


IMON OUTPUT

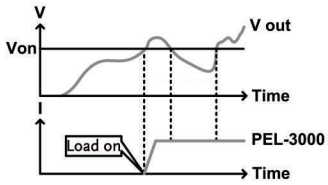
The front panel of PEL-3000, via BNC connectors provides two output signals, which are Trigger Signal and IMON. Under Dynamic or Sequence function, the moment the load current setting is changed BNC on the front panel will output a 4.5V and 2us pulse voltage. This trigger signal can be set to open or close for every step. Users can use trigger signal to synchronize other devices inside the system.

Current monitoring signals, using a BNC connector to compare with the full scale of real load current, output 0 ~ 1V at high and low current levels and 0 ~ 0.1V at medium current level. Therefore, users can monitor load current change without using current probe to save cost.

E. VON VOLTAGE AND VON LATCH FUNCTION



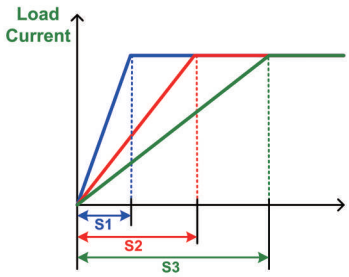
Von Latch = OFF



Von Latch = ON

Von Voltage is the threshold voltage for electronic load to activate or terminate sinking current. When Von Latch is set to off, electronic load operation will be activated if input voltage is higher than Von Voltage and electronic load operation will be terminated if input voltage is lower than Von Voltage. When Von Latch is set to on, electronic load operation will be activated if input voltage is higher than Von Voltage and will continue operation even input voltage is lower than Von Voltage. Von Voltage function can test the transient maximum current capability provided by power supply.

F. SOFT START



Three different load waveforms of Soft Start Time

Soft Start regulates the time of current rising from 0 to preset value during the moment load is activated. This function is to prevent voltage from dropping due to the fast transient rising speed of load current. Sudden voltage drop will result in an unsuccessful activation of electronic load or DUT and a damaged DUT.

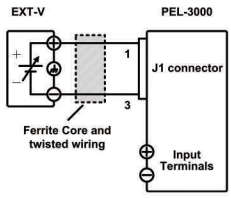
G. PROTECTION MODES

Functions / Protection	OCP	OVP	OPP	OTP	UVP
Adjustable Thresholds	✓	✓	✓	Fixed	✓
Load Off	✓	✓	✓	N/A	✓
Limit Function	✓	N/A	✓	N/A	N/A

The PEL-3000 Series provides many protective functions including over current protection (OCP), over voltage protection (OVP), over power protection (OPP), over temperature protection (OTP) and under voltage protection (UVP). Except for OTP, all thresholds of protective functions are adjustable. When protective function is activated, electronic load will send out warning signal and terminate operation. Other than protective functions, Limit function can also be utilized to maintain electronic load in operation at a preset value. The related settings and selections are as follows: Take UVP as an example. In battery bleeding tests, electronic load will cease operation if battery voltage is lower than the set protective threshold value in order to prevent battery from over bleeding.

H. ANALOG CHANNEL CONTROL

Rear Panel

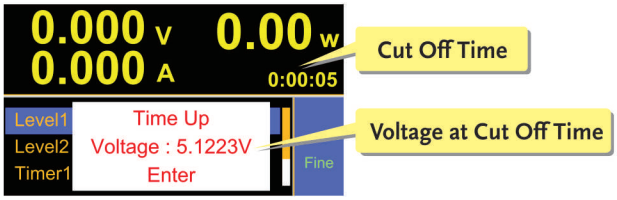


External Voltage Connection

The PEL-3000 Series provides the external analog channel control function, which allows users to connect J1 and J2 MIL 20 pin standard connectors on the rear panel to input voltage or to connect resistance to control electronic load operation. Input voltage is limited to the range of 0 ~ 10V; connecting resistance is limited to the range of 0Ω ~ 10kΩ; and related to load level are 0~100%. For instance, when operating PEL-3021under CC mode and 35A, external input voltage is 1V and sink current is 3.5A. Users can integrate this function into test system and utilize signals generated from the test system to control PEL-3000 Series.

I. TIMER FUNCTIONS

Elapsed Time



Voltage at Cut Off Time

The PEL-3000 series provides count time and cut off time functions. The display screen will show present activation time when electronic load is activated. When electronic load operation is terminated count time will stop and the total operation time will be shown on the display screen.
The activation time of cut off time can be set to the maximum length of 999h 59min 59s. When electronic load is activated this function will start counting time. Electronic load will cease operation (load off) and show the final input voltage on the screen when preset time is reached. Timer function can provides information and application related to time. Users can obtain the total time of limiting electronic load operation to increase the agility of electronic load tests.

PANEL INTRODUCTION

CE | USB | GPIB | Analog Control | RS-232

1. ON / STBY
2. LCD Display
3. Function Keys
4. Operation Key
5. Front Panel Input Terminals
6. I MON, TRIG OUT Terminals
7. Rear Panel Inputs Terminals
8. Frame Control Ports, J1, J2
9. GPIB
10. RS232C Port
11. USB Port

SPECIFICATIONS

Model			PEL-3021			PEL-3041			PEL-3111			PEL-3211
Voltage Current Power			1.5V~150V 35A 175W			1.5V~150V 70A 350W			1.5V~150V 210A 1050W			1.5V~150V 420A 2100W
CONSTANT CURRENT MODE												
Operating Range			0~35A	0~3.5A	0~0.35A	A~70A	A~7A	A~0.7A	A~210A	A~21A	A~2.1A	420A ±(1.2% of set+1.1% of f.s)
Accuracy of Setting	H, M, L		±(0.2 % of set + 0.1 % of f.s.*1) + Vin*2/500 kΩ									
Accuracy of Setting(Parallel)	H, M, L		±(1.2% of set +1.1% of f.s.*3)									
Resolution			1mA	0.1mA	0.01mA	2mA	0.2mA	0.02mA	10mA	1mA	0.1mA	N/A
CR MODE												
Operating Range	Range	H	23.3336S~400μS (42.857mΩ~2.5kΩ)			46.6672S~800μS (21.428mΩ~1.25kΩ)			140.0016S~2.4mS (7.1427mΩ~416.6667 Ω)			28.0002s~484.8μs (35.7135mΩ~2.08334Ω)
		M	2.33336S~40μS (428.566mΩ~25kΩ)			4.6667S~80μS (214.28mΩ~12.5kΩ)			14.0001S~242.4μS (71.427mΩ~4.16667k Ω)			
		L	0.233336S~4μS (4.28566Ω~250kΩ)			0.46667S~8μS (2.1428Ω~125kΩ)			1.40001S~24.24μS (714.27mΩ~41.6667k Ω)			
Accuracy of Setting	H, M, L		±(0.5 % of set*4 + 0.5 % of f.s.*1) + Vin*3/500kΩ									±(1.2% of set +1.1% of f.s)
Resolution			400μS	40μS	4μS	800μS	80μS	8μS	2.4mS	240μS	24μS	N/A
CONSTANT VOLTAGE MODE												
Operating Range	Range	H	1.5V~150V									1.5V~150V
		L	1.5V~15V									1.5V~15V
Accuracy of Setting	H, L		±(0.1 % of set + 0.1 % of f.s)									N/A
Resolution	H, L		10mV/1mV									

SPECIFICATIONS

Model			PEL-3021			PEL-3041			PEL-3111			PEL-3211
CONSTANT POWER MODE												
Operating Range	Range	H	17.5W~175W			35W~350W			105W~1050W			210W~2100W
		M	1.75W~17.5W			3.5W~35W			10.5W~105W			21W~210W
		L	0.175W~1.75W			0.35W~3.5W			1.05W~10.5W			2.1W~21W
Accuracy of Setting	H, M, L		±(0.6 % of set *5 + 1.4 % of f.s*6)									N/A
Resolution			10mW	1mW	0.1mW	10mW	1mW	0.1mW	100mW	10mW	1mW	
PARALLEL Mode												
Capacity			875W			1750W			5250W			PEL-3111 with 4 booster units : Max 9.45kW
SLEW RATE												
Setting Range (CC mode)	Range	H	2.5mA/μs~2.5A/μs			5mA/μs~5A/μs			16mA/μs~16A/μs			16mA/μs~16A/μs
		M	250μA/μs~250mA/μs			500μA/μs~500mA/μs			1.6mA/μs~1.6A/μs			1.6mA/μs~1.6A/μs
		L	25μA/μs~25mA/μs			50μA/μs~50mA/μs			160μA/μs~160mA/μs			N/A
Setting Range (CR Mode)	Range	H	250μA/μs~250mA/μs			500μA/μs~500mA/μs			1.6mA/μs~1.6A/μs			1.6mA/μs~1.6A/μs
		M	25μA/μs~25mA/μs			50μA/μs~50mA/μs			160μA/μs~160mA/μs			160μA/μs~160mA/μs
		L	2.5μA/μs~2.5mA/μs			5μA/μs~5mA/μs			16μA/μs~16mA/μs			N/A
Accuracy of Setting	H, M, L		±(10 % of set*7 + 5μs)									N/A
Resolution			0.1μA ~ 1mA			0.2μA ~ 2mA			0.6μA ~ 6mA			N/A
METER												
Voltmeter Ammeter Ammeter(Parallel Operation)	Accuracy Accuracy Accuracy		±(0.1 % of rdg + 0.1 % of f.s) ±(0.2 % of rdg + 0.3 % of f.s) ±(1.2% of rdg +1.1% of f.s.)									N/A
DYNAMIC MODE												
Operation Mode T1 & T2 Accuracy			CC and CR 0.025mS~10mS/Res : 1μs ; 1ms~30s/Res : 1ms 1μS/1ms ± 100ppm									
Slew Rate	Range	H	2.5mA/μs~2.5A/μs			5mA/μs~5A/μs			16mA/μs~16A/μs			16mA/μs~16A/μs
		M	250μA/μs~250mA/μs			500μA/μs~500mA/μs			1.6mA/μs~1.6A/μs			1.6mA/μs~1.6A/μs
		L	25μA/μs~25mA/μs			50μA/μs~50mA/μs			160μA/μs~160mA/μs			N/A
Current Accuracy			±0.4%F.S.			±0.4%F.S.			±0.4%F.S.			±(1.2%of set+1.1% of F.S.)
PROTECTION FUNCTION												
Overvoltage protection(OVP)			Adjustable ; Turns off the load at 110% of the rated voltage									N/A
Overcurrent protection(OCP) Overpower protection(OPP)			0.03A~38.5A(Adjustable) 0.1W~192.5W(Adjustable)			0.06A~77A(Adjustable) 0.3W~385W(Adjustable)			0.2A~231A(Adjustable) 1W~1155W(Adjustable)			
Overheat protection(OHP)			Turns off the load when the heat sink temperature reaches 95 °C									
Undervoltage protection(UVP)			Adjustable : Turns off the load when detected Can be set in the range of 0 V to 150 V or Off									
Reverse connection protection(REV)			By diode. Turns off the load when an alarm occurs									
POWER SOURCE												
AC100V ~ 230V±10% ; 50Hz / 60Hz ± 2Hz												
INTERFACE												
USB/RS232/Analog Control (Standard) ; GPIB(Option)												
DIMENSIONS & WEIGHT												
			214.5(W)x124(H)x400(D)mm; Approx. 6kg			214.5(W)x124(H)x400(D)mm; Approx. 7kg			429.5(W)x128(H)x400(D)mm; Approx. 17kg			427.7(W)x147.8(H)x592.5(D)mm; Approx. 23kg

*1. Full scale of H range.
*2. Vin: input terminal voltage of electronic load.
*3. M range applies to the full scale of H range.
*4. Set = Vin/Rset.
*5. It is not applied for the condition of the parallel operation.
*6. M range applies to the full scale of H range.
*7. Time to reach from 10 %~90 % when the current is varied from 2 %~100 %(20 %~100 % in M range) of the rated current.

Specifications subject to change without notice. EL-3000GD1BH

ORDERING INFORMATION

PEL-3021 175W Programmable DC Electronic Load
PEL-3041 350W Programmable DC Electronic Load
PEL-3111 1050W Programmable DC Electronic Load
PEL-3211 2100W Booster unit for PEL-3111 only

ACCESSORIES :
User Manual x 1, Power Cord x 1

OPTIONAL ASSESSORIES

GTL-120 Test Lead (Max 40A)
GTL-248 GPIB Cable (2m)
GTL-246 USB Cable, USB 2.0A-B TYPE CABLE, 4P
GTL-255 Frame Link Cable (300mm)
GTL-251 GPIB-USB-HS (High Speed)
GTL-252 Frame Link Cable (550mm)
GRA-413 Rack Mount Kit (EIA+JIS) for PEL-3211
GRA-414-J Rack Mount Kit (JIS) for PEL-3021/3041/3111
GRA-414-E Rack Mount Kit (EIA) for PEL-3021/3041/3111

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